Fourth Report of
Confidential Review
of Maternal Deaths,
Kerala

Why Mothers Die

Kerala 2020-2024

Observations & Recommendations

Editors:
V P Paily, K Ambujam , Betsy Thomas

Maternal Fetal Medicine Committee
Kerala Federation of Obstetrics & Gynaecology

Cover design: The hour glass was chosen (Courtesy **Sheela Paily**) as a reminder of the importance of time in saving maternal lives - any delay in adopting new policies, new innovations, or initiating appropriate treatment costs maternal lives.

Fourth Report of Confidential Review of Maternal Deaths, Kerala

Dedicated to the mothers whom we could not save, but, who indirectly helped us to learn lessons and save thousands of women in child birth.

Also to the obstetricians, nurses and other health workers who trusted us with details of patients under their care and helped us achieve the lowest maternal mortality ratio in the country.

CRMD team 2004 - 2024

Maternal Fetal Medicine Committee
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Associate Editors
Prameela Menon, Megha Jayaprakash, Raji Raj, Parvathi Deth

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Maternal Fetal Medicine Committee
Kerala Federation of Obstetrics & Gynaecology

Foreword

Kerala has long been recognized for its impressive healthcare system and progressive health indicators. The state has achieved significant milestones in maternal health, with a notable decrease in maternal mortality over the decades. Kerala's Maternal Mortality Ratio (MMR) has steadily declined over the years, and the state has consistently been one of the leading performers in India in terms of maternal health outcomes.

"Why Mothers Die" is an invaluable and timely resource, shedding light on the cause of maternal deaths in our state. This book offers an in-depth analysis of maternal deaths in the last 4 years, meticulously uncovering the patterns, underlying causes, and systemic gaps that contribute to maternal deaths. By drawing from these findings, the book provides essential insights that will guide us in the prevention of future maternal deaths.

The aim of this book is not only to educate but to inspire action—action that can save lives and improve the overall health outcomes for mothers across our state.

Through this comprehensive analysis, "Why Mothers Die" also offers a pathway for future improvements. By understanding the challenges, we face today, we can collectively work towards creating a more effective, compassionate, and accessible healthcare system. This book serves as a call to action for all stakeholders—policymakers, healthcare providers, communities, and individuals—to join forces in reducing maternal mortality and improving maternal health of women in the state.

This publication empowers us with the knowledge and the tools we need to make informed decisions, improve healthcare systems, and, ultimately, ensure that every mother survives.

It is my sincere hope that "Why Mothers Die?" will spark meaningful change and that we, together, will create a future where all preventable maternal deaths will be prevented.

With best wishes,
Dr. Rajan Kobragade
Addl Chief Secretary, Health and Family Welfare,
Gov of Kerala , Thiruvananthapuram

Foreword

It is with great pride and a deep sense of responsibility that I pen this foreword for the fourth edition of Why Mothers Die, Kerala (2020-2024), a flagship publication of Kerala Federation of Obstetrics and Gynaecology (KFOG). This edition, meticulously prepared by CRMD team under the leadership of its dedicated State Convenor, Prof VP Paily, reflects KFOG's unwavering commitment to improving maternal health outcomes in Kerala. Building upon the comprehensive third edition, which provided an in-depth analysis of maternal deaths from 2010 to 2020, the current volume offers a focused and condensed perspective on recent developments and updated data from the last four years. This succinct approach ensures that healthcare professionals and policymakers alike can quickly access critical insights to guide their efforts in preventing maternal mortality. As obstetricians, it is our collective responsibility to understand the underlying causes of maternal deaths and to adopt evidence-based interventions to bridge the gaps in care. This publication not only serves as a vital resource but also as a call to action for all stakeholders to work together toward achieving better outcomes for mothers in our state. I extend my heartfelt appreciation to the editors, Dr. V. P. Paily, Dr. K. Ambujam and Dr. Betsy Thomas, for their exemplary efforts in compiling this invaluable resource. I am confident that this edition will serve as a beacon of guidance and inspiration for all those dedicated to the cause of maternal health.

Warm regards,
Dr K U Kunjimoideen
President KFOG (2024-2025)

Foreword

As we present the fourth edition of Why Mothers Die, Kerala, we stand at a critical juncture in the state's maternal health journey-one marked by progress, but also by persistent challenges that require our continued attention. Kerala has long been a model for healthcare excellence in India, especially in maternal health. Its Maternal Mortality Ratio (MMR) is one of the lowest in the country, a testament to the collective efforts of healthcare professionals, government bodies and local communities. This achievement has been underpinned by the relentless work of the Kerala Federation of Obstetric and Gynaecological Societies (KFOG), which has been instrumental in shaping the trajectory of maternal health in the state.

The implementation of evidence-based protocols such as EMOCALS (Emergency Obstetric care And Life Support), PPMD (Prevent the Preventable Maternal Deaths), and ORRT (Obstetric Rapid Response Team) have been critical in reducing maternal deaths and improving healthcare outcomes. Despite these advancements, challenges remain. Between 2020 and 2024, Kerala saw significant improvements, but causes such as obstetric hemorrhage, hypertensive disorders of pregnancy, pregnancy-related infections, and maternal suicides continue to contribute to maternal mortality. These issues demand continued vigilance, innovation, and a proactive approach to maternal healthcare. This edition of Why Mothers Die, Kerala builds on the successes of the past while highlighting the challenges.

With best wishes,
Dr Subash Mallya
Secretary KFOG

Foreword

Kerala has always been an icon of good Maternal care, with maternal mortality rates on par with developed countries.

The reason may be the continuous introspection and verification of Maternal mortality reasons and trying to prevent them in future.

The strive for excellence has been instilled into each Obstetrician. The three editions of "Why Mothers Die" have been very effective in creating an awareness and giving evidence-based methods on how to prevent and deal with such emergencies.

I am sure that the fourth edition will be equally or even more effective in bringing about our dream of decreasing our MMR to a minimum.

Congratulations to Prof Dr Paily Sir and the team of co-authors for the dedicated work put in to bring out this concise fourth edition. It will definitely be useful to the obstetricians of not only our State, but neighbouring states as well.

With best wishes,
Dr Suchitra Sudhir
President Elect 2025-26
KFOG

Preface

(4th Edition 2020 -2024)

While writing these lines, the sense of accomplishment when the third edition was released, is rapidly ending. The CRMD team is concerned that we may not be able to meet the target of MMR 20 for Kerala, by the year 2030. This is due to several reasons, most of them beyond our control. It is a hot topic for media discussions at present. Sadly, the discussions do not seem to go in the correct direction. The drastic drop in the state's birth rate is the main reason. Superficially this will look like a paradox to argue that when the births come down MMR goes up. The reason is that we are not able to bring down the number of deaths parallel to the drop in births. As a result, the numerator (number of deaths in the state) remains more or less the same and the denominator comes down drastically making the ratio go up.

There are other factors which influence this phenomenon. I refer to the demographic transition. Previously youth of Kerala went abroad for jobs and kept their families behind. But now more and more of our youngsters go abroad to settle there with family. The reproductive age group men and women remaining in the State are changing their attitude towards marriage and having children. Many youngsters do not plan to marry but would rather live together without having children and raising a family. Even those planning to have children limit to only one child, while many opt not to have children. As a result, even those women having babies are first time mothers with the associated unique problems of primiparas.

Having sensed this trend developing in the State, we doubled our efforts to address the preventable maternal deaths. A curriculum was developed to train caregivers at the delivery points -doctors and nurses of private and public sectors. Our volunteers conducted the abridged training programme across the State. But it did not match the need of training at the nearly 400 delivery points in the State. To add to the problems, there is the huge emigration of our trained manpower especially nurses to the developed countries leaving posts to be filled by raw, untrained hands. Even though we have never declined to provide the trainers, there is a big gap developing in the numbers of trained nurses and untrained graduates. Unless the government comes out with determination to arrange more training sessions, the standard of care at the delivery points will rapidly decline.

The other problems we pointed out in the previous edition continue to be more important contributors to maternal deaths viz sepsis and suicide. On a positive note, we can show that the deaths due to hemorrhage have consistently decreased. Hypertensive deaths still remain a concern.

The period (2020 -2024) covered by this book saw unprecedented loss of lives, maternal deaths included, due to pandemic Covid19. We lost 123 mothers. That was an experience which we would rather forget, just like the rest of the world.

The recent review of maternal deaths in our state convinced us again the need for being vigilant and devising new strategies as new problems arise. The MDNMSR (Maternal Death and Near Miss Surveillance and Response) was one such step. It gives the opportunity to learn lessons by reviewing near misses. This has proven to be a unique and effective way to address maternal deaths, but we do not see a matching commitment from the concerned authorities. Same is true about the various other suggestions. We hope that the Kerala Federation of Obstetricians and Gynecologists (KFOG) will continue its commitment to work towards preventing all preventable maternal deaths.

V P Paily, *State Coordinator CRMD*
K Ambujam, *Chair Maternal Fetal Medicine Committee*
Betsy Thomas, *Vice Chair Maternal Fetal Medicine Committee*

Acknowledgements

Confidential Review of Maternal Deaths (CRMD) was conceived by the Maternal Fetal Medicine Committee of KFOG right from its inception. It was possible only because of the wholehearted support of the Government of Kerala and the KFOG members across the State. The members participated in it without receiving any remuneration, spending from their own pockets for the travel, accommodation etc. The member societies of KFOG across the state, especially Thrissur, Thiruvananthapuram and Kozhikode hosted the quarterly meetings of the assessors. A large group of senior obstetricians and non-obstetrician assessors helped in reviewing the case records confidentially and identifying the real cause of maternal deaths. This has helped us immensely to plan the measures to prevent such deaths. The government of Kerala, through the National Health Mission, helped in planning the training programs that have helped in preventing deaths due to the common causes like hemorrhage, hypertension, sepsis, suicide and amniotic fluid embolism. There is an ongoing need for such collaboration. We hope that this audit will continue and express our gratitude to the Government of Kerala and the KFOG President and Secretary for all the support.

We especially thank the Department of Health represented by Health Minister Smt. Veena George, the Additional Chief Secretary Health Sri. Rajan Khobragade, the various Directors of Health Services and Director of Medical Education, Dr Meenakshy, Dr. Sandeep and the demographer Ms. Prabha for providing all the support. It is the RCH officers who work most closely with us in planning and executing our projects especially the MDNMSR at the district level. We are most indebted to them.

At the KFOG side, we are grateful to all the presidents and secretaries, especially the present President Dr. Kunjimoideen, Secretary General Dr. Subash Mallya and Treasurer Dr. Ramesh for the support and the office staff Mr. Varkey, Ms. Jolly and Ms. Lakshmy.

Dr. Sheela Paily, as in the past shouldered the responsibility of compiling the data and helping with the production of the book. We are very much obliged to her.

We are most indebted to the rank and file of KFOG who joined us and

trusted us on this unique journey to identify the reasons for maternal deaths and implement measures to prevent them. Some of the seniors like Dr. P K Sekharan, Dr. V Rajasekharan Nair, Dr. Sareena Gilvaz and Dr. P K Shyamala Devi had been an integral part of this venture right from the beginning. Other colleagues like Omana Madhusudanan, Presanna Kumari, Lakshmi Ammal, Neetha George, Sangeetha Menon, S Ajith, Jyoti Chandran, Prameela Menon, Bindu Menon ,Deepthy Murali, Lola Ramachandran, Nishi Roshni, Resmy C R , Agnes Mathew, Radhamony K, Radhamony D, Lalithambica K, Parvathy Deth, Kunjamma Roy, Beena Kumari, Reena N R , Manjula Abhilash, Hema Warrier, Vasanthi Jayaraj, Sheela Shenoy, C.Nirmala, A P Geetha, C V Chandrika, K J Jacob, Megha Jayaprakash, N S Sreedevi, Vinayachandran, V K Chellamma and Raji Raj had been our champions to take the projects to the periphery. The non obstetrician Colleagues at the different centers where the quarterly review meetings were held showed more commitments than even the O & G colleagues. Only with the help of colleagues like Drs P C Gilvaz, N Viswanath, PMJayaraj, P P Mohanan, Geevar Zacharia, Govindan Unni, G Vijayaraghavan, A Vimala, A K Unnikrishnan, Mathew Thomas, Aravind Reghukumar, Kuruvila, Jaicob Varghese, Usha Shenoy and Susheela Innah we could critically analyse the non obstetric causes of maternal deaths and arrive at a diagnosis. Drs Jaicob Varghese and Sachin George and their teams helped us develop the Obstetric Rapid Response Team and give the training. Colleagues like Hari Prasad and Jayasree Thankachi always made us feel that all our efforts are worth it.

It was Dr. M Venugopal, the previous Secretary General of KFOG, who helped with the design and establishment of the lab and workstations of the TOPS programme at Thrissur.

There are many more who helped us in this journey. A big Thank you to all of you.

Mr. David of Smriti Designs as well as Anaswara printers have helped in putting together this manuscript at the last minute. We are grateful to them.

We hope that you will find this 4th edition useful in your day-to-day practice.

Our reward is the conviction that our actions would have saved many women in childbirth, who would have otherwise been lost forever.

V P Paily, K Ambujam, Betsy Thomas

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Abbreviations

ABG	Arterial Blood Gas
ACLS	Advanced Cardiac Life Support
ACOG	American College of Obstetricians and Gynaecologists
AFE	Amniotic Fluid Embolism
AFLP	Acute Fatty Liver of Pregnancy
AHA	American Heart Association
AKI	Acute Kidney Injury
AMTSL	Active Management of Third Stage of Labour
ANC	Ante Natal Care
ANM	Auxiliary Nurse Midwife
ARDS	Acute Respiratory Distress Syndrome
ARM	Artificial Rupture of Membranes
ASHA	Accredited Social Health Activist
ASL	Arterial Spin Labelling
ASQ	Ask Suicide Screening Question
BLS	Basic Life Support
BNP	Brain Natriuretic Peptide
BuMP	Blood Pressure Self-Monitoring in Pregnancy
CBNAAT	Cartridge-Based Nucleic Acid Amplification Test
CHC	Community Health Centre
CRMD	Confidential Review of Maternal Deaths
CPR	Cardiopulmonary Resuscitation
CRRT	Continuous Renal Replacement Therapy
CS	Cesarean Section
CTG	Cardio Toco Graph
DHS	Director of Health Services
DIC	Disseminated Intravascular Coagulation
DMHP	District Mental Health Programme
DMO	District Medical Officer
DVT	Deep Vein Thrombosis
E-CPR	ECMO CPR
ECMO	Extracorporeal Membrane Oxygenation
EmOCALS	Emergency Obstetric Care and Life Support
ERAS	Enhanced Recovery After Surgery
FIGO	International Federation of Gynaecology and Obstetrics
FIR	First Investigation Report
FMF	Fetal Medicine Foundation
GDM	Gestational Diabetes Mellitus
GTCS	Generalized Tonic-Clonic Seizure
HCG	Human Chorionic Gonadotropin
HELLP	Hemolysis, Elevated Liver Enzymes, and Low Platelet
HIT	Heparin-Induced Thrombocytopenia
HSE	Herpes Simplex Encephalitis

HSV	Herpes Simplex Virus
IB	Instrumental Birth
ICH	Intracerebral Hemorrhage
IOL	Induction of Labour
ISSHP	International Society for the Study of Hypertension in Pregnancy
IVF	In Vitro Fertilization
JPHN	Junior Public Health Nurse
KFOG	Kerala Federation of Obstetricians and Gynaecologists
LAST	Local Anesthetic Systemic Toxicity
LCG	Labour Care Guide
LMWH	Low Molecular Weight Heparin
MAP	Mean Arterial Pressure
MDNMSR	Maternal Death and Near Miss Surveillance and Response
MEOWS	Modified Early Obstetric Warning Score
MMR	Maternal Mortality Ratio
MODS	Multiple Organ Dysfunction Syndrome
MOHFW	Ministry of Health and Family Welfare
MRV	Magnetic Resonance Venography
NASG	Non-Pneumatic Antishock Garment
NEWS	National Early Warning Score
NICE	National Institute for Health and Care Excellence
NMDA	N-Methyl D-Aspartate
NT	Nuchal Translucency
OMqSOFA	Obstetrically Modified qSOFA
ORRT	Obstetric Rapid Response Team
PAH	Pulmonary Arterial Hypertension
PAPP-A	Pregnancy-Associated Plasma Protein A
PAS	Placenta Accreta Spectrum
PCR	Polymerase Chain Reaction
PE	Pulmonary Embolism
PHC	Primary Health Centre
PlGF	Placental Growth Factor
PMCS	Perimortem Cesarean Section
PPH	Postpartum Hemorrhage
PPMD	Prevent the Preventable Maternal Deaths
qSOFA	Quick Sepsis-Related Organ Failure Assessment
RCH	Reproductive and Child Health
RCM	Respectful Maternity Care
RCOG	Royal College of Obstetricians and Gynaecologists
ROTEM	Rotational Thromboelastometry
RUPI-L	Relative Utero Placental Insufficiency of Labour
sFlt-1/PlGF	Soluble fms-like Tyrosine Kinase / Placental Growth Factor
SLE	Systemic Lupus Erythematosus
SOFI	Suggestive of Fetal Inflammation
THP	Thinking Healthy Programme
TOPS	Training in Obstetric Procedures Using Simulation
TVUAC	Transvaginal Uterine Artery Clamp
TXA	Tranexamic Acid
UFH	Unfractionated Heparin
UTPI	Uterine Artery Pulsatility Index
VEGF	Vascular Endothelial Growth Factor
VF	Ventricular Fibrillation
VT	Ventricular Tachycardia
VTE	Venous Thromboembolism
WHO	World Health Organization

Why Mothers Die

Kerala 2020-2024

Observations & Recommendations

CHAPTER 01

Introduction

Betsy Thomas

This is the fourth edition of Why Mothers Die, Kerala. This book covers the time period April 2020 – March 2024. We have followed the same process of data collection as mentioned in the previous editions, but there is definitely a slackening in sending data to the CRMD team post COVID. The actual number of maternal deaths in Kerala has come down. However, since the regular national census of 2021 could not be conducted due to COVID, we had to depend on the data from Civil registration regarding live births to calculate MMR.

Unlike previous editions, this book gives importance to the five major killers namely Hemorrhage, Hypertension, Suicide, Sepsis and Amniotic Fluid embolism, where we can think about 'Prevent the Preventable Maternal Deaths (PPMD)'. We have included a special session on labour and delivery. Yet another addition is CRMD snippets in which we analyse whether the deaths are avoidable or not and whether there was any delay from the part of the patient or health care facility. We have also included other conditions which impact MMR and also sessions on MDNMSR and EmOcaLS/PPMD/ORRT.

The highlights of the 20-24 period:

1. COVID as the villain of all times
2. Suicide as a major cause
3. Drastic fall in birthrate (In 2024, it has fallen to an all-time low of 3.45 lakhs)
4. Commendable reduction in the number of maternal deaths but MMR has not dropped parallel to that due to the more marked fall in birth rate.
5. PPMD: Prevent the Preventable Maternal Deaths, a one-day program to train Obstetricians and Nurses
6. TOPS: Training in Obstetric Procedures using Simulation for doctors, a two-day program

The main purpose of the CRMD was to identify why mothers die and to assess whether there were any avoidable factors or delays. The avoidable factors were again subdivided into whether it was avoidable only in the best of the settings or in an average setting. Delay was also analysed: any delay from the part of the patient to reach the hospital or delay after reaching the hospital. Such assessment forms the basis of our PPMD program. In this assessment period, CRMD team could analyse 85.7% of the maternal deaths which happened in our state compared to 68.8% in the last assessment period (2010-2020), thanks to the more efficient reporting happening across the state.

Observations and comments on the findings of the report 2020-24

Hemorrhage

PPH still remains the most common direct cause of death. Out of the 609 deaths reported during the four-year period 2020-24, 70 deaths were due to obstetric hemorrhage accounting for 11.5 % compared to 19.38% in the last edition. Out of the 60 analysed cases of hemorrhage, 36 were atonic PPH, 14 traumatic and seven cases of Placenta accreta spectrum. The paradigm shift from medical management alone as first aid to TVUAC + Suction cannula along with medical management evolved during this period. The current recommendation is to refer all cases of previous cesarean with placenta previa to higher centre as mothers still die of PAS. Patients too sick to be referred should be managed in the primary centre itself as there were five women who died on the way and many of them

reached the higher centre in irreversible shock.

Suicide

There were 62 cases (10.2%) in this group. It is the second commonest cause, second only to hemorrhage if COVID is ignored. This clearly reflects the increased general suicide rates in Kerala. The difference from other causes is that we are not able to analyse circumstances and reasons for suicide because case records are seldom available. The likely factors are more social than organic causes. A number of supportive groups and Help line numbers have been described in the chapter on suicide including TELEmanas, AmmaManasu, Bhoomika etc. It is likely to beat hemorrhage as the commonest cause of maternal deaths if this trend continues.

Hypertensive Disorders

In the four-year period under study, 7.47% of the analysed maternal deaths were due to hypertensive disorders, as against 9.9% in the last edition. A simple digital BP apparatus can reduce the human flaws in a busy antenatal setup. Prediction, prevention, early detection, timely management and delivery are the buzz words. The angiogenic marker testing, particularly the sFlt-1/PlGF ratio, can help to prognosticate and decide the timing of delivery. Intracranial hemorrhage has emerged as the major killer in hypertensive disease. It has to be remembered that Magsulph is never an antihypertensive, but has to be given with other antihypertensive agents.

Amniotic Fluid Embolism

Amniotic fluid embolism (AFE) is a rare but catastrophic condition that can present with the typical triad of hypoxia, hypotension & DIC, often culminating in death. In our series, there were 30 cases over four years. Regular training of practicing obstetricians and labour room personnel in BLS and ACLS provided by KFOG through EmOCaLS (Emergency Obstetric Care and Life Support), ORRT (Obstetric Rapid Response Team) and PPMD (Prevent the Preventable Maternal Deaths) have reduced the maternal deaths due to AFE. 18 out of 30 cases had undergone induction in some form. It is commendable that resuscitative hysterotomy was done in 6 cases. Only seven out of 30 babies survived. Though successfully resuscitated initially, about 13 of the mothers succumbed to bleeding.

Sepsis

"Think of the Possibility of sepsis in all maternal collapse". There should be a high index of suspicion of sepsis in all critically ill obstetric patients. ***"Even if a pathology is identified, if standard treatment fails in such cases, always consider the possibility of superadded sepsis"***. Though Sepsis was assigned as the cause of death in only 21

cases (3.4%), many of the cases assigned to other causes revealed on analysis, sepsis as the contributing cause to maternal death. Many cases who had prolonged ICU stay invariably died of sepsis.

Unknown Causes

The number of cases which had to be put under this group is 38 out of 522 (7.3%) as compared to 15.7 % in the third edition. The cause remaining unknown could be due to paucity of investigations rather than lack of case records. It could also be due to complexity of the cases, as sometimes clinical diagnosis may not be possible and the disease would have rapidly progressed to death. Nevertheless, unavailability of case records from the primary centre continues to be a problem.

MDNMSR

MDNMSR (Maternal Death and Near Miss Surveillance and Response) activities were started in Kerala in January 2019. We have included a chapter on MDNMSR, the Primary objective of which is to ultimately eliminate all preventable maternal deaths. Out of the 336 Near Miss cases discussed last year, 183 were due to hemorrhage (54.46%). Of these, 60 cases were Placenta Accreta Spectrum (maximum contributor); many of them would have ended in mortality if not for early diagnosis, referral and timely intervention. Obstetric hysterectomy as a single criterion has made all these PAS cases near miss.

Continuation of Confidential Review

It is the way forward to further reduce the MMR in our state. We have strong competition from other states in reducing Maternal deaths. Our birth rate is drastically falling compared to other states so that our MMR will rise in the coming years in spite of reducing the actual number of maternal deaths. "***Every mother counts***" should be our motto.

CHAPTER 02

Data and Trend analysis

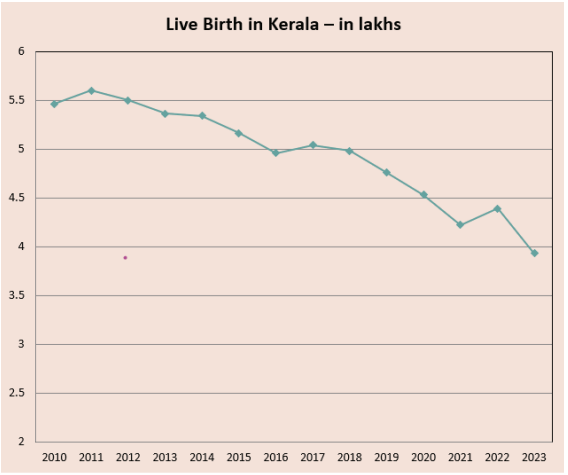
Betsy Thomas

MMR (No. of maternal deaths in 1,00,000 live births) has gone up as live births have drastically come down to a tune of 1.5 lakhs less of births over the last decade. The live birth rate from Civil registration is used here. It has still fallen to 3.45 lakhs in 2024.The actual number of maternal deaths has touched an all-time low of 120 deaths in a year since the inception of CRMD, but MMR has not shown a corresponding decline due to alarmingly low birth rate in Kerala.

Table 1 : Live births Kerala

Year	Live Birth in Kerala - in lakhs (as per Civil Registration)
2010	5.46
2011	5.60
2012	5.50
2013	5.36
2014	5.34
2015	5.16
2016	4.96
2017	5.04
2018	4.98
2019	4.76
2020	4.53
2021	4.22
2022	4.37
2023	3.93

Fig.1 : Live births Kerala



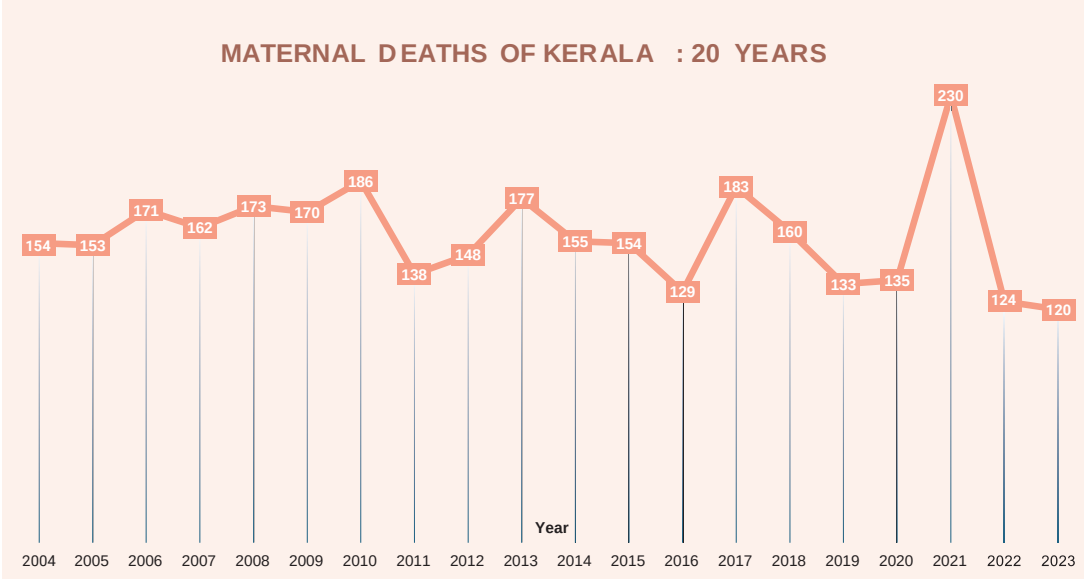
Data : Civil Registration

The CRMD committee is aware of the fact that the maternal deaths are still underreported despite the assurance of confidentiality. When there were multiple causes of death, the case was assigned to only one cause that seemed to be the most appropriate. We have included the cases reported to us (CRMD) and the list supplied by the Director of Health Services (DHS). If a particular case was reported to the CRMD committee and the DHS, to avoid double counting, they were included only in the list of CRMD.

Table 2: Current MMR

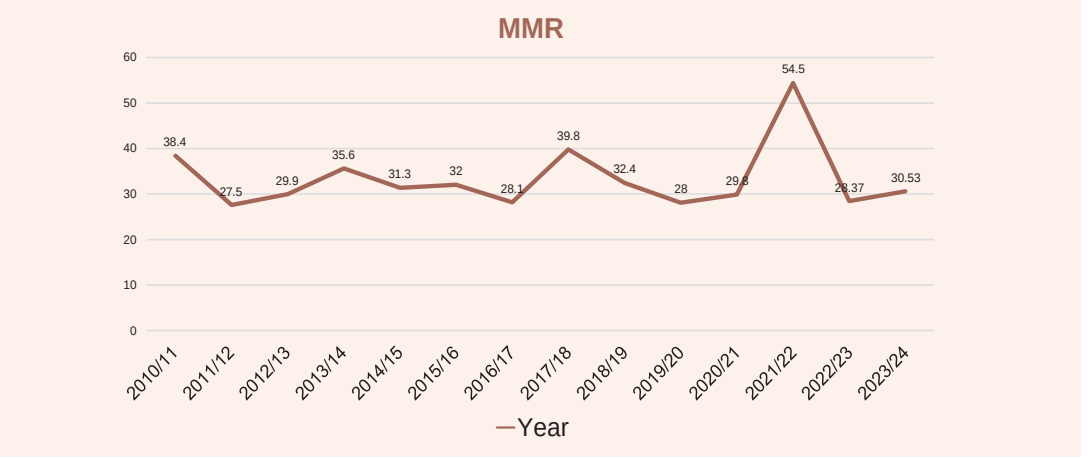
Maternal deaths	20/21	21/22	22/23	23/24
CRMD Analysed cases	111	191	112	108
DHS List – Not analysed by CRMD	24	39	12	12
Total maternal deaths	135	230	124	120
Total live births (in lakhs)	4.53	4.22	4.37	3.93
MMR	**29.8**	**54.5**	**28.37**	**30.53**

Fig. 2 : Maternal deaths in numbers since 2004



The number of deaths has significantly reduced from 186 in 2010 to 120 in 2023. The peak in 2021 (230) is attributable to Covid-19. In toto, we lost 123 mothers to Covid during the assessment period. Despite the fact that actual maternal deaths have gone down, MMR is slowly rising due to 'the power of the denominator' namely reduction in live birth rate. This is very much in contrast to the baby boom expected during Covid. This trend is likely to continue.

Fig. 3 : MMR over last 14 years



We analysed the causes of maternal deaths over the last 4 years maintaining absolute confidentiality. CRMD team meets once in 3 months along with non obstetrician assessors and assign the cause of death to each case and discuss any delays involved and avoidable factors. The causes of death are presented in table:3

Fig. 4 : Major causes of maternal deaths

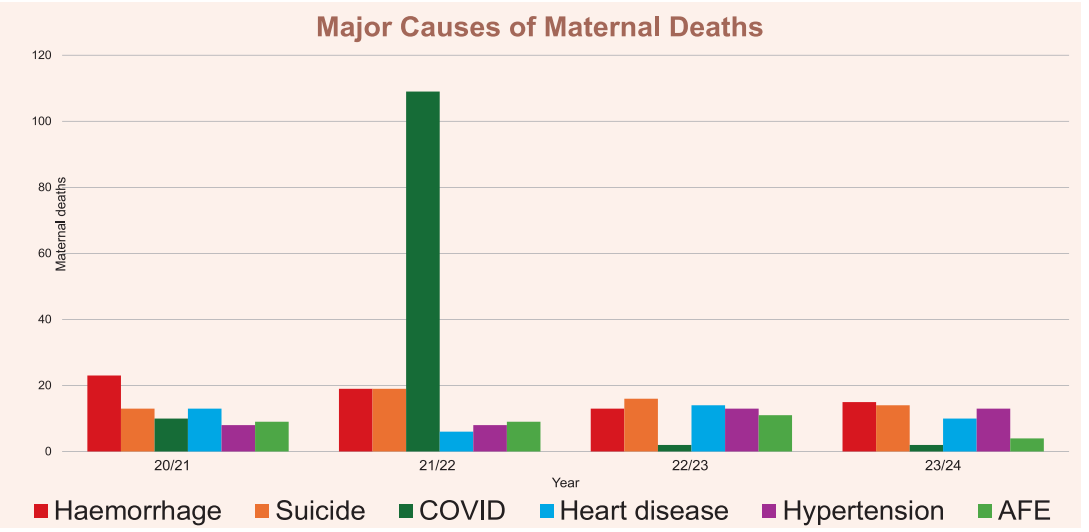


Table 3 : Cause of Death

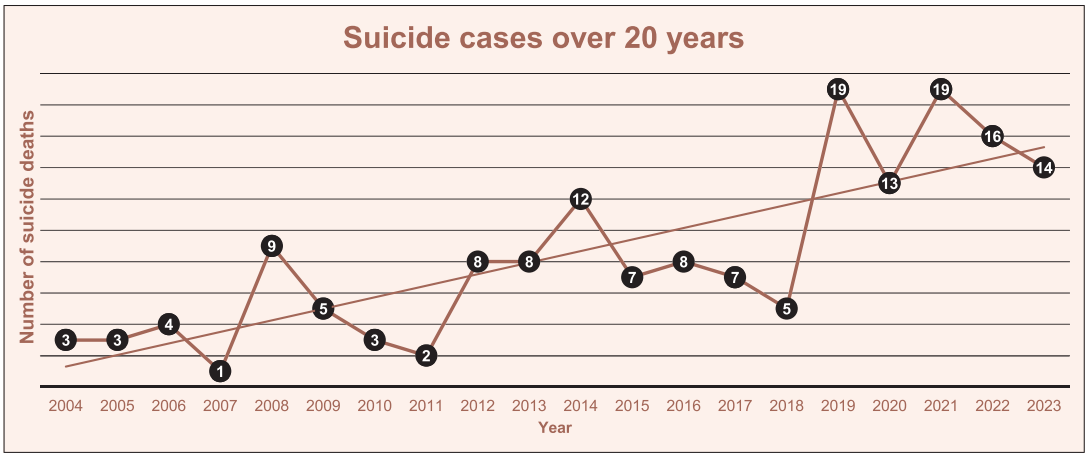
Cause of Deaths	20/21 CRMD	NA	21/22 CRMD	NA	22/23 CRMD	NA	23/24 CRMD	NA	Total
Covid	10		93	16	2		2		**123**
Hemorrhage	17	6	18	1	13		12	3	**70**
Suicide	11	2	16	3	13	3	14		**62**
Heart Disease	13		5	1	14		10		**43**
Hypertensive diseases	7	1	6	2	13		12	1	**42**
AFE	8	1	8	1	10	1	4		**33**
Neurological causes	4	1	4	2	11		6	1	**29**
Respiratory & Viral causes	2	2	6	-	4	1	10 (3 dengue)		**25**
Sepsis	3		3	3	3		7	2	**21**
Pulmonary Embolism	5		5		4		3		**17**
Liver diseases	3		-	-	7		4		**14**
Early pregnancy causes **Ectopic** **Wernicke's** **Abortion** **PAS (Early Rupture uterus)**	 3 1 1 1		 2 1 1		 1 1		 3		**12**
Anaesthetic causes				-			1		**1**
Less common causes	10	1	15	2	10	2	11	2	**53**
Unknown	12	10	10	7	7	5	9	3	**63**
Total	**111**	**24**	**191**	**39**	**112**	**12**	**108**	**12**	**609**

NA : Not assessed

We have given separately the causes directly reported to CRMD and the ones to the DHS. For analysis, we have considered only those cases reported to CRMD, as the details of the cases are available only about them. In interpreting the cause of death, the primary cause is taken into consideration even though the final cause also may be relevant; e.g. a patient who had atonic PPH who underwent obstetric hysterectomy and recovered , but died after a few days due to sepsis. We have taken the stand that it should be included under PPH, as it was the primary cause which set the ball rolling.

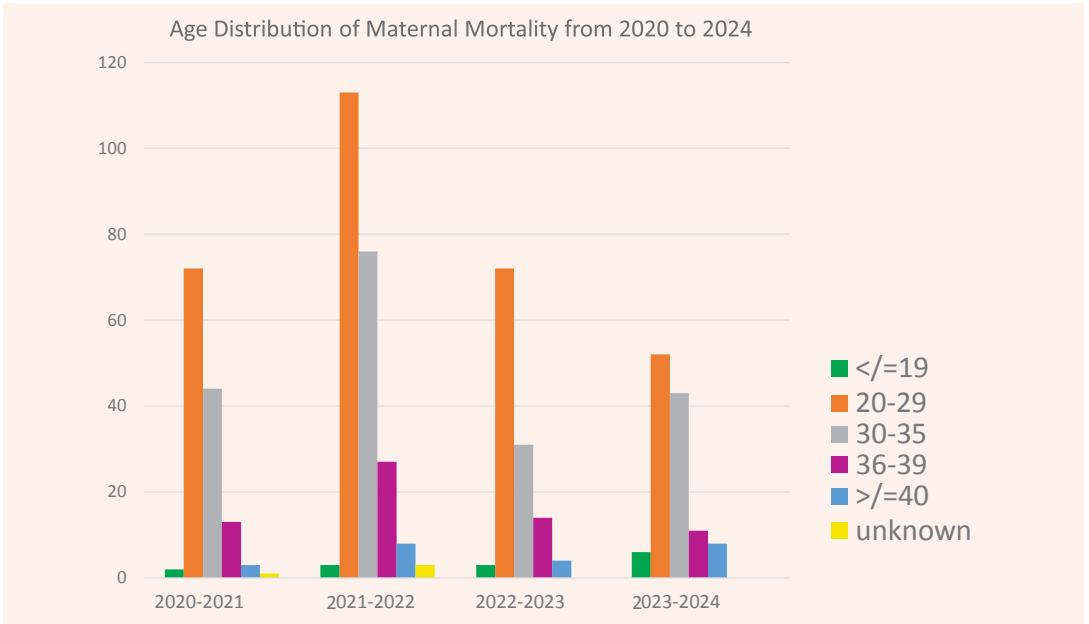
The major killer was COVID which took 109 women in 21-22 assessment year which happened due to Second wave and Delta variant. Our MMR rose to an all-time high of 54.5 same year. Hemorrhage has always topped the list since 2004 when CRMD started. Respiratory and viral causes have come down thanks to Flu vaccine and timely administration of Oseltamivir. The most disheartening fact in the current assessment period is that Suicide has surpassed all other common causes like Hypertension, Heart disease, AFE, Sepsis etc. We have included a chapter dedicated to suicide in this edition.

Fig. 5 : Suicide cases over last 20 years



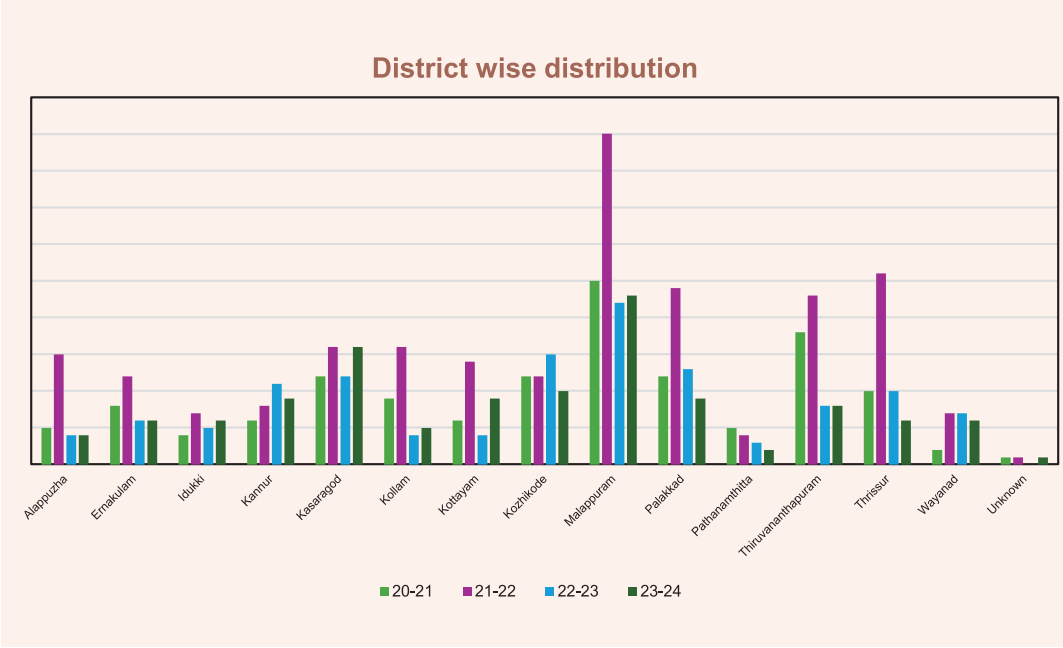
We have analysed 522 maternal deaths over last four years in our quarterly meetings.

Fig. 6 : Age of the deceased mothers



From Fig: 6, it is clear that maximum deaths have occurred in the age group 20-29 years which is the commonest age group of our delivering mothers. Same trend has been seen in previous years too. It is disheartening to see that a significant proportion of mothers above 40 who conceive succumb due to medical co morbidities. Most of these are IVF pregnancies. These elderly women should be medically fit before embarking on infertility treatment.

Fig. 7 : District wise distribution



District wise distribution of deaths helps us to know which is the vulnerable area and then to dissipate information to prevent the preventable maternal deaths (PPMD). Going through the district data , it can be seen that maximum deaths are happening in the district of Malappuram followed by Kasaragod. This is because Malappuram leads in population with 47,85,193 as on July 1st, 2023. Kozhikode and Palakkad used to be ahead of Malappuram in maternal deaths in our 2004- 05 period which got reversed during subsequent years due to increased birth rate of Malappuram (18.44 per 1000 population) vs 13.39 in Kozhikode and 10.77 in Palakkad(2021 data). From the figure it can also be seen that Kannur, Kozhikode and Wayanad remained rather status quo during Covid time.

We have included the detailed data of hemorrhage, hypertension, sepsis, amniotic fluid embolism etc in the corresponding chapters . The data on heart diseases, liver disorders, pulmonary embolism etc are presented here. We had 42 mothers dying due to heart disease during the assessment period. Going through the profile of heart disease cases it is seen that we may not be able to prevent it further but timely diagnosis and referral can definitely reduce mortality.

Table 4 : Heart diseases leading to maternal deaths

Type of heart disease	20/21	21/22	22/23	23/24
Rheumatic heart disease	2	2	3	2
Primary Pulmonary artery hypertension			4	1
Peripartum cardiomyopathy	2	1	5	2
Dissection of aorta	3		1	1
Myocarditis		1	1	2
VSD	3			1
Coronary artery disease	1	1		1
WPW Syndrome	1			
Atrial flutter	1			
Total	13	5	14	10

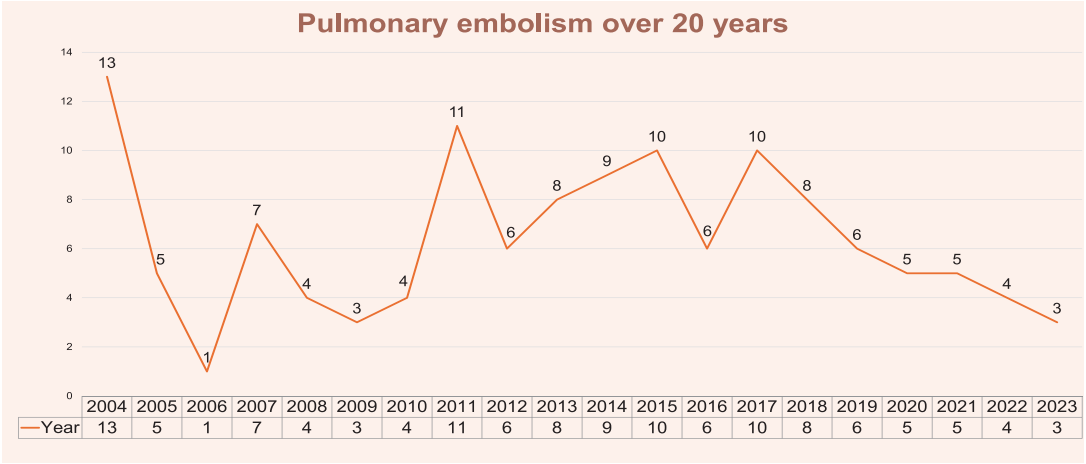
There were 14 cases of liver diseases out of which 8 were due to Acute fatty liver of pregnancy. Though LFT is not a part of routine antenatal investigations, at least those women presenting with fatiguability and vomiting in third trimester should have LFT checked.

Table 5 : Liver diseases

Type of liver disease	20/21	21/22	22/23	23/24
AFLP	2	-	4	2
Viral Hepatitis		-	1	2
Others like chronic liver disease, liver failure etc	1	-	2	
Total	3	0	7	4

Unlike heart disease and liver disorders, pulmonary embolism is mostly preventable and obstetrician has a definite role. It is heartening to see that deaths due to pulmonary embolism has come down significantly in recent years; but the sad fact is that there were avoidable factors in most of the deaths. Though heparin is given in few of the analysed cases, the timing of heparin is very crucial. Once the thrombotic process has started, giving heparin in prophylactic dose will not come for rescue. *(Refer previous edition for timing and indications)*.

Fig. 8 : Pul. Embolism – a comparison over last 20 years



	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Year	13	5	1	7	4	3	4	11	6	8	9	10	6	10	8	6	5	5	4	3

Salient points about mothers who died due to thrombo embolism

20/21

1. 24yrs, G1, Missed abortion ,fever & leg pain – on traction
2. 33yrs, G2, FTND 6th day breathlessness
3. 32yrs, G3, Was hospitalized for 10 days before delivery. Diabetic on insulin & hypertensive on LMWH, Elective LSCS, Collapsed next day.
4. 36yrs, G4, GDM, Covid +ve. Emergency CS. 9th day collapsed
5. 40yrs, G1, IVF.preg ,Diabetic on insulin, Covid. Pre eclampsia Emergency CS, heparinised, Died next day.

21/22

1. 32 yrs, 8wks pregnancy Ectopic. Lap resection – Acute PE same day.
2. 46 yrs, 13wks – Medical termination – mifepristone 200mg
3. 26 yrs, FTND – 5th day collapse
4. 29yrs, Prev.CS, Elective CS – Collapse same day. H/o covid 3 months back
5. 31yrs, Vacuum del – Cervical tear, collapsed same day

22/23

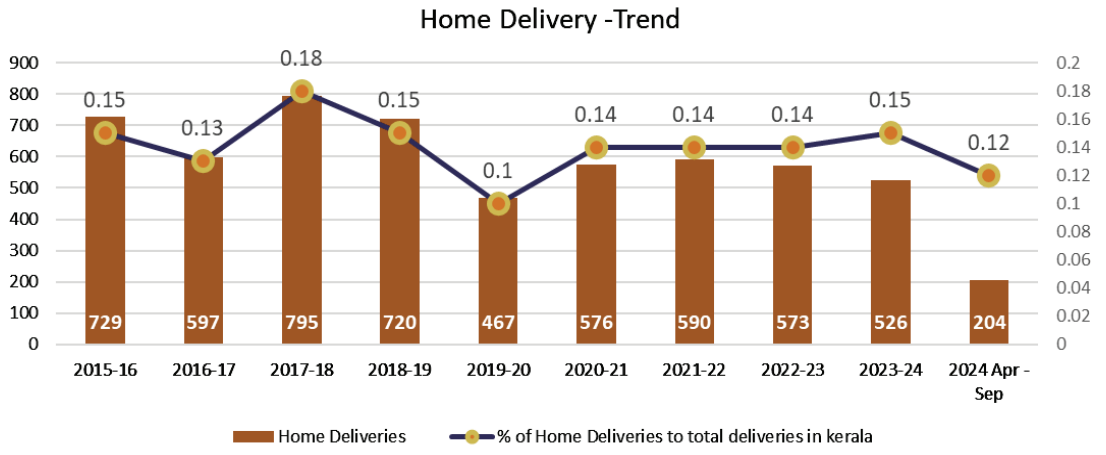
1. 29 yrs, G2 Elective LSCS for twins. Had DVT, Died on the 8th post op day
2. 36 yrs, G3, 16 wks, swelling both legs
3. 24 yrs, G4 A3 Elective CS for unengaged head. Died on 15th day
4. 44 yrs, G1, 34wks, GDM, Hypertension, IVF pregnancy, Twins, Cervical cerclage, Crash cesarean

23/24

1. 34yrs, G4, 30 wks gestation, sudden breathlessness, died on the way to hospital
2. 19yrs, G2A1, 36wks, GDM + Anaemia, Iron transfusion - sudden breathlessness. Emergency CS
3. 37yrs, G2, 37wks, gestational hypertension + hypothyroid, sudden breathlessness. Emergency CS

From this, it is noted that most of them had risk factors in whom heparin was either not given or not timely given. Nine out of 17 cases were Cesarean section (4 Elective). According to KFOG protocol, Cesarean plus one risk factor is an indication for thromboprophylaxis.

Fig. 9 : Home deliveries



Though Kerala boasts about near 100% institutional deliveries, the fact remain that a significant number of deliveries happen at home. These deliveries are attended by untrained people thus increasing the mortality and morbidity. The numbers are coming down in the last couple of years, but that may be a reflection of reducing birth rate of Kerala.

Other relevant data are presented in the respective chapters of this book.

CHAPTER 03

Obstetric Hemorrhage.

K Ambujam

Editor's note:

This chapter on hemorrhage is primarily to highlight the practically important steps and the current concepts we would recommend on the basis of our analysis of maternal deaths in our state. It contains the data for the period 1st April 2020 to 31st March 2024. It shows a paradigm shift in our approach to PPH – Cannula and clamps are recommended when the person conducting delivery feels that there is excessive bleeding, rather than wait for establishing a diagnosis by measuring blood loss. The concept of upper segment and lower segment PPH is brought in and the first step to arrest the bleeding in each is discussed. We discourage the use of condom tamponade when cannula and clamp are available. As a result of these changed strategies we have been able to keep the PPH deaths low. For a more detailed description of the subject, please refer to Why Mothers Die, 3rd edition.

V P Paily

Key Summary Points

- During confidential review, we observed that when obstetric hemorrhage occurred, adequate first aid measures were not taken for immediate arrest of bleeding.
- The importance of AMTSL is not recognised.
- There is no emphasis on immediate arrest of bleeding in the standard recommendations.
- The obstetrician often is not aware of the recent innovations in tackling PPH, they do not seem to be adequately trained.
- Many of the delivery points are not properly equipped even though the obstetrician may be trained.
- Failing to refer properly is another contributing factor leading to death on the way.
- Failing to tackle traumatic PPH at the primary care facility leads to patient bleeding to death before she reaches the higher centre.
- Timely diagnosis of placenta accreta was not made and managing without adequate preparation and planning caused deaths.
- Internal hemorrhage following cesarean section and need for relaparotomy was observed. Ensuring proper technique by securing the angles separately and attaining complete hemostasis at the bladder base and underneath the rectus sheath can avoid a relaparotomy.
- Antepartum hemorrhage, both abruption and major degrees of placenta previa, should be managed in a tertiary care centre with facilities for massive transfusion.

Key Recommendations

1. Women with known risk factors for obstetric hemorrhage should be delivered in centres with facilities for blood transfusion, laboratory work up and surgical procedures.
2. Active management of third stage of labour (AMTSL) must be routinely followed and documented.
3. All women in labour should have an IV line, that too a wide bore one, as PPH is often unpredictable.
4. All labour rooms should have dedicated cervical inspection sets, TVUAC sets, suction cannula sets, and well equipped and maintained PPH box. Sterile absorbent mats with known weights can be used as under pads during delivery. The increase in its weight after delivery will give a more accurate measure of blood loss (one gram weight gain equal to one ml blood loss) than the visual estimation.

5. Immediate measures to arrest the bleeding should be the first step along with prompt resuscitation. The cause of bleeding should be identified. Suction cannula and TVUAC are invaluable first aid tools to arrest the bleeding along with medical management once the bleeding is found to be more than normal.
6. Traumatic PPH should be managed immediately in the same center preferably in the theatre under anesthesia with good light, deep retractors and good assistants.
7. Postpartum patient should be closely monitored for at least 2 hours after delivery. Every 30 minutes, in addition to monitoring pulse and BP, the uterus should be palpated to make sure that it is hard and contracted and in midline and gently pressed down to see if there is any collected blood in the uterus or vagina. Once the patient is stable and has emptied her bladder she may be shifted to the postnatal ward. The same is applicable to patients undergoing cesarean section.
8. When planning to refer to a higher center, properly applied TVUAC clamps, suction cannula or effective packing should be done depending on the type of PPH along with IV fluids, NASG and a proper reference letter. The receiving center should be informed telephonically in advance.
9. Ongoing bleeding can lead to DIC and hence prompt replacement of blood and blood products must be ensured.
10. Decision for surgical management especially for obstetric hysterectomy should be taken timely and not as a last resort.
11. All the steps taken to manage PPH should be systematically documented.
12. All patients managed for PPH should be carefully monitored in High Dependency Unit.
13. In anterior placenta with a previous cesarean scar possibility of placenta previa accreta should be considered and referred to a centre with expertise and facilities.
14. Clinical audit programme should be regularly practiced in each center and positive aspects of management appreciated

Introduction:

Obstetric hemorrhage continues to remain the leading cause of maternal deaths. Out of 522 cases analysed during the last 4 years 60 cases were due to hemorrhage (11.49%). The deaths due to hemorrhage has come down compared to the deaths (17.56%) during the last review period. It was found that post-partum hemorrhage (PPH) was the commonest type of hemorrhage leading to death, atonic being 60%, followed by traumatic 23% and placenta accreta spectrum 11%. Antepartum hemorrhage was contributing to only about

3.33% of the total hemorrhage deaths. The total number of deaths had come down but the contribution of hemorrhage remained on top. This was in spite of improved antenatal care, transfusion facilities and many developments in technology to arrest the bleeding. This forced us to focus on hemorrhage as a cause of maternal deaths in our state and develop strategies to tackle the problem.

Table 1. Incidence of Obstetric hemorrhage in the Analysed cases over the four years

	2020/21	2021;22	2022/23	2023/24	Total
Number of maternal deaths	111	191	112	108	522
Deaths due to hemorrhage	17	18	13	12	60

Table 2. Age wise distribution

AGE	2020 –21	2021 – 22	2022 –23	2023-24	**Total**
Below 19	0	0	0	0	**0**
20 -29	9	8	7	4	**28**
30 -35	4	9	4	6	**23**
36 and above	4	1	2	2	**9**
Total	17	18	13	12	**60**

Table 3. Type of hemorrhage

	2020 -'21	2021 -'22	2022-'23	2023-'24	**Total**
APH	0	0	1	1	**2**
Traumatic	3(R2)	3(R2)	2	6	**14**
Atonic	10	14	8	4	**36**
Placenta accreta	3	1	2	1	**7**
Secondary PPH	1	0	0	0	**1**
Total	17	18	13	12	**60**

R - Rupture

Fig. 1 : Type of Hemorrhage

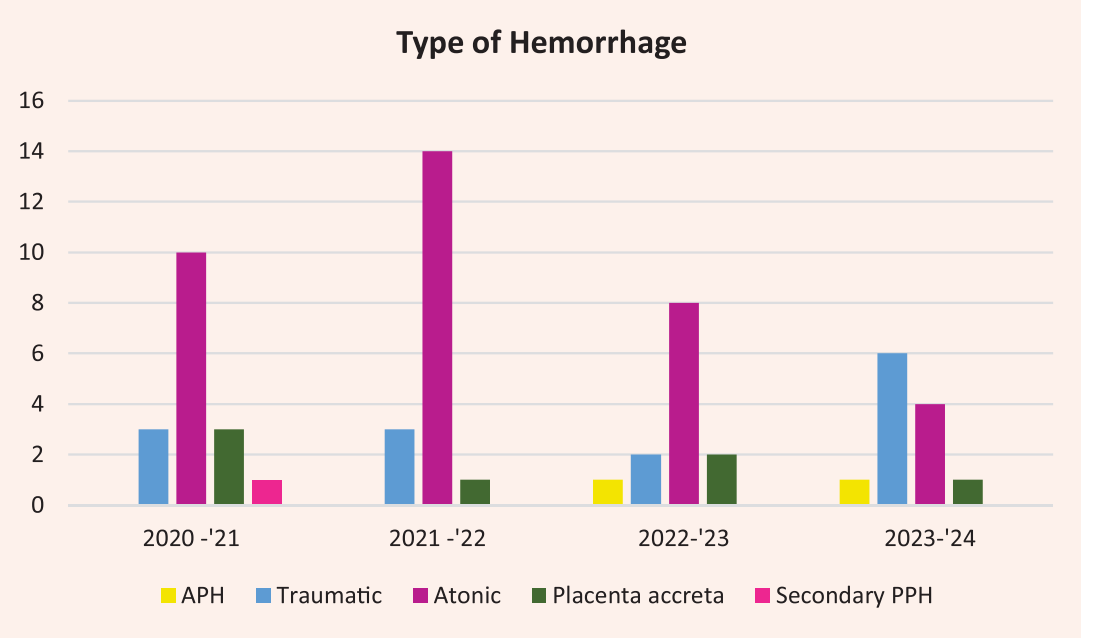


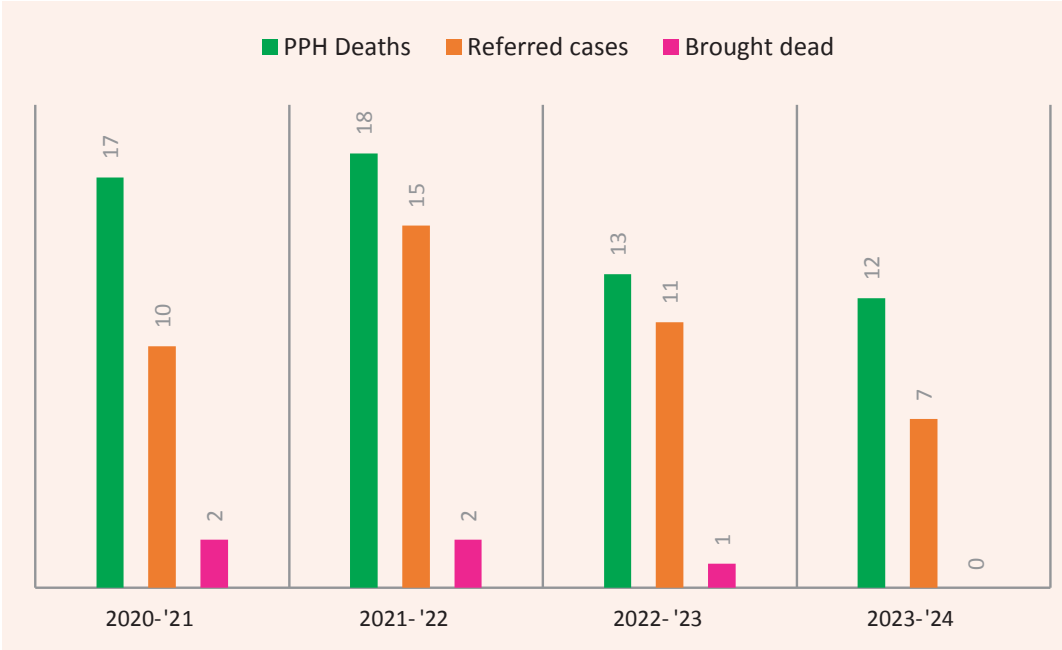
Table 4. Number of hemorrhagic cases referred

Year	PPH Deaths	Referred cases	Brought dead
2020-'21	17	10	2
2021-'22	18	15	2
2022-'23	13	11	1
2023-'24	12	7	0

Table 5. Number of CS and Ob Hyst in hemorrhagic deaths

Year	CS	Ob Hyst	Relap	Total deaths due to hemorrhage
2020-'21	6	9	2	17
2021-'22	6	6	0	18
2022-'23	6	7	2	13
2023-'24	8	6	2	12

Fig. 2 : Number of hemorrhagic cases referred



Active Management of Third Stage of Labour (AMTSL)

1. Five units of oxytocin diluted to 5 ml with sterile water or saline is given intravenously taking about 5 seconds, at the delivery of the anterior shoulder or within one minute of delivery of the baby.
2. Immediately after the IV drug, 10 units of oxytocin is given intramuscularly. In cases where delivery occurs on the way to hospital, and trained staff nurse not present, oral misoprostol 600mcg can be given as alternative. (WHO).
3. If there is predilection for excess bleeding, e.g. Multiple pregnancy, over distended uterus, prolonged labor etc., another 20 units is added to 500 ml of normal saline and given slowly at the rate of 4 ml per minute or 60 drops per minute.
4. Wait for about 30 to 60 seconds for cord clamping and cutting if the fetus is in good condition.
5. Try to deliver the placenta once the contracted uterus is felt in the suprapubic region without waiting for the conventional signs of placental separation. Once

the uterus is well contracted, push the contracted uterus upwards and apply traction on the umbilical cord (controlled cord traction - CCT). If the placenta is not yielding check whether it is trapped by the cervix in which case it may be delivered by traction on the edge of the placenta. If there is no bleeding one may wait up to 30 minutes trying to deliver the placenta every 5 minutes, always following the method of traction counter traction mentioned above. If still not delivered consider manual removal of placenta under anesthesia.

6. **Carbetocin**, a long acting synthetic octapeptide analogue of oxytocin, 100 mcg IV bolus may also be used as AMTSL, can be given IM also It has the advantage that stringent thermal control is not required for storage and multiple injections are not required. But in our experience, its superiority over the above mentioned AMTSL using oxytocin is still to be established. ***Contraindications are hepatic or renal disease, serious cardiovascular disorders and epilepsy.***

Diagnosing PPH

The diagnosis is made keeping in mind the following principles:

1. Traumatic bleeding – Profuse bleeding in spite of a contracted uterus usually starting as soon as the fetus is out rather than after the delivery of the placenta.
2. Atonic – If the whole uterus is flabby
3. Lower segment PPH – If the upper segment is contracted but the lower segment is flabby. In some situations, the atonic and lower segment PPH coexist.

Management strategies varied depending on the differential diagnosis. The first reflex action of the obstetrician should be to arrest the bleeding. The moment excessive bleeding is noticed an aggressive approach is required to tackle PPH rather than waiting for confirmation of 500 ml or more of bleeding to establish a diagnosis of PPH. The person on the spot has to initiate these steps, be it a doctor, nurse or even Auxiliary Nurse Midwife (ANM). So, the doctors, nurses and midwives should be empowered to initiate the first aid measures. The senior person on the spot should take over the control and call for additional help because more manpower may be required. Bimanual compression may be applied first and meanwhile get the medical management carried out. A public address system in the form of a code may be very useful to summon help immediately if bleeding is profuse and patient collapses.

Traumatic PPH

Trauma may be anywhere in the birth canal but the first aid for all of them is local compression and then definitive steps to stop the bleeding. If any pumping vessel is identified, it may be clamped or tied. For local compression sterile mops rather than roller gauze is preferred.

Traumatic PPH is best tackled in the theatre under anaesthesia, with good light, deep retractors and good assistants preferably from the same centre. Tight packing of the vagina after suturing will help to prevent further bleeding. In intractable traumatic PPH there is a place for internal iliac artery ligation followed by suturing the vaginal lacerations. If cervical tear is seen extending upwards, an immediate laparotomy is warranted to identify the tear and suture under vision. Obstetric hysterectomy may be considered as a life saving measure. A broad ligament hematoma if identified should be evacuated and bleeding vessel ligated after identifying the ureter.

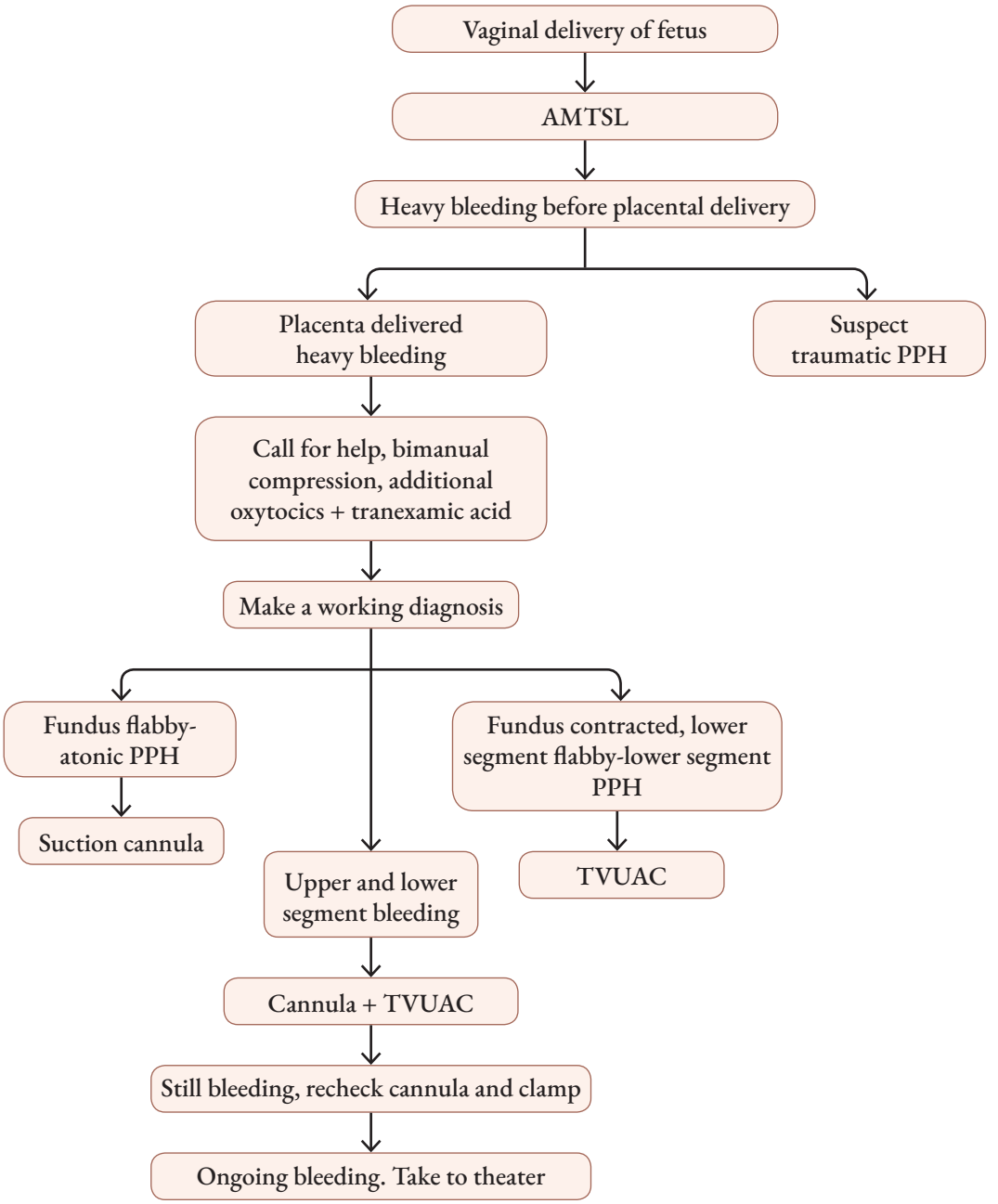
- *After instrumental delivery, thorough inspection of the genital tract is mandatory to rule out cervical tear and vaginal lacerations.*
- In transporting a patient with traumatic PPH, tight and effective packing along with IV fluids and NASG will help her to reach the higher centre in a better state.

Atonic PPH

Unfortunately, atonicity of the uterus still continues to be a major cause of PPH. The hard contracted uterus may not be palpable in the suprapubic area. Sometimes the uterine atonicity may be intermittent. For either of these, cannula inserted into the uterine cavity and application of suction is the first aid as well as definitive treatment.

During confidential review, we observed that when postpartum hemorrhage occurred, adequate first aid measures were not taken for immediate arrest of bleeding. The standard protocols promoted by experts and learned bodies do not emphasize enough the need for immediate arrest of bleeding. So, we developed a new protocol to follow when excess bleeding is noted rather than waiting to establish the diagnosis of PPH.

Fig. 3 - Flowchart 1: Protocol for managing PPH



(AMTSL: active management of third stage of labor; PPH: postpartum hemorrhage; TVUAC: transvaginal uterine artery clamp)

Medical Management

- Methergine 0.2 mgm IM may be repeated every 30 minutes up to 5 doses if there is no contraindication for Methergine.
- Oxytocin infusion 20 units in 500ml of normal saline 60-90 drops /minute.
- Carboprost 0.25 mg IM may be repeated every 15 minutes up to a maximum of 8 doses after ruling out asthma.
- Rectal Misoprost 600 ugm may also be added and is useful while transferring the patient to another centre.
- Tranexamic acid (TXA) should be administered at a fixed dose of 1gm in 10 ml(100mgm/ml) IV at 1ml per minute (administered over 10 minutes) with a second dose of 1gm IV if bleeding continues after 30 minutes. It is recommended that TXA should preferably be administered within 3 hours of onset of bleeding.
- Ensure that the bladder is catheterized by Foley catheter.

Suction device as a means of stopping the bleeding from atonic uterus.

Principle:

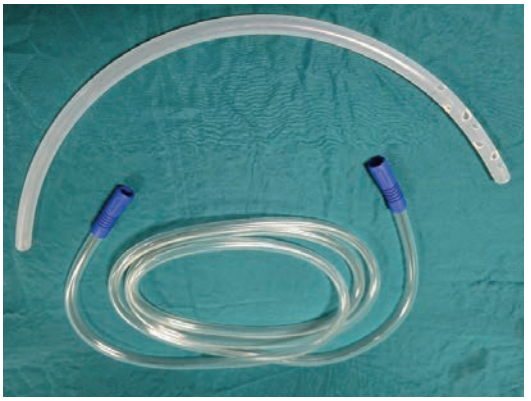
The negative suction results in aspiration of all the blood collected in the uterine cavity. At the same time, the uterine walls will collapse on to the cannula making the muscular walls rigid. Blood vessels passing through the myometrium will get compressed by the rigid myometrium and the bleeding will stop

To apply suction device, retract the vaginal walls using vaginal wall retractors and hold the anterior lip of the cervix. The cannula is introduced into the uterine cavity through the vagina to reach the fundus and is connected to a suction apparatus and a negative pressure of 600mm of Hg is created. Ultrasound scan may be used to confirm the placement of cannula upto the fundus. Make sure that all the holes on the cannula are inside the uterine cavity. Suction is maintained for about 30 minutes. The cannula can be kept in position even up to 24 hours if recurrence of bleeding is expected. It can also be used in atonic uterus during or following cesarean section. But suction device should be avoided in the presence of DIC because the myometrium fails to contract and the whole blood collecting inside the uterus will be continuously sucked by negative pressure resulting in more blood loss.

Fig. 4 : Samartha Ram's cannula

Fig. 5 : Dr Panicker's PPH Suction Haemostatic Cannula

Fig. 6 : Flexi cath devised by KFOG, under trial



Cannula should not be removed immediately after stopping negative pressure. The soft tissues and decidua get sucked into the holes of the cannula making it difficult to remove it, but it can be removed with mild rotational movements along with traction, after suction is cut off for few minutes.

Transvaginal uterine artery clamps (TVUAC).

These clamps were developed by Dr. V P Paily for occluding the uterine arteries in the

Fig. 7 : TVUAC - L clamp

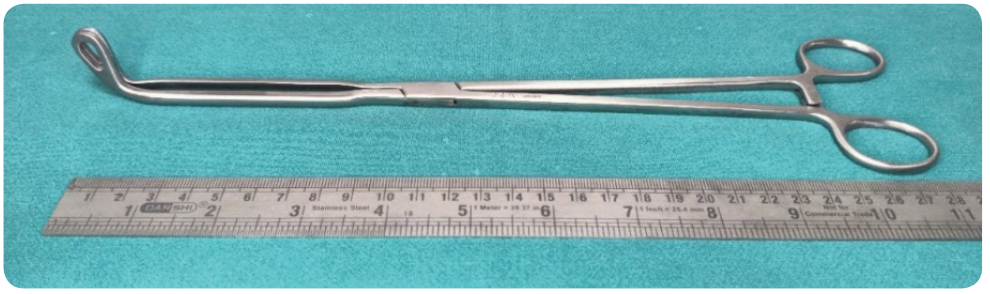


Fig. 8 : The T clamp - longer version for vaginal use.

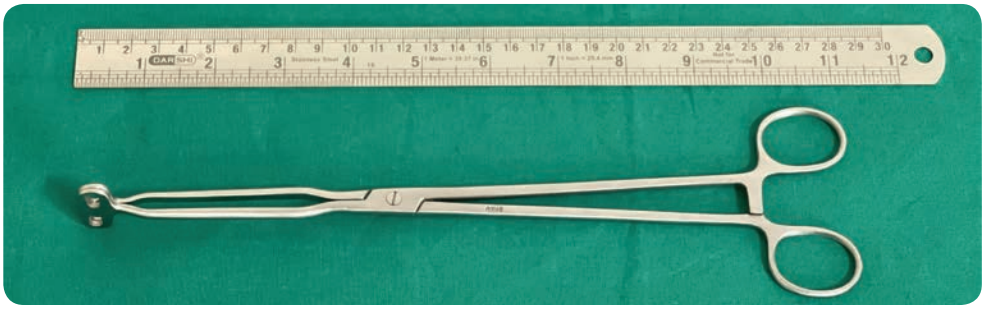
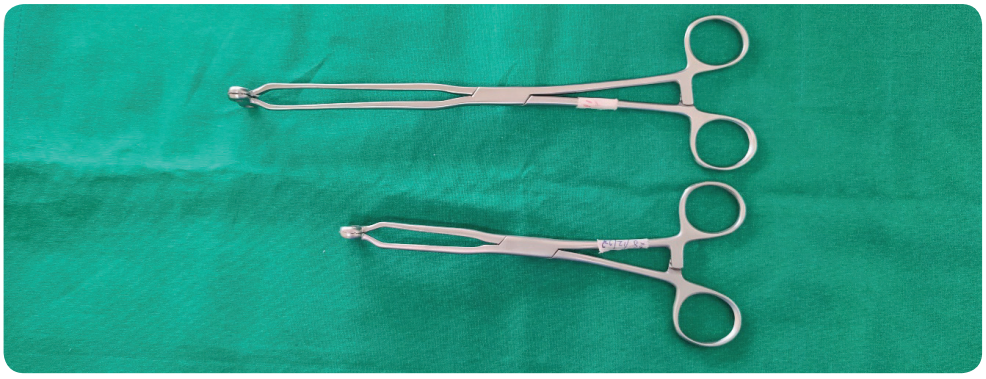


Fig. 9 : The two sizes of T clamp - Shorter version for abdominal use



event of PPH. It is a modified sponge holder specially designed to occlude the uterine vessels transvaginally without the need for anaesthesia.

The original clamp developed by Dr.V.P.Paily had an L-shaped distal end and a right-angled bend about 3cm from the tip. There is 5 mm gap at the shaft level to accommodate the cervix. To apply the clamp, the vaginal walls are retracted with special flat retractors and sponge holders are used to pull the cervix down. It is important to make sure that the clamps are applied at 3'o clock and 9'o clock positions. It is possible that the ureters may get compressed but that is of no consequence as the ureter will be compressed with the surrounding tissues and no damage to the ureter is likely to occur.

Recently TVUAC has been modified from the shape of the L clamp to that of a T clamp, which is easier to introduce and apply. This can be applied transvaginally. The shorter version can be used transabdominally during a cesarean section.

The application is easier regarding the T clamp compared to the L clamp because of the smaller size but one has to make sure that during transvaginal application it is applied at 3'o clock and 9'o clock position so that the vessel will not be missed. During trans abdominal application the vessels are directly seen and clamped. During vaginal application, the operator catches the anterior and posterior lips of the cervix using sponge holders and introduces the clamps with one blade going into the cervical canal and the other at the lateral fornix of the vagina at the 3'o clock and 9'o clock positions. Once the resistance of the fornix is felt, slight upward pressure on the fornix with the clamp in the open position will allow the tip of the clamp to advance by about 1.5 cm to reach up to the level of isthmus where the uterine artery joins the side of the uterus and ascends up. It is then clamped and kept in position for about 30 to 45 minutes. After 30 minutes just release the clamps and watch for bleeding before removing it. The clamp is very effective in lower segment PPH where the upper segment is contracted and lower segment is ballooned out. The clamp may also be used while referring a patient to a higher centre.

There is a theoretical concern of occluding the ureters because of the anatomical proximity but blocking the ureters for a few minutes does not cause any harm. The urine output can be monitored by a Foley catheter, which is usually inserted in PPH. Because of the gap between the blades, compression damage of the oedematous tissues will be minimized. TVUAC can be left overnight with urine output monitoring and ultrasound scan to rule out hydroureteronephrosis.

Both suction cannula and the TVUAC can be used simultaneously. Both these innovations have been found to be very effective first aid measures to arrest the bleeding and may obviate the need for surgical management. Condom tamponade is no longer recommended as it is less effective and more time consuming.

Lower segment atonicity:

This is found to be much more common recently, after induction of labour with prostaglandins has become common practice. Prolongation of second stage may also contribute to lower segment PPH. The upper segment on palpation will be contracted but the lower segment will be flabby and ballooned out. The ideal first aid measure is to apply a TVUAC clamp. Often the atonicity of the upper and lower segments may coexist and the use of the cannula and clamp can act as complementary steps.

Surgical Management

Decision for surgical management should be taken timely. With the use of suction cannula and TVUAC, the need for surgical management has come down drastically.

Stepwise devascularization.

Surgical steps to arrest bleeding from atonic uterus should start with stepwise devascularization, which includes bilateral uterine artery ligation and bilateral ligation of anastomosing branch of ovarian artery close to the cornua. During pregnancy uteroplacental perfusion comes mostly from the uterine arteries. In 4% of cases anastomotic branches of ovarian vessels supply most of the placenta's perfusion. During cesarean delivery we may more readily take up devascularization steps in PPH as the abdomen is open.

For uterine artery ligation, the uterus is exteriorized, bladder is pushed down, the suture (No 1 Polyglycolic acid) is passed from front to back about 2 cm medial to the edge of the isthmus. The suture is then brought from back to the front lateral to the uterine vessels but medial to round ligament. Transillumination will help to avoid accidental injury to the vessels when needle is passed. One should take care to avoid injury to the bowels posteriorly.

For ligating the anastomosing branch of ovarian vessels, the horizontal terminal branches of ovarian artery in the broad ligament and the ascending terminal part of uterine artery are secured close to the cornua without damaging the tube.

Compression sutures

The concept of Brace stitch was introduced by B Lynch as compression sutures in an atonic uterus. Since then, there were many modifications as the original Brace stitch was too cumbersome and time consuming. A simple and easy modification is by Hayman, Arulkumaran and Steer. Using a No 1 delayed absorbable suture taken at the level of the isthmus 2 cm medial to the lateral border of the uterus from front to back, made to run over the fundus medial to the insertion of the tubes. Once the suture is taken on the other side, the assistant compresses the uterus and the surgeon ties the suture over the fundus making sure that it is really tight. The sutures help to keep the uterine body compressed anteroposteriorly, thus occluding the arcuate arteries.

The place of internal iliac artery ligation in atonic PPH has come down, after these two approaches became popular. Internal iliac artery ligation is useful in broad ligament hematoma.

Obstetric Hysterectomy

Obstetric hysterectomy may be resorted to in life saving situations. It should be subtotal hysterectomy unless the bleeding is from the cervix as happens in placenta previa or cervical tears. To save time, adopt the "**clamp, cut and drop**" technique till the uterine vessels is clamped. Pedicles should be double ligated and avoid raw areas in between.

PPH following cesarean delivery:

About one-third of PPH deaths were after cesarean delivery. AMTSL has to be followed here also. The steps described for atonicity and trauma are applicable here as well. At cesarean section a quick method of promptly arresting the bleeding is by clamping the uterine vessels on both sides using the T clamps or even a Green Armytage clamp without waiting for placental separation. These clamps can be applied without dissecting and pushing the bladder down. Since they are atraumatic, no harm is done even if the bladder or even ureter is included in the clamp.

Most of the deaths due to post cesarean hemorrhage were due to intraperitoneal bleeding. So, the cesarean wound closure was modified by securing the angles separately with box stitches. If there is an extension of incision, exteriorize the uterus, look for any torn vessels and secure it separately. Before closing the abdominal wound inspect the bladder base and posterior surface of the rectus muscle to ensure that no bleeders are missed. In cases

where concurrent sterilization is done., preferably do it after replacing the uterus inside the abdominal cavity, also recheck sterilization stumps before peritoneal closure.

Please refer Why mothers Die 3rd Edition for **Antepartum haemorrhage.**

Placenta Accreta Spectrum (PAS)

With the high cesarean section rates, the incidence of PAS is increasing. Pregnancy on a cesarean scar and PAS are a continuum. So if a scar pregnancy is diagnosed in early weeks, counselling for management should consider that if left alone it is likely to become a placenta accreta spectrum. Hence all previous scarred uterus should have a detailed first trimester scan to rule out scar site implantation, Ultrasound with Doppler is good enough to make a diagnosis of placenta accreta and is mandatory by 28 - 32 weeks. MRI may be considered complementary, especially in posterior placenta accreta.

The major new development in the management of PAS was the atraumatic aorta clamp devised by Dr VP Paily. It is described in detail in the chapter on PAS (3rd edition) . The training for safe management of PAS should be given to obstetricians in all major delivery points.

Conclusions

A paradigm shift is required in the approach to PPH to prevent it from progressing to maternal death. This needs radical changes in our approach to its prevention, recognition, and management. Active management of third stage of labour is the primary preventive step but it needs standardization. The most important change required is to start acting when the first signs of excess bleeding is noticed. The suction cannula and transvaginal uterine artery clamp are the first aids for achieving this goal. But timely administration of these methods by the person on the spot is the key to success and hence the importance of training not only doctors but also labour room nurses. We have stopped promoting Condom tamponade and Bakri balloon. All delivery points should have the cannula and clamp and train the entire workforce to apply these devices.

PLACENTA ACCRETA SPECTRUM

Dr Beenakumari. R, Dr Aswathkumar

Early Diagnosis

Most cases of placenta accreta spectrum (PAS) are associated with previous cesarean section. Cesarean Scar Pregnancy, especially the endogenous type, has the potential to develop as PAS. Early diagnosis of cesarean scar pregnancy can be made by the first trimester USG using 5-12 Mhz probe by locating the pregnancy at the previous CS scar & measuring residual myometrial thickness. The residual myometrial thickness of <2mm has high chance of subsequent development of PAS.

Timely management of cesarean scar pregnancy with methotrexate and surgery can prevent the development of PAS. Methotrexate can be given systemically for smaller lesions and locally for lesions > 3cm followed by suction evacuation under USG guidance or by excision of the lesion either by laparoscopy/ laparotomy.

Uterine Conservation in PAS

Recent advances in surgical and parasurgical techniques have aided in the development of fertility sparing uterine conservation procedures. These include Triple-P procedure for placental implantation site resection, uterine artery & internal iliac artery ligation and two step procedures.

Up to grade 3A patients, according to FIGO classification, are selected for uterus conservation surgery. After putting midline vertical incision on abdominal wall, a transverse incision is made on the uterus at the upper margin of placenta. The identification of the extent of placenta is made by intra operative USG, MRI and 3D reconstruction. After the delivery of the baby, Paily's Aorta clamp is applied. Bladder dissection is done carefully. The lower limit of placenta is identified by palpation. Another transverse incision is made below the level of adherent placenta and the portion of lower uterine segment along with the adherent placenta is removed. Uterine incision is approximated. Uterine artery / internal iliac artery ligation is done and later aorta clamp is removed.

CHAPTER 04

Hypertension as a cause of maternal death in Kerala

P K Sekharan; Jyoti Ramesh Chandran; Radhamony K; Lakshmi S; Vinayachandran S; V K Chellamma

Editor's note:

It is gratifying to note that we are making some headway towards understanding the pathogenesis of hypertensive disorders of pregnancy. But it is related to only early onset preeclampsia, which constitutes about 30% of the total case load of hypertensive disorders. At least for these cases there is a scope of preventive steps like low dose aspirin. In reality hypertensive disorders remain a significant threat to maternal lives. Prompt diagnosis on the basis of clinical measurement of blood pressure and appropriate control of it remain relevant. There is now general agreement that hypertension has to be treated at lower values (140/90) than was previously taught –(Something we recommended more than 10 years ago). There is no change in the available drugs and alpha dopa the first line antihypertensive in pregnancy is not available freely in our country. Labetalol has more of beta blocker effect which can lead to fetal growth restriction. In other words, clinical vigil and prompt delivery remain the corner stone of hypertensive disorders management.

Dr. V P Paily

Key Summary Points

From 2021 to 2024, the Confidential Review of Maternal Deaths in Kerala by KFOG reported a total of 522 maternal deaths, with 38 (7.27%) attributable to hypertensive disorders of pregnancy. Preeclampsia remains the second leading cause of maternal deaths in Kerala, following obstetric hemorrhage.

1. Eclampsia related deaths : Of the 38 preeclampsia cases, 22 (65%) progressed to eclampsia and resulted in death. These deaths could have been avoided with timely delivery.
2. HELLP Syndrome : 13 deaths were due to HELLP syndrome, which could have been prevented with timely diagnosis and delivery.
3. Cerebral Hemorrhage : Sixteen deaths were due to cerebral hemorrhage, highlighting the critical need for prompt control of high blood pressure

Key Recommendations:

- **Timely Delivery:** Ensuring timely delivery for women diagnosed with preeclampsia can significantly reduce the risk of progression to eclampsia and related complications.
- **Early Diagnosis and Management:** Early identification and management of HELLP syndrome are crucial to prevent maternal deaths. This requires improved diagnostic protocols and rapid intervention.
- **Blood Pressure Control:** Prompt and effective control of high blood pressure in pregnant women is essential to prevent complications such as cerebral hemorrhage. This includes regular monitoring and appropriate treatment regimens. Most common cause of death in women with preeclampsia is cerebral hemorrhage.
- **First trimester preeclampsia screening** could be offered to pregnant women so that the incidence of early onset preeclampsia could be reduced using low dose aspirin in screen positive cases.
- **The ratio of sFlt-1/PlGF** will predict progression of the disease in suspected and diagnosed cases of preeclampsia so that decision for timely delivery is taken to prevent complications.

Introduction

Preeclampsia is a progressive multisystem disorder affecting 5-7% of pregnant women, making it a leading cause of maternal and perinatal morbidity and mortality. The medical costs of managing preeclampsia are significantly high due to increased hospital care, higher

rates of cesarean sections, and the need for neonatal care resulting from prematurity and foetal growth restriction.

The exact cellular and molecular mechanisms behind preeclampsia remain unclear. However, it is generally considered a two-stage process. The first stage involves impaired uteroplacental perfusion due to defective trophoblastic invasion of the spiral arterioles. The second stage entails generalized endothelial damage and dysfunction, leading to systemic organ failures.

Recent research has highlighted the significant role of angiogenic biomarkers in the pathogenesis of preeclampsia. These biomarkers have shown promise in predicting the progression of the disease, which could assist in determining the optimal timing of delivery to prevent maternal and perinatal morbidity and mortality.

Preeclampsia is categorized based on the timing of onset: early-onset preeclampsia occurs before 34 weeks of gestation, while late-onset preeclampsia develops at or after 34 weeks. Early-onset preeclampsia can be predicted using the FMF algorithm, which has a 90% detection rate and a 10% false positive rate. More than 60% of early-onset cases can be prevented with low-dose aspirin started before 16 weeks of gestation. However, late-onset preeclampsia, which accounts for nearly 70% of all cases, cannot be predicted by first trimester screening and is not preventable with low-dose aspirin.

Table 1 : Deaths due to Hypertension

	2020/21	2021/22	2022/23	2023/24	Total
Total deaths analysed	111	191	112	108	522
Deaths due to Hypertensive diseases	7	6	13	12	38

Table 2 : Types of hypertensive diseases and complications

	20/21	21/22	22/23	23/24	Total
Ch. Hypertension		2	2	1	05
Eclampsia - AP	3	3	7	3	16
Eclampsia -PP	2	1	1	2	06
Cerebral hemorrhage	2	1	7	6	16
HELLP	4		6	3	13
Hepatic hematoma/rupture	1				1

AP – Antepartum PP – Postpartum

Numbers will not tally as same patient may have different complications

Table 3. Period of gestation when Hypertension was detected

	20/21	21/22	22/23	23/24	Total
Before 34 wks	4	4	6	10	24
34 wks and above	3	2	7	2	14

An Update on Preeclampsia

Diagnostic Criteria

Studies have shown that traditional diagnostic criteria for preeclampsia lacked both specificity and sensitivity, especially for predicting adverse outcomes in pregnancy. Previously, the presence of proteinuria alongside hypertension was required for a diagnosis, which often delayed treatment and resulted in complications. In 2013, the American College of Obstetricians and Gynaecologists (ACOG) revised their diagnostic criteria to include women with hypertension and end-organ damage (affecting the kidneys, brain, liver, or haematological system), even in the absence of proteinuria[1].

The International Society for the Study of Hypertension in Pregnancy (ISSHP) also updated their criteria in 2021, agreeing that proteinuria is not essential for diagnosing preeclampsia. They included angiogenic imbalance as evidence of uteroplacental dysfunction.

Revised Diagnostic Criteria for Preeclampsia: ISSHP 2021[2]

New-Onset Hypertension: Systolic BP ≥ 140 mm Hg and/or diastolic BP ≥ 90 mm Hg at ≥ 20 weeks of gestation, accompanied by one or more of the following:

1. Proteinuria
2. Other Maternal End-Organ Dysfunction:
    - Neurological Complications: Eclampsia, altered mental status, blindness, stroke, clonus, severe headaches, or persistent visual scotomata.
    - Pulmonary Oedema
    - Haematological Complications: Platelet count < 150,000/μL, disseminated intravascular coagulation (DIC), haemolysis.
    - Acute Kidney Injury (AKI): Creatinine ≥ 90 μmol/L.
    - Liver Involvement: Elevated transaminases (e.g., ALT or AST > 40 IU/L) with or without right upper quadrant or epigastric abdominal pain.

3. Uteroplacental dysfunction
    - Placental abruption.
    - Angiogenic imbalance.
    - Fetal growth restriction.
    - Abnormal umbilical artery Doppler waveform analysis.
    - Intrauterine foetal death.

Pathophysiology

In normal pregnancy there is invasion of the spiral arteries up to inner third of the myometrium and spiral arteries loose most of their endothelium and muscle fibers making them insensitive to vasoactive agents. In women destined to develop preeclampsia, trophoblastic invasion is shallow resulting in placental ischemia leading to oxidative stress with release of anti-angiogenic factors.

Preeclampsia can be considered as a two-stage disease, a preclinical phase in first trimester characterised by abnormal placentation leading to placental hypoxia and oxidative stress with release of abnormal levels angiogenic factors resulting in the symptomatic phase beyond 20weeks of gestation characterised by maternal syndrome of hypertension and multiorgan dysfunction. The circulating levels of antiangiogenic factor, soluble fms-like tyrosine kinase-1 (sFlt-1) is markedly elevated in preeclampsia and the angiogenic factor, Placental Growth Factor, (PlGF) is reduced[3]. The high circulating levels of sFlt-1leads to maternal endothelial dysfunction and the clinical syndrome of preeclampsia.

Biomarkers in Preeclampsia

Mammalian placentation requires extensive angiogenesis to establish a vascular network for the supply of oxygen and nutrients to the foetus. Both proangiogenic (PLGF & VEGF) and antiangiogenic factors (sFlt-1, soluble endoglin) are released by the developing placenta and the balance between these two is essential for normal placental development and function. sFlt-1 is an antiangiogenic protein produced by the placenta triggered by ischemia. This inhibits the proangiogenic activity of PlGF & VEGF causing endothelial dysfunction.

Angiogenic Biomarkers in Clinical Use

Placental Growth Factor-PlGF

Maternal PlGF level increases initially to reach the peak level by mid pregnancy and gradually decreases towards term. Women who develop PE, there is a premature fall in the level of PlGF and is detectable before the onset of symptoms.

A low PlGF level of ≤100pg/ml was associated with adverse maternal outcome and predicts PE with 76% sensitivity requiring delivery within 2 weeks.

NICE recommends triage PlGF test in suspected PE between 20-35 weeks to diagnose preterm preeclampsia in women with suspected preeclampsia.

Table 4 : Triage PlGF test -NICE[4].

Result	Classification	Interpretation
PlGF < 12pg/ml	Test positive -highly abnormal	Severe placental dysfunction, increased risk of preterm birth
PlGF 12pg/ml to 99pg/ml	Test positive-abnormal	Abnormal, increased risk of preterm birth
PlGF 100 pg/ml or more	Test Negative -Normal	Suggestive of patients without placental dysfunction unlikely to have complication within 2 weeks

The PlGF level of 150 pg/ml at 34 weeks rule out preeclampsia for the next 4 weeks

sFlt-1 / PlGF ratio

In PE, sFlt-1 increases and PlGF decreases. This ratio has a better predictive value than single biomarkers and was approved by US FDA for use in singleton pregnancies between 23 to 34+6 weeks to predict progression of disease.

sFlt-1/PlGF ratio-implication for clinical practice[5].

- sFlt-1/PlGF ratio <38 women most likely will not develop PE for at least one week.
- sFlt-1/PlGF ratio >85 early-onset PE
- sFlt-1/PlGF ratio >110 late-onset PE
- These women are likely to have preeclampsia or placental insufficiency.
- These women who do not have definite diagnosis of PE but are highly likely to develop PE within 4 weeks
- High levels of sFlt-1/PlGF ratio (>655 in early onset PE and >201 in late onset PE) need delivery within 48 hours.
- In early onset PE give antenatal steroids to accelerate lung maturity.
- sFlt-1/PlGF ratio 38-85 (early-onset PE) 38-110 (late-onset PE), these women may be at risk of developing PE within 4 weeks and should be monitored closely. Consider repeat sFlt-1/PlGF ratio testing in 1-2 weeks in early-onset PE. Consider induction of labour and delivery in women with sFlt-1/PlGF ratio of 38-110 in late-onset PE

First Trimester Prediction and Prevention of Preeclampsia

Using the Foetal Medicine Foundation (FMF) algorithm, it is possible to predict 90% of early-onset preeclampsia with a false positive rate of 10%, while the detection rate for late-onset preeclampsia is only 47%. The FMF algorithm combines maternal factors, uterine artery pulsatility index (UTPI), mean arterial pressure (MAP), and placental growth factor (PlGF), and it is superior to the risk scoring systems recommended by NICE and ACOG.

For early-onset preeclampsia risk prediction, the FMF software is available online for free. Maternal characteristics and risk factors, along with MAP, UTPI and PlGF, are entered into the software to assess risk. A value greater than 1/100 is considered positive risk for developing Preeclampsia.

First trimester screening for early-onset preeclampsia is done alongside aneuploidy screening at 11-13+6 weeks. The uterine artery pulsatility index can be measured at the time of NT scan, and blood biochemical markers (PlGF) can be sent with markers (free β-hCG and PAPP-A) for aneuploidy screening. Even without PlGF and UTPI, maternal characteristics and MAP provide better prediction than risk factors alone.

Women found to be at high risk (1/100 and above) are started on low-dose aspirin (150 mg at night, minimum 100 mg), starting from 12 weeks (not later than 16 weeks) until 36 weeks. Only about 10% of screened pregnant women require low-dose aspirin.

Organizations like ACOG, NICE, ISSHP, and FIGO recommend first-trimester screening for preeclampsia using the FMF algorithm and low-dose aspirin for women with a risk of 1/100 and above.

Late-Onset Preeclampsia: Early-onset preeclampsia accounts for only 20-30% of cases, with the majority developing as late-onset preeclampsia. While the FMF algorithm can predict nearly 80-90% of early-onset PE, its ability to predict late-onset PE is limited. Unfortunately, low-dose aspirin does not prevent late-onset PE, which can be severe and contribute significantly to maternal and perinatal morbidity and mortality.

Hypertension in Pregnancy: Diagnosis of Preeclampsia.

Blood pressure in Pregnancy should be measured using a technique preferably using a validated apparatus. (women sitting with back support, with both feet flat on the floor, arms resting on a table, standard cuff size applied on the upper arm kept at the level of heart). Korotkoff V for diastolic BP. Hypertension should be defined as a systolic BP (sBP) ≥ 140 mmHg and/or dBP ≥ 90 mmHg, based on an average of at least two measurements. BP should be repeated to confirm hypertension. If BP is 160/110 and above, recheck in 10-15 minutes and administer anti hypertensives to bring down BP to a safer level.

Hypertension diagnosed ≥ 20 weeks of gestation should be evaluated for evidence of Preeclampsia.

First Trimester Preeclampsia screening -Fetal Medicine Foundation (FMF) Model[6].

- Maternal Characteristics and Medical History
- Mean Arterial Pressure (MAP): Proper blood pressure measurement taken with two readings from both arms, and the mean of four values used for MAP.
- Uterine Artery Pulsatility Index (UTPI): Ultrasound measurement of the uterine artery pulsatility index from both sides, taking the mean.
- Serum Placental Growth Factor (PlGF): A biochemical angiogenic marker included in calculation of first trimester screening.

Gestational Hypertension

Gestational hypertension is defined by a blood pressure of 140/90 mmHg or higher after 20 weeks of pregnancy, without proteinuria or other organ dysfunction. If angiogenic marker testing is available, normal values can support the diagnosis. Women with gestational hypertension should have weekly visits with laboratory evaluations of proteinuria. In the absence of other evidence of preeclampsia, the diagnosis of gestational hypertension is confirmed.

Preeclampsia:

- De novo hypertension (≥ 140/90 mmHg) occurring after 20 weeks of gestation, with proteinuria and/or other organ dysfunction as per ISSHP criteria.

Superimposed Preeclampsia:

- Development of preeclampsia in women with chronic hypertension, characterized by new-onset proteinuria, other organ dysfunction, or evidence of uteroplacental insufficiency. Approximately 25% of women with chronic hypertension develop superimposed preeclampsia.
- Preeclampsia can develop for the first time during labour (intrapartum) or early postpartum.
- ISSHP does not classify preeclampsia as severe because it can deteriorate rapidly without warning. HELLP syndrome is a serious manifestation of preeclampsia.

- Proteinuria: Once confirmed, proteinuria need not be rechecked
- Twice-weekly testing for platelet count, serum creatinine, AST, and ALT is recommended.
- If available, angiogenic marker testing, particularly the sFlt-1/PlGF ratio, can help prognosticate and decide the timing of delivery.
- Women admitted in labour should have a platelet count done irrespective of previous values.
- Women with preeclampsia should initially be assessed in the hospital. Selected cases may be allowed outpatient care with frequent visits.
- Hypertension in pregnancy should be treated to a targeted diastolic BP of 85 mmHg.
- Non-Severe Hypertension: Can be treated with oral Methyldopa (if available), Labetalol 100 mg two to three times daily or Nifedipine SR 10 mg twice daily.
- Severe Hypertension (BP ≥ 160/110 mmHg): Should be treated with IV Labetalol, IV Hydralazine or oral Nifedipine. The aim is to bring down BP to a safer level of 140/90 mmHg within one hour. Rapidly acting Nifedipine, IV Labetalol and IV Hydralazine start having effects within 10-15 minutes.

Table 5 : Dose titration of antihypertensive therapy for urgent control of hypertension in pregnancy (Magee et al 2020)

	Time 0	Time 30min	Time 60min	Time 90min	Time 120min
Labetalol i/v	20mg	20-40mg	40-80mg	40-80mg	40-80mg
Labetalol i/v infusion 200 mg in 100 ml of normal saline - 1ml /min (2mg/min)					
Nifedipine (o)	10mg	10mg	-	10mg	
Hydralazine i/v	5mg	5mg	5mg	5mg	5mg

Magnesium Sulphate for Impending eclampsia and Eclampsia

-KFOG Regimen:

Loading Dose – 4gm $MgSO_4$ given slowly in about 20 minutes using syringe pump or infusion pump. Also give $MgSO_4$ 2gm deep i/m on each buttock.

Maintenance dose of 1 gm per hour given as infusion –using an infusion pump or syringe pump. Continue during labour and cesarean section. Continued for 24 hours after the last fit or delivery.

Clinical monitoring for toxicity

- Every 30 minutes check heart rate, respiratory rate, tendon reflexes, oxygen saturation and hourly urine output.
- Signs of toxicity- Decreased or absent reflexes, respiratory rate <12/min. O_2 saturation <94%, urine output <30 ml/hour, excessive drowsiness or slurred speech.
- If toxicity is suspected, stop $MgSO_4$ infusion, take blood for estimation of serum magnesium level if available, give calcium gluconate 10 ml of 10% solution slowly in ten minutes.

For foetal neuroprotection when delivery is anticipated before 34 weeks, magnesium sulphate in the same dose can be given except the 4 gm intramuscularly at '0' hour.

Indication for delivery at any gestational age.

- Eclampsia
- Severe intractable headache not relieved by analgesics
- Uncontrolled hypertension despite multidrug therapy
- Progressive thrombocytopenia or platelet count <50,000/ml
- Pulmonary oedema
- Abnormal and rising serum creatinine level
- Abnormal and rising liver enzymes
- Hepatic dysfunction, INR>2, hepatic haematoma/rupture.
- Abruption
- Non reassuring foetal status

Cesarean section in Eclampsia:

- Eclampsia is not an indication for cesarean section.
- As far as possible try to achieve vaginal delivery, avoid prolonged labour.
- If necessary, cesarean section is done after stabilising the woman, control high blood pressure, correct thrombocytopenia and coagulation defect, continue Magnesium sulphate during surgery, use smaller size endotracheal tube because of laryngeal oedema.
- Women with uncomplicated preeclampsia should be offered delivery at 37+weeks.

HELLP syndrome:

- HELLP syndrome is a severe form of pre-eclampsia, characterized by Haemolysis (H), Elevated Liver enzymes (EL), and Low Platelets (LP).
- It typically occurs antepartum between 27- and 37-weeks' gestation; however, 15% to 30% of cases present postpartum.
- Only 80% to 85% of affected individuals present with typical hypertension and proteinuria, making diagnosis challenging.
- New-onset epigastric/upper abdominal pain in the second half of gestation or immediately postpartum should raise suspicion.
- Women may present with nonspecific symptoms like malaise, nausea, vomiting making diagnosis difficult.
- Both maternal and foetal health can deteriorate rapidly if HELLP syndrome is not managed promptly.
- Replacement of blood products as necessary.
- Blood pressure control to prevent severe systolic hypertension.
- Intravenous magnesium sulphate for seizure prophylaxis.
- Dexamethasone for reducing inflammation and improving foetal lung maturity.
- Timely delivery of the foetus and placenta to arrest disease progression.

Postpartum care

- BP to be monitored for 5-7 days postpartum
- Antihypertensive therapy should be continued

- Breast feeding is to be encouraged
- Counselling regarding risk of recurrence
- At 3 months postpartum check BP and ensure lab abnormalities has returned to normal.
- Advice regarding leading a healthy lifestyle as they are at a higher risk of developing cardiovascular disease.

Atypical preeclampsia:

- Preeclampsia appearing before 20 weeks of pregnancy.
- Presence of preeclampsia, eclampsia or HELLP syndrome appearing after 48 hours postpartum.
- Normotensive gestational proteinuria with the presence of symptoms or laboratory signs suggestive of microangiopathy/haemolysis.
- Nonproteinuric gestational hypertension plus the presence of severe hypertension or symptoms or laboratory signs suggestive of microangiopathy/haemolysis

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CHAPTER 05

Amniotic Fluid Embolism

Sareena Gilvaz, Agnes Mathew, Bindu Menon, Neetha George, Sathi Murary.

Editor's note:

Amniotic Fluid Embolism (AFE) continues to be a significant contributor to maternal mortality in our state. In the last decade of reporting (Why Mothers Die 3rd edition), the incidence of AFE had shown a tendency for decline towards 2.9 % whereas it has again climbed to 5.5 % in the recent four years. This is a matter of great concern because during the same period, many cases of AFE saved as Near Misses also were reported from the various district level MDNMSR meetings. Read together, it implies that the incidence of AFE has increased much more than what is reflected in the mortality statistics. This should make us think about the possible contributory factors for such a rise and take preventive steps.

Dr. Sareena's team has given a very comprehensive overview of the problem and has suggested practical approach on the management. While prevention takes top priority, we have to train all categories of obstetric care givers in the methods to save the woman when this grave complication strikes totally unexpectedly. KFOG's training schemes like EmOCALS and its condensed version PPMD and the hospital based ORRT training programme are aimed at tackling this problem. We thank **Dr. Neetha George and Dr. Raji Raj** for leading these projects.

V P Paily

Key Summary points

- The rising trend in the rate of maternal death due to amniotic fluid embolism is a cause for concern.
- Kerala has kept her maternal mortality rate low through the various obstetric initiatives taken by the Kerala Federation of Obstetrics & Gynecology (KFOG) and the efforts taken by her obstetricians to carry forth these programs.
- We are striving to keep down our induction protocols and prevention of hyperstimulation is being stressed upon.
- Early pick up and diagnosis of amniotic fluid embolism and the prompt multidisciplinary approach must be adhered to in every eventuality.
- Equipping all the delivery points of the State with the basic first aid instruments have been our focus through the years and stressing the importance of stabilising the patient before transfer to a higher center has paid dividends.

Key Recommendations by KFOG

1. Respectful maternity care in all labour rooms with proper monitoring.
2. Maintaining the Modified Early Obstetric Warning Score (MEOWS) in all patients especially in those requiring specialized care.
3. Regular training of practicing obstetricians and labour room personnel in BLS and ACLS. provided by KFOG through EmOCALS (Emergency Obstetric Care and Life Support) ORRT (Obstetric Rapid Response Team) PPMD (Prevent the Preventable Maternal Deaths).
4. Regular drills for handling maternal collapse to be conducted in their respective institutions.
5. Proper documentation and maintenance of record and prompt reporting of maternal near-miss and death.
6. Let us not make a habit of writing AFE as a diagnosis when we are clueless in the event of a maternal death. Instead, a postmortem would be a viable option even though it is not the final word in a case of AFE.

   Amniotic fluid embolism (AFE) is often quoted as the most dreaded life-threatening complication seen in women in the late stages of labour or immediate postpartum, presenting with the typical triad of hypoxia, hypotension & DIC often culminating in death.

Incidence

World literature quotes the incidence of AFE as approximately 1 in 20000 deliveries. The KFOG analysis of 522 deaths in the last 4 years from 2020 to 2024 gives an incidence of 30 deaths (5.74% of the total maternal deaths) due to AFE. We also find that the incidence shows an increasing trend over the years.

Table 1 : AFE Age distribution

	20/21	21/22	22/23	23/24	Total
19 & below	1	nil	nil	nil	**01**
20 -29	6	4	7	1	**18**
30 -35	1	3	3	2	**09**
36 and above	nil	1	nil	1	**02**
Total	**8**	**8**	**10**	**4**	**30**

Table 2 : Method of induction

	20/21	21/22	22/23	23/24	Total
Misoprostol + oxytocin	3	2	4	-	9
Foley + oxytocin	3	-	3	2	8
oxytocin	-	-	1	-	1
No induction	2	5	2	2	11
Unknown		1			1
Total	**8**	**8**	**10**	**4**	**30**

Table 3 : Mode of Delivery

	20/21	21/22	22/23	23/24	Total
Normal vaginal	1	1	2	2	**06**
Vacuum/ forceps	3	1	1	-	**05**
LSCS	2	4	3	1	**10**
Perimortem CS	2	nil	3	1	**06**
Undelivered	nil	1	1	nil	**02**
Unknown		**1**			**01**
Total AFE	**8**	**8**	**10**	**4**	**30**

Pathophysiology

This syndrome is actually caused by intravenous embolisation of amniotic fluid, which results in rapid cardio respiratory collapse and profound consumptive coagulopathy. The understanding of the mechanism of AFE has evolved from the earlier theories of amniotic fluid (AF) and debris entering the maternal circulation and obstructing the pulmonary arterial flow leading to hypoxia, heart failure and death. During normal delivery AF enters the maternal circulation through the venous channels and as such fetal squames and fetal cells are seen in the maternal peripheral blood normally.

- Unlike what was stated earlier, meconium laden amniotic fluid is more likely to cause symptomatic AFE.
- Disruption of maternal fetal interface allows the material from the fetal compartment to enter the maternal circulation.
- Abnormal activation of pro-inflammatory mediators akin to SIRS causes pulmonary vasoconstriction followed by pulmonary hypertension which in turn causes acute right ventricular failure leading to the hemodynamic collapse seen in AFE.
- The third component of the classic triad namely DIC follows then.

It can be seen that our understanding of the etio-pathogenesis of AFE is still evolving.

Diagnostic criteria for AFE (ACOG)

1. Clinical onset during labour or within 30 minutes of placental delivery
2. Abrupt onset cardio respiratory arrest or both hypotension and respiratory compromise
3. Overt disseminated intravascular coagulopathy
4. No fever ≥ 38° C

The onset is often dramatic. There may be premonitory symptoms like a sense of sudden

Table 4 : Symptoms observed and their incidence as reported in the case records.

	20/21	21/22	22/23	23/24	Total
Total no of cases	8	8	10	4	30
Seizures	6	6	6	4	22
cyanosis	1	2		1	04
Chest discomfort/dyspnoea		2		1	03
PPH/ DIC	4	2	4	3	13
Hypotension/collapse/arrest	4	6	8	3	20

doom, nausea vomiting, agitation, change in mental status etc immediately preceding the event. Respiratory discomfort and seizures (hypoxic) are often seen, which is soon followed by cardio pulmonary arrest and massive hemorrhage from consumptive coagulopathy.

Causes & Prevention – our observations and recommendations

- We have found hyperstimulation as the most common association with AFE in our analysis.
- We advise strict induction protocols, avoidance of vaginal misoprostol and smooth muscle relaxants like Valethamate bromide, Drotaverine, Hyoscine butylbromide etc.
- PGE1 has more propensity for AFE than PGE2 and once the Bishops score is favorable no further doses of prostaglandins should be administered.
- Once adequate contractions are obtained, oxytocin should be titrated accordingly.
- Tocolytic should be administered in the event of hyper stimulation.
- The interval between the oral doses of PGE1 should be preferably 4 hours and for PGE2 intracervical gel it should be 6 hours. If the PGE1 dose is 25 µg, 2 hourly administration may be considered. Be careful while using PGE1 in the multis.
- Oxytocin, when required for augmentation after the pre-induction cervical ripening, should be started only 4 hours after PGE1 and 6 hours after PGE2.
- Following ARM an interval of at least one hour should be observed before augmentation with oxytocin.
- As a basic rule avoid unnecessary inductions and augmentations.
- AFE is also seen during a cesarean or during a difficult instrumental delivery

Differential diagnosis to be borne in mind are

- Pulmonary embolism
- Myocardial infarction
- High spinal
- Eclampsia
- Anaphylactic shock

Unfortunately, no specific diagnostic laboratory test confirms or refutes the diagnosis of AFE and it often remains a clinical diagnosis as of today.

Management

Lab Tests

- Complete blood count with platelets
- Coagulation profile : PT INR (↑), activated partial thromboplastin time APTT (↑) Fibrinogen (↓), FDP (↑) & D- dimer (↑)
- ROTEM when available helps to diagnose and manage DIC
- Blood urea & serum creatinine
- Liver function tests
- Serum electrolytes
- Brain Natriuretic Peptide (BNP & Pro BNP)
- Arterial Blood Gas (ABG) - (Metabolic acidosis occurs in those who have prolonged hypotension and following a cardiac arrest)
- Bedside chest radiograph (dense bilateral infiltrates consistent with pulmonary edema and / or acute respiratory distress syndrome may be seen as AFE evolves)
- Electrocardiography (ECG) - (sinus tachycardia is often seen but it may also reveal arrhythmias like VT & VF, which are shockable and Pulseless Electrical Activity & Asystole which are non-shockable)

Table 5 : Outcome of baby

	20/21	21/22	22/23	23/24	Total
Total no of cases	**8**	**8**	**10**	**4**	**30**
Live	3	2	2		7
Asphyxiated	1	3	4	3	11
Fresh still born	4	1		1	6
Undelivered	-	1	1	-	2
Unknown	-	1	3	-	4

» Bedside ultrasonography is a must. Abdominopelvic ultrasonography to image the abdominal and pelvic structures and also to look for IVC collapse in the presence of hypovolemia. Lower extremity and thoracic USG as and when required

» Echocardiography plays an important role to clinch the diagnosis (Right heart strain with RA, RV dilatation), PAH is pathognomonic. This is often followed by LV dysfunction.

» Fetal monitoring has revealed fetal bradycardia followed by prolonged decelerations. CTG evaluation is not recommended in the circumstances; we should not waste time on it as immediate CPR is of paramount importance in this situation.

Early recognition of maternal collapse and prompt resuscitative measures form the crux of management.

Urgent Management of Maternal Collapse (C-A-B-D-E)

C-Call for help, start Chest compressions (high quality chest compressions)

A-Airway

B - Breathing

D - Displacement of uterus, defibrillation

E - Extraction of fetus (resuscitative hysterotomy)

Simultaneous **C-A-B-D-E**
(Compressions - Airway - Breathing - Uterine displacement - EXTRACTION)

Appropriate airway management for pregnancy:

- Open airway by using head tilt-chin lift maneuver (if not a trauma victim)
- Administer 100% O_2 at ≥15 L/min
- When available, perform bag-mask ventilation
  - Seal mask, ensure no leak around mask; 2-handed technique preferred
  - Deliver each rescue breath over 1 second
  - Give 2 breaths for every 30 compressions
  - Give a sufficient tidal volume to produce visible chest rise or fog within face mask. If not seen, reopen airway and improve seal. Consider using oral airway.
- Avoid excessive ventilation

Chest compressions in pregnancy:

- Use a firm backboard
- Place patient supine
- Place hands in center of chest (as in nonpregnant patient)
- Compress at a rate of at least 100/min
- Compress at a depth of at least 2 inches (5 cm)
- Perishock pause <10 seconds
- Allow complete chest recoil after each compression
- Minimize interruptions
- Perform continuous manual LUD

LUD - Left Uterine Displacement

PMCS (Peri mortem Cesarean Section - Resuscitative Hysterotomy) BOX-Contents

Sterile Scalpel with blade, Antiseptic solution, Suction, Face mask, Apron, Hemostats, Mops, Scissors, Two clamps, suture ligatures.

The primary resuscitation should be carried out observing all the correct protocols in the primary health care facility to stabilise the patient before transferring to a higher center.

ACLS - High quality advanced airway and ventilation with high quality advanced cardiac resuscitation should be provided at the earliest in an institution catering to these facilities.

Post-Cardiac Arrest Care

1. Confirm return of spontaneous circulation (ROSC) only after which CPR should be stopped.
2. Ensure adequate oxygenation and ventilation-100% O2, Maintain normocapnia.
3. Monitor vital signs, including blood pressure, heart rate, and oxygen saturation. Targeting an oxygen saturation of 94% to 98% or a Pao2 target of 75 to 100 mm Hg would be reasonable.
4. Obtain IV access or intra-osseous access for administering IV Fluids Avoid fluid overload.
5. Consider targeted temperature management (cooling) 32-36°C for eligible patients - avoid active warming. Try to keep temp <37.5°C. This is in order to reduce the basal metabolic rate following the arrest.
6. Perform a systematic assessment to identify and treat the underlying cause of cardiac arrest.
7. Consider inotropic agents such as dobutamine during the phase of right ventricular failure to improve right heart output and later systemic hypotension should be treated with vasopressors such as noradrenaline, vasopressin etc., to achieve and maintain the target blood pressure.
8. Consider advanced hemodynamic support in refractory cases like ECMO. Extra corporeal membrane oxygenation (ECMO) has been described in the treatment of AFE when there is severe respiratory and cardiac failure.

9. Assess neurological status regularly- neuroimaging where indicated and neuro-prognostication, as and when required.
10. Manage complications associated with post-cardiac arrest syndrome, such as myocardial dysfunction, multi organ failure, DIC etc.

    2024 AHA Recommendations have also accepted the above measures including E-CPR (ECMO CPR).

Conclusion

In conclusion we would like to end by saying that periodic evaluation, regular drills, and updates have been the Kerala model for the whole country to emulate.

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CHAPTER 06

Sepsis in Pregnancy

V.Rajasekharan Nair, P.K. Syamala Devi, Sreeletha S, Ajith S, Aravind Reghu Kumar, Sangeetha Menon, Sujamol Jacob

Editor's note:

Sepsis remains a significant contributor to maternal deaths. It is gratifying that the number of deaths assigned to sepsis has shown a decline in the period under review. However, one should not lose vigil. Multidrug resistant organisms are on the increase and aseptic practices are the only way to keep infection under control. Obstetricians have to be vigilant to pick up sepsis early and act decisively to control the same. Since majority of the cases are following cesarean delivery, practices like cleaning upper vagina with povidone iodine prior to cesarean section for those in labour, inspection and palpation of the wound during postoperative rounds and if necessary probing it if induration is felt are simple but essential steps to be followed.

Dr V P Paily

Key Summary Points

- Sepsis was the cause of death in 16 maternal deaths during this period under review.
- The leading association of sepsis was with cesarean section (Nine out of 16).
- There would have been other maternal deaths resulting from sepsis as a final cause, but assigned under some other headings because of our policy of assigning maternal deaths to the primary cause.
- Number of deaths due to sepsis has reduced in the period under review when compared with the previous years.

Introduction

Sepsis continues to be a major killer in pregnancy. Around 3 % of maternal deaths in Kerala are reported to be directly related to bacterial sepsis. Since the publication of the last edition of this book there was no major change in our understanding about obstetric sepsis. Sepsis should be viewed as a complex condition with high mortality when the diagnosis and interventions are delayed. Human factor continues to be an important co- factor in the genesis of obstetric sepsis related morbidity and mortality.

Maternal Sepsis is a life threatening condition defined as organ dysfunction resulting from infection during pregnancy or childbirth. It carries a very high mortality, 10 % for sepsis and 40 % for septic shock.

Prevention of sepsis has to be stressed again and again in the context of rising incidence. Hospitals need to institute a performance improvement programme for overall sepsis management

Table 1 : Incidence of Sepsis

	2020/21	2021/22	2022/23	2023/24	Total
Total deaths analysed	**111**	**191**	**112**	**108**	**522**
Number of sepsis	3	3	3	7	16
Abortion related	1	nil	1	3	5
Following CS/ Laparotomy	1	2	2	4	9
Following Vaginal delivery	1	1	nil	nil	2

Key Recommendations.

1. Think of the possibility of sepsis in all maternal collapse. There should be a high index of suspicion of sepsis in all critically ill obstetric patients. Even if a pathology is identified, When standard treatment fails in such cases, always consider the possibility of superadded sepsis. Clinical suspicion is the best way to identify sepsis in its early stages.
2. Symptoms such as general weakness, not feeling well, breathlessness, cough, abdominal pain, diarrhoea, vomiting, foul smelling vaginal discharge, urinary symptoms etc. may be the heralding symptoms of sepsis. They should be given due credit in their respective clinical setting.
3. MEOWS (Modified Early Obstetric Warning Signs) chart may be utilized for early identification of sepsis.
4. qSOFA criteria – for suspecting Sepsis, qSOFA score does not require any lab testing, it is more specific than sensitive, a negative result does not rule out sepsis.
5. Following parameters are taken into consideration for assessment of Modified qSOFA:
    a. Alteration in mental status
    b. Systolic BP <90 mm Hg
    c. Respiratory rate >25 per minute.

    Recommended for use outside the ICU setting to promptly identify patients who are likely to have poor outcome.
6. For sepsis induced hypo perfusion initial fluid resuscitation with a balanced crystalloid solution at the rate of 30ml/kg in 3 hrs. is recommended.
7. Serum lactate alone is not sufficient to rule in or rule out sepsis, but estimation is included in first hour of sepsis bundle, considering its association with prediction of prognosis and sepsis mortality. Procalcitonin estimation is more specific for sepsis compared to CRP or lactate measurement.
8. Empiric broad-spectrum therapy may be employed with one or more antimicrobials for patients presenting with sepsis or septic shock to cover all likely pathogens (including bacterial and potentially fungal or viral organisms).
9. Dosing strategies of antimicrobials should be based on accepted pharmacokinetic/ pharmacodynamic (PK/PD) principles and specific drug properties.
10. For adults with sepsis-induced ARDS, a low tidal volume ventilation strategy (6 mL/kg) over a high tidal volume strategy (> 10 mL/kg) is recommended.

11. Appropriate source control within a time frame of 6 hrs. may be advantageous, but should be considered earlier if appropriate.
12. The Least invasive option which will provide optimum source control may be pursued.
13. Standard recommendations on hand washing, surgical area preparation, antibiotic prophylaxis etc. should be meticulously followed to prevent infection.

Review of current concepts

Diagnosis

- History and clinical signs – exercise high index of suspicion .
- MEOWS chart for early identification
- qSOFA criteria – for suspecting Sepsis, qSOFA score does not require any lab testing, it is more specific than sensitive, a negative result does not rule out sepsis

Modified qSOFA

» Alteration in mental status

» Systolic BP <90 mm Hg

» Respiratory rate >25 per mt

» Recommended for use outside the ICU setting to promptly identify patients who are likely to have poor outcome.

» According to 2016 consensus meeting, patients with 2 or more of qSOFA criteria – poor outcome.

Culture & Sensitivity

» Time consuming, only in 30-40% blood culture positive in sepsis.

» Sepsis markers like white cell count, CRP are nonspecific, Procalcitonin is more specific for bacterial infection.

Quick SOFA score (OM qSOFA score in obstetric clients)

» Cannot be used as the sole screening tool for sepsis. Should continue to use (highly

sensitive though less specific) MEOWS/ NEWS/SIRS for screening along with qSOFA score for the need of highend care.

» Serum lactate alone is not sufficient to rule in or rule out sepsis but estimation is included in 1 hour sepsis bundle considering its association with prediction of prognosis and sepsis mortality.

» ***Procalcitonin estimation is more specific for sepsis compared to CRP or lactate measurement.***

Criteria to assess End organ damage

Symptoms		**Criteria**
Respiratory	-	PaO2/FiO2 < 300
Coagulation		Platelet < 1 lakh
		INR > 1.5
		aPTT > 60 seconds
CVS – Haemodynamic		Persistent Hypotension after fluid therapy
		MAP < 65 mm
		40 mm fall in Systolic BP
Renal Function		Creatinine >1.2 mg/dL
		Urine output < o.5 ml/kg/ for 2 hrs
Mental status		Agitated, confused, unresponsive
Tissue Perfusion		Lactic acid > 2 mmol/litre

1. For sepsis induced hypo perfusion initial fluid resuscitation is 30ml/kg in 3 hrs.
2. Balanced crystalloids to be preferred to normal saline.
3. To prevent fluid overload, use small boluses of 250-500 ml based on fluid response and fluid tolerance, assessed by dynamic measures.
4. For adults with septic shock, can use the clinical measure - (central) capillary refill time to guide resuscitation as an adjunct to other measures of perfusion.
5. For adults with septic shock or high likelihood of sepsis start antimicrobials in

1 hour preferably after collecting appropriate samples for cultures.

6. Initiate empiric broad-spectrum therapy with one or more antimicrobials for patients presenting with sepsis or septic shock to cover all likely pathogens (including bacterial and potentially fungal or viral coverage.
7. Dosing strategies of antimicrobials should be based on accepted pharmacokinetic/ pharmacodynamic (PK/PD) principles and specific drug properties.
8. Daily assessment for de-escalation of antimicrobials should be practiced over using fixed durations of therapy.
9. Norepinephrine remains the first line vasopressor and the target MAP 65 mm of Hg and not more as higher values do not confer additional benefit.
10. For adults with septic shock on norepinephrine with inadequate mean arterial pressure levels, adding vasopressin instead of escalating the dose of norepinephrine.
11. For adults with sepsis-induced hypoxemic respiratory failure, use of high flow nasal oxygen over noninvasive ventilation is suggested.
12. For adults with sepsis-induced ARDS, a low tidal volume ventilation strategy (6 mL/ kg), over a high tidal volume strategy (> 10 mL/kg) is recommended.
13. Appropriate source control within a time frame of 6-12 hrs may be advantageous.
14. The least invasive option which will provide optimum source control may be pursued.
15. Sepsis survivors can have stress and post sepsis syndrome which should be addressed and followed up

Risk factors for Obstetric Sepsis

- Prolonged PROM
- Retained products of conception
- Multiple gestation
- Age >35
- Cesarean section , multiple and prolonged surgeries
- HIV, CHF, SLE
- Pregnancy and puerperium are immune compromised states

Prevention

- Cleanliness
- Screening for asymptomatic bacteriuria and treating the same.
- No routine antibiotics for vaginal delivery (with or without episiotomy).
- Antibiotic prophylaxis for operative vaginal deliveries and cesarean section.
- Vaginal preparation with povidone iodine , prior to cesarean section.

» Sepsis markers like white cell count, CRP are nonspecific, Procalcitonin is more specific for bacterial infection.

Treatment

Early identification and appropriate management in the initial hours. Initial treatment needs to be started immediately.

- Early lactate measurement helps in recognising septic shock.
- Immediate stabilization
- Fluid resuscitation
- Collection of blood and other relevant cultures
- Initiation of antimicrobial treatment ideally within one hour
- Hemodynamic support
- Source control

Surviving Sepsis Campaign (2021) recommends in one hour bundle

1. Measure lactate level
2. Obtain blood and other relevant specimen for culture
3. Administer broad spectrum antibiotics
4. For patients with hypotension or lactate levels of 4 mmol/l or more administer crystalloids 30 ml/Kg (RCOG modified it to 20 ml/Kg due to increased risk of pulmonary edema in pregnancy.) If hypotension persists or develop during or after fluid resuscitation, add vasopressors.

Fluid resuscitation - balanced crystalloid is recommended (2021 consensus) instead of normal saline (many potential adverse effects of normal saline including hyperchloremic metabolic acidosis). After initial hemodynamic stabilization restrict IV fluid administration (may use normalization of lactate level as a guide). When there is a substantial need for crystalloid, albumin is preferred.

Antibiotics

Administer antimicrobials within 1 hour of admission. (Empirical antibiotics are started to cover Gram-positive, Gram-negative and anaerobic organisms, as per local microbial susceptibility patterns. De-escalation is then implemented in accordance with culture results.) ***For each hour's delay in starting antibiotics in septic shock, the mortality increases by 7.8%***

- One or more agents with activity against likely pathogen
- Good penetration into source
- Guided by local pathogens
- Daily reassessment of response
- Duration 7-10 days or more

Procalcitonin level can be used to support a decision to stop antibiotic in suspected sepsis but no evidence of infection.

Vasopressors

Norepinephrine is the agent of choice; Epinephrine is added as the 2nd line agent. Catecholamines, notably dopamine, can cause arrhythmias and the addition of vasopressin can help to reduce catecholamine doses.

Blood transfusion

- Blood transfusion is suggested if Hb <7gm/dl. In the absence of bleeding, Hb should be kept between 7-9 gm/dl.

Platelet transfusion

- Only if platelet count <10000
- If risk of bleeding, transfuse if platelet count <20000
- If active bleeding/surgery, transfuse if platelet <50000

Blood sugar control

- Consider Insulin if blood sugar >180 mg/dl

Corticosteroids

- Not routinely recommended - Only in case of hypotension not responding to vasopressors (2016). (2021 guidelines recommend for patients on who have on-going requirement of vasopressors).
- Dose – Hydrocortisone 200 mg IV/ day - (50 mg IV 6 hrly) X 7 days or until ICU discharge

Source control

Anatomical site and source of infection should be searched for and urgent measures should be taken to remove the septic focus within 12 hours of diagnosis. An effective intervention associated with least physiologic insult should be used. If IV access device is source, that should be removed promptly, after other vascular access is established.

Supportive management

- Supplemental Oxygen – target Oxygen saturation 94-98%
- If severe hypoxia – NIV or high flow Oxygen via nasal canula
- Renal replacement therapy for acute kidney injury
- DVT prophylaxis – Heparin & Intermittent Pneumatic Compression Devices
- Stress ulcer prophylaxis.
- Nutrition

ARDS

- A low tidal volume ventilation strategy with limitation of plateau pressure
- Prone positioning in moderate to severe ARDS
- Prevent aspiration
- Minimal sedation

ECMO

Extracorporeal membranous oxygenation (ECMO) has been used for either cardiac or respiratory failure in a small number of patients in pregnancy and the puerperium, as a consequence of sepsis and septic shock.

The outcomes are generally good, with good recovery of cardiac function – the fetal survival rate is reported as 70% and the maternal rate is 80% (on a par with non-pregnant women).

KFOG – Quality standards

- Dedicated sterile vaginal examination sets
- Dedicated autoclaved delivery sets
- Delivery room has clean running water with appropriate taps
- Written down antibiotic policy
- MEOWS chart in case sheets
- Sepsis – appropriate care bundle to be started
- Multidisciplinary involvement and transfer to appropriate center if sepsis.

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CHAPTER 07

Suicide as a cause of maternal death - steps to address the menace in the Kerala context

Smitha Ramesh, Amritha, P P Ramesh

Editor's note:

This chapter beautifully researched and compiled by Smitha and Amrita, makes one sad about the situation of maternal suicidal deaths in the State. Ever since suicide was added as a direct cause of maternal death, we have been arguing that obstetricians by themselves can do very little to address the issue. As the authors have put it, maternal suicides in our State are the culmination of bio psycho social causes. It is a multidimensional malaise, where the medical factors are not the key elements. The conventional approach to prevent maternal deaths viz: identifying the cause and then taking preventive steps will not work here. The obstetrician seldom gets to know the build up of stress factors that lead to suicide. A break up of the scanty details about the cases that we received shows that very often these cases have occurred as a reaction to break up of relationship often in unmarried youngsters who have developed relationship through social media contacts.

Pregnancy often was unexpected and when identified triggers the suicidal attempt as such pregnancies are socially unacceptable. Six of the 54 cases were girls of age 19 years or below. Unlike what is portrayed usually in the literature, 37 out of 42 happened during pregnancy and not in the postnatal period. So, if we focus on the postnatal period assuming that postnatal stress of looking after the baby or the psychological changes often seen in the post delivery period are the causes, we will miss 37 of 42 cases. This highlights the fact that we cannot go by the recommendations of learned bodies but have to chart our own steps to identify the reasons and appropriate preventive measures of maternal suicides.

The basic principle we follow in CRMD is to analyse the reasons for maternal deaths in our society and chart out action plan relevant to those causes doable in our set up. The fundamental requirement for such a policy to succeed is to analyse our own cases. This is lacking in the case of suicide. We do not know the details of suicide deaths. Often it goes to the police. The relatives are unwilling to reveal the details. There is stigmatization in the society; hence families do not come forward to reveal the details or get help. Because of the relatively young age group involved, we have to check whether drugs and drinks have a role here. In the case of a few , stress at home due to drunken husbands, bullying for dowry or strained relationships with in-laws have been revealed.

True that the government has initiated several steps to address the problem. But we don't seem to make much headway. We feel that the best way to get useful tips to address the problem is to go in depth to analyse the cases that happened in our state. That will reflect the realities in our own State.

Another area to focus is the near miss cases, we mean the failed attempts at suicide. As far as we know, no systematic approach in these lines is happening. We urge the government to take comprehensive practical steps to analyse the various aspects of maternal suicides and near misses that happen in our society. It needs multi departmental cooperation and action from department of health, home affairs, education, social welfare, Women's welfare etc. it is already too late.

V P Paily

Introduction

Suicide is a leading cause of death in adolescents. Suicide rate in Kerala is around 28.5 / one lakh population which is well above the national average of 12.4 / one lakh population[1]. Despite having enviable achievements in health and developmental indices, Kerala still remains in the forefront regarding the suicidal rate.

Suicide is a multidimensional malaise and the causes are biopsychosocial. It has been estimated that more than 75% of young people who die by suicide in Kerala did not have any reported mental health disorder[2]. This stresses the need for addressing unmet treatment gaps in mental health conditions. It is also important to consider psychosocial issues as in Kerala; most of the causes of suicide are not due to major mental illnesses as in the west but due to psychosocial reasons[3]. However, psychiatric disorders affecting women in the perinatal period shall not be ignored as well.

Kerala with its high health indices almost at par with the western world boasts of a low maternal mortality. Out of the 120 maternal deaths in Kerala in 2023-2024, 14 were due to suicide[4]. Factors that led to suicide in these cases could not be ascertained. Suicide, though preventable, continues to contribute to maternal mortality. Almost all the preventable causes have been reasonably effectively dealt with in the last decade. Suicide still remains a major and tragic cause of maternal mortality.

Key summary points

1. Maternal suicide is an important cause of maternal mortality in Kerala.
2. In Kerala with an inherently high suicide rate, suicides are predominantly due to various psychosocial issues

Key recommendations

1. Community based research into suicide and suicide attempts among pregnant and postpartum women are the need of the hour and interventions need to be tailored appropriately.
2. Utilisation of the services of JPHN/ASHA and training lay counsellors and volunteers for identifying and providing primary mental health care for mothers in psychological distress need to be revamped.
3. Psychoeducation sessions for mothers and family members regarding mental health and psychosocial issues including suicide prevention need to be incorporated in all ANCs

4. Dissemination of information regarding the services s available to women in distress and how to access these services need to be implemented in all ANCs
5. A stepped care approach in the delivery of mental health services to perinatal women would be effective
6. Social welfare measures for mothers in psychosocial distress also needs to be considered.

Suicide death as a challenge

Confidential review of maternal deaths (CRMD) in Kerala has evolved a structured and robust methodology to assess the causes of maternal death and formulate local and feasible guidelines.

But that is not the case with maternal suicides. Unless we are able to delineate the causes of maternal suicide in Kerala, we may not be able to address it effectively.

Table.1 No of Suicide deaths

	20/21	21/22	22/23	23/24	Total
Suicide deaths	**13**	**19**	**16**	**14**	**62**
Total deaths	135	230	124	120	609

Table 2. Age wise distribution

year	19 & below	20-29	30 -35	36 and above	Total analysed	Not analysed	**Total**
20/21	nil	5	5	1	11	2	**13/135**
21/22	nil	15	1	nil	16	3	**19**
22/23	2	8	2	1	13	3	**16**
23/24	1	9	3	1	14		**14**
Total	**3**	**37**	**11**	**3**	**54**	**8**	**62**

Table 3. Period of death AN/PN in the analysed group

	20/21	21/22	22/23	23/24	
AN	6	9	11	11	37
PN	1	2	1	1	05
Unknown	4	5	1	2	12
Total	11	16	13	14	54

AN - Antenatal. PN – Postnatal

Table 4. Period of gestation at the time of death

	20/21	21/22	22/23	23/24	**Total**
Up to 12 wks.	2	1	1	4	**8**
12 – 24 wks.	1	5	2	5	**13**
25 and above	1	3	2	-	**6**
Postnatal	1	2	1	1	**5**
unknown	6	5	7	4	**22**
Total	**11**	**16**	**13**	**14**	**54**

What are the challenges in maternal suicide research?

1. Almost all the maternal suicides happen in the community, unlike the other maternal deaths which happen in the hospital. Analyzing hospital deaths are easier than deaths in the community.
2. When a maternal death by suicide happens in the community, junior public health nurse (JPHN) makes a preliminary report and submits it to the medical officer in charge of the primary health center (PHC) / community health center (CHC)as applicable, then to the Reproductive and Child Health (RCH) officer and then to the District Medical Officer (DMO) and subsequently to Director of health Services (DHS). The RCH officer also does a field visit to assess the situations which led to suicide. From preliminary enquiry it has been understood that RCH officers are not able to collect details of maternal suicide due to various reasons - relatives mourning the unexpected demise are unable to co-operate, neighbors fearing the law keep silent. Suicides are shrouded in silence with untold and unaddressed grief. The families may be stigmatized and may be ostracized at various degrees. Though suicide is a biopsychosocial issue, many a time it is portrayed in a reductionistic way exaggerating

the proximal cause. Media, both the mass media and the social media, are eager to point their fingers at a single cause and in a blameworthy manner, enhancing the stigma and leading to disenfranchised grief.

3. Autopsy reports as of now are unavailable to CRMD.

So, what are the feasible methods to approach the situation?

The gaps in research into maternal suicides need to be addressed.

1. RCH officers who currently do the psychological autopsy are personnel holding multiple responsibilities and may not be adequately trained to conduct a sensitive time-consuming psychological autopsy. Deputing trained personnel can be a solution. We already have models in Kerala where psychological autopsy was done by such methods[5,6]. Repeated visits may be needed. Suicide grief being disenfranchised, postvention services can be planned. The psychological autopsy can be embedded within the postvention services with appropriate confidentiality and addressing the legal and ethical aspects of research. Robust qualitative methods of research can be employed. Format for psychological autopsy suitable for the Indian context is available[7].
2. Facilities need to be implemented to share the autopsy reports and FIR of mothers who die by suicide with CRMD, addressing the medicolegal formalities.
3. We can use suicide attempts as a proxy marker of suicide and conduct research on them. Central reporting of maternal suicide attempts in a sensitive way, with a view to addressing their problems, in a biopsychosocial framework needs to be considered.

Interventions can be planned in a much effective manner after assessment of the drivers of suicide. However, interventions can be started, extrapolating the research findings from suicide research in general and from maternal suicide research from other countries.

Universal interventions

1. Adolescent mental health services-in schools like 'life skills education' can be strengthened.
2. School programs for educating adolescents about reproductive safety measures.
3. Premarital counselling sessions to be organized at various platforms.
4. Training of police personnel in mental health, suicide and sensitive reporting of suicide.
5. Media guidelines and implementation of appropriate reporting of suicide by the mass media and social media. Sensationalizing and glorifying suicides needs to be avoided.

6. Restricting the availability of means to commit suicides - like curbing the sale of pesticides and over the counter medications.
7. Raising public awareness of suicide prevention and measures to destigmatize it so as to enhance help seeking.

Selective interventions

High risk women need to be identified - adolescent mothers, mothers with history of mental health conditions, HIV and obstetric complications. Social factors like intimate partner violence, poverty, unwed mothers, mothers with poor support system also need to be picked up. All these issues have to be addressed.

1. All women attending the ANC need to be screened for mental health and psychosocial issues, and suicidal ideation in a sensitive manner using available questionnaires and open-ended questions. The services of Amma Manasu, a maternal mental health program initiated by the government of Kerala to screen mothers during antenatal and postnatal visits for mental health problems, by Junior public health nurse (JPHN) / Accredited social health activist (ASHA) and to provide early intervention and prompt referral can be strengthened[9].
2. Antenatal sessions for couples and families need to be done regularly at all antenatal clinics (ANC) regarding stress and coping, substance use, domestic violence, the legal, mental health and other sources of help available. This can be done by employing trained counsellors. Emphasis needs to be given to include spouses also in the counseling sessions.
3. Telephonic services for counselling can also be employed. The lessons learnt from telephonic counselling operative in government hospitals during Covid can be utilized. TeleMANAS launched by the MOHFW has introduced a helpline number 14416 to provide mental health services to those in need; however, this needs to be strengthened and popularized[8].

   Another initiative by the government of Kerala is 'Bhoomika', targeted to identify and provide psychosocial support to victims of abuse and violence. Accordingly, one gender-based violence management centre is being functional in every district, usually in the district or general hospital managed by a female counsellor.
4. Those who are at high risk can be referred to Psychiatrists. A stepped care approach for managing perinatal mental health issues has been proposed[10] which can be followed.
5. Distress helplines catering exclusively to maternal distress and suicide may be initiated. The services of NGOs can also be utilized for the same. Already NGOs like Maithri in Kochi (helpline number 0484 2540530, from 10 am to 8pm) and

Thanal in Kozhikode (helpline number 0495-2760000,from 10 am to 6 pm) and Disha ,24*7,0471 2552056,2551056 are available as suicide helplines for all.

6. Social welfare measures for pregnant women and shelters for the homeless pregnant women need to be considered.
7. Appropriate utilization of the District mental health programme (DMHP) for prompt referral.
8. Dispaly boards need to be kept in all ANCs regarding the services available and how to access them.
9. Pamphlets need to be distributed at the ANC regarding the sources of help and /or QR code scanning with information regarding the available services

Indicated intervention

Psychiatrists and other mental health professionals have a lead role in delivering this, in liaison with the obstetricians. Obstetricians can be trained in sensitively referring the patients to Psychiatrists. Spending just a minute, to guide the patients regarding the sources of help available for psychosocial distress, (which needs to be made available in every ANC) if done by the obstetrician will be immensely beneficial. Utilizing the rapport and trust that women have with their Obstetricians would be a valuable step towards help seeking for such women. Clearing misconceptions and sensitizing Obstetricians regarding effective use of psychotropic drug use in pregnancy is important.

The Thinking Healthy Program (THP)[11], a simple psychological intervention for perinatal depression adopted by WHO, was effective in treating women with perinatal depression in Pakistan[12].It was delivered by female community health workers. The same programme delivered in Goa, by peers who volunteered was also effective[13].Such interventions can also be thought of in the Kerala context.

Manpower shortage needs to be addressed at every level because the mental health of the health provider is of paramount importance, especially in government settings. An overburdened doctor would not be able to deliver quality mental health services; such interventions should be designed in such a manner that they do not overwhelm the existing overburdened health system. All the same it can be incorporated with the existing system. Most of the health care providers themselves are women too. The doctor population ratio in Kerala exceeds the required, and doctors-gynecologists, psychiatrists, graduate doctors and trained counsellors can be appointed at least on contract basis for delivering the services.

With these multipronged approaches, which require mainly human resources which are aplenty in Kerala where educated qualified personnel are migrating in search of jobs, such mental health measures for pregnant women will be a helpful venture. No expensive or sophisticated machinery are required for this.

Suicides represent only the tip of the iceberg of mental and social distress and psychosocial adversity. There may be many mothers who are subjected to untold stress, attempting to cope and vulnerable to break down at any moment. The universal, selective and indicated interventions outlined above would not only attempt to reduce suicide risk, but may also improve maternal mental health and well-being which will in turn lead to healthy pregnancy and healthy offsprings which are the added benefits.

Questionnaires which may be given (Annexures)

1. Amma mansu
2. Ask Questionnaire for suicide screening
3. Open ended questionnaire and checklists regarding domestic violence, substance use related matters, work stress, financial stress and any interpersonal or other issues

Sources of help which may be provided

1. Pamphlet containing basic relaxation and stress management methods and Help line numbers
2. WHO THINKING HEALTHY A manual for psychosocial management of perinatal depression, available at https://iris.who.int/bitstream/handle/10665/152936/WHO_MSD_MER_15.1_eng.pdf?sequence=1

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'അമ്മമനസ്സ്' – മാതൃ-ശിശുമാനസികാരോഗ്യസംരക്ഷണപദ്ധതി

മാനസികാരോഗ്യ ചോദ്യാവലി

ക്രമ നം	ചോദ്യം	1 (1st Trimester)	2 (2nd Trimester)	3 (1rdTrimester)	4 (6th week immunisation)	5 (14 th week immunisation)	6 (9 th month immunisation)
1.	മാനസിക സമ്മർദ്ദം/ ടെൻഷൻ						
2.	ഉറക്കകുറവ്, വിഷാദം, കരച്ചിൽ എല്ലാത്തിലും താൽപര്യകുറവ്						
3.	ആത്മഹത്യാ ചിന്തകൾ/ പ്രവണത സ്വയം ഉപദ്രവിക്കൽ						
4.	നെഞ്ചിടിപ്പ്, വെപ്രാളം, ശരീരം വിയർക്കൽ, ഉത്കണ്ഠ						
5.	മുൻപ് എപ്പോഴെങ്കിലും മാനസിക പ്രശ്നങ്ങളോ, അപസ്മാരമോ ഉണ്ടായിട്ടുണ്ടോ						
കൂടെയുള്ളവരോട് ചോദിച്ച് അറിയേണ്ടവ							
6.	അമിതമായ ദേഷ്യം, അമിതമായ സംസാരം						
7.	അകാരണമായ സംശയങ്ങൾ, ഭയം						
8.	ഒറ്റക്കിരുന്നുള്ള ചിരി, സംസാരം പിറുപിറുപ്പ്						
9.	കുഞ്ഞിനെ പരിചരിക്കാനുള്ള താൽപര്യകുറവ്, അപാകത						
10.	ശ്രദ്ധയിൽപെട്ട് മറ്റെന്തെങ്കിലും മാനസിക പ്രശ്നങ്ങൾ						
സ്ക്രീൻ ചെയുന്ന നഴ്സിന്റെ പേരും ഒപ്പും							

Primary care Screening Questionnaire for Depression (PSQ4D)*

പ്രാഥമികാരോഗ്യ തലത്തിൽ വിഷാദരോഗം കണ്ടെത്താനുള്ള ചോദ്യാവലി (PSQ4D)

1.	മനസ്സിന് സങ്കടവും വിഷമവും കഴിഞ്ഞ രണ്ടാഴ്ചയിലധികമായി തുടർച്ചയായി അനുഭവപ്പെടുന്നുണ്ടോ	ഉണ്ട് / ഇല്ല
2.	കാര്യങ്ങൾ ചെയ്യാൻ താൽപര്യകുറവും ഉത്സാഹകുറവും കഴിഞ്ഞ രണ്ടാഴ്ചയിലധികമായി തുടർച്ചയായി നീണ്ടുനിൽക്കുന്നുണ്ടോ	ഉണ്ട് / ഇല്ല
3.	അമിതമായ ക്ഷീണവും തളർച്ചയും രണ്ടാഴ്ചയിലധികമായി തുടർച്ചയായി അനുഭവപ്പെടുന്നുണ്ടോ	ഉണ്ട് / ഇല്ല
4.	ഉറക്കകുറവ് രണ്ടാഴ്ചയിലധികമായി തുടർച്ചയായി നീണ്ടുനിൽക്കുന്നുണ്ടോ	ഉണ്ട് / ഇല്ല

മൂന്നോ അതിലധികമോ ചോദ്യങ്ങൾക്ക് ഉണ്ട് എന്നാണ് ഉത്തരമെങ്കിൽ വിഷാദരോഗം ആകാൻ സാധ്യതയുണ്ട്. സ്ഥിരീകരണത്തിനായി ഡോക്ടറെ സമീപിക്കുക
രണ്ട് ചോദ്യങ്ങൾക്ക് ചോദ്യങ്ങൾക്ക് ഉണ്ട് എന്നാണങ്കിലും ശ്രദ്ധിക്കണം

* Indu PS, Anilkumar TV, Pisharady R, Russell PS, Raju D, Sama PS, Remadevi S., Amma KL, Sheelamani A, Audrade C, Primary care screening Questioniare for Depression (PSQ4D) : reliability and valadity of a new for item tool, British Journal of Psychiatry open 2017 3.91-95. illni 10.1192

Ask Suicide Screening questions (ASQ)

1.In the past few weeks, have you wished you were dead? Yes/No

2. In the past few weeks, have you felt that you or your family

would be better off if you were dead? Yes/No

3. In the past week, have you been having thoughtsabout killing yourself? Yes/No

4. Have you ever tried to kill yourself? Yes/ No

If yes, how? _____

_____

When? _____

_____

If the patient answers Yes to any of the above, ask the following acuity question:

5. Are you having thoughts of killing yourself right now? Yes /No

If yes, please describe: _____

Next steps-

If patient answers "No" to all questions 1 through 4, screening is complete (not necessary to ask question #5).

No intervention is necessary (*Note: Clinical judgment can always override a negative screen).

• If patient answers "Yes" to any of questions 1 through 4, or refuses to answer, they are considered a positive screen. Ask question #5 to assess acuity:

o "Yes" to question #5 = acute positive screen (imminent risk identified)

• Patient requires a STAT safety/full mental health evaluation.

Patient cannot leave until evaluated for safety.

• Keep patient in sight. Remove all dangerous objects from room. Alert physician or clinicianresponsible for patient's care.

o "No" to question #5 = non-acute positive screen (potential risk identified)

ആത്മഹത്യ പ്രവണത അളക്കുവാൻ ഉള്ള ചോദ്യാവലി

1.ഈ കഴിഞ്ഞ കുറച്ച് ആഴ്ചകളിൽ താങ്കൾ മരണപ്പെട്ടിരുന്നെങ്കിൽ എന്ന് ആഗ്രഹിച്ചിട്ടുണ്ടോ? ഉണ്ട്/ഇല്ല

2.താങ്കൾക്ക് ഈ കഴിഞ്ഞ കുറച്ച് ആഴ്ചകളിൽ, താങ്കളുടെ മരണം താങ്കൾക്കും താങ്കളുടെ കുടുംബത്തിനും നല്ലതായിരിക്കും എന്ന്തോന്നിയിട്ടുണ്ടോ? ഉണ്ട്/ഇല്ല

3.താങ്കൾക്ക്കഴിഞ്ഞ ആഴ്ചയിൽ സ്വയം കൊലപ്പെടുത്താൻ തോന്നിയിട്ടുണ്ടോ? ഉണ്ട്/ഇല്ല

4.താങ്കൾ എപ്പോൾ എങ്കിലും സ്വയം കൊലപ്പെടുത്താൻ ശ്രമിച്ചിട്ടുണ്ടോ? ഉണ്ട്/ഇല്ല

ഉണ്ടെങ്കിൽ,എപ്പോൾ.....

.....

.....

എങ്ങനെ.....

.....

4.ഇപ്പോൾ താങ്കൾക്ക്സ്വയം കൊല്ലപ്പെടണം എന്ന ചിന്തകൾ ഉണ്ടോ? ഉണ്ട്/ഇല്ല

ഉണ്ടെങ്കിൽ,
വിവരിക്കുക.....

CHAPTER 08

Labour and delivery management

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Editor's Note:

Management of labour and delivery is the most modifiable of all the interventions that obstetricians can undertake to reduce maternal mortality and morbidity. Many of the complications that end up in maternal deaths originate during labour and delivery. Hence the importance of systematic, protocol-based management in labour. Training and retraining of all the healthcare providers in labour units is essential to maintain the protocol-based care.

Instrumental deliveries highlight the importance of training and senior supervision, the absence of which has led to global decline in instrumental deliveries. Training in proper interpretation of CTG becomes crucial in preventing unexpected intrapartum complications for the fetus.

Post delivery monitoring has to be standardised for welfare of the mother and baby, prevention of reactionary and secondary bleeding, thromboembolism etc. This chapter brings together some of the salient points of care in labour and delivery and the puerperium. For more detailed descriptions please refer to 'Why mothers die 3rd Edition'.

V P Paily

Key Summary Points

1. Elective induction only after 39 weeks.
2. Use mechanical methods prior to prostaglandin.
3. PGE1 25-50 microgram 2 to 4 hourly may be used.
4. Preferable to do artificial rupture of membranes prior to oxytocin with at least one hour gap in between.
5. Oxytocin to be delivered via fixed drug delivery systems.
6. To use physiological interpretation of CTG rather than pattern recognition.
7. Judicious use of instruments, getting familiarized with both forceps and vacuum, learning art of digital rotation are essential.
8. Intrapartum ultrasound can be complementary in difficult situations.
9. Active management of third stage of labour (AMTSL) as per KFOG protocol.
10. Identifying and proper suturing of perineal tears and close monitoring in fourth stage.
11. Aseptic techniques and prophylactic antibiotics can reduce sepsis to a great extent in cesarean section.
12. Separate stitch for right uterine angle has shown to reduce relaparotomy due to internal hemorrhage.
13. Uterine wound closure following the principle of "far- near- near- far" can help in good approximation there by reducing chances of niche formation during healing and adherent placenta in future pregnancies.
14. ERAS protocol and thromboprophylaxis are essential.
15. Team work and respectful maternity care (RMC) are corner stones.
16. Dedicated P/V set, PPH trolley, eclampsia box, cervical inspection set, perimortem CS set and regular drills can help us to be better prepared to tackle difficult situations.

Ripening and Induction of Labor:
A Key Strategy in Preventing Maternal Death

Induction of labor is commonly practiced in hospitals, either for medically indicated cases like severe preeclampsia or intrauterine growth restriction, or for elective reasons. It ensures timely delivery and provides convenience for both medical staff and patients. Induction methods include mechanical techniques like the Foley catheter and pharmacological agents such as prostaglandins E1 and E2, as well as oxytocin. A key step is ensuring that the cervix is mechanically ripened with Foley catheter before using prostaglandins, in cases of an

unfavorable cervix.

It is suggested that aligning induction with the body's natural circadian rhythm by starting the process in the evening can improve outcomes. Starting cervical ripening around 9 PM allows the body time to soften and dilate the cervix overnight, leading to a smoother labor process. This approach has been shown to reduce labor duration and the need for less interventions, as compared to starting induction in the morning, when there is often pressure to finish before nightfall.

Whenever Bishop's score is unfavorable it is prudent to start with mechanical methods- Foley bulb alone or along with extra amniotic saline. This should be under strict asepsis. Cervix to be visualized with Cusco and to be held with atraumatic Allis and Foley to be inserted as we do a urinary catheterization without removing the plastic cover. Enough length of Foley should go in so that bulb will be just above the level of internal os. Bulb to be inflated with 50-60 ml distilled water and should be kept under traction. If using extra amniotic saline, it should be warm and can be instilled up to 250 ml.

Misoprostol, a prostaglandin E1 analog, is commonly used for cervical ripening and induction. Administered orally at 50 mcg, it is safe and effective. For primigravida, it is given every 2-4 hours, while for multiparas, it is given every 3-6 hours, based on the Bishop score and previous obstetric history. For instance, a second-time mother with a quick delivery (within six hours) may be induced early morning, while a patient with a longer previous labor (12-14 hours) may start induction at 9 PM with up to eight doses over two days if needed. This gradual dosing prevents complications like uterine hyperstimulation, reducing the likelihood of needing more aggressive interventions.

- PGE2 0.5 mg intracervical or PGE2 vaginal insert can also be used.
- In a patient who is already having contractions further prostaglandin should be deferred. There should be a gap of 4 to 6 hours between last dose of prostaglandin and oxytocin.
- It is always preferable to do ARM (amniotomy) prior to oxytocin with at least 1 hr. gap in between. Exceptions are when head is high mobile or cervix is too unfavorable
- While giving oxytocin it is mandatory to use fixed drug delivery systems like syringe pump or infusion pump.

Proper mental and physical preparation through antenatal classes, breathing exercises, and prenatal yoga greatly enhances the success of labor induction. These practices reduce the mother's stress, improve her confidence, and help her cope better during labor. Presence of a companion also helps the labouring woman feel relaxed. This will help in smooth progression of labour.

Key points to note

- For a high mobile head begin Misoprostol and put in the catheter only when the head is fixed. Ensure she is well hydrated and adequately fed

Prevention of maternal deaths and conduct of labour.

Over one-third of maternal fatalities are caused by complications during labor and childbirth, including postpartum hemorrhage (PPH), eclampsia, sepsis, and obstructed labor. Effective management of normal labor is essential to reduce maternal mortality.

- **Postpartum hemorrhage** (PPH) can be prevented through the Active Management of the Third Stage of Labor (AMTSL) and meticulous monitoring during the fourth stage.

  Once a patient is admitted to labour room, triage after quick review of records and a thorough examination. All labouring women should have a 16/18 G cannula. They can ambulate and take clear fluids. There is no need for routine use of antibiotics. Smooth muscle relaxants should be avoided in active labour.

  In high-risk cases more frequent monitoring is needed.

- **Hypertension,** particularly pre-eclampsia, requires strict control of blood pressure and timely seizure prophylaxis using magnesium sulphate to prevent complications like eclampsia.

- **Sepsis,** A major cause of maternal mortality, can arise from postpartum infections. Preventive measures include vaginal antisepsis with povidone-iodine before delivery, use of dedicated per-vaginal examination kits and adherence to rigorous infection control protocols such as proper hand hygiene.

- **Obstructed labor**, A serious condition, characterized by the inability of the fetal presenting part to traverse the birth canal despite strong uterine contractions. Clinical features include prolonged labor, severe abdominal pain, maternal exhaustion, dehydration, and psychological distress. Uterine hypertonus and excessive contractions may lead to complications such as uterine rupture, fetal asphyxia and maternal hemorrhage. Physical examination may reveal cervical edema, Bandl's ring (a pathological retraction ring), caput succedaneum and moulding. Bandl's ring forms when the thick upper uterine segment contracts against an obstructed fetal part while the lower segment thins and stretches, risking rupture. Diagnosis involves clinical examination, including abdominal and vaginal assessment of uterine tone, fetal position, and cervical dilation. The distended lower segment may mimic a full bladder; however, catheterization confirms the distinction. Imaging modalities like intrapartum ultrasound may aid in assessing fetal position and uterine anatomy. Management of obstructed labor includes emergency cesarean delivery after

administration of uterine relaxants, such as terbutaline, to prevent complications.

Reducing maternal and perinatal mortality requires the presence of skilled birth attendants, facility-based deliveries, and comprehensive intrapartum care following the World Health Organization (WHO) Labour Care Guide (LCG). The WHO LCG provides alert values for labor observations, prompting timely interventions when abnormalities are identified. Continuous monitoring of vital signs, fetal heart rate and labor progression is paramount. Supportive care, including emotional support, pain relief and hydration, contributes to better outcomes. Encouraging mobility and adopting comfortable position enhance labor progression. Recognizing complications early, such as hypertension, sepsis or obstructed labor, is critical for maternal safety.

In cases of obstructed labor with Bandl's ring, characterized by a prolonged second stage, dry vagina and blood-stained urine, prompt surgical intervention is necessary to prevent uterine rupture, maternal hemorrhage and fetal asphyxia. The WHO emphasizes emergency preparedness protocols to address potential complications effectively.

Active management of third stage of labour as per KFOG protocol should be strictly followed. Per rectal examination prior to suturing episiotomy can help in delineating button hole tears.

These measures, combined with diligent monitoring, infection prevention and adherence to internationally accepted guidelines, can significantly reduce maternal and perinatal mortality and morbidity.

Instrumental Birth (IB)

This is a dying art, especially forceps delivery. Cesarean section (CS) in advanced labour has morbidities. The performance of a safe Instrumental Birth may be the best substitute for some cases of CS in second stage.

The first step is abdominal palpation to ensure head is not palpable. Understanding position, station, asynclitism, caput and moulding is crucial. Confirm full dilatation to avoid trauma to the cervix. With large caput, station may be high. Intrapartum USG can be complementary. Whenever possible, attempt digital rotation in the first instance.

A good analgesia and a firm board under the buttocks give a good start. Be familiar with both vacuum and forceps, Paily's forceps especially. Try to make sure that rotation is complete and the sagittal suture is in the midline, especially before application of forceps. Paily's forceps has modifications to reduce trauma to maternal soft tissue and fetus. After application of forceps, if the handles are outside perineum, the station is low enough for IB. Straight or rotational Kielland forceps application needs special training and expertise which is safe in special circumstances.

Vacuum apparatus must be checked for integrity of all attachments. No maternal tissue should be caught in the device. Be calm and be gentle with soft tissues and avoid unnecessary movements of instruments inside the vagina to avoid trauma to mother and baby. Assessment of the size of perineum and rigidity of vaginal walls may be useful before choosing the instrument. When the perineum is short or if vaginal walls are rigid, consider vacuum if possible. This is a common finding in primigravida. One should be ready to abandon IB if there is no descent with traction / if unable to lock handles / if the cup slips more than once.

Episiotomy may be appropriately timed and should be of sufficient length, and be mediolateral. It may not be necessary for a selected group of multigravidas, especially with vacuum. If given early or too big, significant blood loss can happen. If it is too short or too late, significant perineal trauma can happen. Before episiotomy, one should be certain of achieving vaginal birth. Once the head is out, it is best to avoid maternal pushing and unnecessary pulling to avoid further trauma to perineum. Rectal examination and good inspection of the vagina, cervix and perineum under good lighting and assistance is required.

Key Summary with Practice Points

1. Intrapartum USG may be complementary to IB.
2. Familiarity with both instruments is recommended.
3. Placement of a firm board under the buttocks may be useful for IB.
4. Assessment of perineum and vaginal walls may influence the choice of the instrument.
5. Willingness to abandon, if no progress and access to perform crash CS is a must.
6. Estimation of blood loss is mandatory
7. Patient may be examined vaginally in theatre before CS in second stage.
8. Uncooperative patient in second stage can be a challenge and may need Ramifentanil IV by anesthetist.
9. A skilled obstetrician interested in IB can inspire future obstetricians

Cesarean Section.... Key Practice Points

Cesarean delivery is part of the standard care for childbirth & each labour unit must be equipped to perform the same with appropriately trained personnel & surgical equipment. About one third of PPH deaths were identified in those with Cesarean section (WMD,

Kerala 2010-2020) emphasizing the fact that timely Cesarean delivery, perimortem CS when indicated, proper technique and post operative care can often be life saving for these patients.

Integrated stepwise approach to Cesarean section:

1) Informed consent should be case specific
2) Preoperative asepsis & antibiotics -
    - Proper skin preparation using both Chlorhexidine and Povidone Iodine.
    - Clipping of hair rather than shaving.
    - Painting the upper vagina and cervix with povidone iodine before taking up for surgery.
    - Prophylactic antibiotics 60 mins prior to the incision are the key steps in sepsis prevention.

      Inj Cefazolin 1g IV (2gm IV for more than 70 kg), if not available Inj Cefuroxime 1.5g can be given.

      In prolonged labour and failed instrumentation, consider a higher cover as the case demands.
3) Opening abdomen & uterus -

Joel Cohen incision,3cm above the standard Pfannenstiel is preferred. Choose vertical incision in dire emergencies, DIC and PAS. Avoid cutting the superficial epigastric vessels by blunt dissection. Open the peritoneum vertically in its upper third to avoid the bladder especially in 2nd stage CS. Put a small horizontal incision above bladder & enlarge it manually. While putting uterine incision in patients with prolonged or obstructed labour, put the incision at a higher level to avoid inadvertent entry into the vagina. If incision is inadequate, extend as J or U. Classical incision in anterior placenta previa and PAS and low vertical in extreme preterm CS.

4) Extraction of the baby-

Preferably in flexed attitude. In high floating head, use the ventouse or forceps. In deeply engaged head, insinuate the fingers on side of face & gently release the vacuum as the assistant may push up the baby or employ the Patwardhan technique.

5) Active management of 3rd stage of labour to be followed.
6) Uterine wound closure

Exteriorize the uterus if there is extension or tears. Identify internal os so that one does not inadvertently stitch the upper edge of uterine wound to bulging posterior wall and also be sure it's open. Secure both the uterine angles separately with box stitches and then close

with continuous running stitches as single or double layer. Any bleeders should be secured by separate box stitches. If there is extension down, take interrupted sutures from beyond the apex of tear till the main wound. Even if it appears superficial, look for any torn vessels beneath the peritoneum as these may be in spasm to cause catastrophic bleed later.

7) Abdominal wall closure

It is preferable to close the parietal peritoneum. Hemostasis should be ensured prior to closure. Any torn vessels under the rectus sheath should be tackled, If the inferior epigastric vessels are cut, they should be ligated& secured not just cauterized. Mop & instrument count should be ascertained.

8) Proper Post operative monitoring,

ERAS for early recovery & thromboprophylaxis are key to prevent complications following CS.

WHO proposes the Robson classification system as a global standard for assessing & monitoring CS rates within a healthcare facility over time." But every effort should be made to provide CS to women in need, rather than striving to achieve a specific rate."

CTG (Cardio Toco Graph)

Changes in the fetal heart patterns can occur due to various reasons. Intrapartum hypoxia, mechanical stresses like cord and head compression, infections, drugs, feto maternal hemorrhage, all these can cause CTG changes. But the final perinatal outcome depends on the ability of baby to mount its compensatory mechanisms, which in turn depends on fetal reserve and surrounding environment. Now there is a paradigm shift in the interpretation of CTG from the typical pattern recognition to physiology based interpretation. Even though we are following the physiology-based interpretation, the cardinal variables analyzed are the same.

Do Remember DR.C BRAVADO

1. Dr. - Define Risk 2. C- Contractions 3. BRA – Baseline Rate
4. V- Variability 5. A - Acceleration 6. D - Deceleration 7. O - Overall impression

Contractions - Roughly bell-shaped curves or Contractions that last longer than 2 minutes (hypertonus), or 5 or more contractions in 10 minutes (tachysystole) is of concern and needs prompt action.

Baseline - normal range is 110-160 bpm. When assessing baseline, keep in mind baseline

rate and compare with previous baseline. A more than 20 beats/mt or 10% rise in baseline is significant. Make sure baseline is not wavy and is stable

Variability - It is the difference in beats per minute between the highest and the lowest values in a one-minute segment of trace, excluding accelerations and decelerations. It reflects the integrity of autonomic nervous system

Normal Range 5 - 25 bpm

Less than 5 bpm is reduced

More than 25 bpm is increased variability.

If increased variability lasts for more than 30 minutes it is called saltatory pattern which is very very rare. The short segments of increased variability are known as zig zag pattern. It is usually seen in second stage of labour.

- If zig zag patterns last more than a minute - stop oxytocin, give tocolysis
- If seen in second stage - stop active pushing.
- If the zig zag pattern is seen with an increase in the baseline FHR without repetitive decelerations - suspect chorioamnionitis

Accelerations are transient increase in baseline by 15 bpm or more for 15 sec or more. It shows the integrity of the somatic nervous system.

Decelerations are reflex response to any sort of stress to baby. They are now termed as **quick lie and tardy decelerations.**

Quick lie decelerations last for short periods and quickly return to base line. Usually, quick lie decelerations are not associated with hypoxia.

Tardy decelerations show a slow return to baseline, they can be chemoreceptor mediated and can be associated with hypoxia.

Cycling it is a very important feature of CTG. The fetal behavioral states are reflected in the CTG. Periods of fetal sleep will be reflected as low or absent variability and period of wakefulness as normal variability with accelerations. Cycling is a hallmark of a well oxygenated fetus.

When analysing a CTG the main aim is to find out if the baby is hypoxic. Understanding the types of hypoxia and associated CTG changes form the crux of physiology based CTG interpretation.

There are mainly four types of hypoxia.

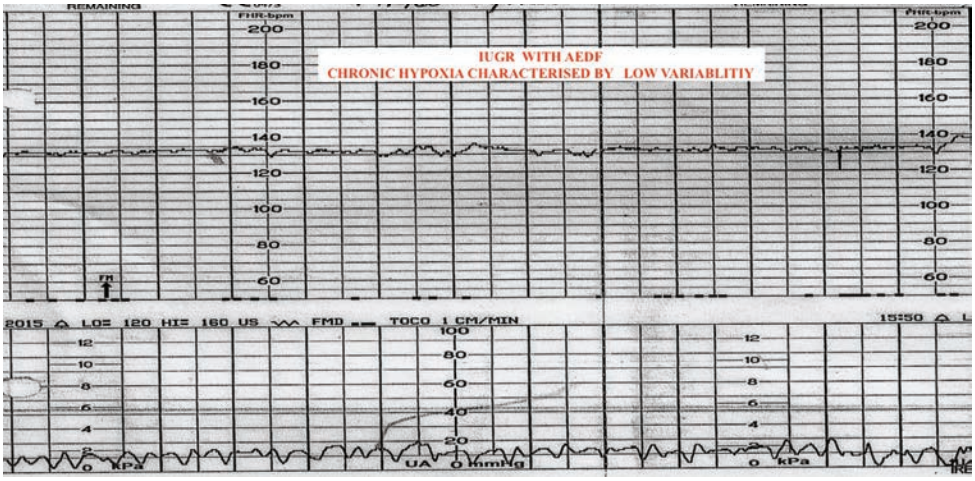
- Chronic hypoxia
- Acute Hypoxia

- Subacute hypoxia
- Gradually evolving hypoxia

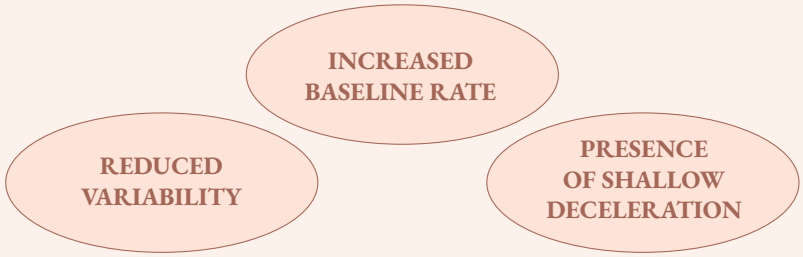
Chronic hypoxia

In this case, fetus is exposed to prolonged period of hypoxia during antenatal period, usually secondary to chronic utero placental insufficiency. Fetal adaptations include decreased fetal growth, reduced movements and diversion of oxygen from nonvital organs. From the admission CTG itself we should be able to predict whether the baby is fit to embark on the journey of labour.

Fig 1. Chronic hypoxia

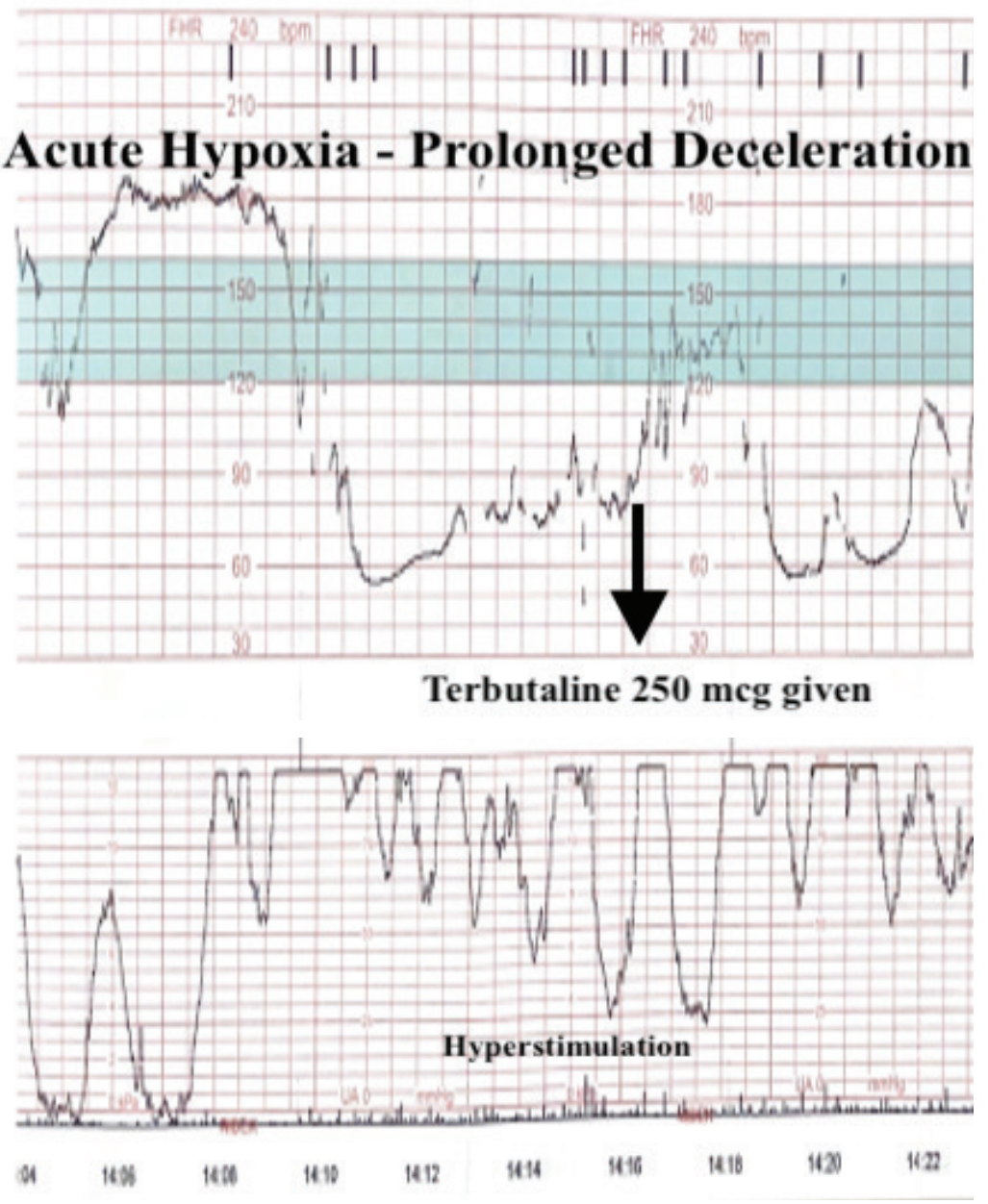


CTG trace in chronic hypoxia



Reduced physiological reserves to compensate for further hypoxic insults
Rapidly decompensate with onset of uterine contractions leading myocardial failure and death

Fig 2. Acute Hypoxia



Acute Hypoxia
-Prolonged deceleration

- **Exclude the three major accidents**

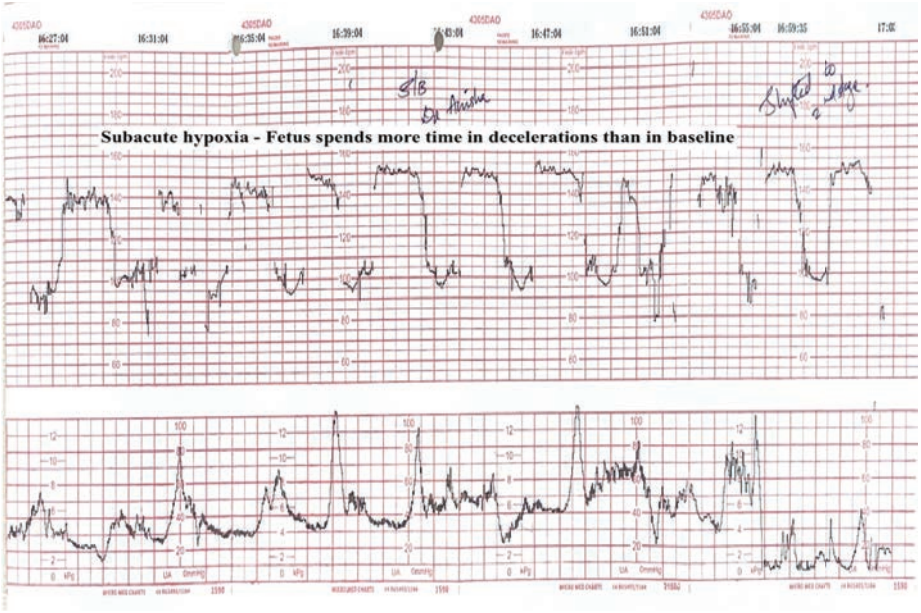
Cord prolapse/
Abruption/Rupture

Present	Absent
Immediate delivery with fastest route possible	**Stop oxytocin** **Give uterine relaxants** **IV fluids fast. Apply 3,6,9,12,15 minute rule.** **Left lateral position.**

Subacute Hypoxia

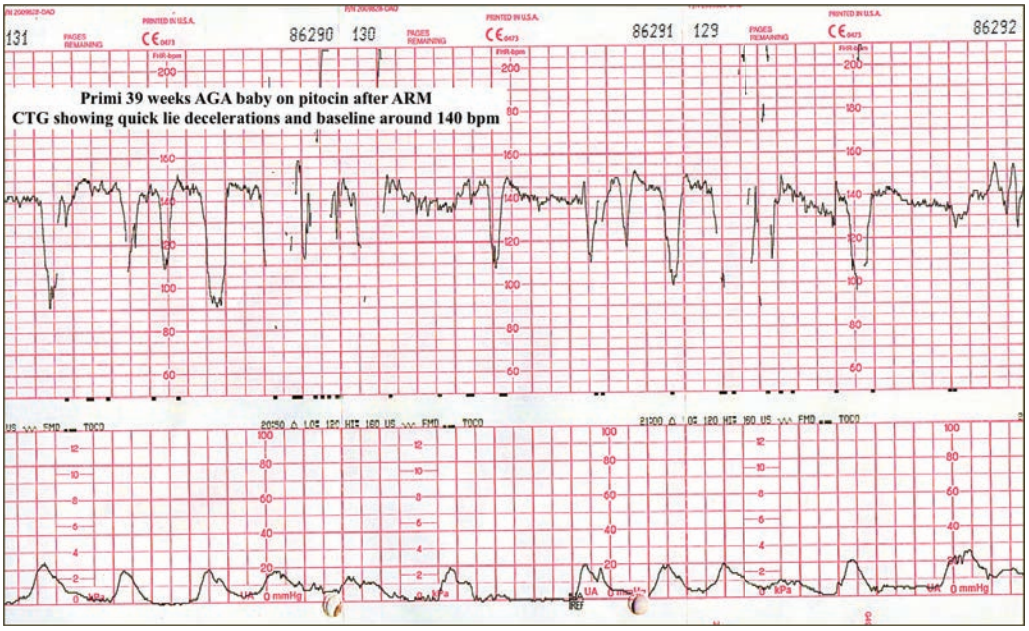
In subacute hypoxia fetus spends most of time in decelerations. pH falls at rate of 0.01 in 2-3 min

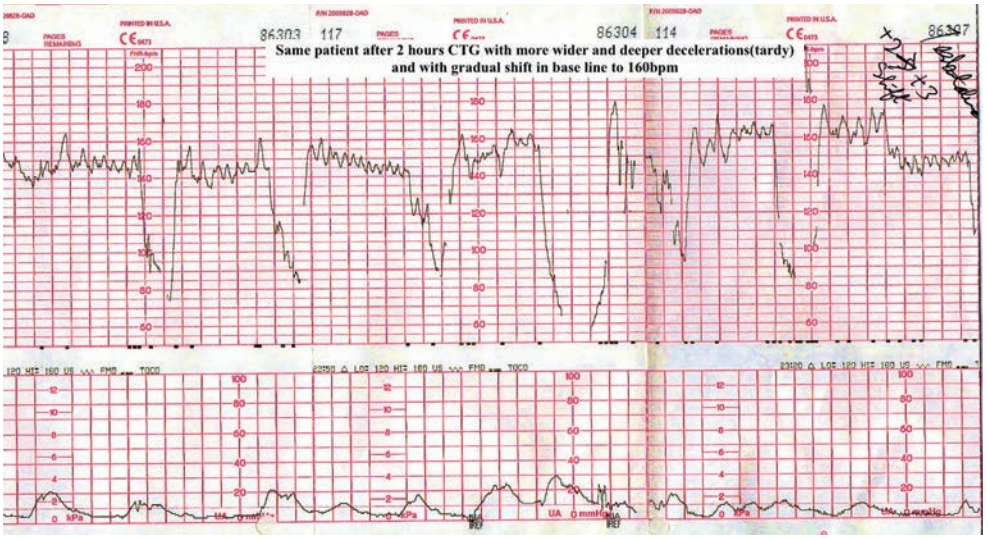
Fig 3. Subacute Hypoxia



Gradually evolving hypoxia - Here fetus gets sufficient time to mount all the compensatory mechanisms.

Fig 4. Gradually evolving hypoxia





Recently updated guidelines have introduced two terms

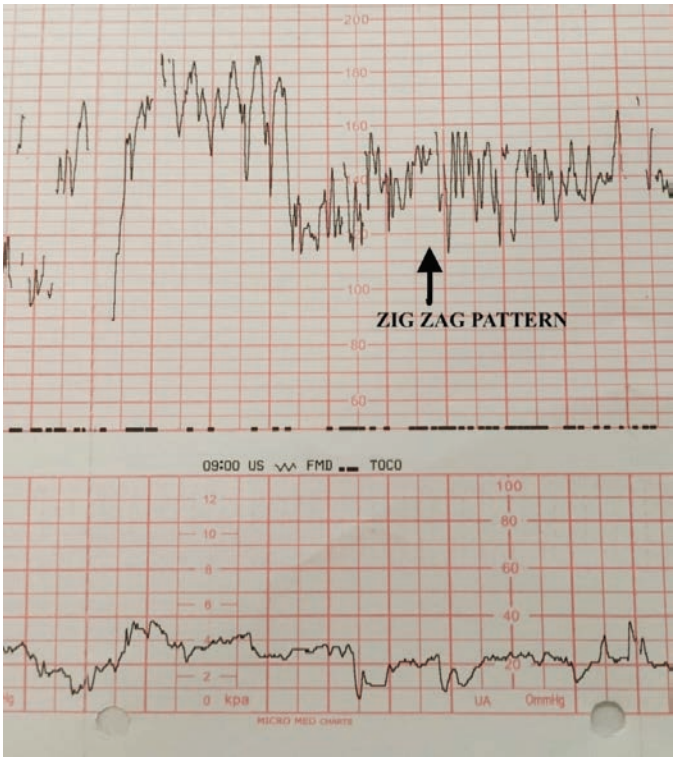
1.Suggestive of Fetal Inflammation (SOFI)

2.Relative uteroplacental insufficiency of labour (RUPI-L)

SOFI - characterized by more than 10% rise in base line which is not preceded by decelerations. It can be associated with Zig-zag pattern/sinusoidal pattern suggesting neuro inflammation. Whenever CTG suggests Fetal inflammation expedite delivery to prevent effects of super imposed hypoxia

RUPI-L This is characterized by wide and deep deceleration as soon as labour starts either spontaneous or induced Baseline rate is in the upper limit of normal and may be associated with periods of increased variability (Zigzag)

Fig 5. Zig zag pattern



Post Delivery Care

- The first 2 hours after delivery is the "golden hour" – close monitoring needed for early detection of PPH. Keep in labour room under close observation.
- Check half hourly – pulse, BP, whether contracted uterus is felt suprapubically. Gently push the uterus down to see if there is any collected blood.
- A seal should be stamped on case sheet to record the findings. Then half hourly monitored for next 2 hours.

Fig 6. Postpartum Monitoring Seal

Time	½ hour	1 hour	1½ hour	2 hr
Pulse Rate				
BP				
Uterine Fundus				
Bleeding				
Urine output				
Sign & Emp ID				

- Early breast feeding should be initiated and rooming practised.
- Usually, the patient passes urine by 3-4 hours, if not check – if bladder is palpable. If bladder is atonic, catheterize for a short duration.
- Do local inspection of genitalia and vaginal examination for any vulvovaginal hematoma before the patient is shifted from labour room. (Associated with perineal pain and bulge in perineum).
- Patients should be encouraged to take lots of fluids and early ambulation to prevent thromboembolism. It should be kept in mind that most common area of thrombosis in pregnancy is left iliofemoral vein. Hence atypical presentations can happen.
- During daily ward rounds – ask for any fresh complaints. Pulse, BP, temperature etc. are recorded. Check – breasts for any retracted nipples or engorgement, uterine involution, perineal care and any calf muscle tenderness.
- Routine antibiotics not needed for uncomplicated deliveries.
- Laxatives may be prescribed if patient has constipation.

- Patient may be discharged after 48 hours of vaginal delivery and 72 hours of LSCS if no complications.

  Give Anti D if indicated.

  Iron and calcium supplements.

  Dietary advice on additional dietary 500 calories and 25 gm protein.
- ***Warning signals to report back*** – heavy bleeding, fever, foul smelling lochia, severe abdominal pain or distension, headache or abnormal behavior.
- Usually, postpartum visit is after 6 weeks – ask for fresh complaints, check vitals and examination including PV examination.
- Advice on contraception.
- Puerperium extends till 6 – 8 weeks, but ACOG has termed it as Fourth trimester and is till 12 weeks post-delivery.

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CHAPTER
09

Other Conditions with impact on MMR

Editor's Note:

This chapter is a pot purie of topics that have impact on maternal mortality, even though less frequently than the leading causes. Most of these topics are covered in the third edition of 'Why Mothers Die' in more detail.

However it is important to be aware of their contribution to MMR and hence added brief details in this chapter.

V P Paily

Neurological Causes of Maternal Death:
Lessons from CRMD

Thomas Iype, Lekshmi Ammal

Maternity is a service offered by women to humanity. Hence, at all levels, healthcare professionals are responsible for safeguarding the health and life of all pregnant and parturient mothers. Neurological causes, though they contribute to a minority of maternal deaths, have to be addressed and prevented wherever possible. ***New onset headaches during any time of pregnancy and post-partum period should be taken as a sinister symptom unless proven otherwise.***

PRES

Pre-eclampsia is an important cause of PRES. Early prediction of Pre-eclampsia can be made in the first trimester by combining risk assessment with maternal factors (gestosis score) MAP (Mean Arterial Pressure), and first-trimester uterine artery Doppler PI values. Screen-positive women will be started on low-dose aspirin from 14 weeks to 34 weeks.

Angiogenic biomarkers can be used to predict pre-eclampsia and also stratify pregnancy into high-risk and low-risk[1,2]. These biomarkers include Placental Growth Factor (PlGF) and soluble fms-like tyrosine kinase 1 (sFlt-1)[3,4.] sFlt : PlGF ratio of < 38 has a negative predictive value of 99.3% and such patients need a follow-up 4 weekly only. Those with a value >85 are high-risk women for Pre-eclampsia and adverse maternal outcomes and hence need urgent hospitalization.

Systematic monitoring of blood pressure and protein levels in urine during antenatal visits has been emphasized to identify pre-eclampsia early to reduce the risk of developing PRES [5]. Home blood pressure monitoring was suggested to improve the detection and treatment of pre-eclampsia[6]. However, the BuMP trials have not supported home blood pressure monitor[7,8.] The implementation of first-trimester screening using a multiparametric algorithm was effective in identifying women at high risk for pre-eclampsia, allowing for aspirin prophylaxis to mitigate the risk of severe outcomes[9]. Autonomic dysfunction associated with pre-eclampsia has been suggested to be a risk factor for the development of PRES[10].

Cerebral venous thrombosis (CVT)

CVT, during pregnancy, is a rare but serious malady. Magnetic resonance imaging (MRI) and magnetic resonance venography (MRV) are recommended as the primary diagnostic tools[11,12]. Low-molecular-weight heparin (LMWH) is the preferred anticoagulant due to its safety profile and effectiveness in both acute and post-acute phases[12,13]. It should be continued throughout pregnancy and the puerperium to prevent recurrence[12,13.] In cases of severe CVT with rapid neurological decline, endovascular treatments such as thrombectomy and thrombolysis have shown promise[14.] Decompressive surgery, such as hemicraniectomy, may be necessary in cases of large venous infarcts or hemorrhages with significant intracranial pressure[15,16.] Antiepileptic drugs are recommended for patients with early seizures to prevent further episodes[12]. Follow-up imaging is essential to confirm the recanalization of the affected sinuses and resolution of thrombi[11]. Most patients with CVT during pregnancy recover fully, although some may experience neurological sequelae[15].

Intracerebral Hemorrhage

There is a need for early and accurate diagnosis of intracerebral hemorrhage (ICH) during pregnancy. Computed tomography (CT) scans remain a critical tool for diagnosing ICH. Pregnancy itself is a known risk factor for ICH, with the risk being particularly elevated during the third trimester and the first 12 weeks postpartum[17]. Key risk factors include preeclampsia, eclampsia, chronic hypertension and gestational hypertension, which significantly increase the likelihood of ICH[18]. In cases of severe hypertension, antihypertensive therapy is recommended, with medications such as labetalol or hydralazine being commonly used[18]. In some instances, emergent cesarean sections are performed to manage the condition effectively[19]. Maternal and fetal mortality remain significant concerns, emphasizing the need for extended postnatal monitoring of high-risk women[17]

Autoimmune Encephalitis (AE)

Recent studies have highlighted the challenges in diagnosing and managing AE during pregnancy. AE often presents with psychiatric symptoms and seizures, primarily in the first and second trimesters. Diagnosis is supported by cerebrospinal fluid (CSF) analysis showing specific autoantibodies, with anti-NMDA receptor (N-methyl-D-aspartate receptor) antibodies being the most common in cases of autoimmune encephalitis. MRI findings are often normal; Arterial spin labeling (ASL) has emerged as a useful diagnostic tool, showing increased cerebral blood flow in affected areas[20–22]. EEG and tumor screenings can aid in diagnosis. Intravenous methylprednisolone and IV immune globulins are used as first-line immunotherapy, with Levetiracetam as a common antiseizure medication. Despite treatment, some women experience long-term neurological deficits and there is a higher rate of miscarriage compared to the general population[23].

Herpetic Simplex Encephalitis (HSE)

Herpes simplex virus (HSV) encephalitis, although rare during pregnancy, requires prompt diagnosis and treatment. It is most commonly caused by HSV-1 and typically occurs in the third trimester. Patients may present with altered mental status, focal neurological signs or seizures(encephalitic syndrome). Diagnosis can be challenging, especially when PCR assays are negative. Repeating the PCR test is recommended, particularly if the initial test was conducted within the first few days of symptom onset[24,25]. Testing for HSV-specific antibodies can be useful when PCR results are negative[26]. MRI findings such as temporal lobe hyperintensities can indicate HSE[24,25.] In cases where initial imaging is negative, repeat MRI may reveal changes consistent with HSE[25,27]. Early treatment with Acyclovir is crucial and significantly reduces mortality and morbidity rates. In cases of high clinical suspicion, continuing antiviral treatment with Acyclovir is crucial despite negative PCR[24,25].

Meningitis During Pregnancy

Meningitis during pregnancy presents unique diagnostic challenges due to the physiological changes in pregnancy.

Aseptic meningitis can present without the classic triad of symptoms. Hence, a high index of suspicion and thorough clinical evaluation is essential [28,29]. PCR is essential for the rapid identification of pathogens, such as enteroviruses in viral meningitis[29]. These methods are crucial, especially when traditional methods are less effective[30].

The management of bacterial meningitis during pregnancy involves the use of empirical antimicrobial therapy tailored to the suspected pathogen. The use of adjunctive therapies, such as dexamethasone, has been shown to improve outcomes in cases of pneumococcal meningitis[31,32]. Management strategies must consider the delivery timing and the potential impact on maternal and fetal outcomes. For instance, delaying delivery in cases of pneumococcal meningitis can reduce the risk of neonatal transmission and improve outcomes[31].

Tuberculous Meningitis : The diagnosis of tuberculous meningitis (TBM) remains particularly challenging due to its non-specific presentation. Rapid recognition is critical[33]. Currently, CSF CBNAAT is used for microbial confirmation. Current treatment regimens are based on pulmonary tuberculosis protocols, but there is ongoing research into the use of high-dose Rifampicin and novel antituberculosis drugs[33].

Headaches, seizures and focal deficits in a pregnant woman, including the postpartum period, should be urgently investigated to identify the brain pathology.

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Maternal Mortality and Heart Disease:
A Persistent Concern

Jayasree Vaman, Radhamony D

Over the past four years, despite efforts to reduce maternal mortality, heart disease remains a significant contributor to maternal deaths. Unfortunately, there has been minimal change in the incidence of heart disease-related maternal mortality.

Observations and Insights

Further analysis reveals that:

1. Rheumatic heart disease: Although largely preventable, rheumatic heart disease continues to affect maternal health. Early diagnosis and treatment can significantly reduce its occurrence.
2. Congenital heart disease Advances in diagnostic techniques have led to increased detection of congenital heart disease. Optimal surgical correction has enabled women with congenital heart disease to survive into reproductive age, contributing to a rise in cases.
3. Increased survival into reproductive age: Improved healthcare outcomes have resulted in more women with congenital heart disease reaching childbearing age, leading to a higher incidence of heart disease-related complications during pregnancy.

Recommendations

To address the ongoing concern of heart disease in maternal mortality:

1. Early diagnosis and treatment: Implement routine cardiac screening for all pregnant women to detect heart conditions, including rheumatic and congenital heart disease. CVS of all pregnant mothers should be auscultated during the first visit.
2. Optimal surgical correction: Ensure timely and optimal surgical interventions for women with congenital heart disease to reduce the risk of complications during pregnancy.
3. Improved access to healthcare: Enhance healthcare infrastructure and access to specialized cardiac care for pregnant women, particularly in rural and underserved areas.

By implementing these recommendations, we can work towards reducing the incidence of heart disease-related maternal mortality and improving overall maternal health outcomes.

There is not much of change compared to previous reports

Disseminated Intravascular Coagulation

B Presannakumary, Jesna

What is DIC?

The International Society of Thrombosis and Hemostasis has defined DIC as an acquired syndrome characterized by the intravascular activation of coagulation with loss of localization arising from different causes. It is always secondary to an underlying disorder and is associated with a number of clinical conditions, generally involving activation of systemic inflammation.

Key Points

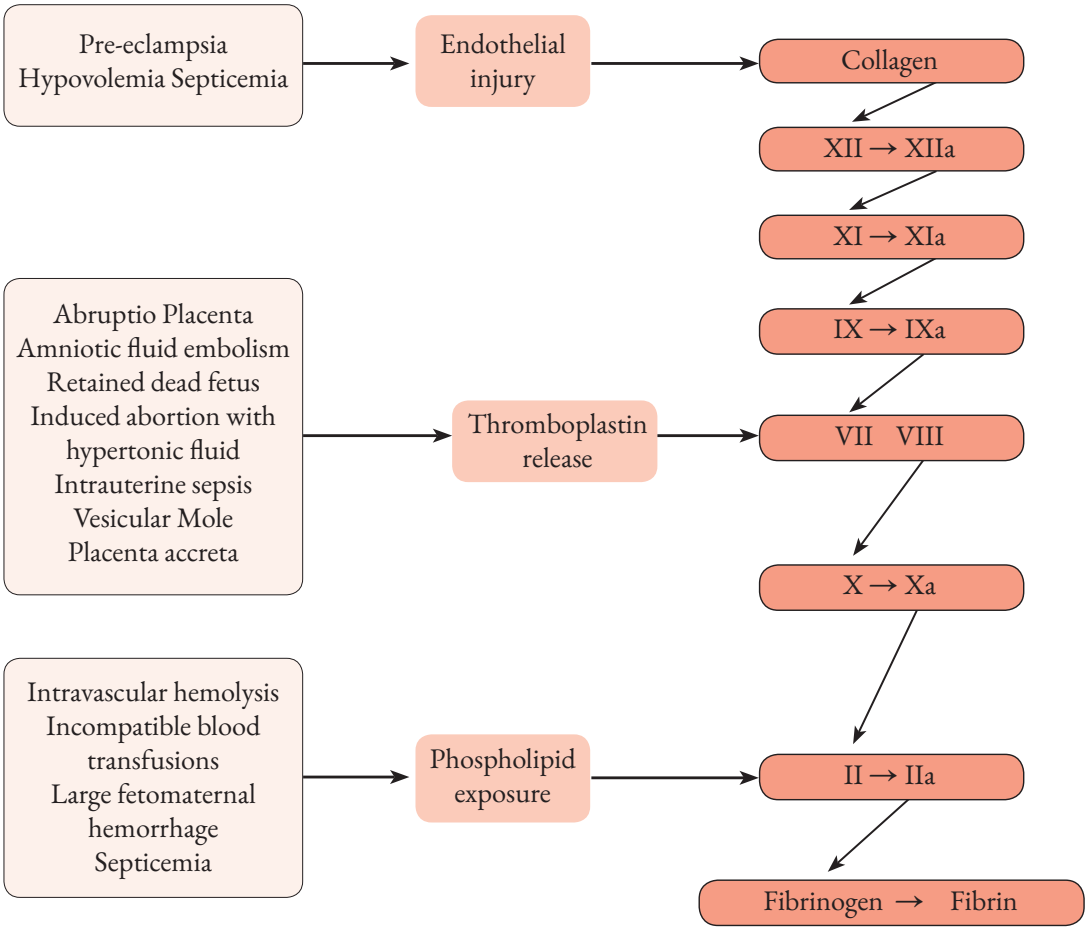
1. DIC occurs following pregnancy complications like abruptio placentae, severe PPH, HELLP syndrome, amniotic fluid embolism, acute fatty liver of pregnancy, septic abortion etc.
2. Management of underlying problem is important in treating DIC.
3. Diagnosis of acute DIC is made by clinical / laboratory finding – Thrombocytopenia, Prolonged PT, APTT, reduced Fibrinogen.
4. DIC following PPH can be prevented by early management and prevention of PPH.
5. Massive transfusion protocol should be initiated, when there is massive hemorrhage. Patient in coagulation failure need approximately ten units of cryoprecipitate.
6. Acute DIC should be anticipated in a pregnant woman with underlying conditions mentioned and effort should be made to recognize and treat latent abnormality to prevent overt DIC.

Key Recommendations

1. Hemorrhage leading to shock should be prevented.
2. Sepsis should be identified and treated early.

3. In HELLP syndrome pregnancy should be terminated early, because endothelial damage can cause DIC.
4. Prolonged hypotension even in absence of hemorrhage can lead to endothelial dysfunction and DIC.
5. In some situations, we may have to perform simultaneous correction of coagulation failure and resort to hysterectomy.
6. A minimum of 6 PRBC, 6 FFP and 6 platelet unit (platelet apheresis) should be made available.

Pathogenesis in Different Situations



Three main triggers of DIC

1. Endothelial injury
2. Thromboplastin release
3. Phospholipid exposure

Diagnosis:

DIC is diagnosed, not by a single laboratory value but by a constellation of laboratory markers. The laboratory markers consistent with DIC are

1. Prolongation of PT and APTT.
2. A rapidly decreasing platelet count.
3. Serum fibrinogen- Fibrinogen levels double in pregnancy. Hence, all cases of DIC do not have low fibrinogen.
4. High levels of Fibrin degradation products including D –Dimer.
5. Peripheral smear shows fragmented RBCs called schistocytes.
6. Clot retraction test - it is a simple bedside test for detecting decreased fibrinogen.

Treatment of Obstetric DIC

DIC can be avoided in most situations by a 'timely' resuscitation and management of underlying disease (e.g. abruption or preeclampsia.)

DIC can be predicted in all previously mentioned high risk conditions except Amniotic fluid embolism. Therapy should be highly individualized.

1. Treat the obstetric abnormality
2. Replace blood products. Replacement of blood products is ideally done after assessment of coagulopathy using ROTEM (Rotational thromboelastography).
3. Treat acidosis, hypothermia and hypocalcaemia
4. Multidisciplinary approach – cardiopulmonary support including use of inotropic therapy, blood transfusion and assisted ventilation if required.

5. Women who are bleeding – Arrest the hemorrhage at the earliest so that DIC can be prevented. In women who bleeds profusely after delivery if attempts to arrest hemorrhage (dealt with in chapter on PPH) fails, we have to resort to obstetric hysterectomy with simultaneous correction of DIC with massive transfusion. It is important to insert a large bore drain before closing the abdomen in all situations where bleeding is anticipated.

Conclusion

- DIC is a rare but serious entity in obstetrics with high morbidity and mortality.
- Condition is difficult to diagnose and we must have a high index of suspicion when dealing with pathologies known to cause DIC.
- Mild untreated cases can rapidly progress to fulminant hemostatic failure.
- Treatment of DIC is aimed at correcting underlying cause and supportive therapy.
- Inadequate resuscitation is the most common cause of maternal death, hence the importance of early intervention.

DIC can be predicted, prevented and successfully treated in most situations, if the obstetrician is alert and the situation is tackled judiciously with the use of blood products, ventilator support when needed, proper monitoring and multidisciplinary input. In situations like severe PPH, decision for hysterectomy should be taken in time. PPH should be treated actively by methods discussed in the chapter on PPH so that DIC will not occur. When there is massive blood loss, blood may have to be pushed. The obstetrician should be vigilant in diagnosing DIC at the earliest and starting treatment.

Respiratory diseases complicating pregnancy

Mathew Thomas, Manjula Abhilash

Respiratory infections, including pneumonia and viral illnesses like influenza, pose significant health risks for pregnant women in Kerala. A cross-sectional study conducted in India found that influenza viruses were responsible for 18.8% of acute respiratory infections among pregnant women, with the majority of cases caused by the influenza A/H1N1pdm09 strain. The study also reported a case fatality rate of 8% among the infected pregnant women, underscoring the severity of influenza during pregnancy. Additionally, the COVID-19 pandemic has highlighted the vulnerability of pregnant women to respiratory infections. Research indicates that pregnant women with COVID-19 can experience severe symptoms, including pneumonia, which may necessitate intensive care. Early treatment with Oseltamivir in viral infections, liberal nebulisation and inhalers in patients with bronchial asthma is also important.

Table 1.Respiratory Diseases

	2020/21	2021/22	2022/23	2023/24	Total
Total maternal deaths (Analysed)	**111**	**191**	**112**	**108**	**522**
Covid	10	93	2	2	107
Pneumonia	2	3	4	4	13
Viral fevers		3(1Dengue)		6(Dengue 3)	9

Vaccination during pregnancy is a crucial preventive measure against respiratory infections. The World Health Organization recommends routine inactivated influenza vaccination for all pregnant women, as they are at increased risk for hospitalization from influenza, especially during the second and third trimesters. Despite this, influenza vaccine uptake among pregnant women in India remains extremely low, with studies indicating a 12.8% uptake for pandemic influenza vaccines and none for seasonal influenza. While specific data on pneumonia vaccination during pregnancy in Kerala is limited, the National Health Mission's Universal Immunization Programme targets pregnant women for vaccination against various preventable diseases. Enhancing awareness and accessibility of vaccinations can significantly reduce the burden of respiratory infections among pregnant women in the region.

Ectopic Pregnancy

**PV Jose, Hariprasad, Simi Kurien,
Suchitra Sudhir**

The maternal mortality due to ectopic pregnancy has declined during the last few years suggesting that earlier diagnosis and treatment may have made an impact.

Ectopic pregnancy requires very early diagnosis and a prompt and effective treatment. A first-visit trans vaginal ultrasound scan should be offered not only to high-risk patients but to all pregnant women. In doubtful cases, beta hCG levels should be measured, and a repeat scan should be performed within one week.

Selection for medical treatment must be done carefully, with close and vigilant follow-up. Surgical intervention should not be delayed when indicated.

In stable patients, administering methotrexate or mifepristone prior to surgery can help reduce bleeding, particularly in cases of scar ectopic or cornual pregnancy.

All patients with previous LSCS should have a dedicated early scan before 8 weeks of pregnancy to locate the gestational sac, as a cesarean scar pregnancy is associated with early pregnancy bleeding, rupture of scar, placenta accreta spectrum, cesarean hysterectomy and maternal morbidity and mortality.

Thromboprophylaxis In Pregnancy

N S Sreedevi

For whom to give thromboprophylaxis?

- Women with pre-existing risk factors
- Obstetric risk factors for VTE
- Transient risk factors

Risk assessment to be performed in early pregnancy / pre-pregnancy

- On admission to hospital
- Intrapartum or immediate postpartum

When to initiate thromboprophylaxis?

- Women having 4 or more risk factors
  Throughout pregnancy, continued till 6 weeks postpartum
- Having 3 risk factors
  After 28 weeks and continue till 6 weeks postpartum
- 2 risk facors
  Postpartum for 10 days

Agents used for thromboprophylaxis

- Heparins - UFH or LMWH

  Do not cross placenta or cause fetal anticoagulation.

  Safe in breast feeding, LMWH is agent of choice

  UFH preferred in peripartum, when increased risk of hemorrhage or regional may be required.

Heparins : UFH vs LMWH

- **UFH** causes HIT (Heparin Induced Thrombocytopenia), bone loss, needs monitoring baseline platelet count after 2-3 days, weeklyx2 weeks then monthly
- **UFH** preferred in patients with severe renal insufficiency
- **LMWH** effective subcutaneously, has more predictable response and do not require routine monitoring.

Suggested doses of LMWH for antenatal and postnatal prophylaxis

Weight	Enoxaparin	Dalteparin	Tinzaparin
<50 kg	20mg/day	2500 u/day	3500 u /day
50 -90kg	40mg/day	5000 u/day	4500/day
91-130 kg	60mg/day	7500 u/day	7000u/day
131-170 kg	80mg/day	10000u/day	9000u/day
>170kg	0.6 mg/kg/day	75u/kg/day	75 u /kg/day

Dosage of anticoagulants for thromboprophylaxis for VTE

- **LMWH** preferred to **UFH**

- **Prophylactic LMWH**

  Enoxaparin – 40 mgm SC once daily

  Dalteparin - 5000 units SC once daily

  Tinzaparin - 4500 units SC once daily

- **Prophylactic UFH**

  5000 u-7500 units SC every 12 hrs in second trimester

  7500u-10,000 units SC every 12 hrs in second trimester

  10,000 units SC every 12 hrs in third trimester/unless APTT is elevated

Contraindications /Cautions to LMWH

- Known bleeding disorders
- Active antenatal or postpartum bleeding
- High risk placenta previa
- Thrombocytopenia -Platelet count <75x109
- Acute stroke in previous 4weeks
- Severe renal disease (GFR <30 ml/minute /1.73m2)
- Severe liver disease (Prothrombin time above normal range or known varices)
- Uncontrolled hypertension (BP >200 mm Hg systolic or >120mm Hg diastolic

CHAPTER 10

Maternal Death and Near Miss Surveillance and Response (MDNMSR)

Lekshmi Ammal,
Manjula Abhilash

Editor's Note:

MDNMSR (Maternal Death and Near Miss Surveillance and Response) was started as a way of decentralising the confidential audit of maternal deaths that we have been doing since 2004. When we piloted the near miss audit in the five government medical colleges of the state, it was obvious that the causes of near misses were similar to the causes of maternal deaths. We then reasoned that auditing near misses can be done at district level and can be used for learning valuable lessons to avoid maternal deaths. Once implemented its benefits were immediately perceived by all involved. Since it is a more pleasant step than auditing maternal deaths, there is less inhibition to present the cases. However, there are practitioners still reluctant to bring up their near misses for discussion for fear of critical analysis by others. Hopefully their apprehensions will disappear soon.

V P Paily

MDNMSR (Maternal Death and Near Miss Surveillance and Response) activities were started in Kerala in January 2019. The background rationale, objectives and organization of the district MDNMSR group and state MDNMSR teams are elaborated in the third edition of the book. Primary objective of the MDNMSR is to ultimately eliminate all preventable maternal deaths.

Background

In early 2000, WHO started to use the term MDSR (Maternal Death Surveillance and Response) instead of maternal death audit. In Kerala, with improved health care services and a decline in maternal mortality ratio, number of maternal deaths started declining. Hence the leadership of Kerala Federation of Obstetrics and Gynecology (KFOG) thought of considering the near miss cases to analyze the maternal health scenario in Kerala. Considering the relevance of near miss case audit in the prevention of maternal deaths, KFOG introduced MDNMSR, incorporating near miss concepts also into MDSR. The organization of MDNMSR teams are designed in such a way that each and every practicing obstetrician is a member of the district team. The district team is headed by the District Collector who presides over the meetings of MDNMSR with RCH officer as the convener. In the absence of the Collector, District Medical Officer will preside. The KFOG is represented by the district captain, who coordinates the activities in the district. There are three vice captains, each assigned with specific duties of

1. Maternal mortality cases
2. Near miss cases.
3. Minutes of district monthly meetings.

To facilitate the administrative involvement the superintendents of various delivery points are also to attend the monthly meetings.

The main responsibilities allocated to the district team are:

1. To ensure reporting of maternal death at all delivery points promptly. A copy of the report is to be sent to the CRMD state coordinator. The case records with details have to be procured from the primary hospital and sent to the State Coordinator. Only the primary case record can give an insight into circumstances leading to maternal death.
2. Reporting of all near miss cases which is a success story and gives equal insights as the maternal deaths.

The state MDNMSR team consists of the president KFOG, Secretary KFOG, all captains, vice captains and RCH officers. This state team coordinates the activities of the district team.

The Kerala experience with MDNMSR activities

The MDNMSR committees at the district level are regularly conducting meetings since January 2019. The one-year time frame between 2019 to 2020, was the time for conception and development of the novel idea of MDNMSR. During this period practically all were physical meetings chaired by the district collector/District Medical Officer. The activities were catching up momentum when the COVID pandemic unsettled all our efforts. As an attempt to overcome the obstacles due to the ban on physical gatherings, we moved on to online meetings. In 2023 we revamped our activities once again and by 2024, all district committees once again gathered momentum and succeeded in setting up their own pace in the conduct of the monthly meetings.

Where have we reached?

1. The near miss case contributions are mainly from various medical college hospitals with a small percentage from private delivery points.
2. The majority of the meetings are now conducted online. The meetings are convened by the RCH officers of the district.
3. Near miss cases are usually presented by the vice-captain or the doctor concerned.
4. The senior members of the profession analyze the cases and discusses the good aspects as well as the gaps in the management.
5. The vice-captain, for keeping minutes of the meetings, makes a report and forwards it to the state MDNMSR committee.
6. The MDNMSR meetings have become a great platform for exchanging academic knowledge, discussing protocols and guidelines as well as difficulties encountered in practice. The MDNMSR meetings have turned into a monthly CME for practicing gynecologists.

Shortcomings of the previous year

1. Still MDNMSR meetings are not streamlined in 20% of the districts.
2. The attendance for the meetings are still sub optimal. We have not been able to reach the peripheral practicing gynecologists to the desired extent.
3. The near miss cases still remain under reported

Our Near miss data for 2024-2025

Category 1 (Pregnancy Specific Obstetric and Medical disorders)
302 (89.88%)

1.1 Hemorrhage	**183**
Placenta Accreta Spectrum (PAS)	60
Atonic PPH	41
Traumatic PPH including rupture	24+9 = 33
Atonic + traumatic PPH	07
Ruptured ectopic	20
Abruption	06
Rectus sheath haematoma	06
Ist trimester bleeding	03
Placenta previa	02
Secondary PPH	02
2nd trimester bleeding	01
Post PPS IP bleed	01
Scar Ectopic	01
Hypertension	51
Sepsis	51
PPCM	06
AFE	08
Wernickes Encephalopathy	01
DVT	02

Category 2 11(3.2%)

Heart Diseases	06
Acute Kidney injury	01
Chronic kidney diseases	01
Respiratory diseases	01
SLE/ Sjogren's	01
Stroke complicating pregnancy	01

Category 3 22(6.8%)

Anaphylaxis	03
Dengue	02
H1N1	02
Myocardial infarction	01
Post Cesarean collapse (Mediastinal Tumour)	01
Ovarian cyst torsion	01
Appendicular abscess	02
Bowel injury	01
Post op paralytic ileus	01
Arrest during cerclage	01
Sickle cell crisis	02
CKD IgA nephropathy	01
Hepatic encephalopathy	02
Bladder injury during Cesarean	01
LAST	01

Inferences from review of near miss cases

1. Many of the delivery points are still not equipped with Uterine Suction Cannula and Trans Vaginal Uterine Artery Clamp.
2. Patients continue to end as Near Miss cases and Mortality cases because we fail to adopt these rescue measures.
3. Hemorrhages are still diagnosed late.
4. Post partum monitoring has to be made more vigilant.
5. Awareness has to be generated through frequent training programmes
6. Placenta Accreta Spectrum (PAS) is increasing. Incidence is one and a half that of atonic PPH
7. Cesarean associated complications are also on the increase.
8. Steps to curtail cesarean sections and training for safe cesarean sections has to be endorsed. Induction of Labour in the right way has to be emphasized.
9. Simple measures like BP monitoring and urine Albumin estimation are not given the due importance.
10. Many a times warning signs and symptoms pointing to severity of Hypertensive diseases are missed leading to Eclampsia and cerebral hemorrhage.
11. Sepsis is increasing, the incidence has risen as high as Hypertension

Decreasing Near Miss Cases, the way forward

1. Efforts are to be made at all levels of health sector including Health policies, Infrastructure, Human Resources etc.
2. We have to focus on the three major causes of mortality and near miss cases.
3. All practicing gynecologists and health workers dealing with maternal care are to be empowered with knowledge and skills through periodic training towards prevention of preventable causes of maternal death.

CHAPTER 11

Preventing the Preventable Maternal Deaths (PPMD)

Neetha George

This project by KFOG was started following WHO recommendations.

WHO explained that if we are to achieve sustainable development goals by 2030, a concerted effort should be made to prevent all the preventable maternal deaths by the year 2025.

To identify the preventable maternal deaths, we rely on the CRMD. At the end of review of every case, the assessors discuss and decide if there were preventable factors in the case. By compiling the informations we decide on which causes to address and what steps to be taken.

Just prior to the launch of PPMD we had launched the ORRT (Obstetric Rapid Response Team). This also was on the basis of CRMD which showed that in many of the delivery points when an emergency strikes, there is delay in initiating effective resuscitative measures. There should be no delay to start intravenous lines, initiating CPR or taking definitive steps to stop escalation of the complications like PPH or eclampsia. Even though, KFOG already had schemes like EmOCaLS (Emergency Obstetric Care and Life Support) which was for two days and conducted in the district headquarters, often the training was limited to doctors. For most of the practicing doctors, especially in the

private sector, it is not possible to be away from the base hospital for two days. Considering all this, we developed the one day program to train doctors and nurses. Obviously. the content of training was to focus on preventing the preventable maternal deaths. The government of Kerala agreed to have the training programmes organised by the RCH officers with KFOG providing the trainers. Dr.Neetha George and Dr.Raji Raj have been leading these programmes with the support of KFOG member societies distributed in all the districts.

V P Paily

Introduction

KFOG has joined hands with the Health Ministry, Government of Kerala and NRHM for a very noble cause -Preventing all preventable maternal deaths by 2025 – to achieve the target set out by WHO. KFOG has also pledged to try to bring down MMR of Kerala to 20 by 2030. Urgent steps to address this issue is to prevent and treat hemorrhage, to recognise and treat hypertension, sepsis, AFE, early pregnancy emergencies etc. Also, we have to empower all doctors and nurses especially in the periphery to start the primary preventive measures of PPH - TVUAC and suction cannula. The early management of severe preeclampsia and eclampsia also should be known to all the labour room staff. The well trained ORRT team and the staff in the labour room and obstetric HDU should be able to tackle a maternal collapse including performing a BLS and ACLS. Prompt recognition of VTE is of paramount importance. The workshop aims at interactive sessions of doctors and nurses on these topics and impart hands on training on mannequins. We thank the Health Department led by the Health Minister for having initiated steps and for taking the lead to save our mothers.

Key summary points

- Declining birth rates have led to increasing trends in MMR.
- Every labouring patient is a potential litigation patient and protocol-based management and regular drills are the only way with which we can decrease our near miss and mortality cases.
- The post-test in PPMD training sessions and feedback forms revealed the importance of training and retraining of labour room personnel.
- A multidisciplinary approach in very high risk cases and incorporating higher modalities of imaging like CT, MRI, sepsis screening like biofire assays, dynamic hemodynamics for sepsis, continuous CTG in all high risk cases etc will help a long way in decreasing unexpected maternal and neonatal deaths.
- Proper documentation and regular auditing of all near miss cases have to be done.

Key Recommendations

1. PPMD training has to be given to all care givers - doctors and nurses in the public and private delivery points
2. Antenatal classes should be attended by all pregnant women. These classes should give information on PPH, Sepsis, Hypertension, AFE, VTE, perinatal mental health, early pregnancy emergencies etc.
3. Prevent and treat all conditions leading to maternal death

   e.g.

   PPH - AMTSL Suction cannula, TVUAC.

   HTN - antihypertensives, anticonvulsants, early termination.

   AFE - strict IOL (Induction of Labour) protocols, prevent hyperstimulation.

   Sepsis - sterilisation and disinfection protocols and antibiotic policy, follow sepsis bundles. early warning scores - MEOWS, OMQ, SOFA.
4. All delivery points should have minimum of three doctors for round the clock services.
   - Improve infrastructure of labour room for providing respectful maternity care
   - Have a good obstetric HDU.
   - Give periodic drills to staff and junior doctors.
   - Essential flow charts and protocol books should be there in labour room itself.
5. Make every patient know that her own obstetrician may not be available at her time of delivery.
6. Develop the ORRT Team
7. 40% of the deaths are still preventable.Thromboembolism, suicide deaths, normal ectopic, neurological causes and autoimmune conditions are now emerging as causes of increasing maternal deaths.
8. Every delivery point should have a blood bank or at least a blood storage facility. Emphasis on anemia prevention. Blood donor should be available for every obstetric patient.

9. Promote influenza vaccination in pregnancy and keep a vigilant watch for Dengue, H1N1, Covid in pyrexia of unknown origin.
10. The Government should continue and enhance financial support to promote PPMD & ORRT.

Organisation of PPMD training workshops

1. RCH officers collect data of all delivery points of the district and the contact details of all the obstetricians and nurses of these delivery points.
2. RCH officers organise workshops to train 50 to 80 delegates (about 15-30 doctors and 40 nurses) per workshop. These are organised at different centres within the district.
3. The RCH officer arranges these workshops in consultation with the contact person of the O&G society of the district. KFOG provides the contact details of these persons.
4. The contact person arranges for the faculty and training material.
5. Local requirements like venue, food, audio-visual, photography, writing pads, local transport, attendance certificate etc. are to be arranged by the RCH officer. Intimation about the workshop should be passed on to the concerned delegates through the hospital administration. Not more than 50% of the staff are to be deputed for a workshop at any time. The remaining staff may be accommodated during other training sessions in the nearby areas. Training sessions may have to be arranged on Sundays as well.
6. All financial details and accounting are to be carried out by RCH officer's staff. This includes TA, DA and transportation charges to the faculty.
7. Four TOT(Training of the Trainers) sessions were conducted and 204 trainers are helping the government to train all the doctors and nurses across the State.
8. We are providing a handbook to all delegates. The cost of which comes to about Rs.100 /- per person.
9. Each district will have a team of trainers (10 to15 members) who will provide the training at the different centres organised by the RCH officer. At present, KFOG is providing the training materials and mannequins for the district. PPMD comes under the Materno-fetal committee of KFOG headed by Dr.Ambujam. The chief coordinator for the state who has spearheaded these activities is Dr.V.P.Paily .

There are around 500 delivery points in Kerala and just within 2years of its inception, PPMD has tried to reach out to obstetricians and nurses from every nook and corner.

Table 1. PPMD Workshop for Training the Trainers 2022 -2024

Date	Place of training	No of doctors
14/8/22	Thrissur	35
11/9/22	Calicut	53
18/9/22	Thiruvananthapuram	71
9/10/22	Thrissur	47

Table 2. Number of doctors and Nurses who attended the workshop in each district 2022 -24

District	Doctors	Nurses
Thiruvananthapuram	193	378
Kollam	77	161
Pathanamthitta	74	53
Kottayam	69	109
Alleppy	60	nil
Ernakulam	80	162
Idukky	85	169
Thrissur	154	260
Palakkad	56	104
Malappuram	63	102
Calicut	112	126
Kannur	120	146
Wayanad	91	217
Kasaragod	nil	nil

Conclusion

Obstetrics is always associated with the unexpected and untimely emergencies and Time is life. So always be prepared to face the most dreaded complications. ACLS and BLS training is imparted as part of our EmOCaLS, PPMD projects and we obstetricians should be the first line personnel to start the resuscitation. Avoid unnecessary cross talks and blame games and stay united with our colleagues during mishaps.

CHAPTER 12

Training in Obstetric Procedures using Simulators (TOPS)

Prameela Menon

Introduction

Training in obstetric procedures using simulators is a novel concept by KFOG. ***"Expect the unexpected" is the tag line in obstetrics***. Though we learn obstetrics in our PG days and through clinical experience, to prepare ourselves to tackle emergencies, we need refresher courses. Not only that, updating regularly is also essential. Though such skill training sessions are common in other fields, OBG lacked such comprehensive training. Hence such a training session was devised keeping in mind requirements of the youngsters as well as the "not so young".

Outline

All scenarios of obstetric emergencies are recreated at our state-of-the-art skill lab in KFOG headquarters. Even labour room and operation theatre is recreated there. Different models and animal tissues are available to learn the skills. Only 9 trainees are included in a batch so as to have one to one interaction. Curriculum starts with basics of abdominal and vaginal examination, progresses in a step wise manner up to maternal collapse and resuscitative hysterotomy (perimortem CS). Training is under the able

leadership of Prof. V P PAILY whose vision, passion and perseverance is the back bone of this programme. Dr Agnes Mathew is the co-director and all renowned teachers of KFOG participate as faculty. The participants are given 2-day intense training at KFOG skill lab following which they can opt for observership for 3 more days at one of the centres – New Alma hospital Mannarkkad, JMMC Thrissur and Rajagiri hospital Aluva.

This is a certified training programme by KFOG. So far 4 batches have successfully completed the training. We have got excellent feedback too. Our trainees included those who are doing their post graduate studies and even those with more than 15 years of experience, both from inside and outside the state.

In this era of litigation and violence against doctors, TOPS helps us to prepare to handle scary situations in labour room and also helps to improve our skills and quality of care.

Trainees as observers at New Alma Hospital

Skill lab training

TOPS

TRAINING IN OBSTETRIC PROCEDURES USING SIMULATION

AN ENDEAVOUR BY KFOG

(Kerala Federation of Obstetrics and Gynaecology)

FACULTY FROM ALL OVER KERALA

Course Director

Dr. V.P. Paily

Co-Director

Dr. Agnes Mathew

Coordinators

Dr. Deepthy M.

Dr. Prameela Menon

Team Leaders

Dr. Ambujam

HOD Rajagiri Hospital, Aluva, Ernakulam

Dr. Sareena Gilvaz

HOD Jubilee Medical College, Thrissur

Dr. Kammappa K. A.

HOD New Alma Hospital, Mannarkkad, Palakkad.

PROPOSED PROGRAMME

(with help of mannequins and hands on training)

On March 29 & 30 (Saturday, Sunday), 2025

- Obstetric Palpation
- Induction of Labour
- Pudendal Block
- CTG Interpretation
- Conduct of Labour
- Episiotomy And Vaginal And Cervical Tear Suturing
- Forceps/ Vacuum
- Digital Rotation
- Destructive Operations
- Vaginal Breech Delivery
- ECV
- Shoulder Dystocia
- Transverse Lie
- Cord Prolapse
- Pph Management
- Cesarean Section
- Placenta Accreta Spectrum
- Obstetric Hysterectomy
- Stepwise Devascularization
- Repair of Perineal Tear (in Animal Tissue)
- Ectopic, Twins
- Manual Removal of Placenta
- Rupture Uterus
- Perimortum Cesarean
- Acute Collapse Management
- Inversion, Puerperal Sterilization
- Immediate Care of New Born

For Course Fee and More Details

Dr. Prameela Menon 9495568522

Dr. Deepthy M. 9847267794

Mrs. Lakshmi Ajay 8129019939

www.kfogkerala.com

CHAPTER 13

CRMD Snippets

Betsy Thomas

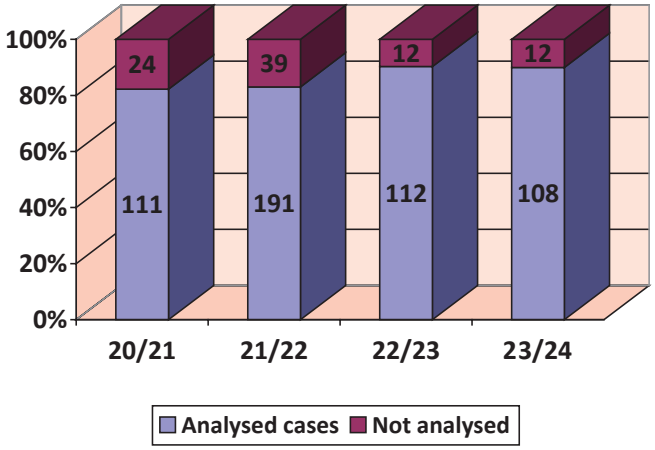
Editor'sNote

This is a compilation of selected cases, published as snippets after each CRMD meetings in the last four years. These were selected because of the learning points they convey.

V P Paily

CRMD snippets are being circulated amongst all societies and clubs, for the last few years so that the message is percolated to all the members. This chapter presents an outline of all cases analysed in the trimonthly CRMD meetings by Obstetric and Non-Obstetric experts. Each case was analysed maintaining absolute confidentiality and at the end of discussion the team decides whether there was any delay from the patient's or Health care provider's side; so also, whether this maternal death was avoidable or not. The concept of PPMD (Prevention of Preventable Maternal Deaths) started from such discussions. In some cases, the team could not assess delay or avoidable factors due to dearth of data. Out of the total 609 deaths in the assessment period, 522 deaths were reported to CRMD team and were analysed by Obstetrician and Non-Obstetrician assessors. (Please refer the chapter on Introduction for further clarification)

Fig: 1 Maternal deaths 2020 - 24: Analysed and not analysed cases
Total no. of deaths analysed: 522



When each case is being confidentially analysed, the CRMD team decides whether there was delay from the part of the patient/ relatives, or after reaching the health facility. Some cases cannot be commented upon which is also mentioned. Fig: 2 gives the details

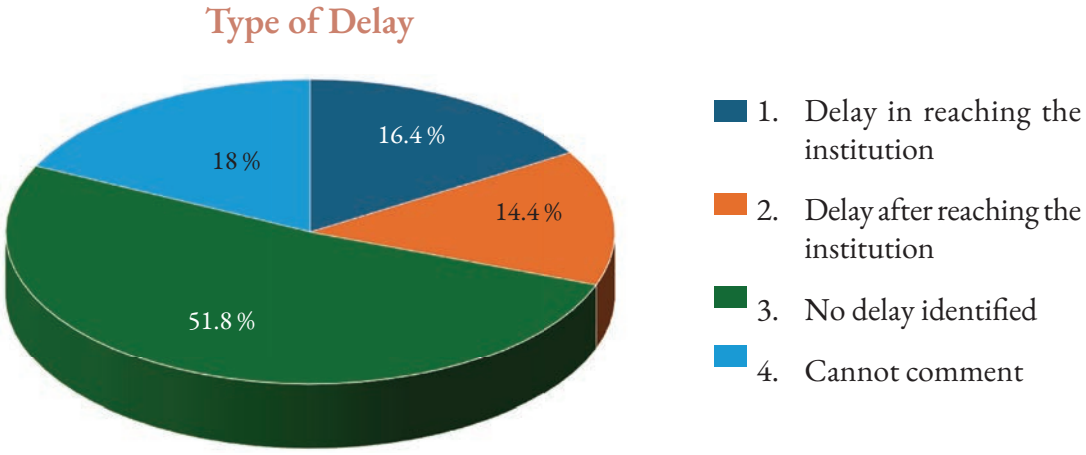


Fig: 2 Type of Delay

Many of the deaths are unavoidable, but the fact remains that a significant number are avoidable. During CRMD meeting, after each case, the team decides whether it was avoidable in an average setting or in an advanced setting or unavoidable. We have compiled the relevant data in Fig 3. Such data forms the basis for PPMD.

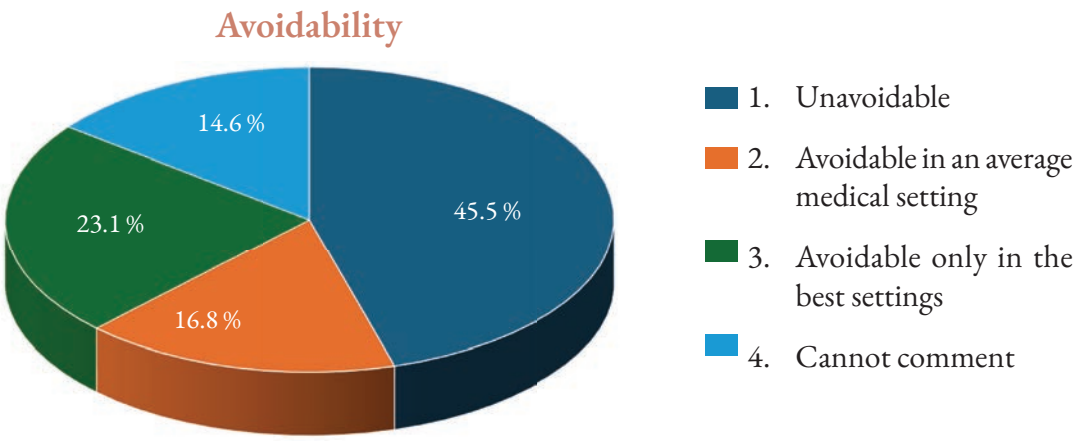


Fig: 3 Avoidability of maternal deaths

Learning from Examples

Examples 1:

A 31-year-old Primi with excessive vomiting and poor intake of food from 6wks of gestation. She had generalised weakness and behavioural symptoms and was admitted in local hospital at 14wks. She developed seizures and became unresponsive and was referred to MCH. She had severe respiratory distress and hypotension. Was intubated and ventilated. Diagnosed to have irreversible brainstem dysfunction and MODS due to sepsis. FHS absent and pregnancy was medically terminated. She was referred to another MCH after starting Meropenem. Investigation showed elevated inflammatory markers. MRI- acute infarcts in pons, frontal region and left side of cerebellar vermis. ECHO showed global LV hypokinesia and severe LV dysfunction. Started on higher antibiotics, tracheostomy done. Serum ammonia elevated. Developed multiple episodes of seizures. Haemodialysis done. EEG showed brain death. Afterwards medical board and ethical committee decided to de- escalate treatment.

Cause of death: Wernicke's encephalopathy

Learning Points:

1. This is a clear-cut case of Wernicke's encephalopathy caused by Thiamine deficiency (B 1) due to excessive vomiting. A simple treatment of IV Thiamine 100 mg daily for 3–5 days would have reverted the pathological process. It is

important to supplement hyperemesis patients with Thiamine, preferably IV.

2. Give IV Thiamine along with or before IV Dextrose in hyperemesis , lest the little available Thiamine be utilised into anaerobic glucose–lactic acid pathway and predispose to Wernicke's encephalopathy – Korsakoff's psychosis spectrum.

Examples 2:

A 28 year old G3P2L2 at 38 weeks found to be COVID positive, was referred to a second centre, Enema given, started leaking. She developed hypotension and was referred to MCH (third centre) where she reached at 3:14 am. On examination Vitals stable, directly shifted to second stage as head was outside the outlet . Delivered a deeply asphyxiated 3.6 kg baby, following which she developed severe atonic PPH, went into shock. Initial first aid measures (TVUAC and Suction cannula) failed, Obstetric hysterectomy done by 5 am. 66 units of blood and products were transfused. Post op she was on ventilator and inotropic support. She had cardiac arrest on post operative day 1 (POD) and was revived . Developed DIC, severe LV dysfunction, AKI, ischemic hepatitis and expired on POD 2 at 5:45 am.

Cause of death: Atonic PPH, Covid

Learning Points: Routine COVID testing and referring a patient just because she is COVID positive, is it justifiable? It took 8 hours for the patient to reach the third centre from the first centre! Though it seems that everything has been done, TIMING of first aid measures like TVUAC and Suction cannula are important. Here TVUAC is applied 10 minutes and Suction canula is applied 20 minutes after the onset of PPH. Please remember TIME IS LIFE! There is a paradigm shift in the order of the first aid measures, TVUAC and Suction cannula should be used even before the medical management as the action is immediate.

Condom tamponade and vaginal packing have lost their role in PPH management. ***AMTSL should be used in all cases including cesarean and documented too.*** The present KFOG protocol for AMTSL is Inj. Oxytocin 5 units IV and 10 units IM at the delivery of the anterior shoulder followed by 20 units in 500 ml Normal Saline (NS) over 2 hours. We have to inform our Anaesthesia colleagues about the protocol as they are the ones to administer the drug during cesarean.

Examples 3:

A 27-year-old gravida 2, 1st FTND, induced with PgE1 and Oxytocin at 38 weeks and delivered at 11.58 AM, 3.5 kg baby. Developed atonic PPH. Medical management and Condom tamponade tried. 1-unit PRBC transfused and referred to MCH with NASG. She

reached in shock; profuse bleeding per vaginum. Developed cardiac arrest. Resuscitated and shifted to theatre. Developed cardiac arrest again. At laparotomy, 6 cm rent on the left uterine wall involving uterine vessels extending to the cervix and vagina. Subtotal hysterectomy and suturing of tear done. Internal iliac artery ligation done. Right external iliac vein got injured CTVS called in and repair done. Massive transfusion given. Post operatively was on ventilator and ionotropic supports. Developed ARDS, AKI and expired on the 7th day.

Cause of death: Traumatic PPH

Learning Points:

- We have witnessed the efficacy and propagated the paradigm shift in management of PPH to arrest of bleeding. The advent of TVUAC and Suction cannula have brought about significant difference in maternal morbidity and mortality due to PPH. ***Every delivery point should have TVUAC and Suction Cannula*** which is the ***First Aid*** (to be used along with medical management if not earlier) in PPH. Condom tamponade is not recommended.
- The tear was missed. If traumatic PPH is suspected, meticulous inspection with adequate light and good instruments in the theatre is recommended. If apex is not seen, suspect extension of tear upwards. Then an immediate laparotomy should be done along with volume replacement.
- As very often DIC is imminent, a vertical incision is ideal. An Aorta clamp can be used to arrest the bleeding while proceeding with hysterectomy. Internal iliac artery ligation in the presence of DIC is best avoided. Cryoprecipitate is the one which replaces fibrinogen and should be the first choice rather than FFP, along with PRBC and platelets. Traumatic PPH later on makes uterus atonic. Aggressive management in the same centre can save life. Referral if not in an ICU ambulance can lead to ongoing bleeding, shock and death on the way.

Examples 4:

A 25-year-old G2P1L1 Prev. LSCS with H/o bleeding at 32 weeks, diagnosed placenta previa. Elective LSCS at term, placenta did not deliver completely, found to be adherent on the left side, removed piece meal. Blood transfusion started; patient went into shock. Spinal converted to GA. Bilateral uterine artery ligation and Hayman's sutures done. Abdomen closed with drain, two hours later patient developed profuse bleeding, suction cannula applied for 15 minutes, bleeding reduced. Vagina packed and referred to higher centre, accompanied by Anaesthesiologist and Gynecologist. Patient arrested on the way.

Resuscitated, pack removed, no active bleeding, massive transfusion given. Though patient showed initial improvement, torrential bleeding started, she went into shock and succumbed same night.

Cause of death: PAS (Placenta accreta spectrum)

Learning Points:

Suspect Placenta accreta spectrum in all cases of previous CS and anterior placenta previa and try to rule out accreta. An MRI can support the diagnosis if suspected by ultra sound. But it is not always needed. All previous cesarean patients with anterior and central Placenta previa have to be referred to higher centre even if no accreta in ultra sound scan, because bleeding after placental delivery can be torrential and unmanageable. Even in posterior placenta previa troublesome bleeding from the placental bed should be expected.

If Placenta accreta spectrum is diagnosed on the table by a vascular lower segment or percreta, do not hesitate to close the abdomen and refer. Only a centre with experienced Obstetricians, Anesthesiologists, Urologists and Blood Bank should take up such cases. The practices which would have made a difference in this case are usage of Aorta / Common iliac artery clamp and timely Obstetric hysterectomy. If it is difficult to use aorta clamp through Pfannenstiel incision (unanticipated cases), B/L Common iliac artery clamps would suffice.

Examples 5:

A 38-year-old G3P2L2 at 38 weeks of gestation, previous 2 LSCS. Elective LSCS done at 12:20 pm, baby transverse lie, delivered with difficulty. Patient monitored in post operative ward. 6 hours later hypotension detected with saturation fall. Managed with inotropes, volume replacement, blood transfusion etc but condition deteriorated, expired at 10:10 pm.

Cause of death: Traumatic PPH following Cesarean

Learning Points:

- Soon after the delivery of the baby the angles should be clamped using Green Armytage or Allis forceps, especially if there has been an extension of the incision before delivering the placenta which will take some time.
- Uterine artery clamp may be used to clamp the uterine vessels which will immediately arrest the bleeding. Make sure AMTSL is followed. Secure the Right angle separately.
- Make sure of complete hemostasis at the bladder base and beneath the rectus

sheath. In case uterus is atonic, suction cannula may be used to make the uterus contract.

- Meticulous post operative monitoring can identify complications early, enabling early interventions. Going through the case records, patient had severe pallor in the first centre with a BP of 90/70. She was referred at 9: 30 pm and expired at 10:10 pm. Think twice before referring an actively bleeding patient — **TIME IS LIFE**. She was a case of previous 2 CS with a Communicating Horn and this should have been noted in the previous discharge summary. During CS examine the uterine cavity, tubes and ovaries and document the findings.

Examples 6

A 27-year-old second gravida underwent LSCS for twins. Developed sudden breathlessness and loss of consciousness at home on POD 21. She was brought to ED in cardiac arrest. CPR done by ACLS protocol, ROSC (Return of Spontaneous Circulation) 12 minutes of CPR and adrenaline. Transferred to cardiac ICU. ECHO showed severe LV dysfunction, RV function normal. She was put on ventilatory support and inotropes. CT brain showed signs of hypoxic ischemic encephalopathy. Situation worsened and she expired next day.

Cause of death: PPCM (Peripartum cardiomyopathy)

Learning Points:

High level of suspicion is required to diagnose PPCM, a disease of the last 1 month and post-partum 5 months of pregnancy. BOARD regime for PPCM: Bromocriptine, Oral heart failure therapy, Anticoagulation, Relaxants(vasodilators), Diuretics. Bromocriptine is recommended now as Prolactin is implicated in PPCM. The risk of recurrence in next pregnancy is 50 %.

In Peripartum cardiomyopathy, there is global hypokinesia. Similar ECHO picture can be seen after a cardiac arrest too.

In Stress cardiomyopathy which can be seen with any stressful situation (more common in women) causing sympathetic overload / adrenergic surge (Takotsubo cardiomyopathy), ECHO shows apical ballooning, CAG is usually normal and recovery is good.

In Hypertrophic Cardiomyopathy, the degree of obstruction decides the prognosis, usually tolerated well unless severe obstruction is present.

Examples 7:

35-year-old G3P2L2 at 28+4 weeks ,2 FTND, LCB - 8yrs. Detected to have hypertension at 25 weeks and started on antihypertensives. 2 weeks later she presented with headache and vomiting, developed seizures in the hospital. Loading dose of MgSO4 and Labetalol given and referred to MCH. O/E patient conscious, BP – 210/110 mm. of Hg, P/A – Uterus 28 weeks, investigations s/o HELLP syndrome. On shifting to OT for CS, developed another seizure. LSCS with sterilisation done and 810g baby delivered who was put on ventilator. She had another seizure and became hypotensive. Started on inotropes. Managed by multidisciplinary team. Developed DIC. MTP (Massive transfusion protocol) activated. Relaparotomy done next day. Subtotal hysterectomy done. Liver surface congested. CRRT (Continuous renal replacement therapy) done. Neurological status worsened. CT – Diffuse SAH with B/L Cerebellar bleed. Cardiac arrest after 5 days.

Cause of death: Hypertensive disorder of pregnancy

Learning Points:

- This is early onset hypertensive disorder of pregnancy. Close in-patient monitoring of such patients should be done from the time of diagnosis of hypertension including Hemogram, RFT, LFT and coagulation profile.
- Her LFT was grossly deranged at the time of admission itself. Early termination of pregnancy should also be contemplated upon in such cases.
- Eclampsia will not kill a patient but intracranial haemorrhage will. The 3-prong treatment of Eclampsia are MgSO4, Antihypertensives and termination of pregnancy.
- Many of us are happy with MgSO4 and delivery but ignore the management of high BP. All the drugs like Labetalol, Nifedipine, Hydralazine etc should be given round the clock and not SOS. Continuing MgSO4 in the right dosage also is mandatory. Our target BP is 140/90 in hypertensive disorders of pregnancy. Early referral, adequate stepping up of antihypertensives and timely termination might have given a better outcome in this case.

Examples 8:

A 27-year-old Primi at 28 weeks admitted with hypertension, proteinuria and gross pedal oedema. MGSO4 given along with labetalol and nifedipine. Discharged, but was readmitted after one week. She developed spotting 6 days later at 1.00 AM and shifted to LR. She had one bout of bleeding and fetal bradycardia, Emergency CS sone suspecting abruptio placenta. At CS, Couvelaire uterus and retroplacental clots were present. While extubating, patient

had arrhythmia, bradycardia and cardiac arrest. Resuscitation failed and death at 5.30 am.

Cause of death: Preeclampsia, Abruptio placenta

Learning Points:

Patient should not have been discharged with 2 antihypertensives that too after giving MgSO4. No role for aspirin after onset of hypertension. No role for water and salt restriction in Gestational hypertension.

This patient was given high dose of Frusemide (80 mg daily) which is not a routine practice in preeclampsia. Spinal anaesthesia is always better than GA except in coagulation disorders and hypotension. In spite of a proteinuria of >8000 mg/day pregnancy was not terminated. Early termination would have definitely changed the prognosis in this case.

Examples 9:

A 23-year-old Primi gravida with gestational hypertension on Labetalol, leaking at 31 weeks 6 days. Managed conservatively. Two days later at 7.45 am fetal distress detected. Emergency CS done under spinal, shifted to recovery room. At 2.30 pm patient had tachycardia, saturation fall, hypotension. Investigations showed abnormal coagulation profile. USG showed hemoperitoneum. Relaparotomy done. 300 ml of altered blood drained. At extubation, patient had cardiac arrest. Put on ventilatory support and inotropes. Echo - good LV function. Nephrology consultation - advised haemodialysis and plasma pheresis. LFT, RFT deranged. Consulted gastro enterologist. Albumin infusion, N Acetyl Cysteine, 40 FFP were given. Five days later heart rate suddenly increased which settled in 15 minutes. Planned referral to a higher centre for CRRT (Continuous Renal Replacement Therapy) and liver transplant. Suddenly developed cardiac arrest from which she could not be revived.

Cause of death: HELLP Syndrome, PPH

Learning Points:

- Going through the notes, it appears that it was a case of HELLP syndrome which was overlooked in the preoperative period.
- PIH profile should be repeated frequently in cases of conservative management so that falling platelets, worsening LFT etc are picked up promptly. Almost 35% of the Hypertensive maternal deaths in Kerala occurred due to HELLP syndrome. sFlt : PlGF ratio might serve to decide the time of termination in Hypertensive disease complicating pregnancy in the future.

Examples 10:

A 26-year-old Primi gravida presented with pain abdomen and vomiting at 38 weeks. As LFT was deranged referred to a higher centre. With a diagnosis of AFLP emergency CS done under GA. Post operatively developed abdominal distension and fall in Hb. Relaparotomy done. Large haematoma evacuated. Abdomen closed with drain. She developed DIC. Massive transfusion given. Thrombocytopenia persisted. She was planned for extubation. She developed a bout of haemoptysis with severe hypoxaemia. Bronchoscopy revealed diffuse alveolar haemorrhage. Prone ventilation given. Developed AKI, fungal sepsis and expired on 20th day after CS.

Cause of death: AFLP

Learning Points:

In AFLP, immediate termination is recommended. As cervix will be unfavourable, often CS has to be done. In such a situation, a midline vertical incision is ideal as it is associated with less bleeding.

Complete hemostasis should be attained before closure. If bleeding is expected an abdominal drain may be put. It is DIC which is the killer and should be managed by ROTEM based correction of coagulation factors. A haematologist may also be involved. Plasmapheresis, CRRT (continuous renal replacement therapy), Liver transplantation etc are the current treatment modalities in intractable cases.

Examples 11:

A 27-year-old Para 1 Live 1, post LSCS with high fever on postop day 5. Admitted in local hospital and detected MRSA Septicaemia. USG showed partially organised collection in the region of right ovary 47x30mm. Treated with Meropenem, Vancomycin and Teicoplanin and discharged 10 days later. Admitted in higher centre 5 days later as fever persisted. Patient was tachypnoeic and hypotensive, managed in ICU. Treated with Meropenem and Teicoplanin. CT done. Minimal fluid in pelvis. Fever persisted, MRI Spine and Pelvis taken; High vaginal swab showed Acinetobacter. Blood culture sterile. Later she developed B/L lower lobe consolidation/collapse with pleural effusion & severe LV dysfunction. Started on NIV, later needed invasive ventilation. Condition progressively worsened, initiated ECMO. Developed MODS, Death on POD Day 31.

Cause of death: Sepsis, MODS, DIC

Learning Points:

This is a pure case of sepsis with MODS. She had multiple hospital acquired

infections. Our approach should be PAM: (Prevent, Aggressively approach and Manage expeditiously).

Prevention is better than cure - Hospital Infection Control Committee and Antimicrobial Stewardship program should be part of every hospital; even the temperature, humidity and the number of air changes of the operation room matter in addition to the proper antibiotic prophylaxis (choice of the drug, timing and dosage), Povidone iodine vaginal toileting, Chlorhexidine skin preparation is important.

Once sepsis is diagnosed, the approach should be multipronged. Removal of source of infection is also important to prevent septicaemia. The isolation of MRSA and Acinetobacter (typically hospital acquired) should remind all of us about proper hand hygiene practices in our daily clinical practice.

Examples 12:

A 29-year-old Gravida 2 Para1 Live 1, delivered in a local hospital at 37 weeks at 11.50 am, immediately following which she had 2 episodes of GTCS and sudden cardiac arrest. Revived after 1 cycle of CPR. IV Lorazepam, Midazolam, inotropes, soda bicarb & Levetiracetam given. Mild PPH ,one unit PRBC given, vaginal pack inserted and referred to a higher centre. On admission patient drowsy, BP 90/60. Peripheral pulses feeble. Sudden breathing difficulty, unresponsiveness, and cardiac arrest. CPR started, intubated. ECHO massive RA, RV dilation. 50 mg IV Alteplase given. ABG severe metabolic acidosis. Adrenaline given. Multiple cardiac arrest and death declared at 2.35 pm same day.

Cause of death: AFE, PPH

Learning Points:

This multipara was already in early labour when she was admitted. Would not it have been more prudent to leave her alone so that she would have got into spontaneous labour? Multiple PGE1 and Rupture of membranes in a multipara would have triggered off AFE. Tonic clonic seizures and cardiac arrest in the immediate post-partum period in a normotensive patient is almost always AFE unless otherwise proven.

AFE is almost always followed by DIC and PPH as happened in this case. AFE patients will not stand a transfer from one centre to another if not stabilised in the first centre. Vaginal pack conceals PPH, here again TVUAC and Suction cannula should have been used. If DIC has already set in, suction cannula may not be advisable but TVUAC can still be used.

In the higher centre Alteplase (thrombolysis) might have been given thinking it is pulmonary embolism. The old saying "Too many cooks spoil the broth" is apt here as the focus was taken away from AFE to pulmonary embolism and Thrombolytic therapy was given in a PPH patient. Dilated cardiomyopathy in a post cardiac arrest patient is a routine finding and need not indicate Pulmonary embolism always. The sequence of events in a patient like this is important to arrive at a clinical diagnosis.

Other Recommendations

- Elective induction is recommended only at 39 completed weeks.
- Cord around the neck in USS is not an indication for cesarean section.
- Oral PGE1 is the drug of choice for IOL and not vaginal PGE1 as vaginal PGE1 increases the risk of cervical and vaginal lacerations.
- The order is ARM followed by Oxytocin after one hour SOS and not Oxytocin before ARM.
- The Golden Hour after delivery is replaced by the Golden 3-4 minutes where we have to identify the bleeding and take steps immediately to arrest bleeding and correct hypovolemia because blood lost will be massive.
- Trans vaginal/abdominal uterine artery clamp and suction cannula are the FIRST AID measures in PPH along with resuscitative measures and drugs. TVUAC and Suction cannula should be used while transferring an atonic PPH patient who continues to bleed.
- Use Tranexamic acid early in the course of PPH.
- Always look under the rectus muscles for bleeding before wound closure as veins can get torn while stretching and opening.
- Proper volume replacement is also crucial to prevent hypovolaemia in a bleeding patient.
- Those institutions with facility of ROTEM and TEG should utilise it in the management of severe PPH.
- It has been proven that those with pre-eclampsia are prone to develop Cerebrovascular and Cardiovascular accidents in future and reduction of lifespan by 10 years, postpartum counselling should address lifestyle modifications also.
- Spinal anaesthesia is fine in preeclampsia if there is no coagulopathy and no desperate urgency to deliver.

- Echocardiography is recommended in selective patients like elderly, early onset Hypertension etc
- Social history also should be a part of routine history taking; it might throw some light on the mental status of the patient
- Agitation in a previously healthy postpartum woman is more likely to be due to hypoxia rather than psychiatric illness.
- Sudden unexpected changes in the hemodynamic status of a couple of patients raised suspicion of adverse reactions to drugs like Antibiotics, Anaesthetic agents etc. You may all note that CRMD snippets reported for the first time the possibility of Tranexamic acid being mistaken for Bupivacaine as they are 'Look Alike' ampoules. Later similar articles were reported from other parts of the world too. Tranexamic acid is a drug which has recently found a place in Operation theatres, in many theatres it is stored in Anaesthesia trolley itself. Let us sensitise our Anaesthesia colleagues regarding this.

CRMD team has been repeatedly observing increased maternal deaths amongst IVF pregnancy, some of the reasons being advanced age, coexisting medical co morbidities, increased operative delivery, absolute bed rest etc. Request to our Reproductive Medicine colleagues is to fully evaluate our women before embarking on IVF especially ruling out high risk factors like cardiac disease. And if she turns out to be high risk after conception, to refer her to a centre where multidisciplinary team can take care of her.

Cerebrovenous thrombosis may lead to intracerebral bleed, here the triggering event is important to decide the treatment.

There was one maternal death due to LAST: Local anaesthetic systemic toxicity. Patient had recurrent seizures soon after spinal anaesthesia. 20% lipid emulsion is the antidote if toxicity is suspected.

Rheumatic heart disease though a rare entity in Kerala now, still exists. Such patients should be treated only in tertiary centres. Diligent history taking and clinical examination at first visit should not become a forgotten art.

Rare infections in our ICUs should raise the alarm of hospital acquired infections.

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Maternal Fetal Medicine Committee
Kerala Federation of Obstetrics & Gynaecology