NARCHI BULLETIN

LHMC, Issue 2, April 2023

Preconception and interconceptional care: ***A stitch in time saves lives***

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Lady Hardinge Medical College & Associated Hospitals, New Delhi -110001

From The President's Pen

Dear NARCHI Members

Greetings!

It is a fact that health of a plant is determined not only by the seed but also the soil in which the seed is sown. Likewise healthy mothers' birth healthy babies and the future health and productivity of a nation is dependent on the health of the mothers and the babies born to them. The proportion of high-risk pregnancies is constantly rising due to multiple factors like late marriages, increasing BMI and related problems like hyperglycemia in pregnancy and hypertension, rising Caesarean section rates, increase in pregnancies by ART etc. Programmes like PMSMA are focusing on identifying and providing care to high risk pregnancies during the antenatal, intranatal and postnatal periods but the care during the inter-conceptional period is missing. This period is a window of opportunity which can be utilized in optimizing maternal health for better outcomes in their subsequent pregnancies. Even those who have completed their families are at an increased risk of developing non communicable diseases such as DM, HT, coronary artery disease and need constant surveillance and advice to delay the onset of these diseases and for early diagnosis and timely management in future. To sensitize the members to this important aspect of health of women in reproductive age group this bulletin of National Association of Reproductive and Child Health (NARCHI) is dedicated to the preconception and interconceptional care for optimization of pregnancy outcomes. Hope you will enjoy reading through the articles contributed by experts and join hands in the efforts of NARCHI Delhi in prevention of NCDs.

Dr Manju Puri

President
NARCHI (Delhi)

From The Secretary's Desk

Dr Sharda Patra
Secretary

Dr Swati Aggarwal
Joint Secretary

Dr Kanika Chopra
Joint Secretary

"Parenting begins the moment you make any conscious effort to care for your own health in preparation for enhancing your child's conception."

-Carista Luminare-Rosen

Greetings from the secretariat of NARCHI- Delhi branch!!

At the outset, we wish to convey our heartfelt thanks to all the ambassadors of "Anemia and cervical cancer mukt dilli" initiatives of NARCHI- Delhi branch in collaboration with the Directorate of Family Welfare. The response has been overwhelming with training and sensitization programs being held at regular intervals in both governimant and private facilities. We sincerely hope that our combined efforts will help make a positive impact on the health of women across Delhi NCR and beyond.

The current issue is focused on "Optimising pregnancy outcome: preconception and interconception counseling ". It is an often neglected field and correct knowledge as well as awareness about its various aspects has the potential to significantly enhance the reproductive outcomes. The topics have been meticulously selected and penned by the experts in the field. We hope that this edition will find a special place in your library. We look forward to inputs and suggestions from your end.

We also take this opportunity yo invite you all for the annual NARCHI conference "NARCHICON 2023" to be held on 26th -28th November. It will be a skill based conference where the emphasis will be on strengthening the clinical and surgical skills of the delegates through video lectures and interactive case based panel discussions. Block your dates to experience the academic marvel.

Happy reading!!

From The Editorial Board

Dr Pikee Saxena
Editor

Dr Vidhi Chaudhary
Co-Editor

Dr Aishwarya Kapur
Co-Editor

Editorial Team

Greetings from the Editorial Team!

After the successful conclusion of 15th World Congress /23rd Indian Conference/ 28th Annual Conference, Delhi Chapter of NARCHICON 2022 from 23rd to 25th September 2022 at The Lalit, New Delhi, editorial team brings an academic feast on topics concerning maternal health. At the outset we would like to sincerely thank all NARCHI members for making the 28th annual NARCHI conference a huge success!

It is our privilege to bring forth April issue of NARCHICON 2023 Preconceptional and interconceptional care" which is a centred around the theme – "Optimising pregnancy outcomes: Preconceptional and interconceptional care" which is a neglected but important time duration which gives a golden opportunity to optimize maternal health before conception for a favourable fetomaternal outcome. This period determines the link to future NCD. The bulletin begins with comprehensive information on preconceptional and antenatal preventive care in different medical disorders in pregnancy ,written by our esteemed faculty across the state.

Upcoming pandemic of obesity which requires special attention for avoiding not only pregnancy related problems but also to avoid long term non communicable diseases for the mother and her child have been discussed by Dr. Pikee Saxena.

Managing cardiac disease and challenges faced in preconception, pregnancy and postpartum to achieve stable maternal and foetal outcomes has been well highlighted by Dr. Ashok Kumar in this issue.

Dr. Y.M Mala has discussed the key points during preconception and interconception care of women with hypertensive disorders of pregnancy to optimise the subsequent pregnancy outcome and associated complications.

Dr Leena Wadhwa has discussed in length the important points to be kept in mind when planning pregnancy in a woman with epilepsy. Safety of antiepileptic drugs in pregnancy has been addressed.

Nearly 1out of every 10 live birth is born to women with hyperglycaemia in pregnancy. Preconception and interconception period provides a window of opportunity for prevention of complications in the next pregnancy and prevents NCD in future. This issue has been discussed by Dr. Rashmi Malik.

Special topic on dealing with hemoglobinopathies in pregnancy has been aptly written by fetal medicine expert Dr Suchita Bachani with insight on necessary preconceptional counselling and tests required prior to contemplating conception in this group of women.

Anaemia eradication still remains a challenge in the country. Quality improvement initiatives have shown success in improving challenging health care issues in our country. Hence this issue has a highlights an important QI process in order to achieve ANEMIA MUKT BHARAT by Dr Manju Puri and Dr Shilpi Nain.

The issue concludes with a detailed view on point of care testing in obstetrical hemorrhage and its practical approach in managing haematological parameters in relation with a bleeding patient.

As always, a quiz for youngsters to stimulate grey matter relevant to theme has also been included.

We hope you would find this issue informative and learn a few novel management approaches in preventive obstetrics. We look forward to your participation and feedback.

Happy reading to all,

We are sure you will enjoy this Scientific feast.

Editorial team

Focus on Obesity in Pregnancy

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Obesity has become the most common medical condition in reproductive age group females and is on a rising trend in both low and middle income countries. It has been predicted that by 2025 more than 21% of women in the world will have obesity. Women with higher grades of BMI experience higher rates of adverse pregnancy outcomes such as gestational diabetes, hypertensive disorders of pregnancy, low cord blood pH, and post-caesarean complications compared to women with lower BMIs.They are also more likely to struggle with poor mental health, breast feeding and post-partum weight gain.

Importance of obesity in pregnancy

Routine surveillance of weight gain during pregnancy is not conducted in many countries. Often BMI is used as an indicator of maternal obesity in reproductive age group affecting pregnancy outcomes and subsequent health of woman and the child. Evidences suggest that obesity during pregnancy not only increase the mother's risk of later NCDs which accounts for the global 70% deaths annually but can also transfer the risk to the offspring through epigenetic mechanisms, alterations in gut microbiome, and sociocultural factors. Excessive gestational weight gain in pregnancy can result in elevated BMI if weight loss is not achieved in the postnatal 6-12 months. Obese pregnant females have more tendency towards caesarean delivery and also have difficulties in initiating breastfeeding. These females are at high risk of sudden stillbirth and thus need close monitoring. Obesity is a risk factor for many anaesthesia-related complications and has been identified as a significant risk factor for anaesthesia-related maternal mortality. Obesity in pregnancy is associated with increased risk of GDM, subsequent DM-II, LGA, metabolic complications in neonates. Their neonates later develop long term consequences like childhood obesity, DM-II, poor cognitive performance, neurodevelopmental disorders later in their life.

Fetomaternal complications due to obesity

Early Pregnancy	Late Pregnancy	Labour and Post-partum	Foetal, Perinatal and beyond
Spontaneous abortion	GDM	Dysfunctional labour	Macrosomia
Congenital anomalies	Pre-eclampsia and chronic hypertension	Increased operative intervention	Birth trauma
	Stillbirths/IUD	Anaesthetic complications	Shoulder Dystocia
	Medical problems	Wound sepsis	Juvenile Obesity
		DVT	Metabolic Syndrome
		PPH	

Pre-conception care

- Advice on weight and lifestyle during periodic health examinations, preconception counselling, contraceptive consultations or any other gynaecological appointment prior to pregnancy.
- Information and advice about the effect of obesity on fertility and the risks of obesity during pregnancy and childbirth should be provided
- Assessment for sleep apnoea and other conditions that could affect health during pregnancy, including those of the cardiac, pulmonary, renal, endocrine, and skin systems
- Weight management strategies prior to pregnancy -There are mainly three ways through which weight reduction can be achieved i.e. life style modification which includes exercise and diet, medical therapy and surgical procedures.
- Lifestyle interventions including diet and exercise are the cornerstone of weight management in preconception, pregnancy and beyond.
- Women with a BMI ≥30 wishing to become pregnant should be advised to take a folic acid supplement daily, starting at least 1–3 months before conception and continuing during the first trimester of pregnancy. The dose should be at least 0.4 mg (400 µg) and consideration should be given to higher dose (5 mg) as obesity is a risk factor for neural tube defects.

Role of bariatric surgery

- Bariatric surgery has become a popular alternative for obese women planning pregnancy as it provides substantial and sustainable weight loss. It is estimated that initial weight loss is 20-30 kg and which is persistently more and can be maintained for 10 years at least.
  There are mainly 3 types of surgeries performed mostly done laparoscopically.

a) Restrictive bariatric surgeries: It restricts the food intake and achieve weight loss due to early and prolonged satiety after a solid meal.
   - Laparoscopic Adjustable Gastric Banding (LAGB): In this surgery the uppermost portion of the stomach is encircled by a band made up of an inflatable balloon, thereby decreasing the gastric volume. Thus, the patient feels early satiety.
   - Gastroplasty: Laparoscopic sleeve resection (gastrectomy)/vertical band gastroplasty (VBG) are the commonly performed procedure in India.

b) Malabsorptive Surgeries: These procedures bypass a certain length of intestine so that the food and digestive juices come in contact with only a short length of bowel causing mal-absorption of the food and thus weight loss. The procedures include bilio-pancreatic diversion

c) Combined restrictive and malabsorptive: Roux en Y gastric bypass: Here the stomach is shortened and the duodenum and the jejunum is bypassed.
   - The management of the post bariatric surgery patient needs multidisciplinary approach. It is advised to delay pregnancy till 12-18 months of bariatric surgery. GDM screening is to be done carefully. Regular monitoring and supplementation of Fe, Ca, FA, Vit D and A and Iodide needs special emphasis
   - Guidelines for indication of Bariatric surgery-

Guidelines	Year	Indications
NIH	1991	Patients with BMI ≥ 40 kg/m^2 or patients with serious co-morbidities and BMI ≥ 35 kg/m^2
Asia-Pacific	2005	Patients with BMI ≥ 37 kg/m^2 or Patients with BMI ≥ 32 kg/m^2 with DM-II or ≥ 2 co-morbidities
NICE	2006	Morbidly obese patients (BMI >40 kg/m2) where lifestyle and/or medications have been found to be ineffective

   - Pregnancy outcomes after Metabolic Surgery

Reduced	Increased
GDM	Nutritional deficiencies
Hypertensive disorders of pregnancy	Mechanical/Surgical complications
Lower maternal weight gain	Increased SGA
Decreased macrosomia	Increased congenital malformations- NTD, Cleft lip/cleft palate

Management of obesity during pregnancy

A) Antepartum Care

- Anti-obesity or weight loss drugs are not recommended for use in pregnancy.
- All pregnant women should have their height and weight measured at their first antenatal visit. Approaches to monitor and manage gestational weight gain should be integrated into routine antenatal care practices.
- Pregnant women with a BMI ≥30 should be advised to avoid high gestational weight gain.
- Weight gain should be limited to 5–9 kg.
- Moderate intensity and appropriate exercise should be encouraged during pregnancy.
- Women with previous bariatric surgery require closer screening and monitoring of their nutritional status and foetal growth throughout pregnancy. They should be referred to a dietitian for advice about their nutritional needs and, where possible, have consultant-led care.
- Women with obesity should continue to take folic acid during at least the first trimester.
- All pregnant women with obesity in early pregnancy should be provided with accurate and accessible information about the risks associated with obesity and how they may be minimized.
- Women should be informed that some screening processes for chromosomal anomalies are less effective in obesity
- All pregnant women should be advised individually on mode of delivery, considering the risk of emergency caesarean delivery.
- Women with obesity with multiple gestations require increased surveillance and may benefit from consultation with a maternal–foetal medicine consultant
- All pregnant women with a BMI ≥30 should be screened for gestational diabetes in early pregnancy
- To help prevent pre-eclampsia, prophylactic aspirin 150mg/day from early pregnancy can be recommended to women with obesity who have other moderate to high risk factors.
- Clinicians should be aware that women with a BMI ≥30, before pregnancy or in early pregnancy, have a pre-existing risk factor for developing venous thromboembolism during pregnancy. Risk of antenatal and postnatal venous thromboembolism should be assessed.
- Women with a BMI ≥35 should be referred for serial assessment of foetal size using ultrasound as they are more likely to have inaccurate symphysis–fundal height measurements.
- Due to the elevated risk of stillbirth associated with obesity, greater foetal surveillance is

recommended in the third trimester in the case of reduced foetal movements.

- Women with a BMI ≥30 are at increased risk of mental health problems, including anxiety and depression. Healthcare professionals should offer psychological support, screen for anxiety and depression, and refer for further support where appropriate and available.

B) Intrapartum Care

- Induction of labour is recommended at 41+0 weeks of gestation for pregnant women with a BMI ≥35 because of increased risk of intrauterine death.
- Women with a BMI ≥40 should be referred to an anaesthetist for assessment in the antenatal period.
- Electronic foetal monitoring is recommended for women in active labour with a BMI ≥35.
- In the case of vaginal delivery for women with a BMI ≥40, early placement of an epidural catheter is advisable in the case of an emergency caesarean delivery.
- In the case of vaginal delivery for women with a BMI ≥40, early placement of an epidural catheter is advisable in the case of an emergency caesarean delivery.
- Establish venous access in early labour for women with a BMI ≥40 and consider a second cannula.
- Women with a BMI ≥30 having a caesarean delivery are at increased risk of wound infection and should receive prophylactic antibiotics at the time of surgery. Women with obesity may benefit from higher doses.
- Women undergoing caesarean section who have more than 2 cm subcutaneous fat should have suturing of the subcutaneous tissue space in order to reduce the risk of wound infection and wound separation.
- Active management of the third stage should be recommended to reduce the risk of postpartum haemorrhage.
- Postoperative pharmacologic thromboprophylaxis should be prescribed based on maternal weight
- Mechanical thromboprophylaxis is recommended before and after caesarean delivery. Women with a BMI ≥35 should be given graduated compression stockings, or other interventions such as sequential compression devices, after cesarean delivery until mobilization, which should be encouraged early.

C) Postpartum Care

- Obesity is associated with low breastfeeding initiation and maintenance. Women with obesity in early pregnancy should receive specialist advice on the benefits of breastfeeding and appropriate antenatal and postnatal support for breastfeeding initiation and maintenance.
- Women who have been diagnosed with gestational diabetes and other pregnancy complications should have appropriate postnatal follow-up.
- Due to the increased risk associated with obesity, where available, women with obesity should be screened for postpartum mental health disorders such as depression and anxiety.
- Women should be informed that weight loss between pregnancies reduces the risk of stillbirth, hypertensive complications, and foetal macrosomia in subsequent pregnancies. Weight loss increases the chances of successful vaginal birth after caesarean delivery.
- Women with obesity should be offered further dietary advice to support postpartum weight management.
- Women with obesity should be counselled on the most appropriate form of postnatal contraception based on BMI.

Anti-Obesity Drugs in Pregnancy

Anti-obesity or weight loss drugs are used for the management of obesity in women of reproductive age. Currently, there is a paucity of information about the effect of anti-obesity drugs on the foetus and access to most anti-obesity drugs (with the exception of orlistat) is limited.

- Orlistat is a lipase inhibitor that acts by inhibiting the absorption of dietary fats.
- Phentermine/topiramate promotes appetite reduction and decreases food consumption. The exact mechanism of action of topiramate on weight loss is not known but may be related to appetite suppression and increased satiety. Use of topiramate in pregnancy is associated with oral clefts.
- Topiramate and phentermine are also individually excreted in breast milk and, therefore, the combination of phentermine/topiramate may also be present in breast milk. Treatment with either medication is therefore not recommended during lactation due to unknown risks on the infant.
- Lorcaserin hydrochloride is a serotonin receptor agonist that is highly selective for the specific serotonin receptor, 5-HT2C, which is involved in the

regulation of appetite.70 It is believed that lorcaserin promotes satiety and results in weight loss from decreased overall food consumption. There are no data on the safety of lorcaserin in human pregnancy. In animal studies, although exposure to lorcaserin during embryogenesis has not demonstrated teratogenicity or embryolethality, exposure in late pregnancy did result in lower birthweight of offspring, which persisted to adulthood. Lorcaserin is therefore contraindicated in pregnancy.

Role of healthcare professionals in obesity management

- The causes of maternal obesity are multifaceted, including societal, environmental, and other factors, calling for a multisystem, life course approach to obesity prevention and management. However, obstetricians and gynaecologists can have a drastic role in influencing obesity risk and prevalence through lifestyle and other interventions with women of reproductive age, before, during, and after pregnancy.
- The preconception and postpartum periods are opportunities for intensive nutrition and weight optimization, while during pregnancy, the focus should be on appropriate gestational weight gain while meeting nutritional requirements.
- While healthcare models and care pathways for women before, during, and after pregnancy vary internationally, obstetricians/gynaecologists and midwives are well positioned to influence population health through maternity and women's health services.
- Often, time constraints during appointments can hamper effective discussions related to nutrition and weight management during antenatal visits.
- Cultural influences may determine the healthcare professional's subjective perception of body image and weight and, in the absence of anthropometric measurement and classification, this could result in underestimation and assessment of weight-related risks. Resources such as the FIGO Nutrition Checklist and guidance may assist obstetricians and gynecologists by increasing professional knowledge and time management when caring for women.

To summarise, managing obesity before, during, and after pregnancy may have widespread short- and long-term benefits for mothers and their children. By addressing nutrition and weight in women of reproductive age, outcomes can be improved and the burden on healthcare systems reduced. Managing obesity will support the achievement of the UN Sustainable Development Goals and the promotion of population health, taking a life course approach to health promotion. Obesity management may include a variety of interventions from healthy diets, physical activity, and other medical or surgical options. Diet and lifestyle are the cornerstone of obesity management and while the degree of weight loss achieved with each intervention may vary, healthy diets and lifestyles should be encouraged and can further support additional interventions where employed. During pregnancy, healthy diets and lifestyle can support management of gestational weight gain. Outside of weight management, women with obesity require specific considerations for medical, surgical, and other care planning and these are outlined in this review.

Suggested Reading

1. Royal College of Obstetricians and Gynaecologists. Care of Women with Obesity in Pregnancy.Green-top Guideline No. 72. BJOG 2018
2. Centre for Maternal and Child Enquiries, Royal College of Obstetricians and Gynaecologists. Management of Women with Obesity in Pregnancy. London: RCOG; 2010.
3. Khan R, Dawlatly B, Chappatte O. Pregnancy outcome following bariatric surgery. The Obstetrician & Gynaecologist 2013;15:37–43.
4. National Institute for Health and Clinical Excellence, National Collaborating Centre for Primary Care. Obesity: the Prevention, Identification, Assessment and Management of Overweight and Obesity in Adults and Children. London: NICE; 2006
5. American Society for Metabolic & Bariatric Surgery. Bariatric Surgical Society Takes on New Name, New Mission and New Surgery. Gainesville, FL: American Society for Metabolic & Bariatric Surgery; 2007 [http://asmbs.org/benefits-of-bariatric-surgery/].
6. American College of Obstetricians and Gynaecologists. ACOG Committee opinion number 315, September 2005. Obesity in pregnancy. Obstet Gynecol 2005;106:671–5

Preconception and Intranatal care in women with Heart Diseases in Pregnancy

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Introduction

Cardiac disease in pregnancy is one of the leading causes of maternal mortality and morbidity. Its overall incidence in developing countries like India is 1-4%[1], which is higher than the western counterparts due to higher incidence of rheumatic heart disease in developing countries. RHD comprises of 56-89% of heart diseases in pregnancy.[2] Its incidence in pregnancy is increasing with the advancements in the cardiac care making previously medically unfit females to achieve child bearing.

The increased morbidity in pregnancy is partly attributed to masking of initial features of cardiac lesions by the physiological changes of pregnancy and the resultant late presentation to the pregnancy heart team.

The physiological changes in cardiovascular system in pregnancy are required to facilitate easy transfer of nutrients to the fetus, to compensate for the reduced preload to the heart due to venacaval compression by the gravid uterus and to protect the mother from excessive solute loss in postpartum haemorrhage.

Preconceptional Care

The cardiac status evaluation in women with known cardiac lesions is crucial before embarking onto pregnancy. The risk of existing condition with added risks in pregnancy preclude some women against pregnancy and it is vital to identify such women and to strongly suggest against pregnancy. The comprehensive preconceptional evaluation is given below.

History and Examination:

1. History suggestive of deterioration of the existing cardiac condition must be elicited. These include : Easy fatiguability, breathlessness, weigh gain, swelling of lower limbs/ dependent parts, chestpain, palpitations and fever.
2. History of any previous cardiac event : arrythmias, heart failure, thromboembolic event.
3. History of previous cardiac surgeries: valve repairs or valve replacements (biological or prosthetic valves).
4. Review of cardiac drugs : To potentially identify teratogenic ones and replace with safer alternatives in prepregnancy period. ACE inhibitors, ARBs, spiranolactone, amiodarone, statins, eplerenone and warfarin are few of the teratogenic cardiac drugs.
5. EXAMINATION: To detect signs of heart failure, to pick any new onset murmurs, any signs of infection.
   - Functional status assessment:
     - Irrespective of the cardiac lesion, the tolerance for the lesion is reflected in the cardiac functional status and is best assessed by New York Heart Association classification as follows [Table 2]:

Table 2: New York Hear Association classes of functional status of heart.

Class 1	Uncompromised	- No symptoms of cardiac insufficiency or experience angina
Class 2	Slight limitation of physical activity	- comfortable at rest, but if ordinary physical activity is undertaken, discomfort results in the form of excessive fatigue, palpitation, dyspnea, or anginal pain.
Class 3	Marked, imitation of physical activity	- comfortable at rest, but less than ordinary activity causes excessive fatigue, palpitation, dyspnea, or anginal pain.
Class 4	Severely compromised	- inability to perform any physical activity without discomfort: Symptoms of cardiac insufficiency or angina may develop even at rest. Discomfort increased if any physical activity is undertaken.

Investigations :

- The strctural evaluation of cardiac status : 2D-Echocardiography, chest X-Ray imaging are used.
- For conduction abnormality detection: 12 -leas Electrcardiography is done.

- o Dynamic testing: exercise testing, stress Echocardiography are used.
- o Cardiac MRI and angiography are used when indicated.
- o Genetic testing: its role is limited to women with known syndromic congenital heart diseases

General preconceptional care :

- o With Folic acid 4mg/day.
- o Cessation of smoking and illicit drugs.
- o Weight optimisation.
- o Optimisation of other known medical conditions: anaemia, diabetes, hypertension etc.'

Cardiac status optimisation prior to pregnancy:

- o Cardiac surgeries are are best done prepregnancy as they have better pregnancy outcome. The fetal loss annd maternal morbidity can be avoided with this strategy.

Intranatal care

When a patient with known cardiac lesion gets pregnant, she must be evaluated by a team of obstetrician, cardiologist and an anaesthesiologist to decide upon the course of management in pregnancy. It is imperative to know the cardiac status at which the pregnancy is embarked upon to provide a guide to know if pregnancy id contraindicated, the level of cardiac care centre required, frequency of monitoring and the mode of delivery. The following stategies help in this evaluation.

1. **Investigations and their limitations in pregnancy:**

   Various tests are available for evaluating an abnormal clinical finding, however, the clinical findings as well as the investigations lack their specificity in pregnancy due to the overlapping physiological changes.

Table 3: Tests for cardiovascular evaluation and their limitations in pregnancy.

	INDICATION	BENIGN FINDINGS IN PREGNANCY	PREGNANCY CONSIDERATIONS
ECG	To assess electrical activity of heart.	• 5–20 degree left axis deviation • transient ST/T wave changes • Q wave, inverted T wave in lead III • attenuated Q wave in leas aVF • inverted T waves in V1, V2 and V3.	
2D Echocardiography [ECHO]	Structural assessment and flow parameters.	• Mild dialatation of chambers • Increased left ventricular wall thickness. • Increased gradient across the valves	Trans thoracic ECHO is preferred in pregnancy and if doubtful findings, transesophageal ECHO can be safely performed with special consideration to increased intra-abdominal pressure, vomiting and aspiration.
EXERCISE TESTING	• Valvular heart diseases • Congenital heart diseases		ESC task force[3] recommends submaximal (80% of predicted maximum heart rate) testing in suspected cases if already pregnant. Avoid dobutamine stress testing wherever safer alternatives are available.
Chest X-Ray	• Only when diagnostic dilemma	• Cardiomegaly • Straightening of left heart border.	Dose of fetal radiation exposure is <0.01mGy[5].
CT SCAN	• To diagnose or exclude pulmonary embolism. • Evaluation of aortic pathology when other modalities fail.		A low radiation CT with radiation of 0.01 to 0.66mGy can be used.
Cardiac MRI	• Preferred to ionizing radiation		
Cardiac catheterization	• Medically refractive arrythmia. Rarely done.		Radial approach preferred.

Predictors of maternal cardiovascular events

Various studies have integrated history, clinical findings and investigations to estimated risk of a cardiac event in pregnancy. This helps in triaging women based on their risk of cardiac event and to provide appropriate care.Few of them are :

- CARPREG Cardiac disease in pregnancy 1
- CARPREG 2 [Table 4][6]
- Modified, WHO classification [Table 5,6][3]
- ROPAC (Registry Of Pregnancy And Cardiac disease)[7].

The modified WHO classification of heart disease in pregnancy3 is widely used as it gives a comprehensive idea of the morbidity and mortality risk associated with different heart lesions in pregnancy and also the level of care that is to be provided and the centres at which such patients are to be managed.

- The category I patients have low risk [2.5 – 5 %] of a cardiac event and can be managed at local centres and a cardiologist evaluation once or twice during the pregnancy is sufficient.
- The category II patients have a moderate risk [5.7-10.5%] of a cardiac event in the pregnancy and can also be managed at a local hospital but cardiac evaluation at least once in each trimester.
- The catergory II-III includes lesions that bridge the low risk and high risk lesions. They need care at a referral hospital and need cardiac evaluation every 2 months.
- The category III lesions have 19-27% risk of a cardiac event in their pregnancy and needs care at an expert centre for cardiac care every 1-2 monthly.
- The category IV includes extremely high risk patients with 40-100% risk of a cardiac event in their pregnancy. They require frequent evaluation every month at an expert cardiac care centre.

Table 4: carpreg 2 risk stratification

1. Prior cardiac events or arrythmias	3	PREDICTIVE VALUE for CARDIAC EVENT. 1 5% 2 10% 3 15% 4 22% >4 45%
2. Baseline NYHA III-IV	3	
3. Mechanical valve	3	
4. Ventricular dysfunction	2	
5. High risk left sided valve disease/ left ventricular outflow tract obstruction	2	
6. Pulmonary hypertension	2	
7. Coronary artery disease	2	
8. High risk aortopathy	2	
9. No prior cardiac intervention	1	
10. Late pregnancy assessment	1	

Table 5: Lesions included in the mWHO heart disease categories[3].

mWHO I	mWHO II	mWHO II-III	mWHO III	mWHO IV
• Small / mildpulmonary stenosis • PDA • Mitral valve prolapse • Successfully repaired simple lesions (ASD/ VSD/TAPVC) • IsolatedAtrial or ventricular ectopic beats	• Unoperated ASD/ VSD • Repaired tetralogy of Fallot • Most arrhythmias (supraventricular arrhythmias) • Turner syndrome without aortic dilatation	• Mild left ventricular impairment (EF >45%) • Hypertrophic cardiomyopathy • Native or tissue valve disease not considered WHO I or IV (mild MS, moderate AS) • Marfan or other HTAD syndrome without aortic dilatation Aorta	• Moderate left ventricular impairment (EF 30–45%) • Previous peripartum cardiomyopathy without any residual left ventricular impairmen • Mechanical valve • Systemic right ventricle with good or mildly decreased ventricular function • Fontan circulation. If otherwise the patient is well and the cardiac condition uncomplicated • Unrepaired cyanoticheart disease. • Moderate MS • Severe asymptomatic AS • Moderate aortic dilatation (40–45 mm in Marfan syndrome or other HTAD; 45–50 mm in bicuspid aortic valve • Turner syndrome ASI 20–25 mm/m2 , tetralogy of Fallot	• PAH • Severe systemic ventricular dysfunction (EF <30% or NYHA class III–IV) • Previous peripartum cardiomyopathy with any residual left ventricular impairment • Severe MS • Severe symptomatic AS • Systemic right ventricle with moderate or severely decreased ventricular function • Severe aortic dilatation (>45 mm in Marfan syndrome or other HTAD, >50 mm in bicuspid aortic valve, Turner syndrome ASI >25 mm/ m2 , tetralogy of Fallot >50 mm) • Vascular Ehlers–Danlos • Severe (re)coarctation • Fontan with any complication

TABLE 6: Risk and management strategies based on mWHO categories of heart disease3

	mWHO I	mWHO II	mWHO II-III	mWHO III	mWHO IV
Risk category	No detectable increased risk	Small risk	Intermediate risk	Significantly high risk	Extremely high risk.
Risk of cardiac event in pregnancy	2.5-5%	5.7-10.5%	10-19%	19-27%	40-100%
Care during pregnancy	Local hospital	Local hospital	Referral hospital	Expert centre for pregnancy and heart disease.	Expert centre for pregnancy and heart disease.
Frequency of cardiac evaluation	Once/ twice	Once every trimester	bimonthly	Mothly or bimonthly	monthly
Location of delivery	Local hospital	Local hospital	Referral hospital	Expert centre for pregnancy and heart disease.	Expert centre for pregnancy and heart disease.

Effect of maternal heart disease on fetus:

Children born to parents with congenital heart disease have varied heritability ranging from 3-50% depending on the type of parental disease.

- ASD
- VSD 10-15 %
- TOF- 20-25%
- Marfans' syndrome -50% with varied penetrance.
- Hypertrophic obstructive cardiomyopathy- 50% with varied penetrance.
- LONG QT Syndrome- 50% with varied penetrance.

Fetus is at an increase disk of growth restriction, intraventricular hemorrhage , intrauterine fetal demise and preterm birth.

Predictors of neonatal events

- NYHA class III/IV or cyanosis during baseline prenatal visit
- Maternal left heart obstruction.
- Smoking during pregnancy
- Low maternal oxygen saturation (<90%)
- Multiple gestations
- Use of anticoagulants throughout pregnancy
- Cardiac medication before pregnancy
- At birth cyanotic heart disease
- Mechanical valve prosthesis
- Maternal cardiac event during pregnancy
- Maternal decline in cardiac output during pregnancy
- Abnormal uteroplacental Doppler flow

Labour and delivery

Timimg of admission:

Patients with good functional status [NYHA 1-2] can be assessed on an outpatient basis until 36 weeks and then hospitalized, however it is recommended that patients with poor functional status such as NYHA classes 3-4 need hospitalization for the entire duration of pregnancy.

Timing of delivery

- For women with stable CVD, there is no cardiac benefit to delivery prior to 39 weeks [STORCC TRIAL]8. Early delivery is reserved for unstable patients and those with obstetric indications.

Mode of delivery

Vaginal delivery is preferred. ROPAC data show that the elective caesarean section results in early delivery and low birth weight with no maternal benefit7. Therefore, caesarean sections must be limited to the following:

1. Obstetric indications.
2. Women on oral anticoagulants (OAC) in labour or stopped OAC within 2 weeks prior to labour.
3. Marfans' syndrome with aortic root dilatation>4.5cm
4. Acute intractable heart failure
5. Severe pulmonary artery hypertension (including Eisenmenger's syndrome)

Induction of labour

- Mechanical methods of induction with cervical ripening balloon (or bulb of foleys catheter) and stripping of membranes with oxytocin infusion are safer options for induction of labour in women with heart disease especially in those where a drop in systemic vascular resistance would be detrimental.
- The use of prostaglandin derivatives for induction of labour is debatable. Misoprostol 25 mcg (PG E1) or Dinoprostone (PG E2) 1-3mg or sustained release

formulation of 10 mg pessary can be used to safely induce labour [ECS 2018]3. Dinoprostone had shown to cause profound hypotension only when blindly injected into myometrium, hence this route must be avoided.

The summary of the various methods of induction and their cardiac safety profile is listed in Table 7[9].

Table 7 : Methods of induction of labour in patients with heart disease[9].

Drug	Dose	Cardiac considerations
Mechanical methods	-	Safe
Oxytocin	0.0001- 0.2 u/ml	Safe, but caution maintained with fluid retention during prolonged infusion.
Dinoprostone	5-10 mg	Safe
Misoprostone	25 ugm	Safe.

Intrapartum care

- Delivery must be undertaken at the appropriate facility as guided by mWHO categories of heart disease in pregnancy.
- Strict asepsis must be maintained.
- Patient positioning: propped up / Left lateral position.
- Strict monitoring of blood pressure, heart rate, oximetry, frequent chest auscultation, continuous ECG monitoring, fluid input and output monitoring must be done to detect early decompensation. Invasive BP monitoring is of uncertain benefit with complications and must be avoided in most cases.[9]
- Supplemental oxygen if hypoxic.
- Intravascular access must be secured and IV fluids are to be given cautiously not exceeding a rate of 80 ml/hour.
- ACOG recommends administration of broad-spectrum antibiotics to women with highest risk of adverse outcomes such as those with congenital heart diseases, prosthetic valves, previous infectious endocarditis and cardiac transplant recipients with valve regurgitations11. The regimen includes

• IV regimen: ampicillin 2gm IV (or) cefazolin or ceftriaxone 1 gm IV If allergic to penicillin: clindamycin 600 mg IV.

• Oral regimen: Amoxicillin 2 gm PO.

if allergic to penicillin: clindamycin 600 mg PO (or) Azithromycin 500 mg PO

- Adequate analgesia must be provided. Epidural analgesia can be used but must be avoided in obstructive lesions or those with diminished ventricular function as it may cause systemic hypotension in 10% of cases.
- Multiple per vaginal examinations must be avoided.
- Continuous electronic fetal monitoring is recommended.
- In the second stage labour, active bearing down must be discouraged and fetal head must be allowed to descent passively as this shortens the active second stage labour and thereby reducing stress on the heart. Assisted delivery with forceps or ventouse may be used to cut short the active second stage if needed.
- Diuretics must be given immediately after delivery to prevent fluid overload due to auto transfusion.
- Active management of third stage of labour must be done.
- In case of atonic PPH – oxytocin, misoprostol (1000mg) can be used. However, ergometrine and prostaglandin F analogues must be avoided.
- Carbetocin, a newer drug approved by WHO for prevention of postpartum hemorrhage, its safety in patients with cardiovascular disorders is yet to be established by RCTs[12].

Post partum care:

- Postpartum period is associated with significant hemodynamic changes and fluid shifts precipitation heart failure, therefore strict vitals monitoring must continue at least for 48 hours post-delivery.
- Oxytocin infusion at 12mU/min for 4 hours reduces the risk of PPH with minimal impact on cardiovascular parameters.
- Early ambulation, meticulous leg care elastic support stockings are important to reduce the risk of thromboembolism.

Contraception :

The WHO -MEC of different contraceptives are enlisted in table 8.

1. Injectable progesterone only contraceptives (DMPA and NET-en) are safe in valvular heart disease
2. Levonorgestrel-based long-acting reversible contraception implants or intrauterine devices are the safest and most effective contraceptives.
3. Low dose oral contraceptives containing 20 mg of ethinyl estradiol are safe in women with a low thrombogenic potential, but not in women with complicated valvular disease (pulmonary hypertension, risk of atrial fibrillation, history of subacute bacterial endocarditis).
4. Barrier methods are unreliable. A good approach

is the combination of barrier methods and long-acting reversible contraception.

5. A copper intrauterine device is acceptable. Antibiotic prophylaxis is not recommended at the time of insertion or removal. If excessive bleeding occurs at the time of menses, the device should be removed.
6. Tubal ligation by minilaprotomy is usually accomplished safely, even in relatively high-risk women. Risks are increased in cases of pulmonary artery hypertension.
7. Vasectomy for the male partner is another efficacious option.

Table 8 : WHO- MEC of contraceptives in heart disease.

1.	Cu-T IUCD	MEC-1
2.	Progesterone only pill	MEC-2
3.	Implants - LNG/ ETN	MEC-2
4.	LNG-IUD	MEC-2
5.	COCP	MEC-3
6.	Progesterone only injections-DMPA/ NET-EN	MEC-3

Valvular heart lesions

Stenotic lesions:

they are poorly tolerated and at an increased risk of maternal and fetal complications. This is due to increased gradient across valves reaching approximately 50% mainly due to increased cardiac output.

1. Mitral stenosis:

Maternal risk:

- MVA < 1 cm2- risk of heart failure (HF) is 1 in 3 patients[13].
- MVA < 1.5 cm2- risk of HF is 1 in 2 patients[13].
- Mortality is 0-3% in western countries, but higher in LMIC[14].
- NYHA >/= II and systemic PAP > 30 mmhg, Severe stenosis – poor prognostic indicators[13].

Offspring risk[13,14] :

- Prematurity – 20-30%
- FGR – 5- 20%
- Fetal death 1-5%

Pregnancy management:

- Patients with significant MS (MVA < 1.5cm2) must be counselled against pregnancy and interventions correcting them must be done in the prepregancy period even if asymptomatic15.
- Surgical Interventions in pregnancy are indicated if16 :

• NYHA III/IV
and/or
• Systolic pulmonary arterial pressure is >/= 50 mmhg not responding to medical management.
• procedure of choice: percutaneous mitral commissurotomy preferably after 20 weeks however, in LMIC closed commissurotomy is an alternative.
• Medical management includes: activity restriction, beta blockers for heart rate control. Anticoagulation with UFH/LMWH/VKA should be considered in heart failure or if ECHO suggestive of enlarged left atrium >/= 60 ml/m2.
  - Vaginal delivery is favored except in those with NYHA III/IV or have PAH or in those with failed percutaneous commissurotomy, where caesarean section is considered.
  - Regular follow up is needed with cardiologist to evaluate stenosis progression or restenosis after commissurotomy as they are dictate late prognosis.

2. Aortic stenosis:

Aortic stenotic lesions are usually due to bicuspid aortic valve rather than rheumatic heart disease as in mitral stenosis.

Maternal risk:

- Risk of heart failure is low <10% even with moderate AS if patient is asymptomatic, however, if symptomatic the risk increases to one in four17.
- In those with severe AS, pregnancy is well tolerated if the pre pregnancy exercise tolerance was normal.
- Mortality is very much preventable with careful management.

Offspring risk

- There is 20-25 % risk of preterm birth, FGR and low birth weight in offspring of mother with moderate to severe AS[17].
- Miscarriages and fetal death rates are <5%.
- If AS is due to bicuspid aortic valve, then fetal ECHO is indicated.

Management

- In women with bicuspid aortic valve, aortic diameters and flow parameters should be assessed before and during pregnancy.
- In an asymptomatic women even with severe AS, pregnancy should not be discouraged when LV size and function and the exercise test are normal and had no recent progression of AS. If they have impaired LV function or pathological exercise test or with recent progression, they must be advised against pregnancy and intervention must be undertaken ideally prepregancy period[16].

• During pregnancy, those who are severely symptomatic despite medical therapy, percutaneous valvuloplasty by an experienced operator is indicated and if this is not possible or the patient's life is at risk,

then early delivery by caesarean section followed by valve replacement should be considered[17].

- In severe AS, monthly or bimonthly cardiac evaluations including echocardiography are advised.
- Medical therapy: diuretics are indicated if congestive features develop.
- Labour and delivery: mode of delivery must be individualized according to the severity of the lesion. In asymptomatic severe AS patients, vaginal delivery is preferred and a cesarean delivery must be preferred in severe symptomatic AS patients.
- Follow-up and prognosis after delivery. Disease progression is frequent after delivery and requires close follow-up.

Regurgitant lesions

1. Mitral and Aortic Regurgitation:

These can be of rheumatic, congenital, or degenerative origin.

Maternal Risk

- HF occurs in 20–25% of women with moderate or severe rheumatic MR 13.
- Women with severe regurgitant lesions or impaired LV function are at an increased risk of heart failure.
- Acute severe regurgitation is poorly tolerated.

Offspring Risk

- FGR in 5–10% in women with moderate or severe MR[13]

Management

- The frequency of cardiac evaluation is dependent on the severity of the lesions
  - mild to moderate regurgitations- once a trimester.
  - severe regurgitation- monthly.
- Medical therapy: diuretics are used to manage symptoms of fluid overload.
- Interventions: valve repair or replacement must ideally be done in pre-pregnancy period. However, in cases of acute severe regurgitation causing heart failure not responding to medical therapy, early delivery by cesarian section followed by cardiac surgery must be undertaken[16].
- Labour and delivery: Vaginal delivery with epidural anesthesia and shortened second stage is advisable unless with heart failure not responding to medical therapy.

2. Tricuspid Regurgitation:

Ebstein's anomaly resulting in TR is more common than a primary TR.

Maternal Risk

- It is determined by left sided valve disease or PH.
- Arrythmias complicating the existing congenital heart disease increases the maternal risk[18].

Management

- In severe symptomatic TR, repair should be considered prepregancy
- However, even severe TR with HF can usually be managed conservatively during pregnancy.
- In patients with moderate TR with annular dilatation >_40mm and coexisting left side valve lesions requiring surgery, repair of the tricuspid valve is to be considered[16].

Pregnancy with prosthetic valves

Choice of valve prosthesis

when a woman in reproductive age needs a valve replacement, careful considerations must be taken regarding the choice of the valve and its implications on future pregnancies. The advantages and disadvantages of mechanical and bioprosthetic valves are described in table 10. The final choice of the valve must be made after extensively discussing with the patient.

Table 10: Advantages and disadvantages of mechanical and bio-prosthetic valves

	Mechanical valves	Bio-Prostetic valves
Advantages	Excellent hemodynamic performance Long term durability	Event free pregnancy with live birth chance is 79% [19].
Disadvantage	Need for anticoagulation. Increased risk of major cardiac event in pregnancy. Event free pregnancy with live birth chance is 58%[19].	Structural valve deterioration significantly affecting pregnancy course and might need re-operation.

Pregnancies with mechanical heart valves:

Pregnancies with mechanical heart valves are a category III in mWHO classification and are at increased risk of maternal cardiac event in pregnancy. They require anticoagulation which in turn increases maternal and offspring risk. Various anticoagulants used in such pregnancies are described in Table 11.

Current evidence (lacking adequate randomized studies) indicates that the use of VKAs throughout pregnancy, under strict INR control, is the safest regimen to prevent valve thrombosis19-22. The management strategies in pregnant women on vitamin K antagonists are given in fig-1 and fig.2. LMWH is possibly superior to UFH for preventing valve thrombosis19,23. addition of aspirin to the anticoagulant regimes only increased the adverse hemorrhagic episodes with no statistical benefit.

Table 11 :Comparison of anticoagulants used in pregnancy with mechanical valves.

		Vitamin K Antagonists	Low-molecular weight heparin	Unfractionated heparin
Maternal risks	Risk of valve thrombosis	0-4%[19]	4.4- 8.7% at peak levels[19,20].	9-33%[20]
	Hemorrhagic complications in mother	↑↑	↑	↑
OFFSPRING RISK	Risk of miscarriage	Overall : 28.6% - 32.5 %[19] Low dose : 13.4- 19.2%	9.2%- 12.2 %[19,21]	9.2%[19]
		Combined VKA + LMWH : 22.7%[21]		
	Embryopathy	Limb defects Nasal hypoplasia. Dose dependent Low dose:0.45- 0.9 %[21] Overall risk : 0.6-10 %[22]	Do not cross placenta	
	Fetopathy	Ocular, CNS abnormalities. Intracranial hemorhhage. 0.7-2%[22]	None.	May occur.
Delivery considerations		Increased risk of intracranial hemorrhage in vaginal delivery- cesarean delivery indicated.	stopped 24 hours prior to delivery	Stopped 6 hours prior to delivery

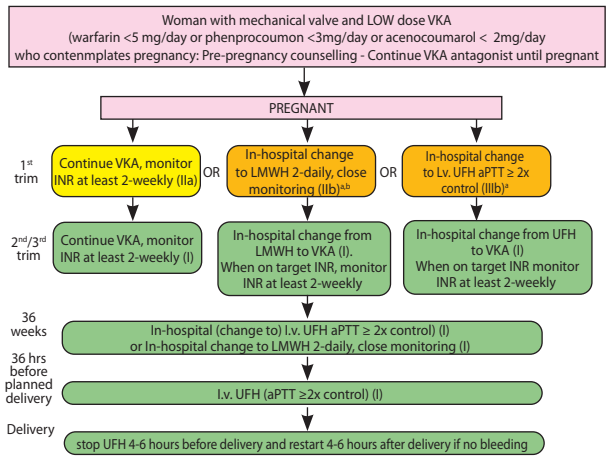

Fig.1: Pregnancy management in women on Low dose VKA

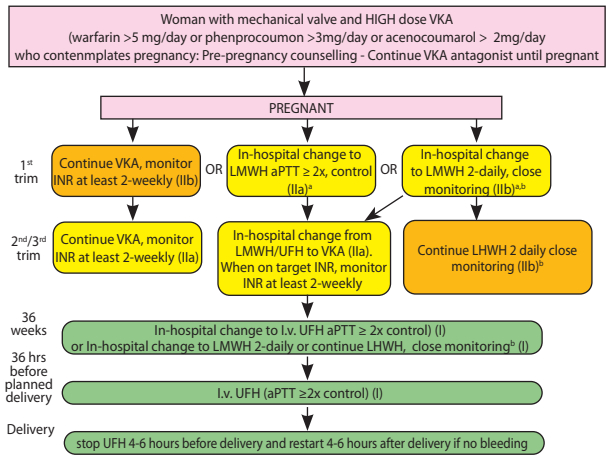

Fig.2: Pregnancy management in women on high dose VKA

Surveillance during pregnancy:

These high-risk pregnancies should be managed by a pregnancy heart team in an expert center. The effectiveness of the anticoagulation regimen should be monitored weekly or every 2 weeks depending on the anticoagulation regimen and clinical follow-up including echocardiography should be performed monthly.

References

1. Bansode BR. Pregnancy and heart disease. Assoc Physicians Ind. 2010;773-6.
2. siu SC, Sermer M, Colman JM, Alvarez AN, Mercier LA, Morton BC, Kells CM, Bergin ML, Kiess MC, Marcotte F, Taylor DA, Gordon EP, Spears JC, Tam JW, Amankwah KS, Smallhorn JF, Farine D, Sorensen S. Prospective multicenter study of pregnancy outcomes in women with heart disease. Rutherford JD. Heart failure in pregnancy. Curr Heart Fail Rep 2012;9:277–281.
3. Regitz-Zagrosek V, Roos-Hesselink JW, Bauersachs J, Blomström-Lundqvist C, Cífková R, De Bonis M, Iung B, Johnson MR, Kintscher U, Kranke P, Lang IM, Morais J, Pieper PG, Presbitero P, Price S, Rosano GMC, Seeland U, Simoncini T, Swan L, Warnes CA; ESC Scientific Document Group. 2018 ESC Guidelines for the management of cardiovascular diseases during pregnancy. Eur Heart J. 2018 Sep 7;39(34):3165-3241. doi: 10.1093/eurheartj/ehy340. PMID: 30165544.
4. American College of Obstetricians Gynecologists' Committee on Obstetric Practice. Committee opinion no.

656: Guidelines for diagnostic imaging during pregnancy and lactation. ObstetGynecol 2016;127:e75–e80.

5. Kelaranta A, Kaasalainen T, Seuri R, Toroi P, Kortesniemi M. Fetal radiation dose in computed tomography. Radiat Prot Dosimetry 2015;165:226–230.
6. Carpreg 2: Silversides CK, Grewal J, Mason J, Sermer M, Kiess M, Rychel V, Wald RM, Colman JM, Siu SC. Pregnancy Outcomes in Women With Heart Disease: The CARPREG II Study. J Am Coll Cardiol. 2018 May 29;71(21):2419-2430. doi: 10.1016/j.jacc.2018.02.076. PMID: 29793631.
7. Drenthen W, Boersma E , Balci A , et al . Predictors of pregnancy complications in women with congenital heart disease. Eur Heart J 2010;31:2124–32.doi:10.1093/eurheartj/ehq200pmid:http://www.ncbi.nlm.nih.gov/pubmed/20584777.
8. Ruys TP, Roos-Hesselink JW, Pijuan-Domenech A, Vasario E, Gaisin IR, Iung B, Freeman LJ, Gordon EP, Pieper PG, Hall R, Boersma E, Johnson MR. Is a planned caesarean section in women with cardiac disease beneficial? Heart 2015;101:530–536.
9. M.R. Johnson Cardiac Effects of Drugs Used for Induction of Labor and Prevention and Treatment of Postpartum HaemorrhageCardiac Problems in Pregnancy (2019), pp. 530-536.
10. Devitt JH, Noble WH, Byrick RJ. A Swan-Ganz catheter related complication in a patient with Eisenmenger's syndrome. Anesthesiology 1982;57:335–337.
11. ACOG Practice Bulletin No. 199: Use of Prophylactic Antibiotics in Labor and Delivery. Obstetrics & Gynecology: September 2018 - Volume 132 - Issue 3 - p e103-e119 doi: 10.1097/AOG.0000000000002833
12. Rosseland L. A., Hauge T. H., Grindheim G., Stubhaug A., Langesæter E. Changes in blood pressure and cardiac output during cesarean delivery: The effects of oxytocin and carbetocin compared with placebo. Anesthesiology. 2013;119(3):541–551. doi: 10.1097/ALN.0b013e31829416dd.
13. van Hagen IM, Thorne SA, Taha N, Youssef G, Elnagar A, Gabriel H, ElRakshy Y, Iung B, Johnson MR, Hall R, Roos-Hesselink JW; ROPAC Investigators and EORP Team. Pregnancy outcomes in women with rheumatic mitral valve disease: Results from the Registry of Pregnancy and Cardiac Disease. Circulation 2018;137:806–816
14. Silversides CK, Colman JM, Sermer M, Siu SC. Cardiac risk in pregnant women with rheumatic mitral stenosis. Am J Cardiol 2003;91:1382–1385.
15. Hameed A, Karaalp IS, Tummala PP, Wani OR, Canetti M, Akhter MW, Goodwin I, Zapadinsky N, Elkayam U. The effect of valvular heart disease on maternal and fetal outcome of pregnancy. J Am Coll Cardiol 2001;37:893–899
16. Baumgartner H, Falk V, Bax JJ, De Bonis M, Hamm C, Holm PJ, Iung B, Lancellotti P, Lansac E, Rodriguez Munoz D, Rosenhek R, Sjogren J, Tornos Mas P, Vahanian A, Walther T, Wendler O, Windecker S, Zamorano JL. 2017 ESC/ EACTS guidelines for the management of valvular heart disease. Eur Heart J 2017;38:2739–2791.
17. Orwat S, Diller GP, van Hagen IM, Schmidt R, Tobler D, Greutmann M, Jonkaitiene R, Elnagar A, Johnson MR, Hall R, Roos-Hesselink JW, Baumgartner H. Risk of pregnancy in moderate and severe aortic stenosis: From the multinational ROPAC registry. J Am Coll Cardiol 2016;68:1727–1737.
18. Drenthen W, Boersma E, Balci A, Moons P, Roos-Hesselink JW, Mulder BJ, Vliegen HW, van Dijk AP, Voors AA, Yap SC, van Veldhuisen DJ, Pieper PG. Predictors of pregnancy complications in women with congenital heart disease. Eur Heart J 2010;31:2124–2132.
19. van Hagen IM, Roos-Hesselink JW, Ruys TP, Merz WM, Goland S, Gabriel H, Lelonek M, Trojnarska O, Al Mahmeed WA, Balint HO, Ashour Z, Baumgartner H, Boersma E, Johnson MR, Hall R. Pregnancy in women with a mechanical heart valve: Data of the European Society of Cardiology Registry of Pregnancy and Cardiac Disease (ROPAC). Circulation 2015;132:132–142.
20. Abildgaard U, Sandset PM, Hammerstrom J, Gjestvang FT, Tveit A. Management of pregnant women with mechanical heart valve prosthesis: Thromboprophylaxis with low molecular weight heparin. Thromb Res 2009;124:262–267
21. Hassouna A, Allam H. Limited dose warfarin throughout pregnancy in patients with mechanical heart valve prosthesis: A meta-analysis. Interact Cardiovasc Thorac Surg 2014;18:797–806.
22. Sillesen M, Hjortdal V, Vejlstrup N, Sorensen K. Pregnancy with prosthetic heart valves - 30 years' nationwide experience in Denmark. Eur J Cardiothorac Surg 2011;40:448–454.
23. Xu Z, Fan J, Luo X, Zhang WB, Ma J, Lin YB, Ma SH, Chen X, Wang ZP, Ou JS, Zhang X. Anticoagulation regimens during pregnancy in patients with mechanical heart valves: A systematic review and meta-analysis. Can J Cardiol 2016;32:1248.e1–1248.e9.

Hypertensive disorders of pregnancy- preconception and interconception care

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Hypertensive disorders complicate 3-10% of all pregnancies and are one of the leading cause of maternal death.[1] There has been a substantial rise in hypertensive disorders due to increase in obesity, unhealthy lifestyle and other comorbidities.

Table 1. American College of Obstetricians and Gynecologists Definitions of Hypertensive Disorders Disorder[2]

Hypertensive disorders	Definition
Hypertension in pregnancy	Systolic blood pressure ≥140 mm Hg or diastolic BP ≥90 mm Hg, or both, measured on two occasions at least 4 hours apart
Severe-range hypertension	Systolic blood pressure ≥160 mm Hg or diastolic BP ≥110 mm Hg, or both, measured on two occasions at least 4 hours apart
Chronic hypertension	Hypertension diagnosed or present before pregnancy or before 20 weeks of gestation; or hypertension that is diagnosed for the first time during pregnancy and that does not resolve it the postpartum period
Chronic hypertension with superimposed Pre-eclampsia	Pre-eclampsia in a woman with a history of hypertension before pregnancy or before 20 weeks of gestation

To combat the increase in incidence and the exacerbations of the hypertensive disorders in pregnancy, care should be started from the pre-conceptional period. Pre-conceptional, post-partum, inter-conceptional and well women care are interrelated and are defined by their timing of pregnancy and delivery. Pre-conceptional care includes optimization of maternal health condition, address modifiable risk factors, improving the maternal and fetal outcome and providing education about healthy pregnancy. At pre-pregnancy visit health care professional should take the opportunity to counsel women about the healthy lifestyle and minimize adverse risks. Pre-conceptional counselling begins while using contraception or planning for pregnancy. Fig 1 shows the continuum of care.

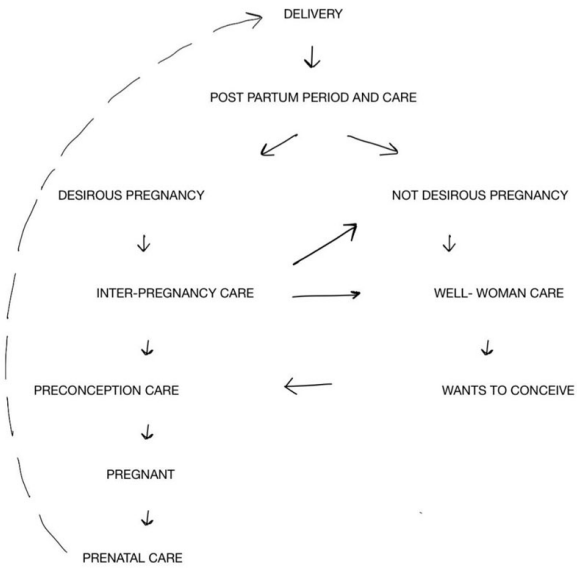

Fig 1. Continuum of care[3]

Pre-conceptional care

Many chronic medical disorders like diabetes, hypertension, heart disease etc. have serious implications on maternal health as well future pregnancy outcome and thus should be optimally managed. It should include collaboration with maternal- fetal specialist and other departments. A multidisciplinary approach yields better outcome.

Various components include-

1. Reviewing personal medical and surgical history, psychiatric illness and chronic medical illness in family.
2. Reviewing prescription and non-prescription medications. Patients with chronic hypertension who are on ACE inhibitors and angiotensin receptor blocker should be counseled about the possibility of birth defects in fetus like CVS malformation, renal dysfunction, oligohydramnios and fetal growth restriction.[4]
3. Counselling-
   a) About the complications during and after pregnancy such as:
      - Maternal risks like - eclampsia, placental abruption, pulmonary edema, HELLP syndrome, acute respiratory distress syndrome,

coagulopathy, renal failure, myocardial infarction, stroke, and retinal injury.

- Fetal risks- Abnormal fetal testing, extreme prematurity, Doppler changes like persistent reversed end-diastolic flow in the umbilical artery, fetal death and still birth.
- Long-term complications- cardiovascular disease (hypertension, myocardial infarction, congestive heart failure), cerebrovascular accident, peripheral arterial disease, nephropathy, retinopathy, mortality

b) Lifestyle modifications- healthy diet, BMI between 18.5-24.9 kg/m^2

c) Exercise may reduce risk of gestational hypertension and pre eclampsia by 30 and 40% respectively.[5]

4. Immunization- check status of Tdap, measles, rubella, mumps, hepatitis b and varicella. After MMR and varicella vaccination, it is safer to avoid pregnancy for 1 month. Those women who have not been immunized with Tdap should receive one dose of Tdap between 28-32 weeks of gestation to protect the neonate from pertusis till 2 months of age.
5. Screening for sexually transmitted infections, HIV, hepatitis, syphilis.
6. Contraception- patients should be counseled pre-conceptionally about various methods available for use. Those patients on ACE inhibitors and Angiotensin receptor blocker should be advised to not conceive while they are on medications or to change to safer option before conception.
7. All reproductive age group women should be advised to take folic acid 400 ug daily at least 1 month prior to conception.
8. Screen for intimate partner violence and counsel about harmful effects of smoking, alcohol and substance abuse.

Inter-conceptional care

Inter-conceptional care is defined as health care needs of reproductive age group women who are between pregnancies with the aim to improve the outcome of the women and the infant.

Table 2: Key steps of interconceptional care

During pre-natal care	During the maternity stay	At the comprehensive post-partum visit	During routine health care or well-women or paediatric visit
Assign a health care professional to provide primary care in immediate post-partum	Discuss about time and location of follow up for post-partum care	Review complications of hypertension and their implication on maternal health	Assess if woman is likely to conceive next year
Discuss about contraception	Discuss about contraception	Ensure contraception	Screen for depression, mental health disorders and intimate partner violence
Breastfeeding counselling	Breastfeeding counselling	Establish breastfeeding	Screen for chronic conditions and optimise
Counsel about long term complications of hypertension		Counsel about long term complications of hypertension	Paediatric colleagues to screen for maternal health

Table 3: Chief clinical components of inter-conceptional care3

	Recommendations
General	- Anticipatory guidance during pregnancy and post-partum care plan - Achieve pre-pregnancy weight by 6-12 months post-partum (BMI-18.5-24.9kg/m2) - Adequate nutrition - Smoking cessation, avoid use of alcohol and drugs - Screen for intimate partner violence - Screen for STDs - If planning for pregnancy-start folic acid 400ug - Review prescription
Breastfeeding	Establish Longer duration is associated with low risk of hypertension, diabetes, metabolic syndrome
Inter pregnancy interval	Avoid interval <6months and explain about risk and benefits of repeat pregnancy within 18months
Depression	Screen, counsel and treat

In high risk condition like hypertensive disorders of pregnancy there are acute exacerbations and thus merit particular attention. As physiological changes of pregnancy reverts to non-pregnant state, blood pressure decreases within 48hours of delivery but increases again 3-6 days post-partum. Thus it is recommended to monitor BP for 7-10days after delivery.

Table 4: Specific recommendations in such conditions.[6]

Condition	Counselling	Interpregnancy test	Goals	Medication of concern
Gestational hypertension	Increased risk of - chronic hypertension (3%), - Pre-eclampsia (7%) - recurrence (11%). - cardio vascular disease (1.5-3 times)	Evaluate BP for resolution of hypertension	- BP<120/80 mmhg - Maintain healthy weight - Discuss about aspirin for future pregnancy	Ace inhibitor, angiotensin receptor blocker
Pre-eclampsia	Increased risk of - recurrence (16-23%), - chronic hypertension (2%) and gestational hypertension (6-12%). - cardio vascular disease (1.5-3 times) - stroke (2-3 times)	Evaluate BP for resolution of hypertension	- BP<120/80 mmhg - Maintain healthy weight - Discuss about aspirin for future pregnancy	Ace inhibitor, angiotensin receptor blocker
Chronic hypertension	Increased risk of - gestational hypertension (9%), Pre-eclampsia (14%). - maternal morbidity and mortality. - Uncontrolled hypertension leading to end organ damage, renal disease and cardiovascular disease (1.7 times) - myocardial infarction and strokes (1.8 times)	Evaluate BP for resolution of hypertension	- BP<120/80 mmhg - Maintain healthy weight - Discuss about aspirin for future pregnancy	Ace inhibitor, angiotensin receptor blocker

References

1. Espinoza J, Vidaeff A, Pettker CM, Simhan H. Gestational hypertension and preeclampsia. Obstetrics and Gynecology. 2020 Jun 1;135(6):E237-60.
2. American College of Obstetricians and Gynecologists. ACOG practice bulletin no. 202: gestational hypertension and preeclampsia. Obstet Gynecol. 2019 Jan;133(1):e1-25.
3. Louis JM, Bryant A, Ramos D, Stuebe A, Blackwell SC, American College of Obstetricians and Gynecologists. Interpregnancy care. American Journal of Obstetrics and Gynecology. 2019 Jan 1;220(1):B2-18.
4. Buawangpong N, Teekachunhatean S, Koonrungsesomboon N. Adverse pregnancy outcomes associated with first-trimester exposure to angiotensin-converting enzyme inhibitors or angiotensin II receptor blockers: A systematic review and meta-analysis. Pharmacology research & perspectives. 2020 Oct;8(5):e00644.
5. Magro-Malosso ER, Saccone G, Di Tommaso M, Roman A, Berghella V. Exercise during pregnancy and risk of gestational hypertensive disorders: a systematic review and meta-analysis. Acta obstetricia et gynecologica Scandinavica. 2017 Aug;96(8):921-31.
6. Jones NR, McCormack T, Constanti M, McManus RJ. Diagnosis and management of hypertension in adults: NICE guideline update 2019. British Journal of General Practice. 2020 Feb 1;70(691):90-1.

Epilepsy and Pregnancy- Preconception and Inter-conception care

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Introduction

- Epilepsy is one of the most prevalent neurological condition encountered in pregnancy with an estimated global incidence of 6.85 per 1000 women.[1] Overall about one in every three epileptic pregnant patients will show an increase in frequency, while the remainder will show a decrease or no change. However, if epilepsy is under control prior to pregnancy, then there is reduced risk of worsening in pregnancy.
- In women who are pregnant, the volume of distribution and the hepatic metabolism of antiepileptic drugs (AEDs) are increased. This, along with decreased compliance with AEDs because of concerns about their effects on the fetus, leads to an increase in seizure frequency.
- Most pregnancies are uneventful in women with epilepsy, and most babies are delivered healthy with no increased risk of obstetric complications in women. A study was carried out to compare children at 2 years of age who were born to women with epilepsy (WWE) vs healthy women and assess the association of maximum AED exposure in the third trimester and subsequent cognitive abilities among children of WWE. The outcome did not differ between the two groups.[2]
- Women with epilepsy have a small increased risk of pregnancy complications that include spontaneous abortion, hemorrhage, hypertensive disorders, preterm birth, fetal-growth restriction, and cesarean delivery.[3]
- Postpartum depression rates are also reportedly higher in epileptic women.

Preconception Care

- Preconception counselling should be available to all women with epilepsy who are considering pregnancy. Successful management of these pregnancies ideally involves prepregnancy consultation and close collaboration between the obstetric and neurology providers as a multidisciplinary team.
- WWE should be provided with verbal and written information on prenatal screening and its implications. They must be made aware of a number of issues relating to future pregnancy, including methods and consequences of prenatal screening, genetics of their seizure disorder, of the different types of epilepsy and their presentation to assess the specific risks to the mother and baby, teratogenicity of AEDs, folic acid and vitamin K supplementation, labor, breast feeding, child care, the risks of self-discontinuation of AEDs and contraception.[9,10]
- WWE should be informed that the risk of congenital abnormalities in the fetus is dependent on the type, number and dose of AEDs.
- Anti epileptic drugs(AED)- The old AEDs generation (benzodiazepines, phenytoin, carbamazepine, phenobarbital and valproic acid) are known to cross the placenta and hence can affect the fetus and are teratogenic. Various studies have found that the more widely used newer AEDs, (lamotrigine, levetiracetam and topiramate) have low risk for teratogenesis, but that topiramate exposure early in pregnancy may be associated with dose-related teratogenesis.[4] When treating pregnant women who have epilepsy, the risks of increased seizure frequency versus the risks of AED use must be weighed carefully.
- Minor congenital malformations, such as facial dysmorphism, stubby distal phalanges and other anomalies (fetal hydantoin syndrome/ fetal antiepileptic syndrome) occur in 6-20% of infants exposed to AEDs in utero; this value is two times greater than the value reported in the general population.[5] Genetic predisposition may have a role to play in these teratopathies.
- Combination therapy is known to increase malformation rates further. Valproate is significantly more teratogenic than carbamazepine, and the combination of valproate sodium and lamotrigine or topiramate is particularly teratogenic.[4,5]
- Attempt should be made to decrease pharmacotherapy to monotherapy at the lowest effective dose of the AED in preconception period.
- The American Academy of Neurology recommends consideration of antiseizure medication

discontinuation before pregnancy in suitable candidates. These include women who satisfy the following criteria:

- (1) have been seizure-free for 2 to 5 years, (2) display a single seizure type, (3) have a normal neurological examination and normal intelligence, and (4) show electroencephalogram results that have normalized with treatment.[14]
- Folic acid supplementation All WWE should be advised to take 5 mg/day of folic acid prior to conception and to continue the intake until at least the end of the first trimester to reduce the incidence of major congenital malformation. Pre-pregnancy folic acid 5 mg/day may be helpful in reducing the risk of AED-related cognitive deficits.[11]
- Avoidance of stress, alcohol, smoking, screen time, deprivation of sleep. These factors influence seizure frequency and hence, patients should be assessed regularly for the same. Healthcare professionals should be alert to signs of depression, anxiety and any neuropsychiatric symptoms in mothers exposed to AEDs.
- Genetic counseling, while currently only possible in a minority of patients, may lead to a better understanding of the epilepsy aetiology, co-morbidities, prognosis and recurrence risks.[6]

Ante natal care

- Physiological changes during pregnancy can significantly alter antiepileptic drug (AED)'s absorption, distribution, metabolism and elimination, thus influencing their plasma concentration. The levels of most antiepileptic drug (AED) concentrations are reduced during pregnancy and this may increase seizure frequency. This alteration is as a result of decreased absorption in the gastrointestinal tract and increased clearance (both renal and hepatic). Albumin levels fall in pregnancy leading to lower total drug levels. These changes reverse back in the postpartum period.[7]
- Patients should be advised strict adherence to AED and to never stop or change AEDs abruptly without an informed discussion.
- AED level monitoring- Although therapeutic drug monitoring could guide adjustment of AED dosage to achieve good seizure control, avoid seizure precipitation during pregnancy or symptoms of toxicity after birth, their concentrations may be unreliable because of altered protein binding. Free or unbound drug levels, although perhaps more accurate, are not widely available. More research on therapeutic drug monitoring of AED use during pregnancy is still needed. [9]
- In pregnant women presenting with seizures in the second half of pregnancy which cannot be clearly attributed to epilepsy, immediate treatment should follow existing protocols for eclampsia management until a definitive diagnosis is made by a full neurological assessment.
- The workup of these patients should involve a neurologic examination, a complete blood count(CBC), serum electrolytes, MRI Brain and electroencephalographic examination in consultation with a neurologist.
- Maternal surveillance -Because of the increased risk of neural tube defects, an MSAFP screening test should be offered. Amniocentesis for alpha-fetoprotein and acetylcholinesterase may be considered if indicated.[10]
- Fetal surveillance- WWE should be directed to undergo a detailed fetal anomaly scan between 18 and 20 weeks, with special emphasis on facial structures, nervous system (neural tube defects) and cardiovascular system. A fetal echocardiogram should also be considered to diagnose potential cardiac anomalies. Serial growth scans are required for detection of small-for-gestational-age babies and to plan further management in WWE exposed to AEDs.[10,11]

Intrapartum care- An IV line should be secured in anticipation of seizures.

- Access to ICU care in situation of seizure or status epilepticus to be pre-planned.
- Labor management should be based on routine standards of care. Most WWE are able to achieve vaginal delivery. Attention must be paid to avoid hyperventilation and maternal exhaustion with good labor analgesia.
- Continuous fetal monitoring is recommended.
- Manage seizures acutely with intravenous benzodiazepines.[8]

Status epilepticus management- Seizure activity that is ongoing and lasts for more than 30 min or recurrent seizure without full recovery of consciousness between episodes is defined as status epilepticus.

- First aid measures aim to avoid injury, maintain airway, administer oxygen should be started immediately. Assess the fetal heart rate or fetal status. Rule out eclampsia.[12]
- Administer a bolus of lorazepam (0.1 mg/kg) or

midazolam (0.2mg/kg). If the seizures are not controlled, administer phenytoin loading dose (20 mg/kg) or levetiracetam (20-30mg/kg) with cardiac monitoring. Phenytoin to be continued at the rate of 4-7mg/ kg/ day, given in 2-4 divided doses according to response. The dose of midazolam can be increased to 0.6mg/kg. If this also is not successful, load phenobarbital (5mg/kg) and continue it at a rate of 1-5mg/kg/hr. Propofol and other anaesthetic drugs may be added to achieve control.[8]

- Check laboratory findings, including electrolytes, AED levels, blood sugar, and toxicology screen. If fetal testing results are non-reassuring, move to emergent delivery.

Postpartum care

- WWE and their caregivers need to be aware that although the overall chance of seizures during and immediately after delivery is low, it is relatively higher than during pregnancy, more so because of increased stress, sleep deprivation, missed medication and anxiety.
- WWE should be advised to continue their AEDs postnatally. Mothers should be well supported in the postnatal period to ensure that triggers of seizure deterioration such as sleep deprivation, stress and pain are minimised.
- If the AED dose was increased in pregnancy, it should be reviewed within 10 days of delivery to avoid postpartum toxicity. Patients should be assessed by a neurologist to adjust the AED dose.
- WWE who are taking AEDs in pregnancy should be encouraged to breastfeed. Based on current evidence, mothers should be informed that the risk of adverse cognitive outcomes is not increased in children exposed to AEDs through breast milk. But also, any signs of neonatal sedation should be looked for.16
- Postnatal mothers with epilepsy at reasonable risk of seizures should be accommodated in rooms where there is provision for continuous observation by a care giver, partner or nursing staff.
- WWE should be screened for depressive disorder in the puerperium. Mothers should be informed about the symptoms and provided with contact details for any assistance.[11]

Care of neonate

- Vitamin K Prophylaxis- All babies born to WWE taking enzyme-inducing AEDs should be given 1 mg of intramuscular vitamin K. Cord blood sample should be submitted for clotting studies. Reports of increased risk of spontaneous hemorrhage in newborns suggest that the inhibition of vitamin K–dependent clotting factors (ie, II, VII, IX, X) secondary to increased vitamin K metabolism and the inhibition of placental transport of vitamin K results from AED use. If the cord blood is deficient in clotting factors, fresh frozen plasma may be required to protect the newborn.[10,11]
- Neonates should be monitored for adverse effects associated with AED exposure in utero, and their developmental milestones should be monitored.

Contraception

- Copper intrauterine devices (IUDs), the levonorgestrel-releasing intrauterine system (LNG-IUS) and medroxyprogesterone acetate injections (DMPA) should be promoted as reliable methods of contraception that are not affected by enzyme-inducing AEDs. WWE taking enzyme-inducing AEDs should be informed that a copper IUD is the preferred choice for emergency contraception. (WHO MEC2)
- Women should be counselled that the efficacy of oral contraceptives (combined hormonal contraception, progestogen-only pills), transdermal patches, vaginal ring and progestogen-only implants may be affected if they are taking enzyme-inducing AEDs (e.g. carbamazepine, phenytoin, phenobarbital, primidone, oxcarbazepine and eslicarbazepine).
- All methods of contraception may be offered to women taking non-enzyme-inducing AEDs (e.g. sodium valproate, levetiracetam, gabapentin, vigabatrin, tiagabine and pregabalin).
- Emergency contraception pills with levonorgestrel and ulipristal acetate are affected by enzyme-inducing AEDs. Women taking lamotrigine monotherapy and oestrogen - containing contraceptives should be informed of the potential increase in seizures due to a fall in the levels of lamotrigine.[11]

Take home message The major pregnancy-related risks to women with epilepsy are fetal malformations and increased seizure rates. Anti epileptic drug, dose modification in pre conception period and seizure control by ensuring strict adherence to AEDs in antenatal period along with fetal surveillance are the main priority to avoid morbidity and mortality risks in such patients. Adoption of effective contraception and continuing AEDs are important in post partum period.

References

1. Stephen, L.J. et al. (2019) "Management of epilepsy in women," The Lancet Neurology, 18(5), pp. 481–491.
2. Meador, K.J. (2013) "Behavioral and cognitive effects of Antiepileptic Drugs," The Roots of Cognitive Neuroscience, pp. 269–283.
3. Viale, L. et al. (2015) "Epilepsy in pregnancy and reproductive outcomes: A systematic review and meta-analysis," The Lancet, 386(10006), pp. 1845–1852.
4. Vajda, F. J., O'Brien, T. J., Lander, C. M., Graham, J., & Eadie, M. J. (2014). The teratogenicity of the newer antiepileptic drugs - an update. Acta neurologica Scandinavica, 130(4), 234–238.
5. Harden, C.L. et al. (2009) "Practice parameter update: Management issues for women with epilepsy--focus on pregnancy (an evidence-based review): Teratogenesis and perinatal outcomes: Report of the Quality Standards Subcommittee and Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology and American Epilepsy Society," Neurology, 73(2), pp. 133–141.
6. Vlaskamp, D.R.M. et al. (2021) "Changes in empowerment and anxiety of patients and parents during genetic counselling for epilepsy," European Journal of Paediatric Neurology, 32, pp. 128–135.
7. Costantine M. M. (2014). Physiologic and pharmacokinetic changes in pregnancy. Frontiers in pharmacology, 5, 65.
8. Aaron B Caughey et am (2021). Seizure Disorders in Pregnancy. Medscape
9. Laganà, A.S. et al. (2015) "Management of women with epilepsy: From preconception to post-partum," Archives of Gynecology and Obstetrics, 293(3), pp. 493–503.
10. Lizama, A.G. and Crawford, P. (2014) "Seizure management in pregnancy," Women with Epilepsy, pp. 170–181.
11. RCOG Epilepsy in Pregnancy(June 2016) Green-top Guideline No. 68
12. Arias' Practical Guide to High-Risk Pregnancy and Delivery A South Asian Perspective 4e
13. Cunningham, F.G. (2022) Williams obstetrics. McGraw Hill.

Pathways of Haemoglobin opathies: Early Diagnosis and Management

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Haemoglobinopathies are the commonest genetic disorders including 270 million (7% of world population) thalassemics worldwide. Clinically significant haemoglobinopathies include α- and β-thalassemia, sickle cell disease (SCD), HbE and HbC disease. Deletions or point mutations in α- or β-globin genes cause abnormalities in the synthesis or in the structure of haemoglobin, leading to α and β thalassemia respectively. The highest prevalence of both diseases has been reported in the Mediterranean area, Middle East, Indian subcontinent, Southeast Asia and north coast of Africa. In India, the prevalence of B-thalassemia carrier is 3-4%. About 10000-15000 babies with Thalassemia Major (TM) are born every year. A higher incidence of hemoglobinopathies has been observed in certain communities, such as Sindhis, Punjabis, Guajrati, Bengalis, Mahars, Kolis, Saraswats, Lohanas and Gaurs. HbS leading to SCD is highly prevalent in the tribal populations of Southern, Central and Western states reaching as high as 48% in some communities. HbE is common in the North Eastern states, and has a carrier frequency as high as 50%, in some areas. HbD is present in about 3-4 % of people in Punjab. However due to migration and intercultural marriages the incidence is more generalised.

Haemoglobinopathies are classified as follows

1. Qualitative disorders: They occur as a result of genetic mutation involving globin protein chain such as amino acid substitutions and cause structural variations of globin chains. Example: These mutations result in HbS, HbC etc.
2. Quantitative disorders: They occur as a result of genetic defects that cause reduced synthesis of globin chains. The globin chains are structurally normal. Example: Thalassemia

Thalassemia is categorised into Major, Intermedia (TI) and Minor or Trait according to severity. Thalassemia Major(TM) requires lifelong blood transfusions and iron chelation, whereas, Thalassemia minor is the carrier state in which the person is clinically normal but there is 25% chance of transmission of the affected genes to the next generation due to autosomal recessive nature of inheritance. Sickle Cell Disease is caused by inheritance of two abnormal HbS genes, one from each parent or HbS gene from one parent and HbE or thalassemia gene from the other. Where both mother and father are 'carriers', there is a 25% chance that their children may inherit the abnormal gene from both parents and thus suffer from a severe thalassemia syndrome or a Sickle Cell syndrome.

In India there is no universal screening programme for haemoglobinopathies (commonly thalassemia) as per World Health Organisation (WHO) directive that' (public health) goals should never be set in ways to impose genetic tests or reproductive decisions on individuals'. Hence the main aim of screening is to reduce the number of affected births. The mission of National Health Mission (NHM) is to 'improve care of all Thalassemia and Sickle Cell Disease patients for their better future and to lower the prevalence of haemoglobinopathies through screening and awareness strategies. Hence, NHM has adopted Preventive strategies aimed at creation of an informed society that is willing to 'voluntarily participate' in screening programme to achieve the public health goal of reduction in prevalence of hemoglobinopathies. All preventive options available at each step should be clearly communicated and non-directive counselling provided to enable the individual to make an informed decision.

Individual groups where screening and diagnosis are indicated:

Pre marital screening to be offered to those individuals or couples who seek it, as it may not be acceptable to all community due to diversities in social norm. However, this may result in two options to a carrier couple that is of not going ahead with marriage or to opt for prenatal diagnosis later in each of the pregnancies whichever is acceptable to them. Religious beliefs and customs may also influence the decision. Screening younger population in in schools and universities can be more acceptable.

Universal adolescent screening for identification of carriers in schools coupled with extensive education, awareness and counselling programmes can ensure awareness to either avoid marriages between two carriers or avail prenatal diagnosis after marriage. Community sensitisation and participation is necessary for successful implementation of this strategy. The tube-based screening tests and clinical detection of

anaemia may also be done at Anganwadis for children not going to school.

Preconception screening to be offered to those individuals or couples who seek it with appropriate genetic counselling. Most will opt for prenatal diagnosis with termination of affected pregnancy. Couple can also opt forPre-Implantation Genetic Diagnosis (PGD) if available. Screening is essential for all couples being evaluated for infertility and opting for for assisted conception. If the woman is a carrier of a significant haemoglobinopathy, her partner or sperm donor should be screened and in case of an ovum donor, latter should also be screened. Pre-conception identification of carriers can be done at sub-centres by ANMs.

Pregnant women should be screened in all antenatal clinics irrespective of the gestational age, prenatal diagnostic tests can then be offered to carrier couples. As most pregnant women are likely to come in contact with health services, number of screened pregnant women is expected to be high.

Universal new born screening (NBS) is being implemented in areas with high prevalence of sickle cell disease. This may also identify sickle cell carriers, other variants and few cases of thalassemia major. Dried Blood spot samples are obtained and transported to District or State level lab for testing. Universal screening of all children with severe anemia (Hb <7 gm/dl) for Thalassemia Major is recommended. This strategy will also identify many cases, though not all, of Thalassemia Intermedia.

Screening of siblings and extended family members of carriers and cases which is called the cascade screening, is an integral component of the screening strategy protocol. Some families with an affected child may be either unwilling to communicate this diagnosis to their extended family and occasionally misinformed members of the extended family may try to distance themselves from the family with affected child, hence counselling is neccessary.

Preoperative/Preanesthesia screening should be done in patients from ethnic groups where the prevalence of Hb S is high, as the presence of sickle Hb may influence preoperative techniques and clinical management.

Pre and post-test counselling should be provided by a haematologist, genetic counsellor, medical specialist or paediatrician well versed with counselling of families with haemoglobinopathies.

Screening for Haemoglobinopathies in Community settings

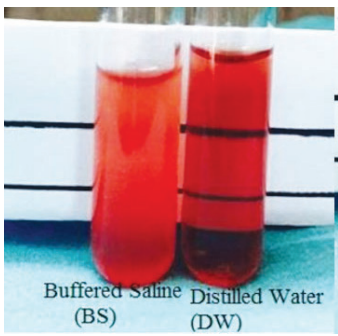
A Stepwise Approach

The evaluation of the haematological picture should be done for the presence and type of anemia in peripheral smears and Red Blood Cell (RBC) indices. Normal values are Haemoglobin: 12-17 gm/dl, Mean corpuscular Volume (MCV:80-100 fl) and Mean corpuscular haemoglobin(MCH):27-32 pg. Thalassemia major and intermedia have microcytic hypochromic red cell indices with raised RBC counts(also called mini Mentzer index). Peripheral smear depicts anisopoikilocytosis (tear drop cells, target cells), microcytosis, hypochromia, and nucleated red cells. MCH is a more reliable parameter than MCV if the samples are not run within a few hours. Atypical b-thalassemia carriers may have a normal MCV and/ or MCH and these individuals may be missed while screening. Carriers of variant Hbs like Hb E and Hb S may also have normal indices in 20-30% of cases.

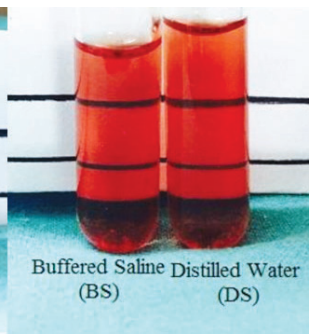
Mentzer index was described in 1973 by William C. Mentzer. It is obtained by dividing MCV by the RBC count and is said to be helpful in differentiating iron deficiency anemia from beta thalassemia. The index is calculated from the results of a complete blood count. If the index is < 13, it is most likely ,thalassemia and if >13, then more likely to be iron-deficiency anemia. Tests selected for initial screening are those with low cost and high negative predictive value.

Tube based Tests

NESTROFT (Naked Eye Single Tube Red cell Osmotic Fragility Test): Screening test used for detecting beta thalassemia trait). This test based on osmotic fragility using 0.36% buffered saline has been used as a preliminary screening test for b-thalassemia carriers extensively in India. In view of the false negative results seen in a small proportion of b-thalassemia carriers, it is not recommended when an automated hematology analyzer is available. If no other facilities are available it can be used for preliminary screening for b-thalassemia carriers. It has a sensitivity of 91-100%, specificity of 85.47%, positive predictive value of 66% and negative predictive value of 97- 100%. Also, since iron deficiency anemia is common in our population, many individuals who are screened would have a false positive result.

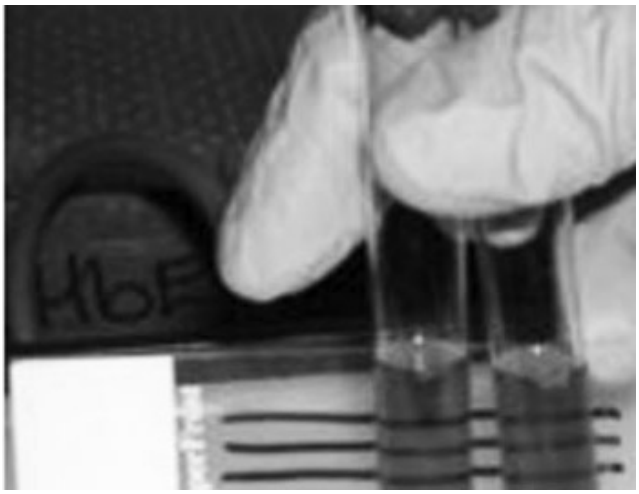


Positive test



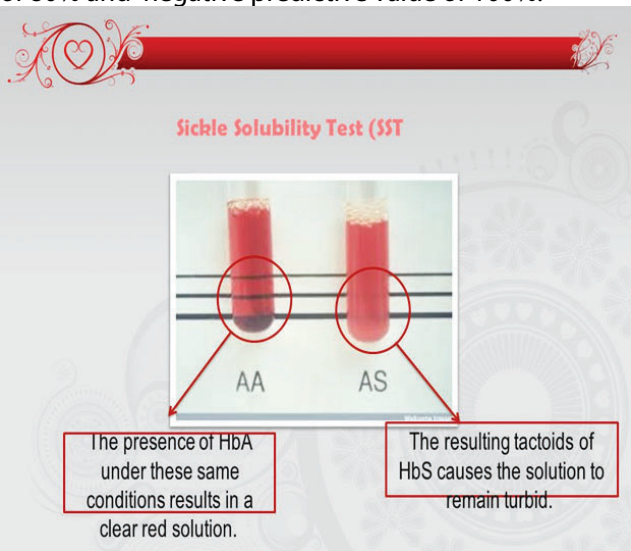
negative test

DCIP test (Di-Chlorophenol-IndoPhenol) is a screening test for haemoglobin E done in eastern states like Assam and Bengal. HbE carrier if married to a person with beta Thalassemia trait, the couple can have a child with transfusion dependent anemia . It has a 100% sensitivity, 98.7% specificity, positive predictive value of 98.6% and negative predictive value of 100%.



Sickle cell solubility test

The solubility test is better for mass screening of HbS carries, because it is rapid (takes just about 5 min), reliable with minimal observer variation, does not need any microscope and requires a small blood sample. It is cost-effective test with a sensitivity of 100%, specificity of 91.66%, positive predictive value of 80% and negative predictive value of 100%.



Application of protein-based screening methods- Diagnostic test

- High performance liquid chromatography (HPLC) is based on whether the mobile phase is polar or non polar:
- Cation exchange HPLC (Hb quantitation)
- Reverse phase HPLC (globin chain separation)

Principal

- Hemoglobin fractions separate based on their ionic interaction
- Each hemoglobin has its own characteristic retention time and is measured from the time of sample injection into the HPLC to the maximum point of each peak.
- Identification of unknown hemoglobin is achieved through comparison with known hemoglobin retention times

Genotype	HbA2	HbF	Variant Hb
Normal	2.3-3.5%	<2	
Beta Thal Trait	4-8	0.5-4	
Delta beta thal trait	<3	5-20%	
HPFH	Normal	15-30%	
HbS trait	3-4%		35-40%
HbD trait	Normal		40-50%
HbE trait	Normal		25-30%

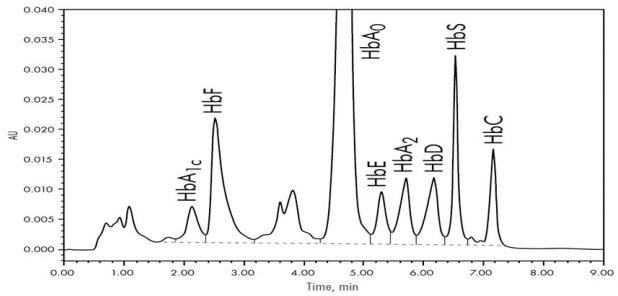


Fig1: Peaks of Haemoglobin variants in HPLC

HPLC advantages

1. HPLC is automated, requires less staff and can run more samples in a short interval of time.
2. HPLC usually separates Hb A, A2, F, S, C, D Punjab and G Philadelphia from each other.
3. HPLC is also applicable for the quantification of HbA1c for the monitoring of Diabetes Mellitus.
4. Small quantity of samples (5 ml) is sufficient for analysis; this is especially useful in paediatric patients.
5. Quantification of normal and variant hemoglobin is available on every sample.

Disadvantages

1. HbH and HB Barts are difficult to identify and cannot quantitate.
2. Minor peaks due to aging and glycosylation.
3. Hemoglobin A2 cannot be differentiated from Hb E and Hb Lepore.
4. Many variants show similar retention times.

Cellulose acetate electrophoresis: Electrophoresis of freshly prepared hemolysates on cellulose acetate membranes at alkaline pH followed by elution of the bands for quantitation of HbA2 is accurate in laboratories that have adequate experience with this technique. However, it is time consuming and cumbersome and is much less used where automated HPLC is available. Densitometric scanning is not recommended for quantitation of HbA2. Cellulose acetate electrophoresis is a cost effective approach for screening for Hb S coupled with the solubility test. Hb H will also be detected as a fast moving band using this technique. Other variants such as Hb E, Hb Q India, Hb Lepore, Hb D Punjab and HbD Iran will also show altered mobility.

All population screening protocols have limitations and detection of all of the asymptomatic states is not possible. Beta- thalassemia carrier genotypes referred to as 'silent' carriers will not be detected on screening or by HPLC. Only carrier states with clear diagnostic cut off values are detectable. Some of the values will fall in equivocal range and may lead to missed detection. Presence of anemia and alpha thalassemia modifies the RBC indices and Hb fractions.

Screening and identification of Alfa thalassemia carriers can be identified at birth by screening cord bloods for the presence of Hb Bart's, a fast moving Hb on cellulose acetate electrophoresis. HPLC will show a spike at the beginning of the chromatogram but the Hb is not quantitated or identified. It is difficult to identify a+ and a0 thalassemia carriers (-a/aa) or (--/aa) in adults using haematological investigations. The MCV and MCH levels and RBC counts will be similar to b-thalassemia carriers but the HbA2 levels will be low or normal. Occasional HbH inclusion bodies may be picked up if the reticulocyte smear. DNA analysis is needed for identification of carriers of a-thalassemia. Hb H disease can be easily identified by the presence of Hb H inclusion bodies and a fast moving band on electrophoresis.

HPLC graphs:

Beta thalassemia intermedia- HPLC from a patient with ß thalassemia intermedia. The majority (~70%) of the haemoglobin is haemoglobin F (green arrow). The main differential for such a high HbF is hereditary persistence of fetal haemoglobin (HPFH). However, HPFH is a benign condition which not associated with anaemia hence makes this diagnosis unlikely (Fig 2). There is normal haemoglobin A (red arrow), as well as a slightly increased fraction of haemoglobin A2 (4.6%, blue arrow). The low fraction of HbA2 makes Hb E unlikely, as it is usually present in quantities of ~30%. Peak of 29% Hb F with normal A2 is HPFH(Fig 3). An Hb D peak of 87.9% is suggestive of Hb D (Fig 4).

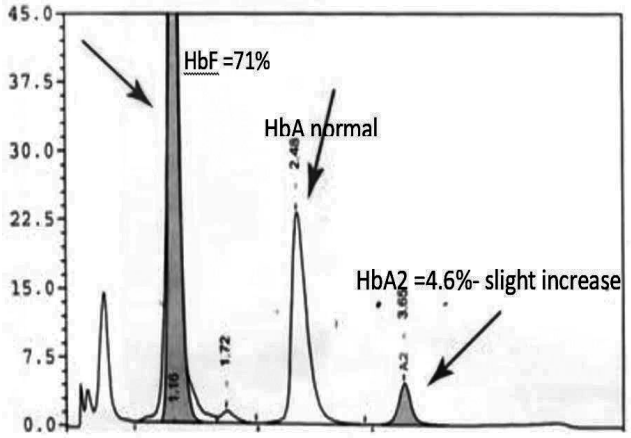


Fig 2. Beta Thalassemia Intermedia

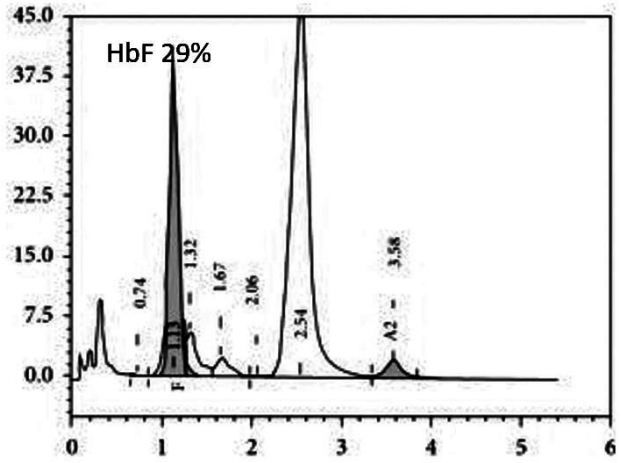


Fig 3. Elevated Hb F (29.1%) suggestive of HPFH.

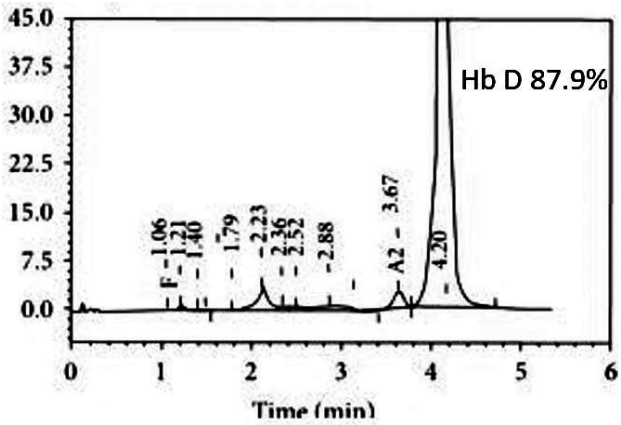


Fig 4. Chromatogram of Hb D Punjab homozygous depicting Hb D(87.9%).

In pre-conceptional period when is the molecular diagnosis required in Hemoglobinopathies?

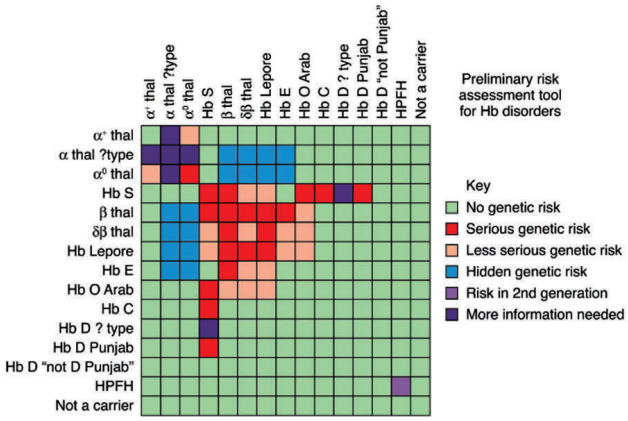


Figure 5: A haemoglobinopathy tool depicting the anticipated clinical severity associated with the occurrence of different homozygous or compound heterozygous states. Peter Turnpenny, Sian Ellard, Ruth Cleaver.Emery's Elements of Medical Genetics and Genomics 16th Edition 2020.

This tool is a ready reckoner to assess the risk of affected off-springs amongst various combinations of Haemoglobinopathies amongst couples. Couples with ambiguous hemoglobin testing results or unusual phenotypes are candidates for DNA testing. Hb A2 levels between 3 to 3.5% may be a case of silent carriers hence molecular testing is required to confirm the diagnosis. Those couple who fall in a positive genetic risk category with reference to Figure 5 need to undergo prenatal molecular testing. Individuals with β-thalassemia trait or hemoglobin trait may have coincident α-thalassemia trait that is masked by the microcytosis associated with the β-globin disorders, and thus α-globin DNA testing should be performed to evaluate risk to offspring of hemoglobin Bart's hydrops fetalis. It is not cost-effective for DNA laboratories to perform analysis on all Thalassemia cases. The majority of couples at risk of having a child affected with β thalassemia or Sickle cell Disease should be identified initially by routine laboratory techniques through the antenatal screening programme. The diagnosis of α thalassemia is more complicated because DNA analysis is the only accurate way to distinguish between α+ and α0 thalassemia. Furthermore, non-deletional forms of α+ thalassaemia are more common than was thought and rapid methods for their detection are not available.

Prenatal Diagnosis: The couples in whom the mutation has been marked due to earlier affected progeny or preconception screening, they can be offered invasive testing in the form of either Chorionic Villus sampling or Amniocentesis depending in the period of gestation for Sanger sequencing in the prenatal sample. The mutation studies (HBB gene sequencing with trio-couple and fetus) is offered in case the mutation has not been identified in the couple in the preconception period.

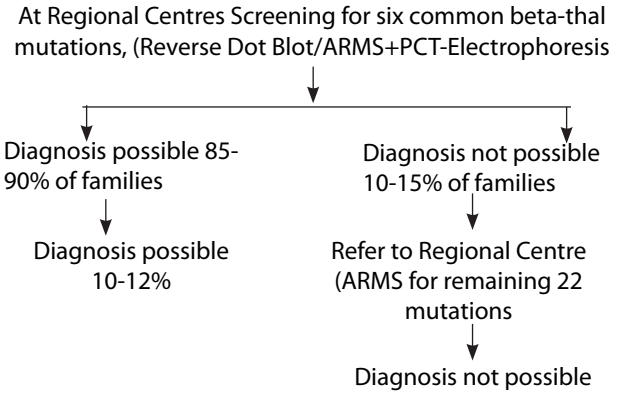
There are 22 common mutations and other rare ones causing beta-thalassemia in Indians, the point mutation detection by different strategies should be applied for the diagnosis of each variant type, which can be divided into two groups:

1) Non-deletional variants, including single nucleotide substitutions and short insertion/deletions
2) Large deletions and duplications.

Limitations of prenatal diagnosis:

- There is a 2% laboratory error reported.
- Termination of pregnancy in case of an affected child, which is difficult for the mother, and may be ethically unacceptable for many people.
- Post-test counselling is extremely important to help the couple cope with emotional stress due to attachment towards their yet unborn child.

Algorithm for Prenatal diagnosis



DNA sequencing

Summary: Screening for identification of carriers of hemoglobinopathies should be done before marriage or after marriage before conception or during the early antenatal period. Measurement of red cell indices and quantitation of HbA2 , Hb F and other variant Hbs are recommended for diagnosis of b-thalassemia carriers and heterozygotes of other Hb variants using automated HPLC. Capillary electrophoresis is also emerging as a suitable technique for screening and can be used. Both governmental and nongovernmental organisations have been conducting public awareness, screening, and genetic counselling programs aiming to reduce the disease burden throughout India for almost half a decade. The states of West Bengal and Gujarat have well established thalassemia control programs that conduct screening and education, keep electronic records of patient data, and carry out prenatal diagnosis. Screening for SCD is performed in endemic regions, such as the state of Chhattisgarh.NBS for SCD is also carried out in some centres, and the use of dried blood spots has enabled screening of home deliveries.

Suggested Reading

1. https://nhm.gov.in/images/pdf/in-focus/NHM_Guidelines_on_Hemoglobinopathies_in_India.pdf. Last accessed 8th February 2023.
2. Bain BJ, Wild BJ. Chapter 14, Investigation of abnormal hemoglobins and thalassemia. Dacie and Lewis Practical Haematology. 11th ed. 2011.
3. K Ghosh, R Colah, M Manglani et al. Guidelines for screening, diagnosis and management of hemoglobinopathies. Indian Journal of Human Genetics April-June 2014;20(2): 101-19.
4. Peter Turnpenny, Sian Ellard, Ruth Cleaver.Emery's Elements of Medical Genetics and Genomics.16th Edition. 2020.
5. Baig MA, Swamy K B, Baksh AD, Bahashwan A, Moshrif Y, Al Sawat A, Al Mutairi N, Alharbi N. Evaluation of role of HPLC (Merits & Pitfalls), in the diagnosis of various hemoglobinopathies & thalassemic syndromes. Indian J Pathol Microbiol 2021;64:518-23.
6. Verma IC, Saxena R, Kohli S. Past, present and future scenario of thalassemic care and control in India. Indian J Med Res 2011;134:507-21.
7. Management of Thalassemia. Indian Association of Pediatrics Guidelines; 2006 p. 169.
8. Chandy M. Developing a National Programme for India.: Control and management of Thalassemia and other Hemoglobinopathies in the Indian Subcontinent_ Synoptic Views. Editor:Ghosh K, Colah R. Published by National institute of Immunohaematology, 2008.
9. Mamtani, M, Jawahirani, A et al., Bias-corrected diagnostic performance of the naked eye single tube red cell osmotic fragility test (NESTROFT): An effective screening tool for ù-thalassemia. Hematology (2006) 11(4) 277-286.
10. Piplani S, Manan R, Lalit M, Manjari M, Bhasin T, Bawa J. NESTROFT- A valuable , Cost Effective Screening Test for Beta Thalassemia Trait in North Indian Punjabi Population. J Clinical and Diagnostic Research (2013) 7(12);2784-2787.

Reducing Prevalence of Anaemia at Childbirth in Booked Pregnant Women: A Quality Improvement Initiative

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Introduction

Problem description

Anaemia in pregnancy is a common and potentially reversible risk factor associated with increased maternal and perinatal morbidity and mortality. It is also associated with preterm births, low birth weight, birth asphyxia and impaired cognitive development of the newborn later in life. Antenatal care is considered as the key element in healthcare delivery system. The important antenatal interventions to prevent anaemia include iron and folic acid supplementation, deworming and dietary counselling

In India, the proportion of women receiving at least four antenatal care visits increased from 51.2% in 2016 to 58.1% in 2019.[1] However, the prevalence of anaemia in pregnant women increased from 50.4% to 52.2% compared to a global prevalence of 36.5%.[2]

Available knowledge

During pregnancy, anaemia adversely impacts not only the mother, but also the fetus and subsequent child health outcomes.[3,4] Iron deficiency is the most common cause of anaemia (IDA) worldwide and remains a significant cause of morbidity.[5]

Government of India (GoI) initiated National Nutritional Anemia Control Programme in 1990 which was followed by a targeted 'Anaemia Mukt Bharat' Intensified National Iron Plus Initiative (I-NIPI) programme in 2018 with the aim to decrease the prevalence of anaemia among pregnant women from 50% in 2015-16 to 32% in 2022.[7]

GoI recommends screening for anaemia by haemoglobin estimation at first visit, 28 weeks, and 36 weeks of gestation. Despite these recommendations and an increasing number of women receiving antenatal care and having institutional births, the problem of anaemia remains unabated. Hence, we planned a quality improvement (QI) initiative to reduce the prevalence of anemia among antenatal women booked at our facility.

Rationale

Baseline data (March, April and May 2021) showed that 86.2% women were anaemic at childbirth, 45.2% of these anaemic women were booked (had at least 4 antenatal visits) at our facility. It was important to understand the reason of anaemia at the time of childbirth despite these women attending regular antenatal clinics and getting free iron folic acid tablets. We focused on the processes involved in screening for anaemia, routine IFA supplementation and related counselling, deworming and dietary counselling received by the women attending the antenatal clinic.

Specific aim

Our specific, measurable, achievable, relevant and time bound aim was to reduce the prevalence of anemia in booked pregnant women admitted in labour from baseline 45.2% to 32% in four months starting from 1st July, 2021.

Methods

Context

Ours is a public health care facility attached to a medical college and located in central Delhi. Our department has five units. The obstetrical team of each unit includes four consultants and six resident doctors (two senior residents and four postgraduate students). Each unit has weekly one antenatal clinic attended by 250 to 300 pregnant women every OPD.

Majority of our pregnant women are from lower socioeconomic status. After registration at the entry of OPD, the pregnant woman gets her blood pressure(BP), weight and height estimated by the nursing officers. The woman then visits her obstetrician for antenatal check-up. Advice for measuring haemoglobin at first visit, 28 weeks and 36 weeks' gestation is pre-printed in the hospital's antenatal card in the investigation column. A Laboratory technician is posted in the OPD and tests haemoglobin by digital haemoglobinometer, whenever ordered by the obstetrician. Haematinics are dispensed from hospital pharmacy at the end of visit. **(FIGURE I)**

The department conducts approximately 10,000 to 12,000 births annually. Antenatal women presenting with labour pains or planned for induction of labour are admitted to Labour Room. Every parturient undergoes haemoglobin estimation and it is recorded in labour register.

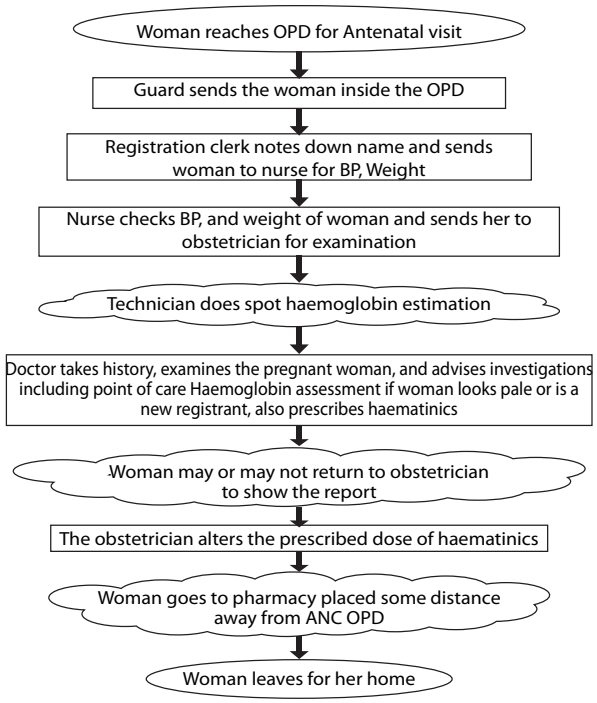

FIGURE I

Intervention

Pre-intervention phase (March 2021 to May 2021)

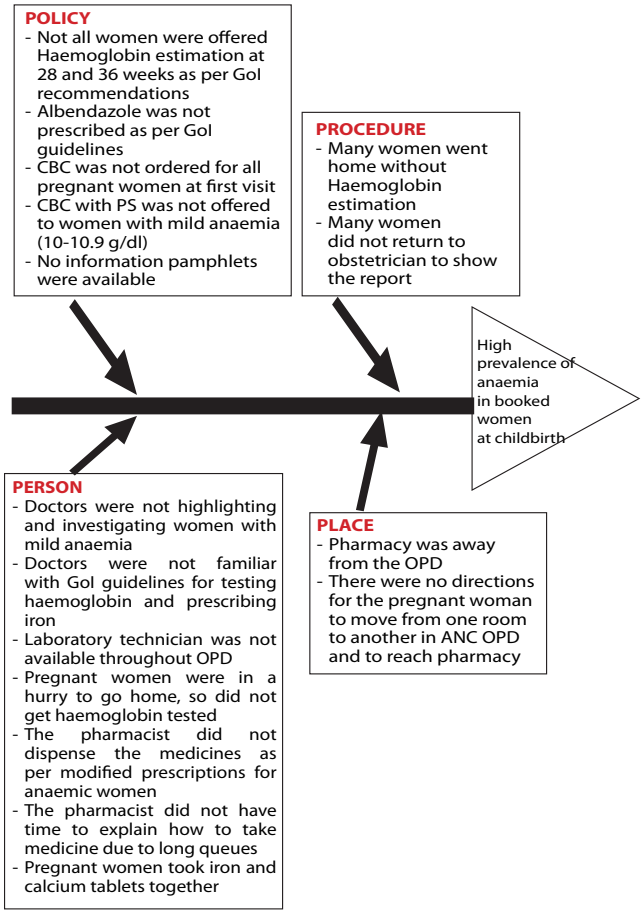

FIGURE II

A team comprising of consultants, resident doctors, nurses, and laboratory technician was formed to address the problem. They assessed the baseline data and analysed the reasons of high prevalence of anemia in booked antenatal women birthing at our tertiary care facility **(FIGURE II)**. It was observed that screening for anaemia at various gestational ages as recommended by the GoI was not being followed.

Intervention phase (June 2021 to November 2021)

As the part of multimodal quality improvement initiative, we adopted distinct pathways at each antenatal visit for screening, prevention and treatment of anaemia, advised relevant investigations and managed anaemia according to the standard guidelines. The goal was to enhance screening and management of IDA during antenatal period and thereby reduce the prevalence of anaemia at birth.

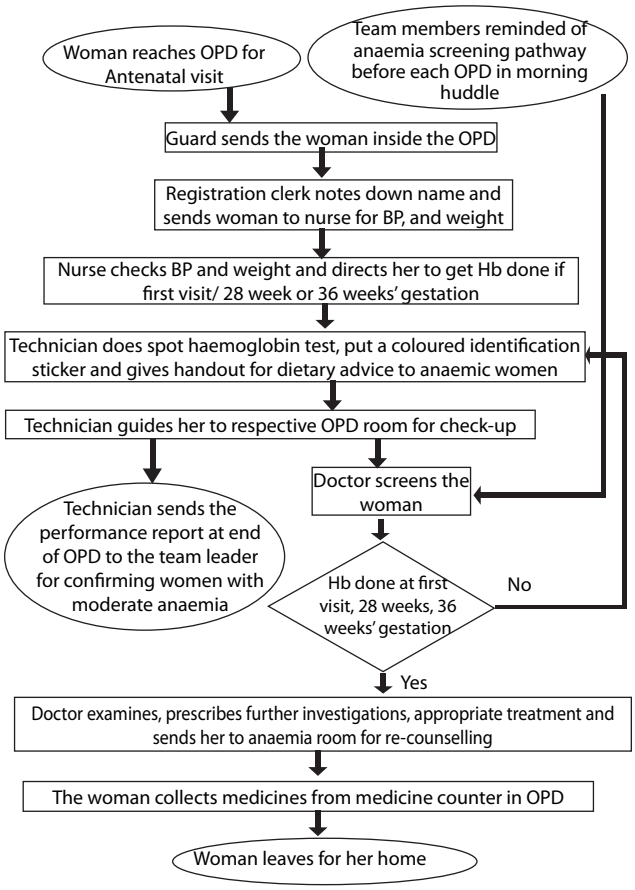

FIGURE III

Interventions were implemented in the antenatal OPD directed at the problems one-by-one through multiple plan-do-study-act (PDSA) cycles and the steps were modified as per feasibility. The interventions are mentioned below:

- Emphasis on hemoglobin testing: Before starting OPD, a reminder was given to OPD nurses and

doctors by the team leader during the morning OPD team huddle. Staff would direct all women to get their spot haemoglobin done at their first visit, 28 weeks and 36 weeks' gestation. Examining doctor would further confirm if eligible women had their hemoglobin tested during consultation and directed those without hemoglobin to the laboratory technician for haemoglobin estimation after obstetric examination with the advice to show the report once it was done. **(FIGURE III)**

- Ensuring availability of hemoglobin testing facility: Hemoglobin was tested through finger-prick method using the HemoCue (Digital haemoglobinometer). Laboratory technician recorded number of Hemoglobin tests performed and was asked to put a sticker over the antenatal card of anemic women for the ease of identification. An extra Haemoglobinometer was kept as a stand-by. Replacement was arranged if the laboratory technician went on leave.
- Anaemia room: A room in OPD was designated as anaemia room where all women with anaemia would be sent from other consultation rooms after examination. In this room, it was checked if the anaemic mothers had been offered appropriate investigations and treatment. They were provided counselling and were followed up in this room later with the investigation reports for extended workup wherever indicated like serum Ferritin level, serum Vitamin B12 level, serum folic acid level. Their compliance to treatment was checked. Later in this room, samples were drawn for Serum Ferritin in women planned for parenteral iron therapy.
- Dietary counselling: Charts showing high protein and iron rich foods were prepared, printed, and kept with the laboratory technician to be handed over to women detected as anaemic on haemoglobin estimation. The attending doctor would counsel the woman.
- Ensuring dispensing of hematinics from the Antenatal OPD: Facility for dispensing hematinics to antenatal women was shifted from general pharmacy to the antenatal OPD to save the pregnant women from hassles of standing in long common queues with other patients in front of pharmacy. The nursing staff would dispense the hematinics.
- Emphasis on proper intake of hematinic: Staff dispensing hematinics counseled the woman on proper intake of Iron and folic acid tablets and calcium tablets. Compliance to intake of hematinic was checked by the examining doctor.
- Arrangement of dispensing deworming tablets from the OPD: All antenatal women got tablet Albendazole once, any time after her first trimester as per GoI guidelines and was dispensed from OPD counter.
- Administration of injectable ferric carboxymaltose to women with IDA: Antenatal women at 28-34-week gestation, diagnosed with iron deficiency anaemia (with ferritin less than 15mcg/dl, negative for haemoglobinopathies on High Performance Liquid Chromatography (HPLC) and non-responsive to oral iron in therapeutic doses, injection ferric carboxy maltose (FCM) was offered and administered.
- Appropriate management was offered in the presence of other deficiencies: A significant number of women were diagnosed with macrocytic or dimorphic anemia on CBC and peripheral smear and documented Vit B12 deficiency. They were prescribed appropriate treatment.

Post intervention phase (December 2021 to May 2022)

This phase assessed the impact of the interventions introduced in the second phase. We followed the trends and continued re-emphasis whenever needed.

MEASURES

Data collection

We collected data prospectively for a period of 15 months from March 2021 to May 2022. All women attending our antenatal OPD were the target population. Total number of women attending the antenatal OPD, number of pregnant women between 28-34week gestation and number of women found anaemic was collected from register maintained by the laboratory technician.

The haemoglobin at delivery was noted from the labour room register. Data was collected weekly by the resident doctors. The characteristic of interest was the percentage of women anaemic at childbirth, calculated as-

number of booked pregnant women (with 4 or more antenatal visits at our facility) birthing in the labour room with a haemoglobin level of < 11 gm%) / total number of booked women delivering at our facility.

Statistical analyses

Laney's P' chart was used to analyze the percentages and change points (major shift in the trend) were identified as per rules.[8] This paper is written in accordance to SQUIRE guidelines.[9]

Result

The Laney's P chart revealed declining trend of anaemia in delivering women. We split the entire time series into three segments (segment 0: Pre-intervention phase, Segment 1: intervention phase, Segment 2: post-intervention phase). Each segment has its own average and Upper Control Limit (UCL) and Lower Control Limit (LCL). The chart showed segment 1 having change point towards the end suggesting significant positive impact of the intervention.

Overall, the median prevalence of anaemia changed from 46.02 (UCL 66.59, LCL 25.45) in segment 0 to 23.54 (UCL 36.54, LCL 10.55) in segment 2. This represented a significant and progressive decline in the prevalence of anaemia over the last one year. **(FIGURE IV)**

In addition, there was a progressive fall in percentage of moderately anaemic women (42.8% to 24%). The goal was achieved after 30 weeks and sustained thereafter. **(FIGURE V)**

Discussion

Strength

Prevention of anaemia in pregnancy is multidimensional. For a pregnant woman to be non-anaemic at childbirth, she needs to be monitored diligently for 9 months. The impact of any intervention takes about 2-3 months to show its impact on the haemoglobin levels. The interventions in this study were based on the GoI recommendations. Majority of the providers were not paying adequate attention to pregnant women with mild anaemia at the registration visit. This resulted in these women progressing to moderate or severe anaemia as the pregnancy progressed to term. This project resulted in sensitization of healthcare providers to the importance of adhering to standard recommendations to reduce anaemia, thereby sustaining the outcomes. It also helped healthcare providers understand the quality improvement methodology and appreciate its power to solve complex problems.

Interpretation

Anemia Mukt Bharat strategy focuses on timely screening by hemoglobin estimation and treatment of anemia by hematinic supplementation, deworming and improving diet. IDA is simple to diagnose and treat but often remains undiagnosed and under treated. Anaemia in pregnancy is often not paid attention to compared to other medical disorders like diabetes, heart disease or hypertension.

In low resource settings, RBC indices (Mean Corpuscular Volume less than 80fL, Mean Corpuscular Haemoglobin less than 28pg) and Mentzer Index

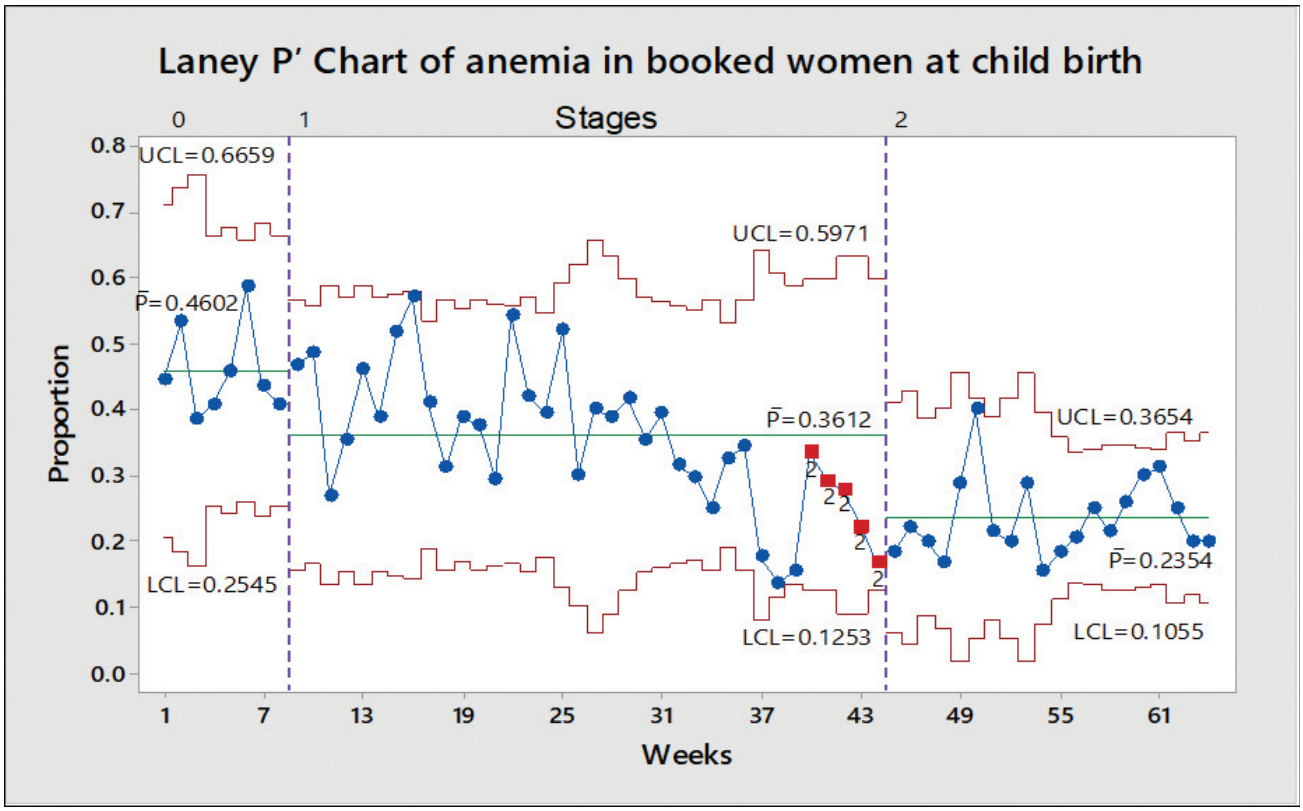

FIGURE IV

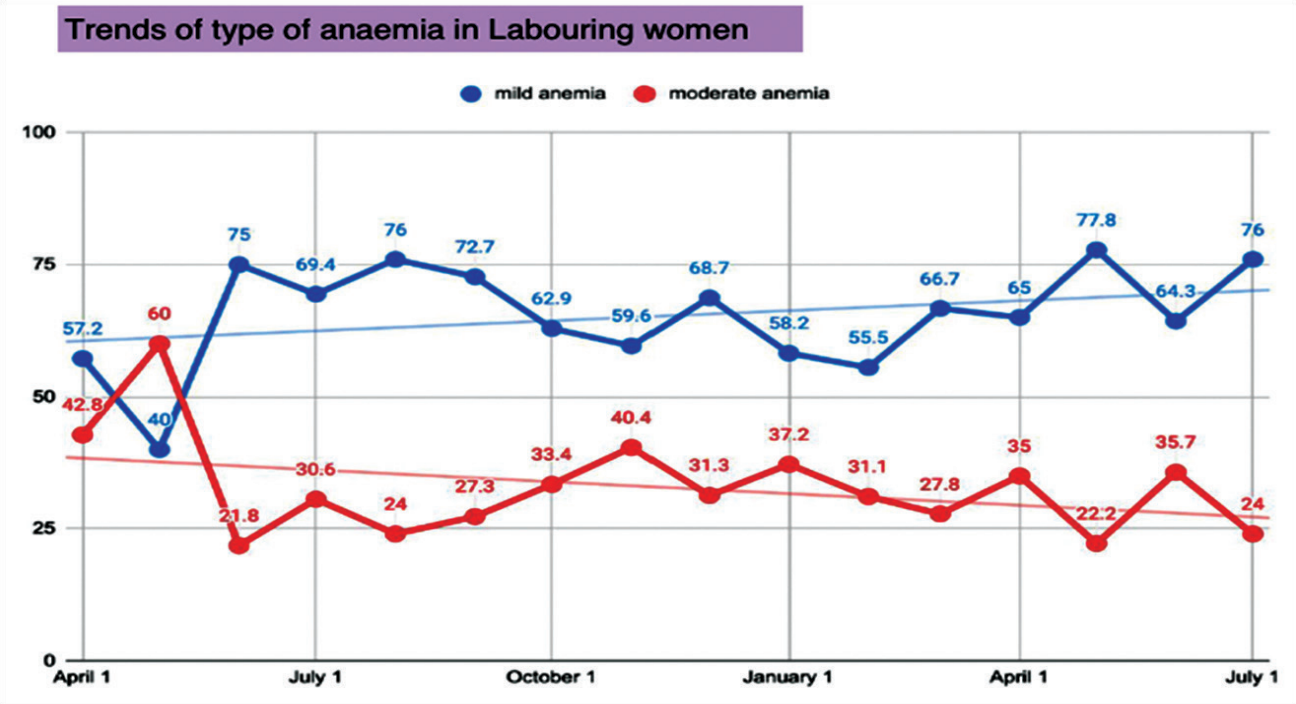

FIGURE V

more than 13 may be used to diagnose the type of anaemia.[10] A serum ferritin level of less than 15 mcg/l has a specificity of 98% and a sensitivity of 75% for iron deficiency.[11] Although guidelines do not recommend routine serum ferritin estimation as a prerequisite for initiating parenteral therapy, we tested serum ferritin levels as a part of detailed anaemia evaluation in our tertiary care hospital.

In 2018, Li Lin et al conducted a retrospective study in China on 43,403 pregnant women to know reasons for non-adherence to haematinics. Occurrence of side effects (40%), lack of awareness of the importance of IFA (30.2%), forgetfulness (14.4%), inadequate or lack of IFA provision in health facility (12.1%) and fear of side effects (3.3%) were noted as the primary reasons for it.[12] We found that the reasons for non-adherence of IFA can be resolved by the healthcare providers by improving the processes. Hence, by adhering to standard guidelines for screening and management of anaemia by simple process changes, we can bring down the prevalence of anaemia in booked women at delivery.

Oral iron supplementation is inexpensive, convenient, and an effective method to prevent and treat IDA in pregnancy. It is important to counsel the women regarding the importance of normal haemoglobin and need for compliance to prophylactic iron and folic acid supplementation in pregnancy. In women, who are non-compliant due to inability to tolerate oral iron or in situations when IDA is diagnosed late in pregnancy, rapid intervention is required. Intravenous iron preparations are recommended in such situations.[13,14] Injectable iron for pregnant women was provided free of cost in our public health facility. Most obstetricians prefer using injection iron sucrose which can be administered in the dose of 200 mg/day, 3 times a week. However, injection FCM is recommended in Anaemia Mukt Bharat Guidelines, can be administered as single dose and saves the women from burden of multiple visits.

In addition to the fall in percentage of women with anaemia at childbirth, there was a significant decrease in women with moderate or severe anaemia. Majority of anaemic women had mild anaemia supporting the effectiveness of the interventions. Additionally, we found that Vit B12 deficiency was an important cause of anaemia especially in last trimester of pregnancy.[15] Administration of a single dose of intramuscular Vit B12 1000 µg was also included as one of the interventions in women with macrocytosis, dimorphic anaemia and Vit B12 deficiency.[16]

Limitation

Oral iron supplements are known to have gastrointestinal side-effects. Non-compliance due to side effects is an important cause of anaemia in pregnancy. With focussed counselling and changing the formulation, compliance can improve without the use of injectable iron. However, in heavy load public

facilities with limited manpower, there is limited time for counselling.

In low resource settings and high prevalence of anaemia in pregnant women, complete iron studies may not be a cost-effective option. Instead of complete iron studies, we used serum ferritin estimation as a marker of iron stores. Ferritin is an acute phase reactant, and its levels may be raised in case of infection. It's serum values need to be correlated with clinical picture.

Conclusion

Major public health problems can be addressed by quality improvement methodology. It involves patience, persistence and perseverance. We facilitated the implementation of the GoI guidelines for screening, prevention and treatment of anaemia. Appropriate counselling, tailored laboratory requisitions and iron prescriptions helped in the reduction of the prevalence of anaemia in booked pregnant women at childbirth. The measures are simple to implement and can be adapted by other facilities to reduce the unabated burden of iron deficiency anaemia in the country and globally.

Acknowledgements

We thank our staff nurses (Sister Rupesh, Sister Pooja Thakkar) and laboratory technician (Mrs Ahichitra) who provided us with technical and material support and helped us to run the screening process smoothly; our postgraduates (Dr Neeraj Jindal, Dr Milo Suka, Dr Gaganpreet Kaur, Dr Prerna) who helped in collecting data; our faculty Dr Triveni GS (Associate Professor) and Dr Deepika Meena (Professor) who managed the anaemic women as well as helped in analysing and interpreting data.

References

1. http://rchiips.org/nfhs/NFHS-5_FCTS/India.pdf./ International Institute for Population Sciences (IIPS) and ICF.2021. National Family Health Survey (NFHS-5), 2019-21: India. Mumbai: IIPS
2. WHO. The Global Health Observatory. Anaemia in women and children. 2021Edition
3. Haider BA, Olofin I, Wang M, et al. Anaemia, prenatal iron use, and risk of adverse pregnancy outcomes: systematic review and meta-analysis. BMJ (Clinical Research Ed) 2013;346:pf3443
4. Zhang Y, Jin L, Liu JM, et al. Maternal Hemoglobin Concentration during Gestation and Risk of Anemia in Infancy: Secondary Analysis of a Randomized Controlled Trial. J Pediatr 2016; 175:106–10.pe2.
5. Pasricha SR, Drakesmith H. Iron Deficiency Anemia: Problems in Diagnosis and Prevention at the Population Level. Hematology/ Oncology Clinics of North America 2016; 30:309–25.
6. http://nhm.gov.in/images/pdf/programmes/child-health/guidelines/Control-of-Iron-Defi ciency-Anaemia.pdf.
7. https://anemiamuktbharat.info/wp-content/uploads/2019/09/Anemia-Mukt-Bharat-Operational-Guidelines-FINAL.pdf Pg 38-39
8. Laney DB. Improved control charts for attributes. Qual Eng 2002;14(4):531–7.
9. Ogrinc G, et al. BMJ Qual Saf 2015;0:1–7. doi:10.1136/bmjqs-2015-004411 Downloaded from http://qualitysafety.bmj.com/ on January 2, 2017
10. PFOGSI General Clinical Practice Recommendations Management of Iron Deficiency Anemia in Pregnancy 2018
11. Hallberg L, Bengtsson C, Lapidus L, Lindstedt G, Lundberg P-A, Hultén L. Screening for iron deficiency: an analysis based on bone-marrow examinations and serum ferritin determinations in a population sample of women. Br J Haematol. 1993;85(4):787–98.
12. Getachew M, Abay M, Zelalem H, Gebremedhin T, Grum T, Bayray A. Magnitude and factors associated with adherence to iron-folic acid supplementation among pregnant women in Eritrean refugee camps, northern Ethiopia. BMC Pregnancy Childbirth. 2018 Apr 5;18(1): 83.
13. Breymann C, Milman N, Mezzacasa A, Bernard R, Dudenhausen J; FER-ASAP investigators. Ferric carboxymaltose vs. Oral iron in the treatment of pregnant women with iron deficiency anaemia: an international, open label, randomized controlled trial (FER-ASAP). J Perinat Med. 2017 May 24;45 (4): 443-53.
14. Elmore C, Ellis J. Screening, treatment and monitoring of iron deficiency anaemia in pregnancy and postpartum. J Midwifery Womens Health. 2022 May; 67(3): 321-31
15. Jyoti Mishra, Abhilasha Tomar, Manju Puri, Anju Jain, K N Saraswathy. Trends of folate, vitamin B12, and homocysteine levels in different trimesters of pregnancy and pregnancy outcomes. Am J Hum Bio 2020 Sep;32(5): e23388.
16. Gandhi RG, Puri M, Shukla S, Yadav A. Study of biochemical and hematological response of vitamin b12 supplementation in pregnant anaemic women with vitamin b12 deficiency. International Journal of Current research 2017 Oct; 9(10):58777-58780.

Care after GDM: Prevention of NCD

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Hyperglycemia in pregnancy (HIP) is one of the most common medical condition complicating pregnancy affecting 16.7% (21.1 million) pregnancies globally in 2021 as per International Diabetes Federation estimates and 70-90% of these cases of HIP are due to Gestation Diabetes Mellitus(GDM) wherein hyperglycemia levels are below the criteria for diagnosing overt diabetes in non pregnant state.[1] GDM is one of the Adverse Pregnancy Outcomes (APO) getting unmasked due to inappropriate response to the normal physiological adaptations of pregnancy to support fetal growth and development and preparation for postpartum lactation. It is well stablished that GDM can adversely affect pregnancy outcomes and good glycemic control during antenatal period ameliorates immediate obstetrical and neonatal risks associated with GDM. As blood glucose levels typically return to normal ranges after delivery in these women, GDM is generally perceived as strictly a medical condition of pregnancy requiring management during antenatal period only, but actually this diagnosis carries long term health implications in terms of increased risk of Non communicable diseases in both the mother and the child. So GDM identifies a subset of women with high risk for NCDs during the pregnancy which acts as a biological "stress test" for the mother's various organ systems, most predominantly the metabolic and cardiovascular systems, thus providing a potential opportunity for primary prevention of these NCDs early in their natural history.

Future Risk of NCDs in women with h/o GDM

Risk of development of Type 2 Diabetes Mellitus (T2DM)

Women with antecedent GDM have around 10 times higher risk of development of type 2 diabetes in future as seen in many studies [RR 9.51 (95% CI 7.14–12.67)][2]. Even milder degrees of antenatal hyperglycemia that doesn't meet the threshold for GDM diagnosis predicts future risk of T2DM[3]. This increased risk is due to shared pathophysiology. GDM occurs in women in whom pancreatic beta cells are unable to sufficiently increase insulin to compensate for the physiological insulin resistance occurring due to maternal adaptations in pregnancy. So, these women have an underlying defect in beta cell compensation which is both chronic and progressive in nature. Chronic insulin resistance also exists in these women placing increased secretory demands on beta cells which leads on to worsening of their function over time, thus increasing lifetime risk of development of T2DM in women with a history of GDM.

Risk of development of cardiovascular disease (CVD)

History of GDM also predicts increased future risk of CVD. A recent meta analysis involving more than 5 million women showed that women with GDM history have two fold higher risk of developing CVD as compared to the women without GDM[4]. This increased risk is seen even in women who do not develop T2DM, so GDM is an independent risk factor for CVD. Even the levels of hyperglycemia in pregnancy in non GDM range predicts higher future risk of CVD as compared to their peers. Much of this increased risk occurs early after GDM pregnancy, with 2.3 fold increased risk for CVD reported in first decade postpartum.[4]

While the precise pathophysiologic basis of this CVD risk remains uncertain, many women with GDM history have an enhanced cardiovascular risk factor profile that becomes apparent as early as 3 months after birth, including higher rates of dyslipidemia, hypertension, and metabolic syndrome. Also evidence suggests that pre pregnancy cardiovascular risk profile can predict subsequent development of GDM. Taken together this suggests that women with GDM may have chronically enhanced cardiovascular risk profile resulting in increased lifetime risk of CVD.[5] In 2011, the American Heart Association added GDM as risk factor for CVD.[6] International Federation of Gynecology and Obstetrics also suggests to acknowledge GDM as a predictor of long term cardiovascular morbidity.[7]

Risk of development of other NCDs

In addition to T2DM and CVD, history of GDM also increases risks of other major medical conditions like advanced liver diseases, chronic renal disease, ophthalmic conditions particularly retinopathy and malignancies. Increased risk of these medical conditions is dependent on the intercurrent development of Type 2 Diabetes.

Risks of NCDs in the Offsprings

Offsprings of GDM pregnancies are at higher risk of developing childhood obesity, Glucose intolerance and later progression to type 2 diabetes and long term

risk of cardiovascular disease. Importantly antepartum treatment of GDM does not reduce these future risks in the offsprings.

As GDM increases future risk of NCDs especially Diabetes and cardiovascular disease, postpartum period provides an opportunity for screening and initiation of preventive measures.

Postpartum Screening

After GDM postpartum screening needs to be done for altered carbohydrate metabolism/ type 2 diabetes and cardiovascular evaluation. American Diabetes Association recommends that after GDM pregnancy glucose screening should be done within six months after delivery.[8] Though its unlikely to detect overt diabetes in early postpartum period (except for pre existing diabetes cases first detected in pregnancy hence sometimes labelled as GDM), detection of prediabetes in these women is very high with approximately one third (30%) women having impaired glucose tolerance at 3 months after delivery.[9] FIGO recommends screening at 6-12 weeks for cardiovascular evaluation and diabetes screening in all women with Gestational Diabetes.[7] This timing coincides with the routine postpartum visit also. Following measures are recommended at this postpartum visit in cases with recent GDM

- Cardiovascular risk screening by measuring Blood pressure, Body Mass Index, evaluation of lifestyle, smoking history and family history of CVD.
- Screening for diabetes by either with HbA1c or fasting glucose or the oral glucose tolerance test (OGTT)

Amongst screening tests, OGTT is preferred over HbA1c as in early postpartum period HbA1c levels might not accurately reflect glycemic control due to the impact of either increased red blood cell turnover in pregnancy or blood loss at delivery (both of which will promote reticulocytosis and thereby lower HbA1c by virtue of less time for exposure to glycemia). Also the OGTT provides greater sensitivity for detecting pre-diabetes, particularly impaired glucose tolerance, a high risk subset for future development of diabetes. Screening at 6-12 weeks postpartum with OGTT diagnoses Diabetes, Impaired Glucose Tolerance (IGT) and Impaired Fasting Glucose (IFG) using non pregnant criteria.

Prediabetes (IGT or IFG) detected on initial screening should receive structured recommended interventions to modify the risk of progression to overt diabetes. Those women whose initial screening results are normal, should undergo ongoing surveillance as all GDM cases carry higher future risk of diabetes and CVD. Various measures initiated at this time can modify these risks of future NCDs in women with GDM history. If initial OGTT is normal, every 3 years screening for T2DM should be done. In cases of Prediabetes, annual screening is recommended.

Breastfeeding

Breastfeeding not only benefits the infant but also promotes recovery from the cardiometabolic stresses of pregnancy. A recent systematic review and meta-analysis of the association of breast feeding with the postpartum risk of progression to T2DM in cases with GDM history reported reduced risks for both pre-diabetes (OR = 0.66; 95% CI, 0.51–0.86) and T2DM (OR = 0.79; 95% CI, 0.68–0.92).[10] Longer duration of breastfeeding is likely to have more effect. Breastfeeding for more than 10 months has also been reported to decrease the risk of diabetes mellitus at 2 years after delivery by 57% in women with a history of GDM.[11] Beneficial effect of breastfeeding in reducing the risk of T2DM in GDM cases is seen even after adjustment of weight changes across childbearing years.[12] Longer duration of breastfeeding is also associated with improvement in glucometabolic parameters, including lower fasting glucose and enhanced insulin sensitivity, lower BMI and improved lipid metabolism as demonstrated by lower triglyceride levels and higher HDL cholesterol. Thus, breastfeeding is potentially of great value as a low cost preventative measure in preventing both T2DM and related metabolic derangements in women with a history of GDM. Though direct evidence for prevention of CV disease in women with history of GDM is currently lacking; but logically breast feeding and improved post-partum lifestyle is likely to reduce the risk significantly.

Lifestyle interventions

Lifestyle interventions including healthy diet and physical activity prevent or delay progression to T2DM in people with impaired glucose tolerance and also decrease cardio vascular diseases. In individuals at metabolic risk, lifestyle modifications are recommended as first line approach. All women with h/o GDM should be offered healthy lifestyle modifications in post partum period to decrease risk of NCDs in future.

Lifestyle interventions have been shown to reduce postpartum weight, BMI and waist circumference in women with previous GDM. This is likely to reduce insulin resistance and thus lowering secretory demands on beta cells and thus their functional deterioration over time.

A recent meta-analysis of 10 RCTs of lifestyle interventions within 3 years of GDM pregnancy found that such intervention reduced the risk of postpartum diabetes as compared to controls

(pooled RR 0.57, 95%CI 0.42–0.78).[13] These findings suggest that all women with GDM should be counselled and encouraged to adopt a healthy life style early after delivery.

Overweight and obese women should join structured programs to support the adoption of a healthy lifestyle aiming to achieve a weight loss of ≥5% of initial body weight over the first year. Evidence shows that even modest weight loss delays progression from to T2DM. Clinically meaningful weight loss (≥5% initial weight) is associated with moderate improvement in BP, low-density lipoprotein cholesterol (LDL-C), triglyceride, and glucose levels among individuals with overweight/obesity.

Diet

Lifestyle modifications to reduce cardiometabolic risks include adopting healthy dietary habits. High calories intake over physiologic needs has been linked to increasing NCDs including T2DM, obesity, CVD), and other chronic conditions. Evidence from scientific studies consistently showed a reduced risk of T2DM with high intakes of cereal fiber or mixtures of whole grains and bran with risk reduction upto 40%.[14] Behavioral counselling for healthy diet and physical activity is also recommended for reducing CVD incidence in at risk population.[15]

Women with h/o GDM should be encouraged to modify their diets as follows to prevent NCDs[15,16]:

- Increase consumption of foods that are high in fibre, such as wholegrain bread and cereals, beans and lentils, vegetables and fruit.
- Reduce the total amount of fat in their diet and eat less saturated fat by choosing foods that are lower in fat and saturated fat, for example
    - Replace products high in saturated fat (such as butter, ghee, some margarines or coconut oil) with versions made with vegetable oils that are high in unsaturated fat, or using low-fat spreads.
    - Choose skimmed or semi-skimmed milk and low-fat yoghurts, instead of cream and full-fat milk and dairy products.
    - Choose fish and lean meats instead of fatty meat and processed meat products (such as sausages and burgers).
    - Grill, bake, poach or steam food instead of frying or roasting (for example, choose a baked potato instead of chips).
    - Avoid food high in fat such as mayonnaise, chips, crisps, pastries, poppadums (papads) and samosas.
    - Choose fruit, unsalted nuts or low-fat yoghurt as snacks instead of cakes, biscuits, mixtures or crisps.

Advise the woman to follow a low-fat diet that provides 30% of daily food energy as fat, distributed over three main meals a day.

Reductions in sodium, and sweets/sugars are also recommended.

Exercise

Regular physical activity has numerous health benefits and should be encouraged in women with h/o GDM. Regular exercise delays progression to T2DM in cases with IGT. Both aerobic and resistance exercises improve insulin sensitivity, glycemic control, lipid profile and blood pressure. Physical activity also improves cardiovascular health. Extensive observational data supports recommendations for aerobic physical activity for reducing ASCVD risk. As GDM history increases metabolic risk, these women should be advised daily physical activity such as brisk walking and reduction in sedentary time.[17] They should engage in moderate aerobic exercises for 150 minutes or vigorous exercise for 75 weeks per week along with resistance training twice per week. It is also recommended to reduce daily time spent in sedentary behaviour. Prolonged sitting should be interrupted with bouts of light activity.[17]

Follow up

Depending on the high risk factors like obesity, family history, blood pressure, lipid profile, postpartum OGTT results, every 1-3 years review should be done in these women with h/o GDM after initiating lifestyle modifications. On these visits, check for weight, BMI, waist circumference, blood pressure and screening test for diabetes. Also reinforce the dietary and physical activity modifications on these review visits.

Drugs

Metformin

Though intensive lifestyle modifications are recommended as first line intervention in prediabetics (IGT or IFG), drug therapy is required if woman is not responding to lifestyle changes with deteriorating glucose levels or she is not able to participate in physical activity particularly if BMI is > 35 kg/m^2 . In these situations Metformin is recommended as first line drug therapy.[17] Metformin has been shown to

reduce the incidence of progression to overt diabetes in prediabetics especially in women with h/o GDM. In Diabetes Prevention Program (DPP) involving overweight adults with pre-diabetes, while intensive lifestyle intervention yielded the greatest reduction in risk of developing diabetes in the overall study population, in women with h/o GDM metformin effect matched lifestyle modification, with both interventions yielding »50% risk reduction compared to placebo[19]. In the long-term follow-up of DPP participants, the effect of metformin on reduction of incident diabetes in this subgroup persisted over 15 years. [20]

Metformin should be started at low dose initially (500mg once daily) and gradually increased to 1500-2000mg/day. Renal function should be checked before starting metformin and then twice yearly.

Other Drugs

Other pharmacological agents have also been studied as intervention to prevent diabetes after GDM but evidence is limited and no definite conclusions can be drawn. Insulin sensitizing agents were shown to reduce the risk of progression to T2DM in GDM women, but safety concerns have limited their clinical usefulness. There is limited evidence that combination of Metformin with dipeptidyl peptidase-4 inhibitor improves beta cell function but effect on risk reduction for diabetes is not clear. Another promising drug category for postpartum NCDs risk reduction in women with h/o GDM is Sodium glucose co-transporter-2(SGLT-2) inhibitors antidiabetic drugs as they offer cardiovascular risk reduction above and beyond their glucose lowering activity, thus raising the possibility of single intervention preventing CVD & T2DM.

Conclusions

To conclude, GDM is not only a medical complication of pregnancy, but rather a marker of chronic cardio metabolic condition that carries lifelong implications. GDM serves as an early indicator of future maternal NCDs and risk modification can be done by early interventions. Post partum period provides an opportunity to risk categorize by screening and initiate meaningful risk-reduction strategies. Although evidence is limited on long term effectiveness of risk-reduction interventions, the postpartum period should still be the focus for actions such as prolonged breast feeding, lifestyle modification (optimal weight goals, exercise, dietary modifications, smoking cessation) and controlling for cardiometabolic risk factors (blood pressure, glucose, lipids, and weight gain) that may help abate the development of future NCDs as early as their preclinical stage, thereby interrupting a vicious cycle of intergenerational transfer of disease.

References

1. International Diabetes Federation. IDF Diabetes Atlas. 10th ed. International Diabetes Federation; 2021. https://www.diabetesatlas.org/en. Accessed 7th feb, 2023.
2. Vounzoulaki E, Khunti K, Abner SC, Tan BK, Davies MJ, Gillies CL. Progression to type 2 diabetes in women with a known history of gestational diabetes: systematic review and meta-analysis. BMJ. 2020;369:m1361. doi: 10.1136/bmj.m1361
3. Kramer CK, Swaminathan B, Hanley AJ, et al. Each degree of glucose intolerance in pregnancy predicts distinct trajectories of beta cell function, insulin sensitivity and glycemia in the first 3 years postpartum. Diabetes Care. 2014;37:3262–3269.
4. Kramer CK, Campbell S, Retnakaran R. Gestational diabetes and the risk of cardiovascular disease in women: a systematic review and meta-analysis. Diabetologia. 2019;62:905–914.
5. Farahvar S, Walfisch A, Sheiner E. Gestational diabetes risk factors and long-term consequences for both mother and offspring: A literature review. Expert Rev Endocrinol Metab. 2019;14:63–74.
6. Mosca L, Benjamin EJ, Berra K, et al. Effectiveness-based guidelines for the prevention of cardiovascular disease in women – 2011 update: A guideline from the American Heart Association. J Am Coll Cardiol. 2011;57:1404–1423.
7. Sheiner E, Kapur A, Retnakaran R, Hadar E, Poon LC, McIntyre HD, Divakar H, Staff AC, Narula J, Kihara AB, Hod M. FIGO (International Federation of Gynecology and Obstetrics) Postpregnancy Initiative: Long-term Maternal Implications of Pregnancy Complications-Follow-up Considerations. Int J Gynaecol Obstet. 2019 Sep;147 Suppl 1:1-31. doi: 10.1002/ijgo.12926. PMID: 32323876.
8. American Diabetes Association. 14. Management of diabetes in pregnancy: Standards of medical care in diabetes-2019. Diabetes Care. 2019;42(Suppl.1):S165–S172.
9. Retnakaran R, Qi Y, Sermer M, Connelly PW, Hanley AJ, Zinman B. Beta-cell function declines within the first year postpartum in women with recent glucose intolerance in pregnancy. Diabetes Care. 2010;33:1798–1804.
10. Ma S, Hu S, Liang H, Xiao Y, Tan H. Metabolic effects of breastfeed in women with prior gestational diabetes mellitus: A systematic review and metaanalysis.

    Diabetes Metab Res Rev (2019) 35:e3108. doi: 10.1002/dmrr.3108
11. Gunderson EP, Hurston SR, Ning X, et al. Lactation and progression to type 2 diabetes mellitus after gestational diabetes mellitus a prospective cohort study. Ann Intern Med. 2015;163:889–898
12. Gunderson EP, Lewis CE, Lin Y, Sorel M, Gross M, Sidney S, Jacobs DR Jr, Shikany JM, Quesenberry CP Jr. Lactation

duration and progression to diabetes in women across the childbearing years: the 30-year CARDIA study. JAMA Intern Med. 2018;178:328–337. doi: 10.1001/jamainternmed.2017.7978

13. Li N, Yang Y, Cui D, et al. Effects of lifestyle intervention on long term risk of diabetes in women with prior gestational diabetes: a systematic review and meta-analysis of randomized controlled trials. Obes Rev. 2021;22(1):e13122.
14. Susan S Cho, Lu Qi, George C Fahey Jr, David M Klurfeld. Consumption of cereal fiber, mixtures of whole grains and bran, and whole grains and risk reduction in type 2 diabetes, obesity, and cardiovascular disease, Am J Clin Nutr 2013;98:594–619
15. US Preventive Services Task Force; Krist AH, Davidson KW, Mangione CM, Counseling Interventions to Promote a Healthy Diet and Physical Activity for Cardiovascular Disease Prevention in Adults With Cardiovascular Risk Factors: US Preventive Services Task Force Recommendation Statement. JAMA. 2020 Nov 24;324(20):2069-2075. doi: 10.1001/jama.2020.21749. PMID: 33231670.
16. NICE guidance. Type 2 diabetes: Prevention in people at high risk. Updated 2017. https://www.nice.org.uk/guidance/ph38 accessed 10 Feb,2023.
17. Rosenzweig JL, Bakris GL, Berglund LF, Hivert MF, Horton ES, Kalyani RR, Murad MH, Vergès BL. Primary Prevention of ASCVD and T2DM in Patients at Metabolic Risk: An Endocrine Society* Clinical Practice Guideline. J Clin Endocrinol Metab. 2019 Jul 31:jc.2019-01338. doi: 10.1210/jc.2019-01338. Epub ahead of print. PMID: 31365087
18. Colberg SR, Sigal RJ, Yardley JE, Riddell MC, Dunstan DW, Dempsey PC, Horton ES, Castorino K, Tate DF. Physical Activity/Exercise and Diabetes: A Position Statement of the American Diabetes Association. Diabetes Care. 2016 Nov;39(11):2065-2079. doi: 10.2337/dc16-1728. PMID: 27926890; PMCID: PMC6908414.
19. Ratner RE, Christophi CA, Metzger BE, et al. Prevention of diabetes in women with a history of gestational diabetes: effects of metformin and lifestyle intervention. J Clin Endocrinol Metab. 2008;93:4774–4779.
20. Diabetes Prevention Program Research Group. Long-term effects of metformin on diabetes prevention: identification of subgroups that benefited most in the diabetes prevention program and diabetes prevention program outcomes study. Diabetes Care. 2019;42:601–608.

Point of care testing in obstetric haemorrhage: Empowering the Obstetricians

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Obstetric haemorrhage is the leading global cause of maternal mortality worldwide. Postpartum hemorrhage (PPH) accounts for as much as two-thirds of cases of obstetric hemorrhage and for about one-quarter of all maternal deaths worldwide. Despite advancements in obstetric protocols, its prevalence has only risen around the globe. Maternal mortality rates, however, represent only the tip of the iceberg in terms of the overall impact of major bleeding on maternal health. Survivors of life-threatening hemorrhage often face long-term health consequences including loss of fertility, psychological trauma and sometimes even sustain permanent organ damage. Thus management of obstetric hemorrhage requires a proactive approach to prevention, early recognition, and timely intervention by a multidisciplinary team. It also calls for further advances in order to refine our approach to hemorrhage and manage it effectively to limit long-lasting complications.

Current Dilemmas in Management of Obstetric Hemorrhage

Conventionally, the assessment of hemostatic competence in obstetric hemorrhage largely relies on clinical observation and coagulation assays including PT, aPTT, INR, Bleeding time, Clotting time and Clauss Fibrinogen estimation. Visual estimation of blood loss in PPH is now widely accepted to be inaccurate.[1] Coagulation tests have the advantage of wide availability and a high but they are limited by lengthy turn-around times and low sensitivities for determining the existence of hypocoagulopathy.[2] They have poor correlation with severity of blood loss and are unable to predict progression of PPH in a rapidly evolving PPH scenario.[3] Derangement of PT, INR and aPTT in the context of PPH usually does not occur until 4000-5000 mL blood loss.[4] Thus normal coagulation assays can sometimes be falsely reassuring.

Most women, especially with mild to moderate PPH, do not become clinically coagulopathic.[5] There is growing evidence that the irrational use of fixed transfusion ratios of RBC : FFP of 1 : 1 or 1 : 2 often result in overtransfusion, particularly of fresh frozen plasma (FFP)[6] and sometimes increased rates of complications due to transfusion such as transfusion-associated circulatory overload and transfusion associated lung injury. Thus there is increasing emphasis on goal directed transfusion of blood products informed by haematological investigations alongside clinical assessment.

Point of Care Visco-Elastic Testing

The novel approach for the use of PCVT in obstetric hemorrhage derives from the strategies and guidelines commonly used in cardiothoracic surgery and trauma resuscitation. It is particularly gaining popularity in guiding management in post-partum hemorrhage.

PCVTs analyze the viscoelastic properties of whole blood and assess the cumulative contribution of the entire process of clot formation in achieving hemostasis (from clot initiation through termination to fibrinolysis).[7] Fibrinogen has been shown to be a reliable marker for risk of severe PPH as it is the first marker to fall when coagulopathy sets in. A fibrinogen level of < 2 g/L has been shown to be associated with 12 times increased risk of severe PPH and a 100% positive predictive value for progression to severe PPH3.[4] PCVTs act as surrogate markers of fibrinogen which can be used to both predict severity of PPH and inform blood transfusion.

Encouraging data show these tests may enable early identification and dynamic monitoring of dysfunctional coagulation states. They have faster turnaround times (15-20 min) compared to conventional coagulation assays which is crucial to improve patient outcomes, particularly in patients with amniotic fluid embolism (AFE) who are at risk for an abrupt hemodynamic collapse.[8] Furthermore, they can be followed serially at the patient's bedside in labor and delivery room, operating room, and in the emergency department. If correctly used as diagnostic adjuncts to conventional methods, they have been shown to decrease blood loss and blood product use in the postpartum period7. PCVT use in management of severe PPH has been shown to significantly reduce the incidence of cesarean hysterectomy, postoperative ICU admission and length of hospital stay as compared with patients not managed using PCVT.[9]

Types of PCVT:

The two commonly studied PCVTs in obstetric hemorrhage include: Rotational Thromboelastometry

(ROTEM) and Thrombo-elastography (TEG).

1. Rotational Thromboelastometry (ROTEM)

In the ROTEM system, a cylindrical cup containing a 340 µl whole blood sample remains fixed while a pin suspended on a ball bearing mechanism initially oscillates through 4° 75′ every 6 sec through application of a constant force. As the viscoelastic strength of the clot increases the rotation of the pin is impeded and is detected optically using a charge coupled device (CDD) image sensor system.[10]

2. Thromoboelastography (TEG)

In the TEG system, a cylindrical cup containing a 340 µl whole blood sample oscillates through 4° 45′ every 5 sec and a pin on a torsion wire is suspended in the blood. As the viscoelastic strength of the clot increases more rotation is transmitted to the torsion wire and is detected by an electromagnetic transducer.[10]

ROTEM and TEG provide essentially the same information about the kinetics and strength of clot formation. In most simple terms, the TEG and ROTEM curves represent the four stages of evolution of a clot from initiation, amplification, propagation and lysis. (Figure 1)

ROTEM has the largest evidence base in regards to PPH, however further research is required to legitimate their use in obstetric hemorrhage. Studies pertaining to use of TEG in the setting of PPH are fewer and more robust clinical evidence is required to validate routine use of TEG in PPH scenarios.

Important nomenclature and significance

ROTEM	TEG	Definition[10]	Significance[11]
Clotting time (CT)	Reaction rate (R)	time in minutes it takes for the trace to reach an amplitude of 2 mm.	Represents Clot initiation. Increase suggests a coagulation factor deficiency
Clot formation time (CFT)	Kinetics time (K):	time necessary for clot amplitude to increase from 2 to 20 mm.	Represents Clot development. Increase suggests fibrinogen deficiency
Angle (α):	Angle (α):	determined by creating a tangent line from the point of clot initiation (CT or R) to the slope of the developing curve.	Represents Clot development. Decrease suggests fibrinogen deficiency
Maximum clot firmness (MCF)	Maximum amplitude (MA)	peak amplitudes (strength) of the clot	Represents clot strength. Decrease suggests either a platelet or fibrinogen pathology
Lysis Index 30 (LI30)	Lysis 30 and Lysis 60 (LY30 and LY60)	percent reductions in the area under curve, that occur 30 and 60 min after MA is reached in TEG and 30 min after CT is detected in ROTEM	Represent hyperfibrinolysis and the potential need for tranexamic acid (TXA)

Additionally for ROTEM, some other important terminologies are as follows:

- A5/A10 : parameters that measure the amplitude of the tracing at 5/10 min after the end of CT.[10]
- Extrinsic thromboelastometry (EXTEM): specialized form of ROTEM that focuses on the extrinsic pathway. Gives a broader assessment of clotting status including fibrinogen, platelets and other coagulation factors.[5]
- Fibrinogen thromboelastometry (FIBTEM): involves a platelet inhibitor reagent which allows the contribution of fibrinogen in clot formation to be measured in isolation. FIBTEM A5 is a measure of clot firmness after 5 minutes and can be used as a surrogate measure of fibrinogen level12. A FIBTEM A5 < 12 mm can be used interchangeably with fibrinogen < 2 g/L when guiding fibrinogen replacement.[4]

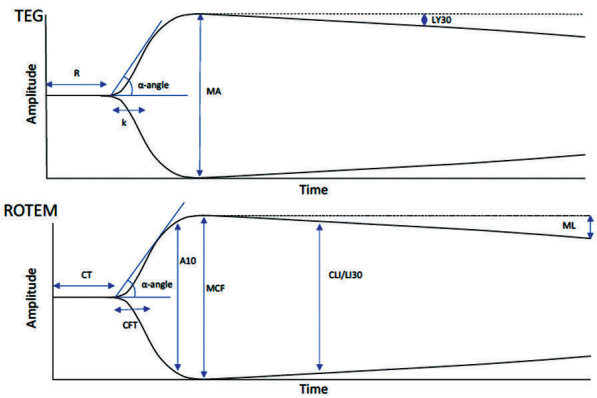


Figure 1 : TEG and ROTEM curves

How to use these tests to guide blood management:

Protocol

There is no standardised protocol with regards to application of ROTEM/TEG and the same needs to be

developed at the local level. The ROTEM protocol of the OBS Cymru13 (the Obstetric Bleeding Strategy for Wales) initiative is depicted in Figure 2.

Target values:

Blood product transfusion should be informed by regular assessment (every 30 minutes) and be goal directed to maintain:[14,15]

- Haemoglobin > 80 g/L[25]
- Fibrinogen > 2 g/L[14,15]
- FIBTEM A5 12 mm[14]
- ExTEM CT < 75 seconds[14]
- PT & aPTT < 1.5 times normal[14]
- Platelets > 75 109/L[14,15]
- Platelets: Conventional coagulation assays measure platelet counts but provide no information on platelet function. Although standard PCVTs (ROTEM/TEG) are limited in their ability to detect platelet dysfunction, however, specialized assays like TEG Platelet Mapping (TEG-PM) have been developed to be used in conjunction with standard PCVTs to provide this information. However their utilization in PPH has been limited.[15] Additionally, other non-VET point-of-care platelet function tests such as Multiplate and VerifyNow P2Y12 can be used to detect platelet dysfunction.[16]
- Fresh Frozen Plasma: Traditionally, FFP has been to replenish fibrinogen in PPH. Recently, studies have advocated against the administration of FFP as it contains lower concentrations of fibrinogen than the plasma of a woman at term which can cause further hemodilution of fibrinogen.[17]
- Fibrinogen Concentrates/Cryoprecipitate: If FIBTEM A5 7-11 mm or Clauss fibrinogen is < 2 g/L: 2 pools of cryoprecipitate or 4 g of fibrinogen concentrate should be transfused. If FIBTEM A5 < 7 mm then 3 pools of cryoprecipitate or 6 g fibrinogen concentrate should be transfused.[13] (As Fibrinogen concentrate is not readily available worldwide, the current standard of care for the administration of high concentration of fibrinogen in a low volume transfusion is by cryoprecipitate).
- Tranexamic Acid: Fibrinolytic parameters of PCVTs are not reliable for guiding the administration of tranexamic in PPH patients.[18] More research is required in this regard.
- Other blood products: It has been recently suggested that the administration of the prohemostatic agents Factor VIIa, prothrombin concentrates, desmopressin can be guided by PCVTs in PPH patients.[18]

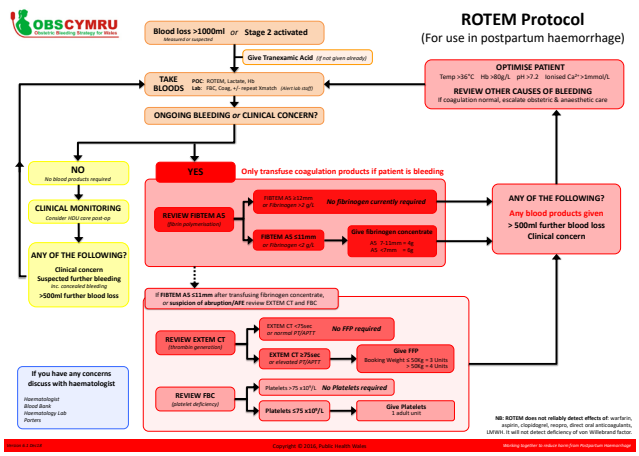


Figure 2: ROTEM protocol of the OBS Cymru13 (the Obstetric Bleeding Strategy for Wales) initiative

Challenges and Limitations

Although there is accruing evidence in favour of PCVTs, there are several shortcomings pertaining to their routine use. There can be significant variability in precision of results between different machines thus making internal and external quality control imperative to ensure accuracy of results.[18] Despite various advantages, they are still underused due to poor understanding of correct technique and result interpretation, a paucity of standardization, and a lack of large clinical trials in obstetric population. Cost of the units is another limiting factor and more cost effective unit or implementation must be found before it can be incorporated into routine clinical practise, particularly in resource limited settings. There was insufficient evidence to assess the cost-effectiveness of VE devices in women with PPH.

Current Impetus of PCVT:

The Association of Anaesthetics of Great Britain and Ireland (AAGBI) guidelines advocate the use of point of care testing in the setting of PPH to assess and guide management of coagulopathy.[6] FIGO 2022[19] guidelines state that during management of PPH, "Monitoring several resuscitation parameters is essential until tissue hypoxia reverts. These parameters include pH, base deficit, lactate, hematocrit, and coagulation—ideally evaluated with conventional laboratory tests and point-of-care testing (POCT) of viscoelastic coagulation such as thromboelastography (TEG) and rotational thromboelastometry (ROTEM)". NICE guidance 20 states there is insufficient evidence to recommend their routine use in PPH.

Scope of Future Research

The use of PCVTs in prediction and management of obstetric hemorrhage is still in an incipient state and

more research and standardisation is required in the obstetric population before it can be incorporated in routine use. Possible clinical application of PCVTs could be explored in the identification of women who show a severe hypercoagulable state and could benefit from antithrombotic prophylaxis. Application of PCVTs in antepartum haemorrhage and its role in guiding management of pregnancy is understudied. Role of PCVTs in guiding use of tranexamic acid and platelet transfusion, prothrombin complex etc also remains largely unanswered. Cost-effectiveness of PCVTs especially in Indian settings needs more research. Also, whether PCVTs provide any added advantage over clinical estimation and conventional coagulation assays requires more evidence.

References

1. Quantitative Blood Loss in Obstetric Hemorrhage: ACOG COMMITTEE OPINION, Number 794. Obstetrics & Gynecology. 2019; 134:e150-e156.
2. Butwick A, Lyell D, Goodnough L. How do I manage severe postpartum hemorrhage? Transfusion. 2020;60:897–907.
3. Charbit B, Mandelbrot L, Samain E, Baron G, Haddaoui B, Keita H et al. The decrease of fibrinogen is an early predictor of the severity of postpartum hemorrhage. J Thromb Haemost. 2007;5: 266-273.
4. Collins PW, Bell SF, de Lloyd L, Collis RE. Management of postpartum haemorrhage: from research into practice, a narrative review of the literature and the cardiff experience. Int J Obstet Anesth. 2019; 39: 175-175.
5. McNamara H, Mallaiah S. Managing coagulopathy following PPH. Best Pract Res Clin Obstet Gynaecol. 2019;61:106-120.
6. Klein AA, Arnold P, Bingham RM, Brohi K, Clark R, Collis R, et al. AAGBI guidelines: the use of blood components and their alternatives. Anaesthesia. 2016; 71: 829-842.
7. Hartmann J, Walsh M, Grisoli A, Thomas AV, Shariff F, McCauley R et al. Diagnosis and Treatment of Trauma-Induced Coagulopathy by Viscoelastography. Semin Thromb Hemost. 2020;46:134–146.
8. Collis RE, Collins PW. Haemostatic management of obstetric haemorrhage. Anaesthesia 2015;70 (Suppl. 1):78-e28.
9. Snegovskikh D, Souza D, Walton Z, Dai F, Rachler R, Garay A et al. Point-ofcare viscoelastic testing improves the outcome of pregnancies complicated by severe postpartum hemorrhage. J. Clin. Anesth. 2018;44:50–56.
10. Whiting D, DiNardo JA. TEG and ROTEM: Technology and clinical applications. Am J Hematol. 2014;89: 228-232.
11. Liew-Spilger AE, Sorg NR, Brenner TJ, Langford JH, Berquist M, Mark NM et al. Viscoelastic Hemostatic Assays for Postpartum Hemorrhage. J Clin Med. 2021;10:3946.
12. Amgalan A, Allen T, Othman M, Ahmadzia HK. Systematic review of viscoelastic testing (TEG/ROTEM) in obstetrics and recommendations from the women's SSC of the ISTH. J. Thromb Haemost. 2020; 18: 1813-1838.
13. OBS Cymru Quality and Safety Sub Group of Maternity Network Wales. All wales guideline: prevention and management of postpartum haemorrhage. 2017. Available at: http://www.wisdom.wales.nhs.uk/sitesplus/documents/1183/All%20Wales%20Prevention%20of%20Postpartum%20Haemorrhage%20%281.4%29_2018.pdf.
14. Royal College of Obstetricians and Gynaecologists. Prevention and management of postpartum haemorrhage. BJOG: An International Journal of Obstetrics & Gynaecology. 2016; 124: e106-e149.
15. Solomon C, Collis RE, Collins PW. Haemostatic monitoring during postpartum haemorrhage and implications for management. Br J Anaesth. 2012;109:851–863.
16. Dragan B, Adamik B, Burzynska M, Dragan SL. Gozdzik W. Platelet Receptor Activity for Predicting Survival in Patients with Intracranial Bleeding. J Clin Med. 2021;10:2205.
17. McDonnell NJ, Browning R. How to replace fibrinogen in postpartum haemorrhage situations? (Hint: Don't use FFP!). Int J Obstet Anesth. 2018;33:4–7.
18. Curry NS, Davenport R, Pavord S, Mallett SV, Kitchen D, Klein AA, Maybury H, Collins PW, Laffan M. The use of viscoelastic haemostatic assays in the management of major bleeding: A British Society for Haematology Guideline. Br J Haematol. 2018 Sep;182(6):789-806.
19. Escobar, MF, Nassar, AH, Theron, G et al. FIGO recommendations on the management of postpartum hemorrhage 2022. Int J Gynecol Obstet. 2022; 157(Suppl. 1): 3– 50. doi:10.1002/ijgo.14116
20. National Institute for Health and Care Excellence (NICE). Detecting, managing and monitoring haemostasis: viscoelastometric point-of-care testing (ROTEM, TEG and Sonoclot systems) (DG13). 2014.

Quiz

Vidhi Chaudhary
Professor, Obs & Gynae

Q-1. How long should a women wait for conception after the last dose of MMR vaccine?

Q-2. Which chelation therapy is safe for use in second and and third trimester of pregnancy in women with thalassemia major with iron overload.

Q-3. What should be the ideal target levels for liver iron concentration using a FerriScan® or liver T2*.

Q-4. How many women with epilepsy will not have seizure deterioration in pregnancy , if they are seizure free in last 12 months .

Q-5. Name two Viscoelastic tests for point-of-care (POC) devices most commonly used for coagulation analyses in the acute settings.

Q-6. What are the biomarkers diagnostic for Peripartum cardiomyopathy in addition to left ventricular dysfunction.

Q-7. What are the target levels of fasting and 2-hour postprandial glucose for adequate glycaemic control in women with gestational diabetes mellitus.

Answers

1. 28 DAYS **2.** Desferrioxamine **3.** Liver iron should be < 7 mg/g (dry weight) (dw). **4.** two-thirds .
5. Thromboelastographic System (TEG) & Rotational Thrombelastic System (ROTEM)
6. B-type natriuretic peptide (BNP)/N-terminal proBNP (NT-proBNP)
7. FPG< 90 mg/dl; 2hr Postprandial plasma glucose<120mg/dl

Gear up for the academic extravaganza!!

NARCHICON 2023

24th – 26th November, 2023

Organized by NARCHI-Delhi Branch, Lady Hardinge Medical College, New Delhi

HIGHLIGHTS

Workshops:

Pre-conference video workshop on enhancing skills in Obstetrics & Gynaecology
Post conference satellite workshops on postnatal care

Talks and Panels:

Trouble shooting in vaginal birth: Tackling tears, hematomas & sphincter injuries.

Reviving the art of vaginal surgery: Suture less vaginal hysterectomy, vaginal removal of big uteri & adnexa, High uterosacral plication

Surgical competence-Raising the bar: Extraperitoneal C-section, V-NOTES hysterectomy.

ART & Surrogacy bill decoded: Panel discussion.

Bridging gaps - Cross talks between Obstetrician, Neonatologist, Radiologist & Anaesthetist

Uterus sparing surgeries for pelvic organ prolapse.

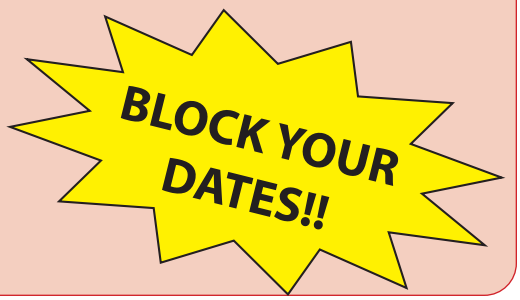
Trouble shooting in Caesarean Section: Morbidly obese mother, preterm, 2nd stage CS.

Adnexal masses-What a gynaecologist must know? A Panel discussion

Orations: Abnormal cervical screening way forward, Antepartum surveillance in multiple gestation

Competition: Obstetric Drills

Quiz on Skills & Drills in Obstetrics & Gynaecology



Events held under NARCHI, Delhi Nov 2022 -Feb 2023

25th November

Public forum on Iron Deficiency anemia was conducted in Gynae OPD organised by department of Obstetrics & Gynaecology, LHMC under the aegis of NARCHI, DELHI. The program was attended by Antenatal patients. The aim of the forum was to increase awareness about anemia among pregnant woman. Anemia room was inaugurated by Dr V K Sharma, (Additional MS), Dr Reena (HOD, Obs & Gynae) and Dr Manju Puri (Dir Proff, Obs & Gynae).

2nd December

On the occasion of World AIDS Day, Department of Obstetrics & Gynaecology, LHMC in collaboration with ART centre, Paediatrics centre of excellence (pCoE), Lady Hardinge Medical College, New Delhi under the aegis of NARCHI organised a public forum on PREVENTION OF PARENT TO CHILD TRANSMISSION OF HIV on 2nd December, 2022 in Gynaecology OPD.

Webinar was organized by AOGD Safe motherhood committee & NARCHI Delhi on 2nd December, 2022 on Hyperglycemia in pregnancy, 3rd session: Care around birth. The webinar was attended by 300 delegates.

3rd December

NARCHI Delhi in collaboration with Directorate of Family Welfare, Govt of NCT of Delhi organized training of trainers' capacity building of health care providers in prevention of cervical and breast cancer in Lady Hardinge Medical College. It was attended by 30 doctors from 26 facilities across Delhi including Ayush and homeopathic doctors.

3rd December

NARCHI Delhi branch in collaboration with Directorate of Family Welfare, Govt of NCT of Delhi organized a training of trainer's program for health care providers for capacity building in prevention of Anemia in pregnancy. It was attended by 51 medical officers of government and private hospitals (inclusive of Ayush and homeopathic) across Delhi.

10th December

NARCHI Delhi in collaboration with DHFW NCT organized a TOT in Respectful maternity care health for 25 doctors from 15 facilities.

10th December

NARCHI Delhi in collaboration with Directorate of Family Welfare, Govt of NCT of Delhi organised training of trainer's capacity building of health care providers in prevention of stillbirth. It was attended by 25 doctors.

22nd December

A cascade sensitization program on cervical and breast cancer awareness was organised at Guru Govind Singh hospital led by Dr Mrinalini Mani, Dr Anupam Nidhi under NARCHI Delhi and DFW for 50 hospital staff.

24th December

A cascade sensitization program on cervical and breast cancer awareness was organised Acharya Shree Bhikshu hospital led by Dr Sushma Sinha, Dr Suchita Bahl under NARCHI Delhi and DFW for 50 Nursing orderlies, Security Guards and housekeeping staff.

30th December

A cascade sensitization program on cervical and breast cancer awareness was organised at ESI Hospital, Manesar led by Dr Monica Madan under NARCHI Delhi and DFW for 30 health care workers.

10th January

A cascade sensitization program on cervical and breast cancer awareness was organised at Baba Saheb Ambedkar Medical College led by Dr Sandhya Jain, Dr Vinita Gupta under NARCHI Delhi and DFW for 70 hospital staff.

11th January-13th January

A 3-day cascade training program on cervical and breast cancer awareness was organised at Smt Girdhari Lal Hospital led by Dr Rekha Rani under NARCHI Delhi and DFW for ASHA workers. It was attended by 30 ASHA workers.

12th January 13th January &18th January

A 3-day cascade sensitization program on Anemia, cervical and breast cancer awareness was organised at Jag Pravesh hospital led by Dr Kusum Dogra under NARCHI Delhi and DFW for 40 ANM's and 35 ASHA workers.

17th January

A cascade training program on Anemia, cervical and breast cancer awareness was organised at DM OFFICE led By Dr Piyush Gupta under NARCHI Delhi and DFW. It was conducted for multiple batches of 551 Asha, 1768 Anganwadi worker and 87 ANM.

19th January

A public awareness program on causes of anemia, symptoms, prevention & treatment was organised at Jag Pravesh hospital for 150 pregnant women led by Dr Kusum Dogra under NARCHI Delhi and DFW. 35 ASHA workers were also trained under Anemia Mukt Bharat campaign.

19th January

A sensitization program on Anemia Mukt Bharat and Cancer prevention was organised at Guru Gobind Singh Hospital led by Dr Mrinalini Mani under NARCHI Delhi and DFW for 50 grade D employees and 20 ASHA workers.

21st January

Nehru Homeopathic Medical College, Defence Colony conducted sensitization of 150 ASHA on Anemia Mukt Delhi led by Dr Priya Malhotra.

21st January

Tibia College and hospital conducted sensitization under NARCHI Delhi and DFW of 25 patients, staff and interns on Anemia Mukt Delhi.

21st January

Sanjay Gandhi Memorial hospital conducted sensitization of 40 ASHA workers on Anemia Mukt Delhi. It was led by Dr Poonam Joon under NARCHI Delhi and DFW.

23rd January

Cascade training of 25 Medical officers of West District peripheral units on Anemia Mukt Delhi and injectable contraceptives was conducted by Guru Gobind Singh Hospital by Dr Sushma Sinha, Dr Anjali & Dr Smita under NARCHI Delhi and DFW. All MOs took a pledge to cascade further at their respective workplaces on 23rd January.

24th January

Jag Pravesh Chandra hospital conducted sensitization of 35 ASHA on Anemia Mukt Delhi with family planning training under NARCHI Delhi and DFW. It was led by Dr Kusum Dogra.

24th January

Guru Gobind Singh Hospital conducted a cascade sensitization of 25 ANM's on West district done on Anemia Mukt Delhi under NARCHI Delhi and DFW. It was led by Dr Sushma Sinha, Dr Anjali & Dr Smita. Bhagwan Mahavir hospital conducted sensitization of ASHA about anemia prevention and treatment.

27th January

Burari Hospital led by Dr Divya Chauhan conducted sensitization of 40 nurses on Anemia Mukt Delhi. Departmental session on Anemia Mukt Bharat was also taken along with establishment of T$ anaemia room

27th January

A sensitization program on cervical and breast cancer awareness was organised at GIMS, Greater Noida led by Dr Ritu Sharma for 50 nursing students under NARCHI Delhi and DFW.

30th January

Jag Pravesh Chandra Hospital sensitized 35 ASHA workers on Anemia Mukt Delhi under NARCHI Delhi and DFW. It was led by Dr Kusum Dogra.

1st February

Jag Pravesh Chandra Hospital led by Dr Kusum Dogra 35 ASHA workers were sensitized on Anemia mukt Delhi and family planning under NARCHI Delhi and DFW. A pledge was also taken for cancer mukt Bharat.

1st February

A training program on cervical and breast cancer awareness was organised at Burari Hospital led by Dr Divya Chauhan under NARCHI Delhi and DFW for 50 Health care workers.

1st February

Acharya Shree Bhikshu Hospital conducted a workshop on anemia mukt Delhi under NARCHI Delhi and DFW. The workshop was attended by 42 ASHA workers.

2nd February

A sensitization program on cervical and breast cancer awareness was conducted at GTB Hospital led by Dr Shakuntla Kumar under NARCHI Delhi and DFW. It was attended by 50 HCW.

3rd February

A sensitization program on cervical and breast cancer awareness was conducted at DDU Hospital led by Dr Pinkee Saxena under NARCHI Delhi and DFW. It was attended by 50 HCW.

3rd February

A sensitization program on cervical and breast cancer awareness was conducted Kasturba Hospital led by Dr Shivani Aggarwal under NARCHI Delhi and DFW. It was attended by 40 HCW.

4th February

Mata Gujri hospital conducted public awareness program under NARCHI Delhi and DFW where approximately 50 adolescent girls and women were sensitized about anemia and cancer prevention as well as menstrual hygiene. Iron and folic acid were distributed to attendees.

4th February

A sensitization program on cervical and breast cancer awareness was conducted BSA Hospital led by Dr Sandhya Jain under NARCHI Delhi and DFW. It was attended by 60 HCW.

8th February

A workshop on Respectful Maternity Care was conducted at BSA hospital led by Dr Vinita Gupta under NARCHI Delhi AOGD and DFW.

9th February

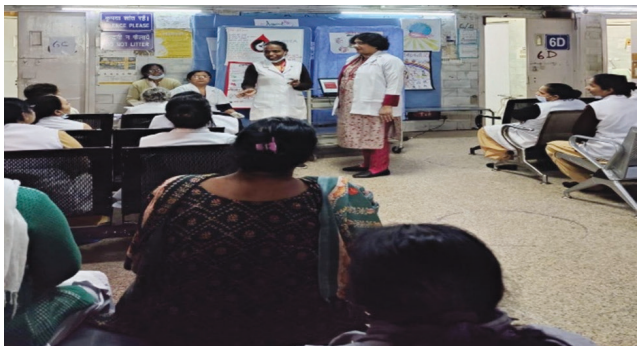
A sensitization program on cervical and breast cancer awareness was conducted at Acharya Shree Bhikshu Hospital led by Dr Sushma Sinha under NARCHI Delhi and DFW. It was attended by patients and their relatives.

10th February

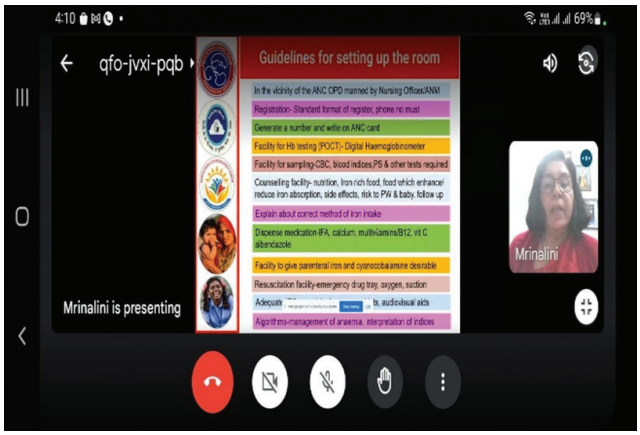
A workshop was conducted on Respectful maternity care at Acharya Shree Bhikshu Hospital led by Dr Sushma Sinha under NARCHI Delhi and DFW. It was attended by 31 doctors and nursing officers.

11th February

Deen Dayal Upadhya Hospital led by Dr Shashi Lata Kabra conducted a cascade sensitization program for anemia prevention under NARCHI Delhi and DFW among nursing staff and group C and D workers. It was attended by 50 health care workers.



East Delhi Gyne Forum under ageis of NARCHI Delhi doctors conducted 3 hours online TOT. It was attended by 18 doctors.



15th February

Webinar was organised by DGFS under ageis of NARCHI on "Anemia Mukt Bharat" to spread awareness about anemia in pregnancy and adolescent. Webinar was attended by 100 obstetrics & gynaecologists.

16th February

A sensitization program on cervical and breast cancer awareness was conducted Burari Hospital led by Dr Divya Chauhan under NARCHI Delhi and DFW. It was attended by 50 HCW's.

21st January 30th January-1st February, 6-8th February, 14-16th February

A fortnight sensitization program on cancer prevention, family planning and anemia was organised at Hamdard Institute of Medical sciences and Research, Delhi led by Dr Aruna Nigam for 450 ASHA workers under NARCHI Delhi.