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Critical Care in Obstetrics

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President's Address

Dr. Rishma Dhillon Pai
President FOGSI

Anyone who stops learning is old, Whether at 20 or 80
Anyone who keeps learning, stays young.
The greatest thing in life is to keep your mind young.

- Henry Ford

Dear Colleagues,

It gives me great pleasure to communicate with you once again through the ICOG Newsletter. This wonderful academic communication has become extremely popular as it is a focused publication on subjects of day to day importance to all of us.

Critical care in obstetrics is a major issue of concern given the high maternal mortality rate in our country.

FOGSI is working at many levels to improve maternity care. Our 'Manyata' programme is a massive Pan India One to help improve quality care in nursing homes where majority of the deliveries take place and help in their accreditations. FOGSI Mamta TV in all our waiting rooms, which help educate patients on important health issues while they wait for their doctor. The PMSMA programme with government of India will improve antenatal care. We have three critical care conferences coming up in Ahmedabad, Indore and Patna, which will help gynaecologists improve their expertise.

I congratulate Dr. Mala Arora and Dr. S. Shanthakumkari for bringing out this important newsletter.

Chairperson's Address

Dr. Mala Arora
Chairperson ICOG
chairpersonicog@gmail.com

Five women in India die every hour during childbirth. WHO statistics show that 303,000 mothers are lost per year around the globe. These are precious young lives lost largely due to preventable causes.

In an endeavor to save these lives we need to train our obstetricians in the art of Critical Care. Every mother that becomes critically ill merits to be stabilized and safely transferred to an intensive care / high dependency unit. Adequate training and minimal equipment can arm the obstetrician at the grass root level to stabilize critically ill mothers.

This newsletter presents an insight into critical care as well as the conference is an endeavor to impart this training.

Today we are seeing a decline in maternal mortality rate in our country, which has dropped from 254/100,000 in 2006 to 139/100,000 in 2016 and we hope to continue this trend over the coming years.

Secretary's Message

Dr. S. Shantha Kumari
Secretary ICOG

Dear All !

Obstetrics in general deals with healthy young women who participate in the process of pregnancy and childbirth with the aim of having a healthy baby and remaining healthy themselves. We often quote philosophers in saying that a pregnant woman should never be referred to as a "patient" because pregnancy care is usually considered a normalcy event! Nevertheless, catastrophic events related to pregnancy can be life threatening and history is full of examples where tragedies have ensued due to lack of "Critical care in Obstetrics".

Less than 2percent of women may need intensive critical care during pregnancy or peripartum period but if this is insuffiicent in any way then the final outcome can escalate to even maternal and fetal mortality. Hence the importance of critical care in Obstetrcis cannot be understated. Massive postpartum hemorrhage and the complications hypertensive disorders are the most common indications of ICU admissions in the obstetric population and knowing the frequence of both these conditions in our women, it is imperative that every obstetrician keep herself abreast with the basics of critical care. The incidence of ICU admission for pregnant and postpartum women ranges from 0.7 to 13.5 per 1000 deliveries. The recent statement on the availability of ICU for surgical patients has created a buzz in the medical fraternity and although the doctors must read the entire document and understand the finer details, the nutshell message is that every surgical patient should have access to critical care when needed. The paradox is that "when needed" may sometimes be a retrospective observation and then the damage is huge.

I whole heartedly appreciate this initiative on increasing awareness on this very crucial subject - especially in an era that maternity wards are being frequented by women who are older than what they used to be in the preceding decades such that theirown co morbidities are high. Thanks to the advancement of care in parallel medical subspecialities, it is not unusual to find women with significant health conditions like severe heart disease, recipients of liver transplants or even treated cases of malignancies get pregnant and reach out forObstetric care. Such care will always carry the risk of requirng critical care at any time. The onus is now on teh Obstetrcian to do teh best by the pregnant women and thus keep abreast the lastest developments in obstetric critical care.

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Greetings to All!

We present to you yet another issue of 'ICOG Campus' dedicated to **'Critical Care in Obstetrics'**

It is a well-known fact that obstetric practice entails dealing with life threatening complications requiring an urgent critical care. This necessitates High Definition Unit(HDU) /Intensive Care Unit(ICU) like care including continuous patient monitoring, invasive monitoring facilities, and a trained multi-disciplinary manpower capable to address these special interventions to save critically ill mothers.

Critical care in obstetrics is a much needed area to be developed in country like us with high mortality and morbidity. For every maternal death, there are some 80 maternal morbidities. If we can cater to these morbidities aptly, we will be able to save many of our mothers from wrath of obstetrical complications.

This dedicated issue of ICOG Campus aims to sensitize the obstetricians about the critical issues of their obstetric patients. It covers in its ambit special features on need and setting up of HDU/ICU, concept of Labour-delivery-recovery units, physiological aspects in critically ill patients, antibiotics in sepsis, critical appraisal of blood transfusion and simplified overview of ABG analysis. Few interesting near miss case scenarios with management protocols will provide a ready reckoner for the practitioners. Intriguing brain teasers at the end to keep up with the tradition.

We expect that our readers will enrich themselves about this highly specialized and progressively expanding discipline, which is the need of an hour.

I wish happy reading to all.

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Guest Editors "Critical Care in Obstetrics"

Dr. Alpesh Gandhi, Consultant, Obstetrics & Gynaecology, Arihant Hospital, Ahmedabad • Vice President FOGSI 2013 • Governing Council Member ICOG

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Dr. Parul Kotadwala, Consultant Ob-Gyn, Ahmedabad • ICOG Governing Council Member. **June Issue**

Dr. Parag Biniwale, Consultant Obgyn, Pune • ICOG Governing Council Member, Hon. Secretary, ICOG (2018-20).

Dr. Sunita Tandulwadkar, Vice-President FOGSI (2017) • Elected Board Member, ISGE (2013-2017), Clinical Secretary, Indian Society of Assisted Reproduction (ISAR) • Chief, Ruby Hall IVF & Endoscopy Centre, Pune. **July Issue**

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Dr. Duru Shah, Director, Gynaecworld, the center for women's health and fertility • President, ISAR • Founder President, The PCOS Society, Past President, FOGSI and IMS • Past Chairperson, ICOG Prof. **August Issue**

Dr. Bharati Dhorepatil, Director & Chief IVF Consultant, Shree Hosp's Ssmile IVF Center Vice President FOGSI 2016 • President (Elect), Pune OBGYN Society. National Co-ordinator, FOGSI-PCOS Registry • Ex. Chairperson, Clinical Research Committee, FOGSI.

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The Need and Indications for admissions to High Dependency Unit (HDU)/ Intensive Care Unit (ICU)

Dr. Alpesh Gandhi

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Vice President FOGSI 2013

WHAT IS THE NEED ?

Safe Maternity is viewed as a basic human right worldwide. Health of a woman reflects health of the nation. Maternal mortality is an important indicator of maternal health. Because of various government schemes and efforts by many organizations in India, hospital delivery rate has improved a lot and reached up to 84% and MMR has reached up to 167 deaths per 100,000 live births in 2013 in India. MMR in developed countries is < 20. Maternal mortality is 'just the tip of the iceberg'. There is a vast base to this iceberg – which is unseen and known as maternal morbidity (near miss). Recent WHO systematic review, global prevalence of SAMM (defined as severe life-threatening obstetric complication necessitating an urgent medical intervention in order to prevent likely death of mother), varies from 0.01 to 8.23%. The case fatality ratio is 0.02–37%. Incidence of high-risk pregnancy is approximately 15% in India. At every 5 min, one woman dies from a pregnancy related complication in India (UNICEF). Prevalence of SAMM necessitating urgent medical intervention can be as high as 8.23% in India (WHO).

Care of critically ill patients is a unique challenge in obstetrics as deterioration is fast and there may be an existing comorbid medical condition. In UK, nearly 30% big hospitals are having High Dependency care Unit facility. In our country, the facility was nearly nil before 2010. Therefore, these women are being managed in the labour rooms or routine wards without monitoring facilities and trained health care providers. In order to provide timely care to these mothers and reduce preventable maternal deaths, close monitoring and skill-based services by trained professionals in a dedicated obstetric high dependency unit (HDU)/ICU with state-of-the-art technology is the need of the hour.

OBSTETRIC ICU/HDU

Obstetric ICU is an dedicated to manage only for obstetric patients having critical obstetrical or medical or surgical complications, managed by staff oriented for obstetric physiology and pathology.

An Obstetric HDU is an area in the obstetric department where patients can be cared for more extensively than on a normal ward, but not to the point of intensive care. So they are intermediate care units. Patients may be admitted to an HDU because they are at risk of requiring intensive care admission (step up) or at the same time, patients in the Intensive Care Unit who have had an improvement in their condition require a stay in the High Dependency Unit (HDU) before admission to a general ward (step down). HDU would not normally accept patients requiring mechanical ventilation, but could manage those receiving close monitoring. Patients with multi organ failure cannot be kept in HUD but patients requiring single organ support can be admitted in HDU.

Critically ill obstetric patient is safer if admitted in Obstetric HDU/ICU than MICU because if required, patient can be shifted easily and promptly to LR or Operation theatre, neonates can be taken care better as NICU is near and foetal monitoring is also possible. Obstetric HDU and Obstetric ICU are nearer to each other in the obstetric department and so step up and step down facility can be used easily. In Obstetric ICU, beds have the facility to be converted into labour table. In Obstetric HDU/ICU, a trained or experienced dedicated full time obstetrician and staff is trained in obstetric complications/emergencies is always available.

TRIAGE POLICY

Patients may be transferred directly to Obstetric HDU/ICU from an emergency department if required, or from a ward if they rapidly deteriorate, or immediately after surgery if the surgery is very invasive and the patient is at high risk of complications. Depending on the clinical condition and severity of illness, the Obstetrician will take decision whom to admit in obstetric HDU/ICU or who will require routine care / delivery.

ADMISSION INDICATIONS

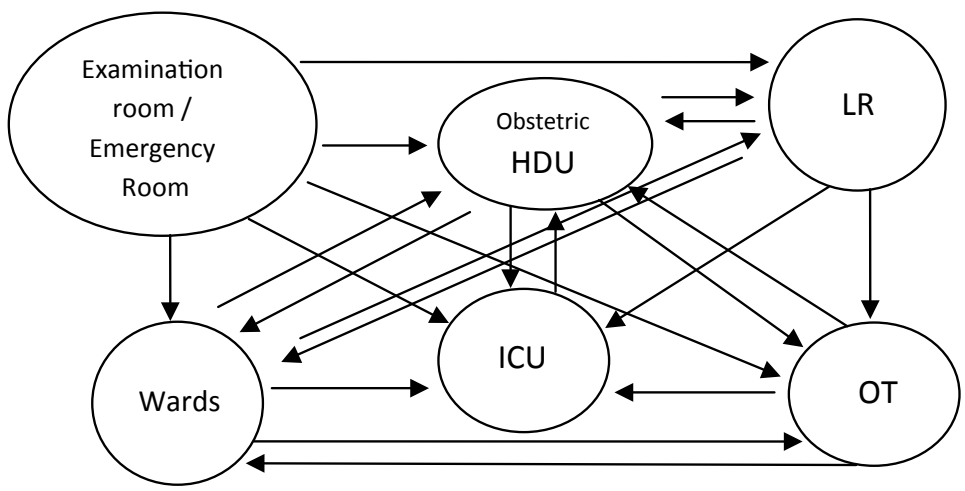
Obstetric disorders constitute 2/3 of admissions and 1/3 is due to pregnancy with medical disorders in obstetric HDU/ ICU. Antenatal admissions are more common with medical complications and hypertensive disease of pregnancy while post-partum patients are admitted more with hemodynamic instability mostly from obstetric haemorrhage, infection and post-operative complication.

During examination, a quick initial assessment is done. Obstetric Patient with following conditions/diagnosis may require admission in Obstetric HDU:

a. Hemodynamic instability
b. Respiratory dysfunction,
c. Neurologic complications.
d. Acute kidney injury
e. Hematological complications

High Dependency care unit admissions are mainly constitutes of high risk patient likely to develop problems, having Single organ dysfunction, requiring minimal O_2 support, blood transfusion or non invasive monitoring. Obstetric ICU admissions are mainly constitute of patients requiring two or more organ systems support, Invasive monitoring, Ventilatory support, Inotropic support, massive blood transfusion, renal replacement therapy, risk of sudden catastrophic deterioration or multidisciplinary team is required.

While shifting or referring of a patient to Obstetric HDU/ICU, the decision has to be informed to relatives & consent is taken, patient should be escorted by doctor /staff with case sheets and all existing treatment



Criteria for admission in Obstetric HDU/ICU:		
Obstetric HDU	**Obstetric ICU**	
• Systolic Blood Pressure(SBP) < 90 or > 160 mm Hg • Diastolic Blood Pressure: < 50 or > 110 mm Hg • Mean Arterial Blood Pressure < 60 mm of Hg • Heart Rate < 60 or >110 per minute • Respiratory Rate: > 25 per minute • Urine < 0.5ml /Kg/Hour (< 30 ml per hour) • Any organ dysfunction	• RR < 8 or >35 per minute • Heart rate <50 or >140 beats / minute • Systolic B.P. < 80 mm Hg, or 30 mm Hg below patient's usual B.P. • U/O < 400 ml in 24 hrs, or < 160 ml in 8 hrs and unresponsive to simple routine measures. • GCS < 8 in the context of non-traumatic coma. • Any unarousable patient. • S. sodium <110 or >160 mmol L	• S.potassium <2.0 or > 7.0 mmol L • pH < 7.1 or > 7.7 • PaO2 < 6.6 kPa and/or PaCO2 > 8.0 kPa. • SaO2 < 90% on supplemental oxygen. • Need for advanced • Respiratory support • Inotropic support • DIC • Multi-organ failure • ARDS

SCOPE OF HDU: Conditions which may require admission in Obstetric HDU/ICU	
Obstetric Complications	**Pregnancy with Medical Complications**
• Pregnancy / Labor Pain with Severe Anemia (< 7 gm %) and its complications.	▪ Gestational Diabetes.
▪ Accidental Hemorrhage- Placental abruption, couvelaire uterus	▪ Diabetic Ketoacidosis
▪ Post Partum Hemorrhage	▪ Cardiac Diseases
▪ Placenta Previa	▪ Jaundice
▪ Adherent Placenta and other placental abnormalities.	▪ Thyrotoxicosis
▪ Obstetric hysterectomy	▪ Thyroid storm
▪ Severe Preeclampsia/ Hypertensive crisis	▪ Pheochromocytoma
▪ Eclampsia	▪ Endocrinal crisis like addison's disease etc.
▪ Broad ligament hematoma	▪ Post operative ARF and other renal problems
▪ HELLP Syndrome	▪ Leukemia and other hemolytic disorders.
▪ Pregnancy with DIC	▪ Dengue
▪ Sepsis & systemic inflammatory response syndrome (SIRS).	▪ complications of Malaria
▪ Pregnancy with Thrombophylias.	▪ Asthma and other respiratory problems.
▪ Multiple gestation with complications	▪ PPCM-Postpartum cardiomyopathy
▪ Pregnancy with complications due to uterine anomaly and pathologies	▪ Appendicectomy or any other surgical emergency
▪ Hydatidiform Mole	▪ Pregnancy with OHSS. (Ovarian Hyperstimulation syndrome)
▪ Ruptured Ectopic	▪ Acute Panceatitis
▪ Burns during pregnancy	▪ Trauma
▪ Perforation during abortion	▪ Poisoning
▪ Postoperative patients requiring hemodynamic monitoring, or intensive nursing care	▪ Pregnancy with Cancer
▪ Pulmonary edema due to peri-operative fluid overload, CCF, complication of severe pre-eclampsia or tocolytic therapy with β-agonists etc.	

(Pregnancy with H1NI, Pyometra, HIV and infectious diseases should be admitted in Isolation Room in Obstetric HDU/ ICU)

including oxygen and patent IV line, monitoring the vitals of the patient should be continued and ensuring patent airway. Baby should be shifted with mother if she has delivered.

CONCLUSION

It is important to provide critical care services to obstetric patients and if quality obstetric health care is provided in time, then we should be able to save 80% of 3,03,000 pregnant women who die in the world every year (WHO-2015). It is said that, dedicated obstetric HDU/ICU to provide quality emergency care is the need of the hour.

REFERENCES

1. Souza JP, Gülmezoglu AM, Vogel J, Carroli G, Lumbiganon P, Qureshi Z, Costa MJ, Fawole B, Mugerwa Y, Nafiou I, Neves I, Wolomby-Molondo J-J, Bang HT, Cheang K, Chuyun K, Jayaratne K, Jayathilaka CA, Mazhar SB, Mori R, Mustafa ML, Pathak LR, Perera D, Rathavy T, Recidoro Z, Roy M, Ruyan P, Shrestha N, Taneepanichsku S, Tien NV, Ganchimeg T, et al. Moving beyond essential interventions for reduction of maternal mortality (the WHO Multicountry Survey on Maternal and Newborn Health): a cross-sectional study. The Lancet. 2013;381:1747–55.
2. Saravanakumar K, Davies L, Lewis M, Cooper GM. High dependency care in an obstetric setting in the UK. Anaesthesia. 2008 Oct;63(10):1081-6.
3. Dattaray C, Mandal D, Shankar U, Bhattacharya P, Mandal S. Obstetric patients requiring high-dependency unit admission in a tertiary referral centre. International Journal of Critical Illness and Injury Science. 2013;3(1):31-35. doi:10.4103/2229-5151.109416.
4. Ryan M, Hamilton V, Bowen M, McKenna P. The role of a high-dependency unit in a regional obstetric hospital. Anaesthesia. 2000 Dec;55(12):1155-8.

Standardization of Labor Rooms at Delivery Points - a Critical Intervention for Improving Maternal and Fetal Outcomes

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Vice President FOGSI (Elect) 2018

INTRODUCTION

The best indicator of a country's health is maternal and perinatal mortality. High institutional delivery rates have not resulted in proportionate reduction in these mortalities. This points out to the need of providing quality services in the Labor Rooms. Providing a skilled health care provider, availability of adequate resources and presence of an enabling environment can definitely lead to translation of competencies into action. Most important is to practice evidence based good clinical practices with readiness or preparedness to deal with the immediate complications.

STANDARDIZATION OF LABOR ROOMS

Labor Rooms at every delivery point should be the focus area for delivering high quality services during childbirth. They should be standardized throughout the country. The Govt. of India released guidelines in 2016 explaining how to upgrade the Labor Rooms for standardization i.e. constructing new labor rooms /delivery units as per need or reorganizing the existing labor rooms. The guidelines focus on five important areas:

1. Space and Lay out
2. Equipment and accessories
3. Consumables
4. Human resources
5. Practice and Protocols

1. SPACE AND LAYOUT

The most important factor for defining the space and layout of the labor room is the number of labor beds in the facility. Two types of labor rooms are being recommended:

- **Labor-delivery-recovery (LDR) room concept** (a pregnant woman spends the duration of labor, delivery, and 4 hours postpartum in the same bed)
- **Conventional labor rooms** (a pregnant woman is admitted to labor room only at or near full dilation of cervix and is shifted to the postpartum ward after 2 hours).

LDR concept is more client-centric and ensures better care, privacy and comfort to the pregnant woman during labor process. It also obviates the need for having additional waiting area or labor area and associated services. It is being recommended that, *if there is adequate space available* without any significant resource constraints, all the facilities with more than 500 deliveries in a month should be upgraded to have labor rooms as per the LDR concept. One LDR unit has four LDR beds. No of beds for LDR concept is calculated by formula

No. of LDR beds = {(Projected LDR events in a year)*(Average length of stay)} / {(365)* (Occupancy rate)}

Calculation:

Step 1: Determine the number of LDR events in a year, i.e. the number of vaginal births per annum (projected number of births per annum plus the projected number of unplanned C-section births).

Step 2: Take 0.67 days or 16 hours (12 hours for labor and delivery, 4 hours recovery, including the room clean-up) as the average length of stay.

Step 3: 75% or 0.75 is the recommended occupancy rate for health facilities.

Step 4: Insert the numbers attained in the above steps, in the formula, and calculate the number of LDR beds required. For e.g., LDR bed requirement for a hospital with 7200 projected deliveries (6120 normal deliveries 1080 C-sections out of which 600 are unplanned C-sections) can be calculated as follows:

- Number of LDR events in a year: (6120+600) = 6720
- Number of LDR beds required = (6720* 0.67)/ (365*0.75) = 16 beds or four LDR Units

The LDR based labor room complex will have two main components—Core LDR unit and support areas. A standard LDR unit should have 4 labor areas with one labor table each, one nursing station, one newborn care area, two toilets and two washing areas. Recommended components of the LDR unit are:

Labor Area

- Each measuring 10'X 10'
- An opaque partition between two consecutive labor areas.
- Each having one labor table, one stool for birth companion, adequate lighting and ventilation, a ceiling/wall mounted fan.
- Vital monitors in each labor area is desirable
- Adequate light; ambient light, with additional focus lights for the labor tables and examination tables for procedures.
- Each labor bed should have recommended specifications:
  - Adjustable side rails.
  - Facilities for Trendelenburg/reverse positions.
  - Facilities for height adjustment (hydraulic pump preferably).
  - Stainless steel IV rod.
  - Mobility: swiveling castor wheels & brakes.
  - Mattress should be in three parts and seamless in each part with a thin cushioning at the joints, detachable at perineal end.
  - Disposable draw sheet.
  - Steel basins attachments.
  - Calf support, handgrip, leg support.

Newborn Care Area (NBCA) centrally located with the following:

- Radiant warmer.
- Resuscitation kit with functional bag and mask.
- Mucus extractor.
- Pre-warmed baby receiving towels.
- Shoulder roll.
- Pediatric stethoscope.
- A clock with seconds hand on the wall near the NBCA.
- An oxygen cylinder/oxygen concentrator in the vicinity of the NBCA.

Nursing Station: centrally located with a storage cupboard for storing documents and supplies, a white board on the wall next to the nursing station. The space below the platform should be used for storing the **crash trolley** loaded with 5 trays (autoclaved delivery tray, baby tray, episiotomy tray, normal drug tray and emergency drug tray) There should be one crash trolley per labor table.

Toilets two in number (western style) with wash basin

Handwashing Area: a steel sink , two elbow-operated taps with 24x7 running water supply, a geyser, soap dispenser and hand washing protocols on the wall above the hand washing area.

Washing Area: area of 6'2" X 6'having two taps with running water supply and a geyser.

Support area includes waiting /registration area, triage /examination room, procedure room, staff rooms, changing room, store room, clean and dirty utility room, and air handling unit.

It is recommended that each labor room complex has access to CSSD for supply of sterile utilities to labor rooms.

Conventional labor rooms:

Where space for LDR rooms is not available, the labor rooms should be upgraded using the Conventional Labor Room concept. *Calculations of beds is by same formula as of LDR concept but average stay is taken as 0.33 days (In LDR Concept it is 0.67 days)*

The recommended number of labor tables per health facility as per delivery load are:

< 20 deliveries /month	1
20-99 deliveries /month	2
100-199 deliveries /month	4
200-499 deliveries /month	6
>500 deliveries /month	to be calculated as per LDR concept

Conventional labor rooms will have all the facility of LDR complex but there is one labor room having required no of labor beds. Women are kept in separate area before and after delivery and are observed routinely for 2 hrs after child birth.

The labor tables should be placed in a way that there is a distance of at least 3' from the side wall, at least 2' from head end wall, and at least 6' from the second table in case of two-table labor room.

There should be a reception and registration area near the entry of the labor room complex that is separate from the regular in patient reception area of the mothers in labor and in emergency.

2. EQUIPMENT AND ACCESSORIES

All the labor rooms should have equipment and accessories with appropriate specifications and in adequate quantities, as per the recommendations[1,2] (Table 1)

Other equipment and supplies:

HIV Kits

Refrigerator

Wheel chairs and stretchers

Table 1: Equipment and Accessories

- Fetoscope
- Autoclaved delivery tray for each labor table
- Stethoscope
- Protein urea test kit
- Glucometer (calibrated for venous blood samples)
- Digital BP instrument
- Adult digital thermometer
- Wall clock with seconds hand 1 in each Labor room and 1 opposite to each NBCC
- Tags for mother and baby
- Cheatle forceps
- Disposable sterile gloves
- Disposable utility gloves
- A sterile tray with Sim's speculum and swab
- Hb test kit
- Sanitary napkins (@2for each delivery)
- Sterile pad (@4 sterile pads for each delivery)
- M C P card (one M C P card and a safe motherhood booklet for each delivery)
- Standardized Case sheet including the Safe Child birth Checklist and Partograph
- Disposable gowns for service provider and birth companion
- Disposable face masks and caps and shoe covers for service provider and birth companion
- protective eye cover for provider.
- Gown for mother
- Disposable sheet for covering labor table for each delivery
- Radiant warmer
- Baby digital thermometer
- Baby forehead thermometer
- Pediatric resuscitator bag (volume 250 ml) with masks of 0 and 1 size
- Baby weighing scale
- Mucus extractor
- Disposable baby receiving sheets
- Socks and caps for the baby (disposable)
- Disposable cord clamp
- Color coded buckets/ bins [yellow, red, blue & white (puncture proof for sharps)] with color-coded bags and biomedical waste segregation and disposal
- Hub cutter
- Plastic buckets of which the inner bucket should be perforated or fenestrated for chlorine solution.
- Mops with stand
- Overhead water storage tank
- Autoclave (electrical or gas stove)

(Only horizontal autoclaves to be used)

3. CONSUMABLES

Consumables such as cotton, thread, gauze, catgut, IV drip sets, needles, medicines-oral and parenteral, leucoplast, soap, hand-wash, betadine solution, mosquito repellent etc.

4. HUMAN RESOURCES

All the labor rooms should have human resources in adequate numbers strictly as per recommendations[1]. HR posted in Labor rooms should not be rotated outside the labor rooms. Number of Obstetricians, Medical officers, anesthetists, pediatrician, Staff nurses/ANMs/cleaning staff, guard should be as per number of deliveries and available cesarean facility.

All normal deliveries in labor room should be conducted by staff nurses. OBG, EmOC trained M O and anesthetists should also be available on call at all times.

5. PRACTICES AND PROTOCOLS

Triaging: Every client coming to the institution for delivery should be triaged into two categories by the examining obstetrician—category 1(Low risk cases) which can undergo a normal delivery by skilled birth attendants and category 2(High Risk cases) in which regular care by an obstetrician is needed. The institutions where there is an HDU, category 2 cases should be sent and category 1 cases should be delivered by the nurses in the labor rooms. The institutions managing category 2 cases, the obstetrician should be available all the time.

***Labor Room Protocols*:** Labor Room protocols should be in place regarding entry to labor room for women in labor and staff working in labor room, protocol for safe care in the labor room. There should be display of all essential practice protocols e.g. AMTS, Partograph, Essential Newborn care, hand washing etc.)

Essential Practices to be followed: The essential practices should be performed in all the delivery cases. (Table 2)

One should remember, induction/ augmentation should not be done routinely. Also, whenever needed, augmentation of labor should be done only in centers capable of performing cesarean sections.

Don'ts (harmful practices)

- No routine enema
- No routine shaving

Table 2 : Essential Practices for all Delivery Cases

At the time of admission	In Labor room	After Delivery
• Measurement of BP and temperature of mother • Measurement of Fetal Heart Rate • Measurement of Hemoglobin • Measurement of urine protein • Assessment of gestational age	• Partograph • Active management of third stage of labor • Delayed cord clamping • Essential newborn care Drying and wrapping of baby • Immediate resuscitation if required. • Skin to skin contact of the newborn • Immediate initiation of breastfeeding • Injection vitamin K ·	• Assessment of maternal bleeding • Assessment of newborn condition by measurement of temperature and respiratory rate • Assessment of maternal condition by measurement of BP and temperature

- No routine induction/augmentation of labor
- No place for routine suctioning of the baby
- No pulling of the baby. Allow natural slow delivery (3 minutes – 1min for head, 1 min for shoulders and 1min for body). Only assist when required at the time of delivery of body (prevents PPH)
- No routine episiotomy
- No fundal pressure
- No immediate cord cutting
- No immediate bathing of the newborn
- No routine resuscitation on warmer (every baby should not be kept on warmer unless there is an indication)

Skill Training The teams are being trained in the skill of conducting normal deliveries, identifying cases at risk and managing immediate complications. Uniform protocols for conduct of deliveries as developed by GOI should be followed.[1,2,3,]

Assessing pregnant women requiring HDU/ ICU care A maternal early warning system (Modified Obstetric Early Warning System) to assess women requiring special care is being tested. This includes regular recording of variables like, pulse, systolic blood pressure, diastolic blood pressure, respiratory rate, temperature, oxygen saturation, mental status (AVPU) and urine output. These are recorded on a colour-coded chart and if 2 or more values are in the yellow zone or 1 value is in the red zone, it is a trigger to scale up the care. This system is envisaged to be especially useful for use at the primary and secondary care levels to enable early recognition of critical conditions needing tertiary care referrals.

Bio-medical Waste (BMW) Management Biomedical waste is the waste that is generated during examination, immunization, investigations, diagnosis and treatment such as bandages or surgical sponges; which includes blood, blood products (fresh or dried blood) or other body fluids. There are three kinds of waste generally found in health facilities: general waste, medical waste, and hazardous waste. It is important to dispose all kinds of waste properly, since improper disposal of medical and hazardous chemical waste poses the most immediate health risk to the community[2].

Supportive supervision for quality of care Labor room should have a cleanliness checklist for cleanliness assessment. There should be periodic review of the availability of essential supplies. Senior faculty should observe practices to ensure all essential practices are being performed appropriately and in timely manner. Periodically a labor room practice review meeting should be organized at each facility.

CONCLUSION

Universal implementation of standard practices and adherence to the guidelines all over the country will definitely help in reducing maternal and perinatal mortality.

REFERENCES

1. Guidelines for Standardization of Labour Rooms at delivery points 2016 http://nhm.gov.in/images/pdf/programmes/maternal-health/guidelines/Labor_Room%20Guideline.pdf
2. Maternal and Newborn Health Tool Kit 2013 http://cghealth.nic.in/ehealth/2014/RMNCH_A/2Maternal_Newborn_Health_Toolkit.pdf
3. Daksh skill Labs for RMNCH-A services 2014 http://nhm.gov.in/images/pdf/programmes/maternal-health/guidelines/SKILLS_LAB_TRAINING_MANUAL_FACILITATOR.pdf and http://nhm.gov.in/images/pdf/programmes/maternal-health/guidelines/SKILLS_LAB_TRAINING_MANUAL_Participant%20.pdf

Do What You Can With All You Have,
Wherever You Are

- Theodore Roosevelt

Impact of Physiological Changes in Management of Critically Ill Obstetric Patient

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INTRODUCTION

Pregnancy is a period during which many physiological changes take place as an adaptation to support the growing fetus and to protect the mother during parturition. An understanding of these changes by the critical care physician and obstetrician is very important as the treatment strategies and goals change with respect to the altered physiology. Almost all the body systems undergo alterations during pregnancy, which includes the cardiovascular system, haematological system, respiratory system, gastrointestinal and urinary systems.

CARDIOVASCULAR SYSTEM

- The physiological and anatomical changes in the cardiovascular system during pregnancy, labor and parturition are described in Table 1. As is seen, the most prominent change is the increase in plasma volume, to the tune of 50% (Figure 1). This represents an increase of approximately 1500 mL, of which 1000 mL is plasma volume and 500 mL is erythrocytes[1]. This volume expansion may be even greater in multifetal gestations. However, the blood volume may expand little, if at all, in patients with severe preeclampsia or eclampsia.[2]

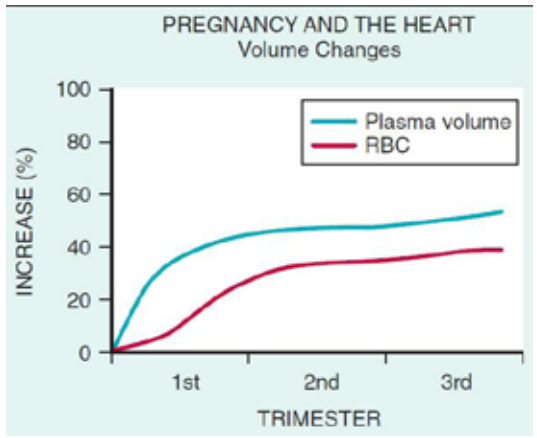

Fig. 1: Volume changes in pregnancy

- The other remarkable change is the increase in cardiac output by almost 40% (Figure 2). This translates to a cardiac output of 6L/min from a non-pregnant value of 4L/min[3]. The increase in heart rate and stroke volume is responsible for the increase in CO (CO=HR*SV).
- Systemic vascular resistance (SVR) is the afterload against which the heart must pump. It has been seen that there is a

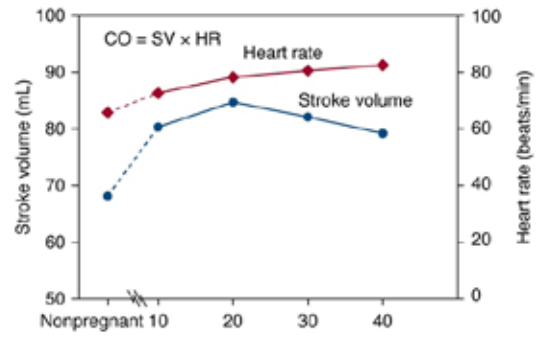

Fig. 2: HR & SV during pregnancy

Table1: Physiological and Anatomical changes in the cardiovascular system in pregnancy.

Parameter	Change	Antenatal period	Labor	Post partum
Plasma Volume	Increase 50%	Increases from 6 weeks, peaks 30- 32weeks	Remains Same	There is fall due to blood loss
Stroke volume	Increase 20%	Increases from early pregnancy Peaks at 20 weeks, gradually falls	During straining in 2nd stage(valsalva) there is a fall	Normal in 6 weeks
Heart rate	Increase 15-20 bpm	Rise more in 2nd half	Further rise seen	Prelabor level by 1 hour; normal in 6- 12 weeks
Arterial Blood Pressure*	Decrease 10-15%	Declines by 5-10mmHg in 2nd T, normal values in 3rd T	Rise by 10-25 % during contractions.	Normal values
Cardiac output**	Increase 40%	Increases from 8 weeks, peaks at 32 weeks	Further increase by 25-50%	Immediate post partum rise by 80%**;.pre labor level in 1 hr ;Normal by 6-12 wks
Uterine Blood Flow	~ 10 % of Cardiac ouput at term	-	-	-
Cardiac anatomy	Heart rotated cephalad and to the left, Increase chamber size, particularly the left atrium	-	-	-

*The reduction in blood pressure in pregnancy is predominantly secondary to a decrease in the diastolic component which in turn is due to reduction in systemic vascular resistance because of progesterone, and the development of the placenta, a low resistance vascular bed.

** The increased cardiac output that develops in pregnancy is further augmented during the third stage of labour as a result of auto-transfusion of blood from the utero-placental to maternal circulation as the uterus contracts

fall in SVR starting in early pregnancy, reaching a nadir at approximately 14–24 weeks of gestation, then rising to pre-pregnancy values by term.[3] The primary cause of the fall in SVR is likely to be peripheral arterial vasodilatation in early pregnancy, mediated by progesterone and vasodilators such as nitric oxide.[4]

CRITICAL IMPLICATIONS OF CARDIOVASCULAR CHANGES IN PREGNANCY

1. The absence of normal increase in blood volume and hemo-concentration in preeclampsia/eclampsia is responsible for poor tolerance of these patients to blood loss after vaginal or operative delivery as compared to normal patients. At the same time increased vascular permeability in these patients can lead to pulmonary oedema when vigorous intravenous fluids are given.
2. The normal increase in CO is not seen in certain cardiac conditions like severe mitral stenosis, which has more or less fixed output which leads to several critical hemodynamic changes in the mother. Besides, increase in blood volume and heart rate makes the patient of heart disease more vulnerable for heart failure.
3. This fall in SVR is very important to take into consideration when treating critically ill pregnant patients with sepsis, as the SVR in them is reduced due to endotoxins.
4. A fall in pulmonary vascular resistance (PVR) is also observed in normal pregnancy. The change in PVR may affect the shunting in pregnant patients with septal cardiac defects.
5. Another important cardio-vascular change in pregnancy which can affect the care of the critically ill gravida, is the decrease in venous return with a resultant drop in cardiac output in the supine position also called the supine-hypotension syndrome. This is of utmost importance in patients with fixed cardiac output states, e.g severe mitral stenosis; and in cases where a decrease in CO can be life threatening e.g severe aortic stenosis. Hence the importance of nursing these patients in the lateral position and of using a wedge while performing caesarean section cannot be undermined.
6. The decrease in the colloid osmotic pressure and the colloid osmotic pressure-pulmonary capillary occlusion pressure gradient during pregnancy makes these women susceptible to fluid overload and pulmonary oedema especially in the background of hypertensive disorders of pregnancy.
7. Many of the cardiovascular features which are encountered in cases of heart disease are also seen in normal pregnancy, which can lead to a diagnostic dilemma (Table 2).

Table 2: Cardiovascular features mimicking heart disease

- Signs
  - Peripheral edema
  - JVP
- Symptoms
  - Reduced exercise tolerance
  - Dyspnea
- Auscultation
  - S3 gallop
  - Systolic ejection murmur
- Chest x-ray
  - Change in heart position & size
  - Increased vascular markings
- EKG
  - Nonspecific ST-T wave changes
  - Axis deviation
  - LVH

HAEMATOLOGICAL SYSTEM

There are many haematological changes, during normal pregnancy. There is a drop in the haemoglobin by at least 1g/dl; this being mainly a result of increased plasma volume and dilutional effect. There is also a leukocytosis, especially during third trimester and labour, with the leukocyte count being on an *average 15000/μL and at times reaching as high as 25000/μL*[1,5]. This is a very important change which has to be interpreted cautiously as *it may lead to a wrong diagnosis of infection.* Platelet count may decrease marginally because of hemodilution though there may be a rise in platelet volume. The condition known as "gestational thrombocytopenia" may be seen in 5-10% of the pregnant women and is a diagnosis of exclusion, after ruling out other common causes e.g, preeclampsia, folate deficiency, lupus and autoimmune thrombocytopenic purpura[6].

Pregnancy is a procoaguable state which is a physiological mechanism to decrease blood loss during parturition. However it is a double edged sword as it makes a pregnant woman more prone to venous thromboembolism by 4-6 fold[7]. The levels of factors VII, VIII, IX, X, XII, fibrinogen and Von Willerband factor increases whereas the levels of natural anticoagulants antithrombin III and protein C are unchanged or increased, whereas protein S levels fall. Fibrinolytic activity also decreases, mainly due to a sharp rise in the plasminogen activator inhibitors.

RESPIRATORY SYSTEM

The respiratory tract undergoes many changes during pregnancy, mediated initially by changes in the endocrine system and later by the enlarging uterus, in order to provide oxygen for increased maternal demands and for fetal physiology. These changes act to lower maternal PCO2 to half that of the fetus, thereby facilitating more effective gas exchange.

Oxygen consumption in pregnancy increases by 30–50 mL/min, two-thirds of which covers additional maternal requirements (mainly the kidneys) and one-third is for the developing fetus. Under the effect of progesterone there is an increase in the depth of respiration though the rate remains fairly constant. *The minute volume which is product of respiratory rate and tidal volume and is defined as the amount of air moved into and out of the lungs in 1 minute,*

Table 3: Normal ABG values in non-pregnant and pregnant women

Parameter	Non pregnant	Pregnant
pH	**7.35-7.45**	**7.40-7.46**
pCO_2	35-45 mmHg	27-34 mmHg
pO_2	80-100 mmHg	95-105 mmHg
HCO_3	22-26 meq/l	18-21 meq/l
SPO_2	93-100%	95-100%

is increased in pregnancy because of increase in the tidal volume by 40%[6]. The minute volume also increases by 40%, from 7.5 L/min to 10.5 L/min[8]. This results in a fall in the arterial pCO2 from a normal of 40mmHg to a level of 30mmHg in pregnancy. To compensate for this respiratory alkalosis there is an increased excretion of the bicarbonate by the kidneys, leading to a fall of serum bicarbonate to about 20 mEq/L from a normal of 24 mEq/L. *This compensated respiratory alkalosis can result in a decreased buffering capacity for further metabolic acidosis (as in sepsis).*

The arterial blood gas analysis in pregnancy is also altered, with the pH being more towards alkaline side (Table 3).

Besides these changes there are other changes, such as decrease in the expiratory reserve volume and residual volume, leading to decrease in functional residual capacity by about 500ml. However it is the 20% fall in residual volume which further increase alveolar ventilation. *The decrease in functional residual capacity can result in rapid fall in oxygen in response to respiratory insults.* Vital capacity, which is the maximum volume of air expired after maximum inspiration however remains unchanged in pregnancy.

Due to the requirements of the fetus, the goals of respiratory support are different, for achieving adequate fetal oxygenation. PaO2 of 70mmHg and SpO2 of 95% are required to meet this (vs 55mmHg and 88% in non pregnant).

URINARY SYSTEM

The renal pelvis, calyces and ureters increase in size due to the rising progesterone levels. The enlarging uterus may also cause compression of the ureturs at the pelvic brim resulting in mild to moderate hydronephrosis, which is more pronounced on the right side. By the third trimester, 80% of women will have evidence of hydronephrosis[9]. *The result of these changes is mild obstruction and urinary stasis, increasing the risk of infection and*

Table 4: Changes in the thyroid hormones during pregnancy

NORMAL CHANGES IN PREGNANCY	
Physiological Changes	**Impact**
Iodine clearance (renal & transplacental)	Relative iodine deficiency state Risk of fetal & Maternal hypothyroidism
Plancental deiodination of T4	T4 → Reverse T3
TBG ↑	TT3 & TT4 levels ↑ FT4 same
1st trimester HCG ↑ (Weak TSH effect)	FT4 ↑ & TSH ↓ Fetal & placental devp
3rd trimester – placenta enlarge, preparation for delivery	FT4 ↓ & TSH ↑ Mild hypothyroidism
TSHR Ab reduced	Grave's disease improvement
Postpartum increase in thyroid Ab	Postpartum thyroiditis Grave's disease exacerbation

misinterpretation of diagnostic imaging.

There is an increase in the renal blood flow and glomerular filtration rate by about 50%. The daily urine output however is not altered to a significant extent. The serum urea and creatinine hence are reduced and the normal *upper limit of serum creatinine is considered to be 0.8mg/dl*.

Loss of glucose through the kidneys is normal in pregnancy due to increased GFR and reduced distal tubular re-absorption; therefore, screening for gestational diabetes using urinalysis alone is unreliable. Alteration in GFR also causes an increase in the urinary protein excretion. It was seen that the 95th percentile of urinary protein excretion in normal pregnant patients over 24 hrs was 260 mg/day[10], which justifies the cut off of 300mg /day for defining preeclampsia.

In pregnancy there occurs a marked rise in all components of the renin-angiotensin system. resulting in a large increase in extracellular water volume (by 4–7 L) and retention of sodium and water, which acts to maintain normal blood pressure. *This water retention causes a decrease in plasma sodium from 140 to 136 mmol/L*

The clinical significance of high GFR becomes more significant when considering the drug levels in some conditions, e.g, in epileptics on phenytoin, where the drug levels in the serum become lower during pregnancy, which may necessitate changes in the dosage.

A very important point of consideration is, that the blood supply of the kidney is the first to be compromised in case of any obstetric haemorrhage, as physiologically the body does not recognize kidneys as a priority area. Hence the perfusion rapidly falls and acute tubular necrosis is a common occurrence in obstetric patients who have been haemodynamically challenged. Immediate and aggressive fluid resuscitation is essential to prevent this dreaded complication.

GASTROINTESTINAL TRACT

The progestogenic effect leads to a lower sphincter tone; and this along with raised intragastric pressures due to the effect of the growing uterus leads to reflux and heartburn. *The decreased gastric emptying time seen typically during labor, can give rise to aspiration during general anaesthesia*.

The stasis of the gall bladder predisposes a pregnant woman to stone formation. *The alkaline phosphatise may be increased due to placental production* and does not necessarily indicate hepatic obstruction. However the elevated transaminase levels do indicate an underlying pathology as they are not altered during pregnancy.

THYROID GLAND

The dynamics of the thyroid hormones undergo several changes as the pregnancy progresses. The clinician should be familiar with this so as to interpret the values correctly in the context of the trimester of pregnancy (Table 4)

CONCLUSION

- Profound changes in physiology and anatomy take place in pregnancy
- These affects most organ systems
- Can dramatically impact treatment of critically ill women
- Almost all clinicians will encounter and treat pregnant women at some time
- Under-appreciation of changes will lead to suboptimal treatment or outright mistakes

REFERENCES

1. Cunningham FG, Leveno KJ, Bloom SL, et al: Maternal physiology. *In:* Williams Obstetrics. Twenty-Second Edition. New York, McGraw-Hill, pp 121–150
2. Zeeman GG, Cunningham FG: Blood volume expansion in women with antepartum eclampsia. Presented at the Annual Meeting of the Society for Gynecologic Investigation, Los Angeles, CA, March 18, 2002
3. Bosio PM, McKenna PJ, Conroy R et al. Maternal central hemodynamics in hypertensive disorders of pregnancy. Obstet Gynecol 1999; 94: 978–984.
4. Weiner CP, Knowles RG & Moncada S. Induction of nitric oxide synthases early in pregnancy. Am J Obstet Gynecol 1994; 171: 838–843.
5. Taylor DJ, Phillips P, Lind T: Puerperal haematological indices. *Br J Obstet Gynaecol* 1981; 88:601
6. Yeomans ER, Gilstrap LC. Physiologic changes in pregnancy and their impact on critical care. Crit care med 2005;33 (suppl):5256-258
7. Heit JA, Kobbervig CE, James AH et al. Trends in the incidence of venous thromboembolism during pregnancy or postpartum: a 30-year population-based study. Ann Intern Med 2005; 143: 697–706.
8. Spatling L, Fallenstein F, Huch A et al. The variability of cardiopulmonary adaptation to pregnancy at rest and during exercise. Br J Obstet Gynaecol 1992; 99(Suppl 8): 1–40.
9. Carlin A, Alfirevic z. Best Practice & Research Clinical Obstetrics and Gynaecology Vol. 22, No. 5, pp. 801–823, 2008
10. Higby K, Suiter CR, Phelps JY, et al: Normal values of urinary albumin and total protein excretion during pregnancy. *Am J Obstet Gynecol* 1994; 171:984 –989.

You Are Never Too Old
To Set Another Goal Or To Dream A New Dream

- C.S. Lewis

Antimicrobials in Sepsis: An Update

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INTRODUCTION

Antimicrobial therapy plays a crucial role in the management of patients with sepsis and septic shock. In sepsis, mortality is not necessarily caused by infection itself, but also by the physiologic response to infection that leads to multi-organ dysfunction. Therefore, starting antimicrobials early after recognition of sepsis not only prevents injury caused by the microbial activity and toxin production but also modifies host responses to infection, thereby averting further damage caused by the sepsis.

INTERNATIONAL GUIDELINES FOR MANAGEMENT OF SEPSIS AND SEPTIC SHOCK (2016)[1]

- Administration of IV antimicrobials as soon as possible after recognition and within one hour for both sepsis and septic shock (strong recommendation, moderate quality of evidence). Each hour delay in the administration of antimicrobial therapy is associated with substantial increase in mortality, adjusted OR 1.119 per hour delay, 95% CI 1.103-1.136, p<.0001.[2]
- Appropriate routine microbiologic cultures (including blood) should be obtained before starting antimicrobial therapy in such patients if doing so results in no substantial delay in the start of antimicrobials (BPS). However, if there is delay in obtaining culture samples antimicrobial therapy should be initiated.
- Empiric broad-spectrum therapy with one or more antimicrobials are recommended for these patients to cover all likely pathogens (including bacterial and potentially fungal or viral coverage) (strong recommendation, moderate quality of evidence).

As compared to monotherapy, multidrug antibiotic therapy is associated with decreased 28-day mortality, 36.3% and 29%, respectively, HR 0.77; 95% CI 0.67–0.88.[3] The survival rates are better with appropriate than inappropriate initial antimicrobial therapy, 52.0% and 10.3%, respectively, OR 9.45; 95% CI, 7.74 to 11.54; p < 0.0001.[4]

However, the choice of empiric antimicrobial regimens in patients with sepsis and septic shock are complex and should be according to the anatomic site of infection, properties of antimicrobials to penetrate that site, prevalent pathogens within the community & hospital, resistance patterns of these pathogens, the presence of invasive devices, patient's comorbidities and immune status.

- Dosing strategies of antimicrobials should be optimized based on accepted pharmacokinetic/pharmacodynamics principles and specific drug properties in patients with sepsis or septic shock.(BPS)

Patients with sepsis have an increased volume of distribution due to the rapid expansion of extracellular volume as a consequence of aggressive fluid resuscitation. This leads to suboptimal drug levels of antimicrobials in these patients.[5,6] As appropriate antimicrobial dosing is central in improving outcome, antimicrobial therapy in these patients, should always be initiated with a full, high end-loading dose of each agent used. Even in patients with altered renal function, full loading dose of antimicrobials should be given and adjustments are only required in calculating total dose and dose frequency.

Also, different antimicrobials have different required plasma targets for optimal outcomes.

- ✓ For aminoglycosides and fluoroquinolones, clinical success depends on higher peak plasma levels in relation to pathogen minimum inhibitory concentration (MIC).
- ✓ For Vancomycin, higher trough plasma concentration (lowest concentration reached, before the next dose of antimicrobial) is required
- ✓ For Beta-lactams, longer duration of plasma concentration above the pathogen MIC is required for superior microbiological and clinical cures

This can be achieved by once daily dosing for aminoglycosides, optimizing dose within a nontoxic range for fluoroquinolones, administering loading dose according to the actual weight of patient for vancomycin and by increasing the frequency of dosing for beta lactams. For example, Gentamicin administered as 5-7 mg/Kg every 24 hours, Ciprofloxacin as 500mg every 12 hours, levofloxacin 750 mg every 24 hours, vancomycin as loading dose of 25-30 mg/kg (instead of usual 1 gram) and piperacillin/tazobactam as 3.75 mg 6 hourly (instead of 4.5 mg 8 hourly).[7,8,9]

- Antimicrobial therapy should be narrowed after pathogen identification and sensitivities are established and/or adequate clinical improvement is noted. Systemic antimicrobial prophylaxis should not be given to patients with severe inflammatory states of noninfectious origin (BPS)
- Combination therapy (administering more than one antimicrobials) is not routinely recommended for ongoing treatment of most serious infections, including bacteremia and sepsis without shock (weak recommendation, low quality of evidence). However, this does not preclude the use of multidrug therapy to broaden antimicrobial activity.

  Combination antimicrobial therapy targets and accelerates clearance of a suspected or known pathogen rather than broadening antimicrobial coverage. Multidrug therapy refers to administering multiple antimicrobials to broaden the spectrum of therapy.
- If combination therapy is initially used for septic shock, de-escalation with discontinuation of combination therapy within the first few days should be done in response to clinical improvement and/or evidence of infection resolution. This applies to both targeted (for culture-positive infections) and empiric (for culture-negative infections) combination therapy (BPS)
- Antimicrobial treatment duration of 7 to 10 days is adequate for most serious infections associated with sepsis and septic shock. Longer courses can be given to patients who have a slow clinical response, undrainable foci of infection, bacteremia with S aureus, some fungal and viral infections, or immunologic deficiencies, including neutropenia. (weak recommendation, low quality of evidence)
- Shorter courses are appropriate in patients with rapid clinical resolution following effective source control of intra-abdominal or urinary sepsis and those with anatomically uncomplicated pyelonephritis (weak recommendation, low quality of evidence)
- Patients with sepsis and septic shock should have daily assessment for de-escalation of antimicrobial therapy in (BPS)
- Procalcitonin levels can be used to support shortening of the duration of antimicrobial therapy and discontinuation of empiric antibiotics in patients who initially appeared to have sepsis, but subsequently have limited clinical evidence of infection (weak recommendation, low quality of evidence)

- Specific anatomic diagnosis of infection requiring emergent source control should be identified or excluded as rapidly as possible in patients with sepsis or septic shock. Measures to control source of infection be implemented as soon as medically and logistically practical after the diagnosis is made (BPS).
- Intravascular access devices that are a possible source of sepsis or septic shock should be promptly removed after other vascular access has been established (BPS).

TIMING OF ANTIMICROBIALS ADMINISTRATION

Funk et al stated, if "Time is tissue" when it comes to thrombolytic therapy for acute myocardial infarction and thrombotic stroke, then an appropriate rule for life-threatening infections, particularly septic shock, is "Speed is life."[10]

However, there could be barriers to timely administration of antimicrobials either due to delayed recognition of sepsis and septic shock or delay in administering antimicrobials due to limited vascular access and need for lengthy infusions. Various policies have been proposed to minimize delay in starting antimicrobials, like administering antibiotics prior to transfer from emergency rooms, to order all initial IV antibiotics as stat doses, administering 1st dose of antibiotics as bolus and to use standardized treatment approach based on symptom-based treatment pathway & sepsis protocols.[1]

ANTIMICROBIAL PROTOCOLS FOR OBSTETRIC INFECTIONS

(Recommendations as per National Treatment Guidelines for Antimicrobial Use in Infectious Diseases for obstetric infections)[11]

For sepsis in Pregnancy/after pregnancy- Piperacillin-Tazobactam 4.5 g IV 6 hourly or Cefoperazone+Sulbactam 3 g IV 12 hourly and MRSA cover with Vancomycin/ Teicoplanin may be required if suspected or colonized.

For septic abortion/Endomyometritis/Septic Pelvic Vein Phlebitis- Empirical therapy with Ampicillin 500 mg 6 hourly + Metronidazole 500 mg IV 8 hourly. In case of previous partial treatment with antibiotics, send blood cultures and start Piperacillin-Tazobactam or Cefoperazone-sulbactam till the sensitivity report is available. Alternative regimen- Ceftriaxone 2g IV OD.

For uncomplicated Pyelonephritis- Empirical therapy with Amikacin 1 g OD IM/IV or Gentamicin 7 mg/kg/day OD, Alternative regimen- Piperacillin-Tazobactam 4.5g IV 6 hourly or Cefoperazone+Sulbactam 3 g IV 12 hourly or Ertapenem 1 g IV OD

For complicated Pyelonephritis- Empirical therapy with Piperacillin-Tazobactam 4.5 gm IV 6 hourly or Amikacin 1 g OD IV or Cefoperazone-Sulbactam 3gm IV 12 hourly. Alternative regimen- Imipenem 1g IV 8 hourly or Meropenem 1gm IV 8 hourly. De-escalate to Ertapenem 1 gm IV OD, if Imipenem/meropenem is initiated. Monitor renal function if aminoglycoside is used.

For necrotizing fasciitis- Empirical therapy with Piperacillin-Tazobactam 4.5 gm IV 6 hourly or Cefoperazone-Sulbactam 3 gm IV 12 hourly + Clindamycin 600-900 mg IV 8 hourly. Alternative regimen- Imipenem 1g IV 8 hourly or Meropenem 1gm IV 8 hourly + Clindamycin 600-900 mg IV TDS/linezolid 600 mg IV BD/daptomycin 6mg/kg/day. Alternative regimen- Ceftriaxone 2g IV OD.

For secondary peritonitis, Intra-abdominal abscess/ GI perforation- Empirical therapy with Piperacillin-Tazobactam 4.5 gm IV 8 hourly or Cefoperazone-Sulbactam 3 gm IV 12 hourly, In sick patients-fluconazole iv 800 mg loading dose day 1, followed by 400 mg OD. Alternate regimen- Imipenem 1g IV 8 hourly or Meropenem 1gm IV 8 hourly or Doripenem 500 mg 8 hourly or Ertapenem 1 gm IV OD. *Source control is important to reduce bacterial load, if excellent source control is achieved antimicrobials for 5-7 days; otherwise 2-3 weeks.*

For community acquired Pneumonia- Empirical therapy- Amoxycillin-clavulanate 1.2 g IV TDS Or Ceftriaxone 2g IV OD Duration 5-8 days. Alternative regimen- Piperacillin-Tazobactam 4.5 gm IV 6 hourly or Imipenem 1g IV 6 hourly or Cefoperazone-Sulbactam 3 gm IV 12 hourly. If MRSA is a concern- add Linezolid 600mg IV/Oral 12 hourly. If atypical pneumonia suspected- Doxycycline 100mg 12 hourly or Azithromycin 500 mg oral/IV OD.

For mastitis with abscess- Drainage with antibiotic cover for MRSA, Clindamycin 300 QID or Vancomycin 15 mg/kg IV 12 hourly (maximum 1gm 12 hourly) Or Teicoplanin 12 mg/kg IV 12 hourly x 3 doses followed by 6 mg once daily IV

For ventilator Associated Pneumonia- Beta Lactam + beta lactamase inhibitor- Piperacillin/ Tazobactam Plus Aminoglycoside (Amikacin, Gentamicin, or Tobramycin) OR Antipseudomonal fluroquinolone (Cipro/ Levofloxacin), For MRSA- Vancomycin or Linezolid. Second line Therapy- Meropenem 60 mg/kg/day I/V every 8 hrly and Vancomycin 40 mg/kg/day I/V every 6-8 hourly. Third line Therapy- Colistin base IV 2.5-5 mg/kg/day I/V every 6-12 hrly (1mg= 30000 IU) and Vancomycin - 40 mg/kg/day I/V every 6-8 hourly

CONCLUSION

Key to mortality reduction in sepsis and septic shock is, to administer early and appropriate antimicrobials. Early refers to antimicrobials within 1 hour after recognition of potential septic shock; and appropriate refers to antimicrobials with, in-vitro activity against all suspected pathogens, penetration of suspected anatomical site of infection, proper route, dose and frequency of administration.

REFERENCES

1. Rhodes A, Evans LE, Alhazzani W, Levy MM, Antonelli M, Ferrer R, et al. Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock: 2016. Intensive Care Med. 2017;43(3):304-377.
2. Kumar A, Roberts D, Wood KE, Light B, Parrillo JE, Sharma S, et al. Duration of hypotension before initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock. Crit Care Med. 2006;34(6):1589-96.
3. Kumar A, Zarychanski R, Light B, Parrillo J, Maki D, Simon D et al. Early combination antibiotic therapy yields improved survival compared with monotherapy in septic shock: a propensity-matched analysis. Crit Care Med. 2010;38(9):1773-85.
4. Kumar A, Ellis P, Arabi Y, Roberts D, Light, Parrillo JE, et al, Initiation of inappropriate antimicrobial therapy results in a fivefold reduction of survival in human septic shock. Chest. 2009;136(5):1237-1248.
5. Pletz MW, Bloos F, Burkhardt O, Brunkhorst FM, Bode-Böger SM, Martens-Lobenhoffer J, et al. Pharmacokinetics of moxifloxacin in patients with severe sepsis or septic shock. Intensive Care Med 2010; 36:979-83.
6. Blot S, Koulenti D, Akova M, Bassetti M, De Waele JJ, Dimopoulos G, et al. Does contemporary vancomycin dosing achieve therapeutic targets in a heterogeneous clinical cohort of critically ill patients? Data from the multinational DALI study. Crit Care. 2014;18(3):R 99.
7. Barza M, Ioannidis JP, Cappelleri JC, Lau J. Single or multiple daily doses of aminoglycosides: a meta-analysis. BMJ. 1996 Feb 10;312(7027):338-45.
8. Men P, Li HB, Zhai SD, Zhao RS. Association between the AUC0-24/MIC Ratio of Vancomycin and Its Clinical Effectiveness: A Systematic Review and Meta-Analysis. PLoS One. 2016; 11(1): e0146224.
9. Zelenitsky S, Rubinstein E, Ariano R, Iacovides H, Dodek P, Mirzanejad Y,et al. Vancomycin pharmacodynamics and survival in patients with methicillin-resistant Staphylococcus aureus-associated septic shock. Int J Antimicrob Agents 2013; 41:255–260.
10. Funk DJ, Kumar A. Antimicrobial therapy for life-threatening infections: speed is life. Crit Care Clin. 2011;27(1):53-76.
11. National Treatment Guidelines for Antimicrobial Use in Infectious Diseases. National Centre for Disease Control, Directorate General of Health Services, Ministry of Health & Family Welfare, Government of India. Version 1.0 (2016). http://pbhealth.gov.in/AMR_guideline7001495889.pdf.

Blood Transfusion: What and When and How?

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INTRODUCTION

Hemorrhage is the leading cause of intensive care unit admission and one of the leading causes of death in the obstetric population.[1]This highlights the significance of an in depth understanding of the indications for and complications associated with blood product replacement in obstetric practice. Moreover, it becomes incumbent on the part of physician to be sure that a particular blood product is indicated and that standard transfusion practices as well as precautions are practiced.

The aims of blood transfusion (BT) are to increase the oxygen carrying capacity of blood by giving red blood cells, to restore the blood volume so as to maintain effective tissue perfusion and to replace platelets, coagulation factors and other plasma proteins. The decision of blood transfusion in a critically ill patient should be made judiciously, balancing between the benefits and risks.

INDICATIONS OF BLOOD TRANSFUSION IN OBSTETRICS PATIENTS[2,3]

I. *Antepartum Period*

1. **Pregnancy <34 weeks**
   a. Hb <5gram% even without clinical signs of cardiac failure or hypoxia.
   b. In 5-7 gram % in presence of impending heart failure.
2. **Pregnancy >34 weeks**
   a. Hb <7gram% even without clinical signs of cardiac failure or hypoxia.
   b. Patient with severe anemia who is decompensated.
3. **Anemia not due to hematinic deficiency** (e.g. Hemoglobinopathy or Bone marrow failure syndromes). Hematologist should always be consulted.
4. **Acute Hemorrhage**
   a. Always indicated if Hb <6gm%
   b. If patient becomes hemodynamically unstable due to ongoing hemorrhage.

II. *Intrapartum Period*

a. Hb <7gram% (in labor); Decision of BT depends on medical history or symptoms.

III. *Postpartum Period*

a. Anemia with signs of shock/ acute hemorrhage with signs of hemodynamic instability.

b. Hb <7gm% (postpartum); Decision of BT depends on medical history or symptoms.

BLOOD TRANSFUSION IN SPECIAL CONDITIONS

Post operative period[4]

In hemodynamically stable post-operative surgical patients, transfusion should be considered if Hb<=8g/dl or in presence of symptoms of inadequate oxygen delivery(chest pain of cardiac origin, orthostatic hypotension or tachycardia unresponsive to fluid resuscitation or congestive heart failure).

Patients in the intensive care unit and with sepsis[5]

- In critically ill, normovolaemic patients, transfusion is considered at a Hb level of ≤7 mg/dl with a target of 7-9 g/dl.
- During the early resuscitative phase of severe sepsis if there is evidence of inadequate oxygen delivery to the tissues (central venous oxygen saturation <70%, mixed venous oxygen saturation <65% or lactate concentration >4 mmol/L), blood transfusion is considered to achieve a target Hb of 9-10 g/dl.
- In the later phases of severe sepsis, the guidelines are similar to those for other critically ill patients with target Hb of 7-9 g/dl.
- Blood transfusion should not be used to assist weaning from mechanical ventilation if the Hb is >7 g/dl.

VARIOUS BLOOD PRODUCTS TRANSFUSED IN CLINICAL PRACTICE

Whole blood

A unit of whole blood has a volume of 350 ml and one unit increases hemoglobin by 1 g/dl and hematocrit by 3%. It is used in case of non-availability of Packed Red Blood Concentrates(PRBCs). There is no justification for whole blood transfusion to stop bleeding due to coagulopathies. It must be used within 30 minutes of removing from refrigerator. The rate of transfusion should be 150-200 ml/hr and should be completed within 4 hours (discard unit if this period has exceeded). ABO and Rh compatibility and Cross matching is a must. However, in emergency, till availability of compatible blood, O negative blood can be used.

Packed Red Blood Cell Concentrates(PRBCs) /Packed Cell Volume(PCV)/Red Cell Concentrates(RCC)/Plasma Reduced Blood(PRB)[2,3]

A unit of PRBC has a volume of 200 ml and one unit increases hemoglobin by 1 g/dl and hematocrit by 3%. Its indicated in cases with severe anemia during pregnancy associated with maternal decompensation, severe acute blood loss following spontaneous delivery or cesarean section, intrapartum Hb < 7 gm%, replacement of acute blood loss in obstetric hemorrhage along with other components and post-partum anemia with signs of shock. It must be used within 30 minutes of removing from refrigerator and should be completed within 4 hours (discard unit if this period has exceeded). The rate of transfusion should be 150-200 ml/hr. The target Hb to be achieved is 7-9 gm/dl. ABO and Rh compatibility and cross matching is a must. In emergency, till availability of compatible blood, O negative blood can be used.

Platelet Rich Plasma (PRP)

1 PRP unit has 50-70 ml volume and increases platelet count by 5-8x10^9/l. One Platelet pharesis unit increases platelet by 40-50x10^9/l. It is indicated in bleeding due to thrombocytopenia, with count less

than $50X10^9$/l where surgery or delivery is anticipated and cases where platelet count is less than $20X10^9$/l. The rate of transfusion should be 50-150 ml/hr. A unit of PRPs should be transfused immediately and should be completed within 30 minutes of removal from optimal storage condition. The target platelet count to be achieved is $50X10^9$/l . ABO and Rh compatibility is needed.

Fresh Frozen Plasma(FFP)[6]

1 unit of FFP has 50-70ml volume and 1 ml of FFP contains 1 unit of coagulation factor activity. It is indicated for replacement of multiple coagulation factors, Disseminated Intravascular Coagulation (DIC), depletion of coagulation factors with patients with large amount of transfusion and warfarin overdose. The dose of FFP is 12-15ml/kg and rate of transfusion is 150-300 ml/hr. It should be transfused as soon as possible preferably, but can be done within 6 hours of thawing and must be completed within 30 minutes. The aim of transfusion is to achieve target PT and APTT INR less than 1.5. ABO compatibility is needed; however cross matching is not required. Anti D prophylaxis is not needed, if Rh negative women has received Rh positive FFP.

Cryoprecipitate[6]

It is indicated in correction of microvascular bleeding in massively transfused patients with hypofibrinogenemia. It has no advantage over FFP and is especially useful in patients who need fluid restriction. The rate of transfusion should be 150-300 ml/hr. It should be transfused as soon as possible preferably but can be done within 6 hours of thawing. The transfusion should be completed within 30 minutes. The target is to achieve Fibrinogen level more than 150 mg/dl. Although ABO compatibility is preferred but not essential. 1 unit/10 kg body weight raises plasma fibrinogen by 50mg/dl. Anti D prophylaxis is not needed, if Rh negative women receive Rh positive cryopecipitate.

Newer Alternative : Recombinant Factor VIIa (*rFVIIa)*

It is a promising new alternative to blood component therapy. The mechanism of action is to augment the intrinsic clotting pathway by binding with tissue factor and directly activating factors IX and X. Its use may be considered as a treatment for life-threatening postpartum hemorrhage (PPH), but should not delay or be considered a substitute for a live-saving procedure such as embolisation or surgery, or transfer to a referral centre.[6] The most commonly reported effective dose is 50-100 ug/kg intravenously every 2 hours until hemostasis is achieved, with vast majority of patients requiring only one dose.[7] There is no evidence to support the prophylactic use of rFVIIa to reduce blood loss for caesarean section.[4] It is important to ensure adequate levels of platelets and clotting factors because rFVIIa increases clotting by acting on these subtrates.[8] There is no risk of viral transmission as the drug is derived from recombinant technology.

MASSIVE BLOOD TRANSFUSION

In patients, likely to need massive transfusion, resuscitation is started with blood products as soon as possible to prevent dilution coagulopathy. The blood products are administered in a ratio of 4 unitsRCCS:4 units FFP: 4 units Platelets: 4 units cryoprecipitate.

PROTOCOL TO BE FOLLOWED FOR BLOOD TRANSFUSION

Once the decision to transfusion has been made, everyone involved in the transfusion process must ensure that right blood gets to right patient in right time.

CHECKLIST[8,9]

- Verify patient/component compatibility and identity; done by two people, atleast one of whom should be a doctor or registered nurse.
- Donation number on blood bag label should match the accompanying document.
- Check blood bag for signs of hemolysis, clotting or contamination; Check for any leaks/seal/discoloration.
- BT SET: must be new (170-200u filter). Change the set atleast 12 hourly during BT or after every four units of blood.
- Use slow infusion through 21-25 G cannulas; for rapid infusion, use large bore cannulas e.g.14 G.
- Platelets should be administered before Red Cell Concentrate(RCC) with same set and if it is to be used after RCC transfusion, use a separate BT set.
- Start BT; Note baseline observations, encourage patient to notify in case of discomfort, shivering, itching, flushing, shortness of breath. Ensure patient is in setting, where can be directly observed.
- Monitoring
  - ✓ Before start of BT [record baseline observations; general condition(GC), temperature, pulse rate(PR), blood pressure(BP), respiratory rate (RR)and fluid balance (intake/output charting].
  - ✓ Monitoring is continued 15 minutes after starting transfusion, atleast every hour during transfusion and on completion of transfusion and four hours after completion of transfusion.
- Documentation
  - ✓ Informed Consent. If patient is not in a condition to give consent, retrospective consent can be taken once she recovers.
  - ✓ Reason for transfusion, and signature of the person administering.
  - ✓ Record GC, PR, BP, RR before, during and on completion of the transfusion. Record the volume and type of blood products transfused, unique donation no. of all products transfused, blood group, time of start and completion of transfusion and any adverse effect.
  - ✓ Note type and volume of each unit transfused.
- The blood component pack with the BT set should be stored for 24 hours in case adverse reaction investigations need to be carried out.
- In case of any transfusion reaction the transfusion is stopped and blood product returned to blood bank with the bag and BT set and maternal blood sample with details of reaction documented on the transfusion reaction form.

IMPORTANT ASPECTS

There is no evidence of benefit of warming blood, when transfusion is slow. Keeping patient warm is more important than warming the blood. Warmed blood is needed for large volume rapid transfusion in adults>50 ml/kg/hour. Routine use of pre-medication is not recommended. Use separate i/v line for fluids or I/V drugs.[8,9]If a patient needs more than three units of blood within 24 hours, then calcium must be administered.

TRANSFUSION REACTIONS

Acute transfusion reactions must be recognised and managed efficiently. The severity of the reactions can be categorized as mild, moderate and severe category.

Category1: Mild- The earliest sign is urticarial rash leading to pruritis due to hypersensitivity reaction. On recognition, the transfusion should be slowed and antihistamine should be administered intramuscularly. If there is no improvement within 30 minutes or there is worsening, treat as moderate category.

Category2: Moderately severe- Flushing, urticaria, rigors, fever, restlessness and tachycardia. Patient complain of anxiety, pruritis, palpitations, mild breathlessness and headache. Immediately transfusion, should

be stopped. This is due to hypersensitivity or febrile-non- hemolytic transfusion reaction. Airway should be managed and oxygen administered. The blood unit with BT set, freshly collected urine and new blood sample (plain and EDTA vial) should be returned to the blood bank. Antihistamine, IV corticosteroid and bronchodilators (if bronchospasm) should be given. If there is clinical improvement, restart the transfusion slowly with new blood unit. However if there is no clinical improvement within 15min or there is worsening, treat as category 3. Collect urine for next 24 hours for evidence of hemolysis. If available, WBC filter may be used in repeated transfusion.

Category 3: Life Threatening- Rigors, fever, restlessness, hypotension, tachycardia, hemoglobinuria and unexplained bleeding(DIC).The patient may complain of anxiety, chest pain, pain along transfusion line, respiratory difficulty, loin/back pain and headache. The reason for severe reaction may be acute intravascular hemolysis, bacterial contamination, septic shock, fluid overload, anaphylaxis, or Transfusion Related Acute Lung Injury(TRALI). On recognition of this category, stop transfusion and manage as in category 2. Adrenaline (1:1000) can be given in the dose of 0.01mg/kg body wt as slow intramuscular injection. Senior doctor must be notified. New blood sample should be sent. 24 hour urine sampling should be done and intake output monitoring to be done. Bleeding from puncture sites and wounds should be assessed to rule out DIC. If patient is hypotensive, crystalloids and/or inotropes should be given. Acute Renal Failure(ARF) and bacteremia should be managed (if present).

IN ALL CASES OF REACTIONS

- Report all BT reactions to blood bank and doctor responsible for the patient.
- Record, type of transfusion, time lapse between start of transfusion and reaction; volume and bag number.
- Immediately take blood sample from different site for - repeat ABO/Rh/ antibody screen and cross match, CBC, coagulation screen, urea and creatinine, electrolyte.
- Return to blood bank: blood bag and BT set, blood culture in blood culture bottle, first specimen of patient's urine following reaction and completed transfusion reaction form.

CONCLUSION

Blood and its components are life-saving but with inherent risks. So a blood transfusion should be ordered judiciously based on benefits versus risks assessment. The collected blood should be separated into its components and used in conditions with specific requirements for optimal utilization. The aim should be to minimize unnecessary blood transfusions, thereby promoting proper use. Recombinant factor VIIa is a new adjunct for treatment of massive hemorrhage and should be considered, if available. Early recognition of BT reactions and their management can help in reducing morbidity.

REFERENCES

1. Heinonen S, Tyrvainen E, Saarikoski S, et al. Need for maternal critical care in obstetrics: a population based analysis. Int J Obstet Anesth 2002;11(4):260–4.
2. Treatments for iron-deficiency anaemia in pregnancy.Available online at http://apps.who.int/rhl/pregnancy_childbirth/medical/anaemia/gwguide/en/ (last accessed on 2/12/16).
3. Blood transfusion in Obstetrics. Greentop Guidelines No.47,May 2015.
4. Carson JL, Grossman BJ, Kleinman S, Tinmouth AT, Marques MB, Fung MK, et al. Red blood cell transfusion: A clinical practice guideline from the AABB. Ann Intern Med. 2012;157:49–58.
5. Retter A, Wyncoll D, Pearse R, Carson D, McKechnie S, Stanworth S, et al. Guidelines on the management of anaemia and red cell transfusion in adult critically ill patients. Br J Haematol. 2013;160:445–64.
6. K Rege, J Bamber, MC Slack, S Arulkumaran, P Cartwright, D Stainsby, FAM Regan, Bood Transfusion in Obstetrics,Green Top Guidelines No.47,Dec 2007,Minor revision July 2008.,pg 1-10.
7. Andrea J.Fuller,Brenda Bucklin,Blood component therapy in obstetrics,Henry L.Galan, William F. Rayburn editors, Obstetric and Gynecological Emergencies, Philadelphia,Saunders Obstet Gynecol Clin N Am 34(2007) 443-458.
8. The Clinical Use of Blood. available online at http://www.who.int/bloodsafety/clinical_use/en/Handbook_EN.pdf.(last accessed on 2/12/16)
9. Blood transfusion: summary of NICE guidance: BMJ 2015;351:h5832. doi: http://dx.doi.org/10.1136/bmj.h5832

You are never given a wish
without also being given the power
to make it come true.
You may have to work for it,
however.

- Richard David Bach

ABG Analysis - What an Obstetrician Should Know?

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INTRODUCTION

Acid-base disturbances are commonly encountered in critically ill patients in ICUs and result from a wide variety of metabolic and respiratory disorders. Besides, telling about the seriousness of the underlying diseases, acid-base disturbances have significant hemodynamic and other physiological effects. So, an early diagnosis and treatment of these disturbances is an important component of the management of critically-ill patients. This requires a systematic approach to interpretation of blood gases and simultaneously measured electrolytes.

ACID-BASE TERMINOLOGY

The acidity of body fluid is measured in terms of hydrogen ion concentration [H^+] and expressed as pH, which is the negative log of the [H^+]. The normal pH varies between 7.36 and 7.44 with an average of 7.4, which corresponds with the [H^+] concentration of 40 Nano equivalents.

- *Acidemia* is defined as increase in absolute [H^+] and fall in pH below 7.36, whereas
- Alkalemia is defined as decrease in [H^+] and a rise in pH above 7.44.
- *Acidosis* is a pathophysiological process that tends to acidify body fluids (lower plasma [$HCO3^-$], or increase in PaCO2) and if unopposed will lead to a decrease in pH
- *Alkalosis* is a pathophysiological process that tends to alkalinize body fluids (raise plasma [$HCO3^-$], or lower PaCO2) and if unopposed will lead to increase in pH

ACID-BASE PHYSIOLOGY

The acid-base status of the body is normally kept within the narrow range of pH despite the daily production of large amount of acid, as a result of various metabolic activities. The pH of the body fluids is determined by the amount of acid produced, the ability of the lungs and kidney to excrete the acid load and the buffering capacity of the blood.

If an extra acid or base is introduced, the body tends to mitigate the change in pH through the action of multiple buffers and activation of compensatory mechanisms. A buffer is a substance that can either absorb or donate protons to a solution. The important extra cellular buffers at physiologically relevant pH are: bicarbonate

($HCO_3^- + H^+ \leftrightarrow H_2Co_3 \leftrightarrow H_2O + CO_2$); plasma proteins ($protein^- + H^+ \leftrightarrow$ H-proteins);

Hemoglobin ($Hgb^- + H^+ \leftrightarrow$ H-hgb); and phosphates ($HPO_4^{2-} + H^+ \leftrightarrow H_2Po_4^-$). The

principal buffering system for non carbonic acid in the extracellular fluid is the carbonic acid – bicarbonate pair.

Clinically when we assess a patient's acid – base status we evaluate the carbonic acid bicarbonate system, since it is easily measured.

The $pCO_2 – HCO_3$, buffer system is reflected in the following formula

CO_2 gas → CO_2 (dissolved) + $H_2O \leftrightarrow H_2CO_3 \leftrightarrow H^+ + HCO_3^-$

The relation of pH to this buffering system is expressed by the Henderson – Hasselbalch equation:

$$pH = pK + \frac{\log HCO_3}{(0.03) \times pCO_2} = \frac{Kidney}{lung} = \frac{Metabolic}{Respiratory}$$

Thus the pH, is determined by the ratio of the serum bicarbonate concentration to the partial pressure of CO_2 in the arterial blood. The bicarbonate concentration is regulated by the kidneys and the pCO_2 is regulated by the lungs.

The interrelation of [H^+], pCO_2 and [HCO_3^-] can also be illustrated by the Henderson equation

$$[H^+] = 24 \times \frac{pCO2}{[HCO_3^-]}$$

This equation is helpful as a bedside tool to predict or evaluate the accuracy, in other terms the internal consistency of the three acid base parameters.

SIMPLE ACID-BASE DISORDERS

As already mentioned, the pH of a solution is determined by the ratio of HCO_3^- and pCO_2. The pathologic processes that primarily change the bicarbonate levels are referred to as metabolic disorders and pathologic processes that primarily alter the CO_2 levels in blood are referred to as respiratory disorders.

Metabolic Acidosis : primary decrease in bicarbonate levels

Metabolic Alkalosis : primary increase in the bicarbonate levels

Respiratory Acidosis : primary increase in the CO_2 levels

Respiratory Alkalosis : primary decrease in the CO_2 levels

In each of the four primary disorders, the initial process not only alters acid-base equilibrium directly, but sets in motion secondary compensatory responses that changes the other component of the pCO_2 – Bicarbonate pair, so as to bring the ratio of HCO_3^- to pCO_2 back towards normal and thus helps normalize the pH.

In metabolic acidosis the primary disturbance is fall in the HCO_3^- level, the body in an attempt to return the pH back to normal induces a fall in pCO_2 via hyperventilation. Similarly, in metabolic alkalosis the primary increase in bicarbonate is compensated for by a decrease in ventilation and increase in pCO_2. In respiratory acidosis the compensatory response is a rise in HCO_3^- due to decreased renal excretion of HCO_3^-. The compensatory responses have following characteristics.

1. The compensatory process tends to return the pH back to normal but never completely, except in cases of primary respiratory alkalosis.
2. Compensatory process requires normal functioning kidneys and lungs and take time to occur.
3. The lack of compensation in an appropriate interval defines the presence of a second primary disorder.
4. The compensatory response creates a second laboratory abnormality.
5. The appropriate degree of compensation can be predicted.

   a. *Metabolic acidosis*: the expected change in pCO_2 is as follows:

   $pCO_2 = [1.5 \text{ X } (\text{Serum } HCO_3^-)] + 8 \pm 2$ or

   pCO_2 = last two digits of the pH

   b. *Metabolic alkalosis*: the expected change in pCO_2 is as follows:

   $pCO_2 = 40 + 0.6 (\Delta [HCO_3^-])$ or

$\Delta pCO_2 = 0.6$ (Measured HCO_3^- – 24)

c. *Acute respiratory acidosis*: the expected increase in bicarbonate is as follows:

$$\uparrow\Delta [HCO_3^-] = \frac{\Delta\ pCO_2}{10}$$

d. *Chronic respiratory acidosis*: the expected increase in bicarbonate level is as follows:

$$\uparrow\Delta [HCO_3^-] = 3.5 \times \frac{\Delta\ pCO_2}{10}$$

e. *Acute Respiratory alkalosis* : the expected decrease in the HCO_3^- level are:

$$\downarrow \Delta [HCO_3^-] = 2 \times \frac{\Delta\ pCO_2}{10}$$

f. *Chronic Respiratory alkalosis*: the expected decrease in the HCO_3^- level are:

$$\downarrow \Delta [HCO_3^-] = 5 \times \frac{\Delta\ pCO_2}{10}$$

As mentioned earlier the Primary defect in metabolic acidosis is fall in HCO3 which can occur due to one of the following three mechanisms:

a. Excess acid production that overwhelms renal capacity for excretion, e.g., diabetic ketoacidosis.

b. Loss of alkali that leaves un-neutralized acid behind, e.g., diarrhea.

c. Renal excretory failure, i.e. normal total acid production in face of poor renal function, e.g., chronic renal failure of any cause.

In order to differentiate between these causes, it is important to calculate anion gap. The anion gap is shown in the following equation:

Unmeasured anion (UA) + Cl^- + HCO_3^- = Unmeasured cation (UC) + Na^+

UA – UC = Anion gap = Na^+ - (CI^- + HCO_3^-) = 12

If the metabolic acidosis is caused by the addition of Cl^- as anion; then it will

be designated as normal anion gap acidosis, and if the metabolic acidosis is caused by the addition of anion other than Cl^-, then it is designated as high anion gap acidosis.

Delta anion gap (ΔAG):- It is the difference between the patient's anion gap and a normal anion gap.

ΔAG = observed AG – upper normal AG

ΔHCO_3 = lower normal HCO_3^- – observed HCO_3^-

In an uncomplicated high anion gap metabolic acidosis, delta anion gap is equal to the delta bicarbonate.

Any significant deviation from this rule implies the existence of a mixed acid-base disorder.

a. When delta anion gap (ΔAG) is greater than delta HCO_3^- ($\Delta HCO3^-$) it indicate mixed high anion gap acidosis and primary metabolic alkalosis.

b. When Δ $HCO3^-$ is greater than ΔAG it indicates mixed high anion gap and normal anion gap acidosis, or a mixed high anion gap acidosis and chronic respiratory alkalosis with a compensating hyperchloremic acidosis.

Urine anion gap :- In patients with a hyperchloremic metabolic acidosis, one can use urine anion gap to distinguish between renal tubular acidosis (RTA) and acidosis caused by diarrhea. Urine anion gap is calculated as follows:

(Urine Na^+ + urine K^+) – (Urine Cl^-)

A negative urine anion gap suggests diarrhea as a cause of metabolic acidosis where as a positive urine anion gap suggests the presence of RTA with a distal acidification defect.

APPROACH TO A PATIENT WITH ACID-BASE DISORDER.

The approach to acid-base derangements should emphasize a search for the cause, rather than immediate attempt to normalize the patient. A full consideration of the careful history such as vomiting, diarrhea, sepsis, diabetes, renal disease, alcohol or other toxin ingestion should be given. A detailed physical examination for evidence of fever, signs of volume depletion, tachypnea or bradypnea, hypo or hypertension should be carried out. Serum electrolytes such as Na^+, K^+, Cl^- and HCO_3^- should be measured in every case. A stepwise, conventional, approach is as follows:

Step I: Do the numbers make sense? Check for the internal consistency of various parameters with the help of Henderson equation: $[H^+]=24XpCO_2/HCO_3^-$

Step II: Determine whether the patient is acidemic (pH<7.36) or an alkalemic (pH>7.44). In mixed disorders the pH may be in the normal range, but the bicarbonate level, the pCO_2 or the anion gap will be abnormal and signal the presence of an acid-base disturbance.

Step III: Is the primary or overriding disturbance respiratory or metabolic? In the patients with acidemia an increase in pCO_2 levels indicate primary respiratory acidosis and a decrease in bicarbonate levels indicate metabolic acidosis, where as in patients with alkalemia, a decrease in the level of pCO_2 levels indicate primary respiratory alkalosis and an increase in the levels of HCO_3^- indicate primary metabolic alkalosis. A quick trick is to see the direction of change in pH and pCO2 and interpret is as :

- Primary Metabolic Condition

  pH changes in the same direction as pCO2 or pH is abnormal but pCO2 remains unchanged

- Primary Respiratory Condition

  pH changes in the opposite direction as pCO2 or pH is abnormal but HCO3- remains unchanged

Step IV: Is there appropriate compensations for the primary disturbance? In an effort to preserve the pH, the primary disorder sets off a compensatory reaction which is predictable as shown below

Step V: If a metabolic acidosis is present, is there an increased anion gap?

Step VII: If there is an increase in anion gap, is the delta anion gap equal to delta bicarbonate. If not, there is an additional non-gap acidosis or a metabolic alkalosis.

Step VIII: Put it all together – what is the most likely diagnosis?

REFERENCES

1. Stewart PA: How to Understand Acid-base: A Quantitative Acid-Base Primer for Biology and Medicine. Elsevier, New York, 1981
2. Fencl V, Jabor A, Kazda A, et al: Diagnosis of metabolic acid-base disturbances in critically ill patients. *Am J Respir Crit Care Med* 2000; 162:2246-2251
3. Julie A. Breyer, Basic Acid-Base Terminology. 6th National Critical Care Medicine Review Course.
4. Narins RG, Emmett M. Simple and mixed acid-base disorders: a practical approach. Medicine, 1980;59(3):161-86
5. Gabow PA, Kaehny WD, Fennessey PV, et al. Diagnostic importance of an increased serum anion gap. N Engl J Med, 1980;303:854-58
6. Jocobson HR, Seldin DW. On the generation, maintenance, and correction of metabolic alkalosis. Am J Physiol, 1983;245:F425-32
7. Wrenn K. The delta (Δ) gap: an approach to mixed acid-base disorders. Ann Emerg Med, 1990;19:1310-13
8. Melvin L.Morganroth, M.D. The Journal of Critical Illness Vol. 5, No. 5, May, 1990

FEW ABG CASE ILLUSTRATIONS

CASE 1

A 22 year postpartum woman presents with fever and foul lochia

pH=7.32 pCO_2=22.5 pO_2=92

Na=137 K=4.1 Cl=100

HCO_3=11 Lactate- 4

Step 1

pH shows acidemia

Step 2

Associated with CO2 and pH both moving in same direction (decrease) and hence metabolic.

Step 3

Compensation: predicted pCO_2 should be = 1.5 X [HCO_3] + 8 $\pm$ 2 = 1.5 X [11] + 8 $\pm$ 2 = (16.5 + 8) $\pm$ 2 = 24.5 $\pm$ 2. Given pCO_2 is 22.5; thus appropriate respiratory compensation is present.

Step 4

Anion gap (AG) = {Na – (HCO_3 + Cl)} = 137-111 = 26; thus wide AG metabolic academia (due to addition of lactic acid).

Step 5

Delta anion (14) = delta bicarbonate (15); hence simple disorder

Diagnosis – Post Partum Sepsis with Lactic Acidosis

CASE 2

A 35 years old preeclamptic patient presents with discomfort in the left leg.

BP is 170/95 HR=100 RR=28 Temp=99.5° F

pH=7.53 pCO_2=16 pO_2=97

Na=136 K=4.0 Cl=100

HCO_3=14

pH and pCO_2 show evidence of respiratory alkalemia.

Predicted delta $HCO_3 = 2 \times \frac{40\text{-}16}{10} = 4.8$

or predicted [HCO_3] should be 19.2.

However given [HCO_3] is 14. Therefore , metabolic acidosis is also present. AG = 136 – 114 = 22; hence respiratory alkalemia with wide AG metabolic acidosis.

Diagnosis : Deep Vein Thrombosis with Pulmonary Embolism

CASE 3

A 34 year-old diabetic patient presents with nausea, vomiting and abdominal pain.

pH=7.46 pO_2=88 pCO_2=33

HCO_3=22 Na=133 K=3.5

Cl=86 Finger-prick glucose=430

pH and pCO_2 suggest respiratory alkalosis.

Predicted delta $HCO_3 = 2 \times \frac{7}{10} = 1.4$;

Hence appropriate. AG = 133 – (86 + 22) = 25; delta AG = 13; delta [HCO_3} is 1.4. As delta AG > delta {HCO_3} there is wide AG metabolic acidosis and metabolic alkalosis

Diagnosis: Diabetic Ketoacidosis (Metabolic Acidosis) with Vomiting (Metabolic Alkalosis)

CASE 4

A 34 year old lady is admitted to the hospital with persistent community acquired pneumonia. That has poorly responded to a weak-long antimicrobials therapy. She mild cyanosis and tachypnoeic. Her lab data are as follows.

pH=7.44 pCO_2=25 pO_2=48

HCO_3=17

History, pH and pCO_2 suggest chronic respiratory alkalosis. Compensation: predicted

Delta $HCO_3 = \frac{(40 - 25)}{10} \times 5 = 7.5$;

hence appropriate metabolic compensation..

Diagnosis: Chronic Respiratory Alkalosis with Appropriate Metabolic Compensation.

You are braver than you believe,
smarter than you seem, and
stronger than you think

- A. A. Milne

Massive Post-Partum Haemorrhage

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CASE SCENARIO

A 25 year old G2 P1L1, admitted in active labor at 40+3 weeks with 3 cm dilatation after uncomplicated pregnancy. Patient had normal progress in cervical dilatation with a prolonged second stage requiring oxytocin augmentation and ultimately vacuum extraction (VE) delivery of a 3600-gram neonate. Placenta delivered within 5 minutes but she started bleeding after that. Oxytocin was increased to 20 U in D5 RL and running at 125 cc/hr. Patient passed large clots 20 minutes after delivery. BP 120/80, pulse 90. Uterus soft and flaccid. Patient received 1 ampoule of carboprost intramuscular and 1000 mcg misoprost per rectal.

Patient's blood was typed and crossed. Oxytocin infusion was continued and dose increased to 80U and uterine massage continued. Bleeding did not stop. Vitals deteriorated; BP 90/60, pulse 130. Lab studies other than haematocrit sent (20ml of blood withdrawn). Pelvic exam and cerical exploration done. It revealed bleeding from cervical os with no tears in cervix or vagina and "boggy" uterus. Clots expressed. Patient's vitals further deteriorated BP 70/40, pulse 158. Despite 3 ampoules of carboprost and IM methylergonovine, bleeding continued and there was "oozing" from IV site as well. Patient shifted to OT. Call for help sent. Multidisciplinary team approached. Emergency laparotomy followed by stepwise devascularisation was done. Bleeding did not stop and vitals did not improve so subtotal hysterectomy was resorted to. She was shited to ICU for further management. After adequate resuscitation with blood products and two days of ICU stay, patient was received in the High Definition Unit (HDU). Both mother and baby were discharged in good condition on 10th postoperative day.

On probing this patient in the postoperative period, she revealed history of bleeding after delivery in her previous pregnancy as well for which she required blood transfusion.

BACKGROUND

Postpartum hemorrhage (PPH) is an obstetric emergency. It is one of the top five causes of maternal mortality in both high and low per capita income countries, although the absolute risk of death from PPH is much lower in high-income countries. PPH more than 1000 ml and continuing to bleed or clinical shock is known as massive PPH. It occurs in 1 to 5 percent of deliveries.[1,2]

ETIOPATHOGENESIS

4 T'S

- **Tone** : most common cause is uterine which complicates 1 in 20 births and is responsible for at least 80 percent of cases of PPH.[3] (Overdistension of uterus (eg, multiple gestation, polyhydramnios, macrosomia), Intra amniotic infection, Functional/ anatomic distortion of uterus, Uterine relaxant drugs like Magnesium sulfate, Nifedipine, Bladder distension)
- **Trauma** : lacerations (including uterine rupture) or surgical incisions; uterine inversion.
- **Tissue** : Retained products of conception or clots
- **Thrombin** : Coagulopathy women with an inherited disease (Haemophilia, Von Willebrandt disease, H/O previous PPH), **A**cquired bleeding diathesis (Gestational Thrombocytopenia, HELLP), severe reduction of clotting factors due to persistent heavy bleeding and hemodilution of the remaining clotting factors (Severe Pre-eclampsia-eclampsia, Intrauterine fetal demise, Severe infection, Abruptio placenta, Amniotic Fluid Embolism), Therapeutic anticoagulation

MANAGEMENT

- ***Thorough history taking*** helps in knowing the at risk cases and taking adequate precautions to prevent PPH. Personal or family history of previous PPH, obesity, high parity, Asian or Hispanic race, precipitous labour, uterine overdistention, chorioamnionitis, uterine inversion, leiomyoma, Couvelaire uterus, inherited bleeding diathesis, acquired bleeding diathesis (eg, amniotic fluid embolism, abruptio placentae, sepsis, fetal demise), assisted reproductive technology, and use of some drugs (uterine relaxants, antithrombotic drugs, possibly antidepressants.
- ***Patient Assessment*** - Vital signs : Blood pressure, heart rate, respiratory rate, peripheral oxygen saturation, and urine output.
- ***Estimation of blood loss:*** Quantify the amount of blood loss by collecting blood in graduated volumetric containers, using visual aids that correlate the size and appearance of blood on specific surfaces and measuring the difference into the weight of bloody materials and the known weight of the same materials when dry.[4] Pictorial Reference Guide to Aid Visual Estimation of Blood Loss can also be used.[5] (Figure 1)
- ***Assessment of severity of haemorrhage*** — The Advanced Trauma Life Support manual describes four classes of haemorrhage to emphasize the progressive signs and symptoms leading to the shock state.[6]

Class I haemorrhage involves a blood volume loss of up to 15 percent. The heart rate is minimally elevated or normal, and there is no change in blood pressure, pulse pressure, or respiratory rate.

Class II haemorrhage occurs when there is a 15 to 30 percent blood volume loss and is manifested clinically as tachycardia (heart rate of 100 to 120), tachypnea (respiratory rate of 20 to 24), and a decreased pulse pressure

Class III haemorrhage involves a 30 to 40 percent blood volume loss, resulting in a significant drop in blood pressure and changes in mental status

Class IV haemorrhage involves more than 40 percent blood volume loss leading to significant depression in blood pressure and mental status. Pulse pressure is narrowed (≤25 mmHg), and tachycardia is marked (>120). Urine output is minimal or absent. The skin is cold and pale, and capillary refill is delayed.

- ***Laboratory evaluation***
  - **Complete blood count**, including platelet count – For every 500 ml of blood loss, haemoglobin levels falls by one gram/dl; however, the initial haemoglobin/ haematocrit value does not accurately reflect the amount of blood loss acutely.
  - **Type and crossmatch** for multiple units of packed red cells.
  - **Coagulation studies --** prothrombin time, activated partial thromboplastin time, INR, fibrinogen. The coagulation panel should be repeated every 30 to 60 minutes to observe trends until PPH is controlled.

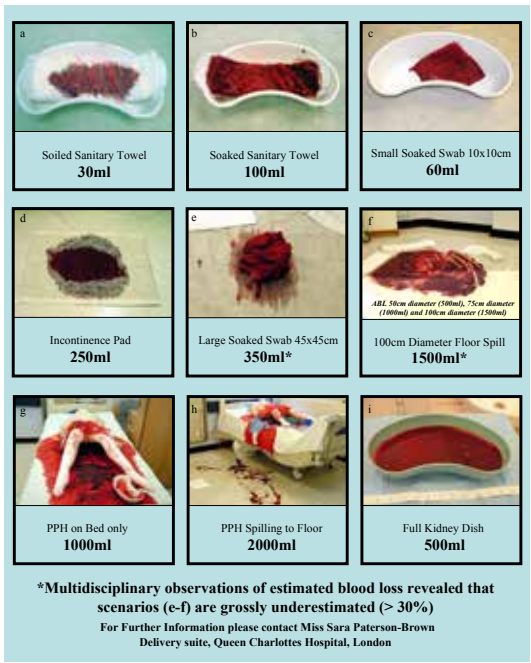

Fig. 1: Pictorial Reference Guide to Aid Visual Estimation of Blood Loss
(adapted from Bose P, Regan F, Paterson-Brown S. Queen Charlottes Hospital, London)

- ***Protocol of management of PPH***

  - Assemble team and notify appropriate departments (obstetrics, nursing, anesthesiology, blood bank, laboratory).

  - Initiate uterine massage and/or manual compression and establish large-bore (two 16- or 18-gauge, ideally 14-gauge) intravenous access.

  - Tamponade bleeding from the uterine cavity. Balloon tamponade should be initiated early if bleeding is brisk, particularly if the patient is not hemodynamically stable, and blood products are not readily available. Foley catheter, Bakri balloon, Sengstaken Blakemore Oesophageal Catheter, Condom Catheter or Urological Rusch Balloon may be used.

  - Administer oxygen (10 to 15 liters/ minute) by face mask. Anaesthesia team should evaluate airway and breathing; intubate if indicated.

  - **Fluid Therapy and Blood product transfusion**[7]

    Crystalloid - Upto 2L isotonic crystalloid (target systolic pressure 90 mmHg) and maintain urine output at >30 mL/hour.

    Colloid - Upto 1.5L until blood arrives

    Blood - May start with O, Rh neg, K neg, then group specific in case of dire emergency

    FFP - After 4 units of RBC, FFP at the rate of 12-15ml/ Kg to be given. If PT/ APTT are ≥1.5 times the normal

    Platelet Concentrate - 1 pool of platelets if count < 75000/ml & haemorrhage continuing

    Replacement of blood components is more important than crystalloid infusion if massive hemorrhage has occurred or is likely. Aggressive use of plasma replacement is important to reverse dilutional coagulopathy, the 1:1 pRBC : FFP ratio is maintained until tests of hemostasis are available.[8]

  - **Administer uterotonic drugs** to reverse atony: It should be possible to determine within 30 minutes whether uterotonic treatment will reverse atony. If it does not, prompt invasive intervention is usually warranted.

    Begin with oxytocin -40 units in 1 liter of normal saline or Ringer's lactate. Using an intravenous infusion pump, start at 10 to 40 milliunits per minute. Adjust rate to achieve and maintain uterine contraction. 15 units in 250 ml normal saline or Ringer's lactate may be given if a high concentration must be administered rapidly. Expect rapid response.

    Carboprost tromethamine (PGF2alpha, Hemabate) 250 micrograms intramuscularly every 15 to 90 minutes, as needed, to a maximum of 2 mg (eight doses)

    Misoprostol- 800mcg sublingual may help later as it takes 1-2.5 hrs to increase uterine tone

    Trenexamic acid- 0.5-1g in addition decreases the blood loss further

  - **Inspect the vagina and cervix** for lacerations; repair as necessary. Evacuate any retained products of conception. Replace uterus if inverted.

  - **Perform laparotomy** if the above measures fail. Surgical approaches that are quick, relatively easy, and effective should be tried first. In utilizing these measures, the surgeon should be cognizant of the amount of blood loss and the stability of the patient, and should perform hysterectomy rather than resort to temporizing measures if her cardiovascular status is unstable or if it appears that the anesthesiologist will not be able to keep up with her fluid needs. Options include:

  - Ligate bleeding sites.

  - Perform uterine artery ligation, including the utero-ovarian arcade. Arterial embolisation if available in emergency hours, may be done.

  - Place a B-Lynch stitch or other uterine compression suture, if bleeding stops by compression

  - Perform hysterectomy - Hysterectomy is the last resort for atony, but should not be delayed in women who have disseminated intravascular coagulation and require prompt control of uterine haemorrhage to prevent death. Planned hysterectomy is often the appropriate first-line approach for placenta accreta.

  - Suture deep pelvic bleeders.

  - Tamponade pelvic bleeding with pelvic packing.

Maternal mortality — Maternal mortality after PPH averages approximately 2 percent, with wide variations worldwide depending on both the overall health of pregnant women in the population and the resources for treatment of PPH.[9]

REFERENCES

1. Sheldon WR, Blum J, Vogel JP, et al. Postpartum haemorrhage management, risks, and maternal outcomes: findings from the World Health Organization Multicountry Survey on Maternal and Newborn Health. BJOG 2014; 121 Suppl 1:5.
2. Callaghan WM, Kuklina EV, Berg CJ. Trends in postpartum haemorrhage: United States, 1994-2006. Am J Obstet Gynecol 2010; 202:353.e1.
3. Combs CA, Murphy EL, Laros RK Jr. Factors associated with postpartum haemorrhage with vaginal birth. Obstet Gynecol 1991; 77:69.
4. Bateman BT, Berman MF, Riley LE, Leffert LR. The epidemiology of postpartum haemorrhage in a large, nationwide sample of deliveries. Anesth Analg 2010; 110:1368.
5. Bose P, Regan F, Paterson-Brown S. Improving the accuracy of estimated blood loss at obstetric haemorrhage using clinical reconstructions. BJOG. 2006;113:919–924.
6. Westhoff G, Cotter AM, Tolosa JE. Prophylactic oxytocin for the third stage of labour to prevent postpartum haemorrhage. Cochrane Database Syst Rev 2013;CD001808.
7. Postpartum Haemorrhage, Prevention amd Managemnt. GreenTop guidelines no.52
8. Shakur H, Elbourne D, Gülmezoglu M, et al. The WOMAN Trial (World Maternal Antifibrinolytic Trial): tranexamic acid for the treatment of postpartum haemorrhage: an international randomised, double blind placebo controlled trial. Trials 2010; 11:40.
9. Ruiz Labarta FJ, Pintado Recarte MP, Alvarez Luque A, et al. Outcomes of pelvic arterial embolization in the management of postpartum haemorrhage: a case series study and systematic review. Eur J Obstet Gynecol Reprod Biol 2016; 206:12.

Cardiomyopathy in Pregnancy

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CASE SCENARIO

A 20 yrs old primigravida with 8 months amenorrhea was admitted to emergency room with complaints of difficulty in breathing for 1 week, more so in lying down position and loss of fetal movements for one day.

There was no significant past, medical or surgical history.

On general examination, pulse was 120 /min, labored breathing with rate of 35/min, BP was 144/105, SPO2 was 85%, mild pallor and pedal oedema was present. Bilateral fine crepitation at lung bases were heard on auscultation. Her complete blood count, kidney function test and liver function tests were within normal range. Obstetrical sonography showed a 32 week IUFD fetus in longitudinal lie. Arterial blood gas analysis showed metabolic acidosis, chest radiograph showed bilateral alveolar infiltrates. Cardiology and pulmonology referrals were made. She was given supportive therapy in the form of injection furosemide 40 mg.,

Injectable Soda bicarbonate , non invasive ventilation was started with Fio2 50% and PEEP of 8. Injection labetalol and magnesium sulphate were administered. She was later intubated as she was not responding to non invasive ventilation and was induced with dinoprostone gel.

Her condition improved after delivery and was extubated after 24 hrs of delivery. Her echocardiography was done which showed global hypokinesia, with dilated left ventricle, ejection fraction of 30%. She was started on carvedilol 3.125 mg OD, tab torsemide and spironolactone 10/25mg OD, tab ramipril 2.5mg BD and low molecular weight heparin.

Patient improved symptomatically and was discharged after two weeks. She was diagnosed as a case of peripartum cardiomyopathy retrospectively.

BACKGROUND

Peripartum cardiomyopathy (PPCM) is defined as a non-familial form of peripartum heart failure characterized as an 'idiopathic cardiomyopathy presenting with heart failure secondary to left-ventricular (LV) systolic dysfunction towards the end of pregnancy or in the months following delivery, where no other cause of heart failure is found' as proposed by the Working Group on PPCM of the Heart Failure Association of the European Society of Cardiology.[1] Incidence is 0.1% of all pregnancies.

PREDISPOSING FACTORS

- Preclampsia
- Gestational hypertension
- Autoimmune disorder
- Viral myocarditis
- Prolonged tocolysis
- Antioxidant deficiency
- Malnutrition, selenium deficiency
- And other malnutrition
- Abnormal hemodynamic response
- Apoptosis and inflammation
- Prolactin
- Genetic forms of cardiomyopathy

DIAGNOSTIC CRITERIA

All 4 of the following:

Classic

- Development of cardiac failure in the last month of pregnancy or within 5 months postpartum
- No identifiable cause for the cardiac failure
- No recognizable heart disease before the last month of pregnancy

Additional

Strict echocardiographic indication of left ventricular dysfunction:

a. Ejection fraction <45% and/or

b. Fractional shortening <30%

c. End-diastolic dimension >2.7

CHALLENGE IN DIAGNOSIS

PPCM may induce cardiovascular disease in a non-cardiac patient in the situation of pre-existing complications of pregnancy, i.e gestational hypertension, pre-eclampsia and HELLP syndrome.[1] It is also reported that certain genetic forms of cardiomyopathies may get unmasked and present as PPCM due stress of pregnancy. [2,3,4] Pregnancy, delivery, and the peripartum period pose challenging physiological concerns due to the tendency of weight gain, oedema, fatigue, and breathlessness, which may be assumed to be normal and thus delaying the diagnosis of PPCM in many patients. Also, oxidative stress increases during pregnancy.

Clinically, PPCM may present as dilated cardiomyopathy (DCM) but the left ventricle may not always be dilated. The ejection fraction is nearly always reduced below 45%.[1]

PPCM is considered an independent disease, whose diagnosis relies on the exclusion of other cardiomyopathies.[1,5] It remains a diagnostic challenge. There must be high index of suspicion while evaluating a patient of cardiomyopathy as it may present as acute onset or an insidious onset of heart failure. Sometimes the presentation can be in the form of abdominal discomfort, chest pain that is pleuritic in nature and associated with palpitations.[1,6]

MANAGEMENT PROTOCOL[6]

Investigations

- Electrocardiogram (ECG)- no specific findings peculiar to PPCM, should be performed to rule out or point pulmonary embolism or an acute ischemic event.
- Echocardiography- most important tool for diagnostic confirmation or exclusion of PPCM
- Chest X-ray- signs of decompensated heart failure with pulmonary congestion or oedema / pneumonia /pleural effusion.
- Cardiac magnetic resonance imaging.
- Cardiac catheterization/myocardial biopsies.

Biomarkers: NT-pro BNP, 16-kDa Prolactin, Interferon-γ , Asymmetric Dimethylarginine (ADMA), Cathepsin D, Soluble FMS-like tyrosine kinase-1 (sFlt-1) and microRNA-146a .

TREATMENT

PPCM is treated according to the ESC guidelines for heart failure in pregnancy.[1] The therapeutic interventions need to consider the health of the mother and the fetus.

NON-PHARMACOLOGICAL THERAPY

- fluid restriction 2L/day
- low sodium diet 2gm/day
- light daily activity

ANTEPARTUM MANGEMNT

- Beta-blocker, thiazide diuretics, or furosemide treatment can be given in some patients with PPCM before delivery, however, as diuretic therapy may impair perfusion of the placenta with potential harm to the fetus, the lowest dosages possible of diuretic therapy have to be used.
- i.v. infusion of an inotrope (e.g. dobutamine) should only be considered in patients with severe hypotension and/ or signs of cardiogenic shock.
- As soon as haemodynamic stability is achieved, inotropes should be tapered and general recommendations for patients with heart failure in pregnancy should be followed.[1]
- Early treatment with beta-blockers at very low dosages appears to be protective even in patients with severely depressed ejection fraction.
- LMWH may be considered if ejection fraction is less than 35%

POST PARTUM MANAGEMENT

- ACE inhibitors (captopril, ramipril, analapril)
- Angiotensin receptor blockers (candesartan, valsartan) if intolerant to ACE inhibitors
- Nitrates or hydralazine if sensitive to above two
- Loop diuretic as per GFR
- Vasodilators (hydralazine, isorbide dinitrite),
- Beta blockers
- Aldosterone antagonist
- Warfarin if ejection fraction<35%

A general agreement among experts (study group of PPCM of the HFA/ESC) suggests continued therapy with standard heart failure medications for a minimum of 12 months

The use of an intrauterine device is recommended for PPCM patients since hormonal contraceptives may interact with heart failure medication.

CONCLUSION

The symptoms of PPCM are generally overlapping with other pregnancy related conditions like preeclampsia, anemia, congenital or valvular heart ailments and myocarditis. The patient may present with fatigue, shortness of breath and oedema that may be found in otherwise normal pregnant female. Therefore, the diagnosis of peripartum cardiomyopathy is that of high degree of suspicion.

REFERENCES

1. Silwa K et al. Current state of knowledge on aetiology, diagnosis, management, and therapy of peripartum cardiomyopathy: a position statement from the Heart Failure Association of the European Society of Cardiology Working Group on peripartum cardiomyopathy. Eur J Heart Fail.2010;12:767–778.
2. Van Spaendonck-Zwarts KY, Posafalvi A, Van den Berg MP, Hilfiker-Kleiner D, Bollen IA, Sliwa K, Alders M, Almomani R, van Langen IM, Van der Meer P, Sinke RJ, van der Velden J, Van Veldhuisen D J, van Tintelen JP,Jongbloed JD. Titin gene mutations are common in families with both peripartum cardiomyopathy and dilated cardiomyopathy. Eur Heart J. 2014 Aug 21;35(32):2165-73
3. van Spaendonck-Zwarts KY, van Tintelen JP, van Veldhuisen DJ, van der Werf R, Jongbloed JD, Paulus WJ, Dooijes D, van den Berg MP. Peripartum cardiomyopathy as a part of familial dilated cardiomyopathy. Circulation 2010; 121: 2169 – 2175.
4. van Tintelen JP, Pieper PG, van Spaendonck-Zwarts KY, van den Berg MP.Pregnancy, cardiomyopathies and genetics. Cardiovascular Res 2014; 101: 571– 578.
5. Selle T, Renger I ,Labidi S, Bultmann I ,Hilfiker-Kleiner D. Reviewing peripartum cardiomyopathy: current state of knowledge. Future Cardiol 2009; 5:175–189.
6. Johnson-Coyle L, Jensen L, Sobey A; American College of Cardiology Foundation; American Heart Association. Peripartum cardiomyopathy: review and practice guidelines. Am J Crit Care. 2012;21(2):89-98.

Don't take rest after your first victory
because if you fall in second,
more lips are waiting to say that
your first victory was just luck

- A.P.J. Abdul Kalam

Eclampsia and PRES

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CASE SCENARIO

A 25-year-old primigravida at 36 weeks gestation, presented with complaints of acute onset headache, altered sensorium, reduced vision and one episode of seizure. She was a booked patient but was a defaulter for last 3 months There was no past history of hypertension, cardiac diseases, vision abnormalities or seizures. The patient was disoriented, restless, afebrile with bilateral pedal oedema. Blood pressure was 170/110 mmHg with a heart rate of 100 beats per minute. Her respiratory rate was 20 breaths per minute and chest was clear on auscultation. Room air saturation was 98%. Pupils were equal and reactive to light. Bilateral plantar reflexes were flexor. There was no focal neurological deficit. Other system examinations were normal. She was immediately given loading dose of Magsulf and intravenous labetalol 20mg and shifted to critical care obstetric ward. Her blood pressure reduced to 160/100 mm of Hg but patient started complaining of total loss of vision. Complete blood picture (Hb of 10.8 g %), renal and liver function tests, clotting parameters, and electrocardiogram were done and found to be normal. Urine analysis revealed proteinuria 2+.

A neurological consult was taken who found no gross neurological abnormality and ordered a MRI. Before MRI could be done patient had another seizure which was controlled by giving additional 2gm magnesium sulphate. As she had poor bishop score, she was immediately prepared for cesarean under general anesthesia she delivered a female child of 2.5 kg with an APGAR score of 6.9.

After cesarean, her blood pressure remained in range of 160-170systolic and 110 -100 and blindness and disorientation persisted. She was given labetelol for blood pressure control and magnesium sulphate was continued for 24 hours after delivery. Fundus examination was normal. MRI was done which revealed oedema in posterior hemisphere and a diagnosis of PRES was made. On 4th post-operative day her vision started improving and by 6th day it was 6/6. She was discharged on 10th post-operative day with a normal blood pressure not on any anti-hypertensive medicine

BACKGROUND

The terms posterior reversible encephalopathy syndrome (PRES) refer to a clinico-radiologic entity first described by Hinchey et al in 1996, characterized by headaches, confusion, visual disturbances, seizures, and posterior transient changes of oedema on neuroimaging.[1]

PRES can develop in association with a vast array of conditions[2]

- Acute hypertension
- Gestational hypertensive diseases
- HIV infection causing immunosuppression
- Cisplatin, Tacrolimus, Cyclosporine A and steroid drugs.
- Hemolytic uremic syndrome
- Glomerulonephritis
- Blood transfusion
- Porphyria
- Tumors
- Hypercalcemia

PRES and eclampsia share many clinical and etiopathogenic characteristics and patients may present with a combination of these two entities. Earlier retrospective studies and case series reported a very low incidence of PRES (7%) with eclampsia.[1,3] More recent reports have found PRES in a high proportion of eclamptic women (>90%) possibly due to wider availability of imaging modalities of CT scan and Magnetic resonant imaging(MRI).[4] PRES can occur any time in pregnancy with preeclampsia but most cases of PRES are diagnosed in postpartum due to presence of typical features and ease of performing imaging studies postpartum.

PATHOGENESIS

The exact pathogenesis of the condition is not known. A rapid rise in blood pressure leads to altered autoregulation of cerebral blood flow producing dilatation of cerebral arterioles with opening up of endothelial tight junctions and leakage of plasma and red cells into the extracellular space, producing cerebral oedema. The cerebral white matter is more susceptible to accumulation of fluid in the extracellular spaces (vasogenic oedema) as it is composed of myelinated fiber tracts in a cellular matrix of glial cells, arterioles, and capillaries. The posterior circulation has less sympathetic innervation of the vertebrobasilar vasculature to protect the parenchyma from rapid increases in arterial blood pressure and is therefore more involved in this type of damage. According to another hypothesis, patients with PRES develop vasospasm secondary to sudden and severe rises in blood pressure and ischaemia of brain tissue. Ischaemic damage to brain tissue first produces cytotoxic oedema and then extracellular oedema. Probably in early cases the oedema is vasogenic but if the condition is not corrected it becomes cytotoxic later.

DIFFERENTIAL DIAGNOSIS

In a woman presenting with eclampsia and vision disturbance, confusion, behavior disturbance and change of consciousness, PRES should be kept in mind but differential diagnosis like cortical blindness, retinal detachment or hypertensive encephalopathy should also be considered. Altered sensorium or unconsciousness could be due cerebrovascular accident or cortical vein thrombosis. CT and MRI confirm the diagnosis of PRES and exclude other conditions.

IMAGING

The presence of oedema is responsible for the characteristic picture seen on CT and MRI. The regions affected in the CT are observed as diffuse hypodense area. In the MRI imaging, they are seen as iso/hypo intense areas in T1 weighted images while they are seen as hyperintense areas in T2 weighted and FLAIR images involving mostly posterior cortical, sub-cortical and deep parenchymal areas. All brain structures, especially the parietal and occipital lobes, may display involvement.[5]

Visual abnormalities (blurred vision, hemianopsia) are found in 26 % to 67% of the patients with PRES and cortical blindness in 8% to 33 %. Cortical aetiology of blindness is being diagnosed more often due to wider availability of imaging modalities. [6] Among patients with a follow-up CT or MRI, 49%-75% have a resolution of the initial abnormalities within 5 days to 17 months.[7]

MANAGEMENT

Two important aspects

- Termination of pregnancy
- Control of hypertensive emergency

AIM OF TREATMENT

- Decrease the MAP by 20–25 % within the first 2 hours
- Bring down blood pressure to 160/100 mmHg within the first 6 hours.
- Control seizures

More rapid blood pressure reduction is not recommended since it can aggravate

the cerebral perfusion pressure alterations and promote ischemia. Intravenous antihypertensive drugs are necessary.[8] Appropriate choices include labetolol, nicardipine, or nifedepin. Nicardipine has higher selectivity for blood vessels than the myocardium and causes less reflex tachycardia than nifedipine. Furthermore, the dosage of nicardipine can be more easily adjusted.[9]

Magsulf is the drug of choice for control of seizures. It helps cerebral vasodilatation by inhibiting calcium-dependent vasoconstriction and shows neuroprotective activity by preventing ischemia. It also decreases blood brain barrier permeability and limit vasogenic oedema.[10] Propofol, benzodiazepines and phenytoin are recommended for the treatment of cases developing refractory status epilepticus.

COMPLICATIONS OF POSTERIOR REVERSIBLE ENCEPHALOPATHY SYNDROME[11]

- ***Cerebral ischemia*** Cerebral infarction is the earliest sign of irreversibility in PRES. Ischemia following vasogenic edema may involve conversion to cytotoxic edema with longer exposure to the initial source of toxicity, which can lead to necrosis and apoptosis
- ***Cerebral hemorrhage*** Hemorrhage may occur in the cerebral, subarachnoid or intraventricular region. This occurs because of leak or rupture of vessels within ischaemic foci due to oxidative stress with overproduction of reactive oxygen species (ROS) and oxidative damage to lipid membranes in the blood-brain-barrier.
- ***Cerebral herniation*** Edema of the posterior part of the brain, particularly cerebellum and brainstem, may cause transtentorial cerebral herniation.

Due to these complications of ischaemia and/or bleeding, permanent neurological deficits may remain or even death can occur if PRES is not adequately and quickly treated. Permanent deficit is mostly in form of epilepsy. Death is reported in up to 15% of the patients with PRES.[2,12] Delayed identification or care of the patient appears to be involved in most patients with a fatal outcome.

SUMMARY

Early recognition of PRES in eclampsia is of paramount importance because prompt control of blood pressure will cause reversal of the syndrome. Delivery, Antihypertensive, control of seizure and anti-edema measures are the main stay of treatment. Delay in the diagnosis and treatment can result in permanent damage to affected brain tissues

REFERENCES

1. Hinchey J, Chaves C, Caplan LR. A reversible posterior leukoencephalopathy syndrome. N Engl J Med 1996;334:494-500.
2. Servillo G, Striano P, Striano S, Tortora F, Boccella P, De Robertis E, et al. Posterior reversible encephalopathy syndrome (PRES) in critically ill obstetric patients. Intensive Care Med 2003;29:2323–6.
3. McKinney AM, Short J, Truwit CL, et al (2007) Posterior reversible encephalopathy syndrome:incidence of atypical regions of involvement and imaging findings. AJR Am J Roentgenol 189: 904–912
4. Mayama M, Uno K, Tano S, Yoshihara M, Ukai M, Kishigami Y, Ito Y, Oguchi H. Incidence of posterior reversible encephalopathy syndrome in eclamptic and patients with preeclampsia with neurologic symptoms. Am J Obstet Gynecol. 2016;215(2):239.e1-5.
5. 5. Hugonnet E, Da Ines D, Boby H, Claise B, Petitcolin V, Lannareix V, et al. Posterior reversible encephalopathy syndrome (PRES): Features on CT and MR imaging. Diagn Interv Imaging 2013;94:45–52.
6. Karuppannasamy, Divya, et al. "Cortical visual loss in posterior reversible encephalopathy syndrome in late postpartum eclampsia: Case series." Indian journal of ophthalmology 62.5 (2014): 635.
7. Casey SO, Sampaio RC, Michel E et al. Posterior reversible encephalopathy syndrome: utility of fluid attenuated inversion recovery MR imaging in the detection of cortical and subcortical lesions. Am J Neuroradiol. 2000 ;21:1199-206.l
8. Varon J, Marik PE. Clinical review: the management of hypertensive crises. Crit Care. 2003;7:374-84.
9. Demirel I, Ozer AB, Bayar MK et al. Anesthesia and Intensive Care Management in a Pregnant Woman with PRES: A Case Report. Case Rep Anesthesiol. 2012, Article ID 745939, 5 pages, 2012.Case Rep Anesthesiol. 2012.; 745939. doi:10.1155/2012/745939.
10. Euser AG, Bullinger L, Cipolla MJ. Magnesium sulphate treatment decreases blood-brain barrier permeabilityduring acute hypertension in pregnant rats. Exp Physiol.2008 ;93 :254-61.
11. Trikha A, Sharma A, Kumar R. Posterior reversible encephalopathy syndrome. J Obstet Anaesth Crit Care 2014;4:59-63.
12. Lee VH, Wijdicks EF, Manno EM et al. Clinical spectrum of reversible posterior leukoencephalopathy syndrome. ArchNeurol 2008 ;65: 205-10.

The Only Limit To Our Realization Of Tomorrow
Will Be Our Doubts Of Today

- Franklin D. Roosevelt

Acute Pyelonephritis in Pregnancy

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CASE SCENARIO

A 22years old primigravida presented in obstetrics emergency as a referred case in early labour at 36+4 weeks of gestation with complaints of high grade fever and left sided flank pain for 3 days along with breathlessness for 1 day. On examination, she was conscious, oriented. Her PR -124b/min, temp -103^{0}F, RR-34b/min and Spo2 was 88%. Her urine microscopy showed field full of pus cells, TLC was 18,000/cmm and ultrasound KUB revealed left sided pyonephrosis suggestive of acute pyelonephritis.

She was admitted immediately to the obstetrical critical care and started on oxygen therapy and Intravenous antibiotics. ABG showed respiratory acidosis. Chest X-ray revealed bilateral opacities suggestive of Acute respiratory distress syndrome. The patient was intubated and put on ventilator. However, her saturation remained below 90%. Anticipating that vaginal delivery may not be tolerated due to increased oxygen consumption in ARDS, emergency cesarean section was done and a 1.78 Kg girl baby was delivered. Following cesarean, her condition gradually improved, fever subsided and weaned off the ventilator after 28 hours.

BACKGROUND

Urinary tract infection is one of the most common medical complications of pregnancy.[1] Pregnancy related anatomical changes such as pressure on the bladder from enlarging uterus, increase in the size of the ureters due to smooth muscle relaxation, decreased bladder tone and the immunosuppression of pregnancy further increase the risk of UTI in pregnancy. Risk of UTI starts at 6th week and peaks during the 22-24th weeks. In majority of the cases, it is preceded by asymptomatic bacteriuria.[2] If left untreated ,it progresses to acute pyelonephritis in 20-40% of the cases.[3] It occurs in 1-2% of pregnant women in the setting of routine prenatal screening for asymptomatic bacteriuria.[4]

RISK FACTORS FOR DEVELOPMENT OF PYELONEPHRITIS

- Presence of asymptomatic bacteriuria
- Multiparity
- Diabetes mellitus
- Urinary tract stones or malformations
- Low socioeconomic status

COMPLICATIONS

Acute Pyelonephritis may result in significant maternal morbidity, as well as fetal morbidity and mortality. Gram-negative bacteria possess endotoxin that, when released into the maternal circulation, can lead to a cascade response of cytokines, histamine, and bradykinin. The resulting capillary endothelial damage, diminished vascular resistance, and alterations in cardiac output may lead to serious complications. 20% of women with severe pyelonephritis develop complications like anaemia, bacteremia, septic shock, acute respiratory syndrome, acute renal failure, preeclampsia, intrauterine growth restriction and preterm labour.[5] Anemia may be due to endotoxin mediated hemolysis. Acute renal failure associated with microabscesses and suppurative pyelonephritis can occur independent of sepsis.[6]

CLINICAL FEATURES

Patients present with fever, flank pain and lower urinary tract infection symptoms due to ascending infection from lower urinary tract

DIAGNOSIS

- Urine routine and microscopy characteristically demonstrates significant bacteriuria, pyuria, red blood cells and occasional leucocyte casts.
- Urine culture and sensitivity
- Blood culture- bacteremia present in 15-30% of hospitalized patients
- Imaging- Renal ultrasound is the preferred to avoid contrast or radiation exposure. Symptoms and fever persisting beyond the first 24-48 hours of treatment warrant a repeat urine culture and renal ultrasound to rule out persistent infection and urinary tract pathology.[6,7]

DIFFERENTIAL DIAGNOSIS

- Nephrolithiasis- Fever is rare and renal USG shows kidney stones
- Abruption of placenta- fever is absent and uterus is tense and tender. Either there is vaginal bleeding or USG reveals a large retroplacental hematoma.
- Intraamniotic infections- history of prolonged rupture of membranes. Examination reveals uterine tenderness and foul smelling vaginal discharge. Urine routine does not reveal bacteria

TREATMENT

- Hospitalization is required for treatment and intravenous antibiotics till woman is afebrile for 24 to 48 hours and shows symptomatic improvement.
- Initial empiric therapy of pyelonephritis with parenteral, broad spectrum beta-lactams guided by local microbiology and susceptibility data as well as expected patient tolerance (Table 1)

Table 1: Diagnosis and treatment of acute pyelonephritis (normal renal function)

Diagnosis	Symptoms + urine culture: Fever > 38°C, lumbar pain, skeletal and joint pains, nausea/vomiting with or without accompanying dysuria, polyuria ≥ 10^5 CFU/ml in mid-stream urine specimen
Mild or moderate acute pyelonephritis	Ceftriaxone 1 g every 24 h Cefepime 1 g every 24 h Amoxicillin with clavulanic acid 1.2 g every 12 h Aztreonam 1 g every 8–12 h
Severe acute pyelonephritis/ immunosuppression/ urinary stasis	Ticarcillin with Clavulanic acid 3.1 g every 6 h Piperacillin with Tazobactam 3.375 g every 6 h Meropenem 0.5 g every 8 h Ertapenem 1 g every 24 h Doripenem 1 g every 8 h

- Fluoroquinolones and aminoglycosides should be avoided during pregnancy.
- Once afebrile for 48 hours, switch to oral therapy guided by culture and sensitivity results and discharged to complete 10- 14 days of treatment.
- Options for oral therapy mainly limited to beta-lactams, eg. cephalexin or amoxicillin-clavulonate; in the second trimester, trimethoprim-sulfamethoxazole can be given. Nitrofurantoin and fosfomycin are not appropriate for treatment of pyelonephritis due to inadequate tissue levels [8]
- Carbapenems are reserved for the treatment of more severe cases, and those caused by multi-drug resistant bacteria.

PREVENTION

- ***Treatment of asymptomatic bacteriuria in pregnancy-***

  Asymptomatic bacteriuria (ASB) is defined as isolation of same bacterial strain in quantitative counts of $\geq 10^5$cfu/ml in two consecutive urine specimens or a single catheterized urine specimen with one bacterial species isolated in a quantitative count $\geq 10^2$cfu/ml in the absence of symptoms of urinary tract infection.[9] Since 30% of women fail to clear asymptomatic bacteriuria following a short course of therapy, a follow-up culture should be obtained as a test of cure after completion of treatment.[10]

- ***Avoidance of incomplete therapy/ recurrence***

  All pregnant women with ASB should have periodic screening after therapy, since as many as one third of them experience a recurrent infection. Follow-up cultures should be obtained 1–2 weeks after treatment and then repeated once a month.[11]

- ***Treatment of persistent /recurrent bacteriuria***

  Longer antibiotic therapy using the same agent (e.g. 7 instead of 3 days of treatment) or another first line drug is recommended. Subsequent treatment courses are administered until the bacterial counts drop to non-significant levels.[9] If bacteriuria persists despite repeated courses of therapy, as well as in women with additional risk factors (e.g. immunosuppression, diabetes, sickle cell anemia, neurogenic bladder) or recurrent/ persistent UTIs before pregnancy, one should consider antimicrobial prophylaxis.

- ***Antimicrobial prophylaxis***

  For recurrences associated with sexual activity – Post-coital prophylaxis with single antibiotic dose (e.g. Nitrofurantoin 50–100 mg *p.o.* or cephalexin 250–500 mg *p.o.*)[9,11] For other women -Nitrofurantoin 50–100 mg in the evening until the end of the pregnancy. Follow- up urine culture is performed only at the beginning of the third trimester. In case of significant bacteriuria, prophylactic doses should be replaced by another course of antimicrobials, based on susceptibility testing.[12]

CONCLUSION

Pregnant women are at risk of serious complications from untreated urinary tract infection and pyelonephritis. Hence it is imperative to assess risk factors for UTI in pregnancy and screen pregnant women at their first antenatal visit. ASB should be treated with appropriate antibiotics and follow up cultures should be done to avoid persistence or recurrence of infection. Antimicrobial prophylaxis throughout the pregnancy is required for women with risk factors or with recurrence of infection.

The case presented here validates the fact that early diagnosis and prompt management of acute pyelonephritis is imperative to prevent severe life threatening complications like ARDS in pregnancy. Multidisciplinary care involving obstetricians, nephrologists, microbiologists and intensivists is required for care of such cases. Furthermore, early assessment of fetal wellbeing and plan of delivery at term are necessary to optimize both maternal and fetal outcome.

REFERENCES

1. Hoban DJ, Nicolle LE, Hawser S, Bouchillon S, Badal R antimicrobial susceptibility of global inpatient urinary tract isolates of Escherichia coli: results from the Study for Monitoring Antimicrobial Resistance Trends (SMART) program: 2009-2010. Diagn Microbiol Infect Dis. 2011; 70: 507-511.
2. Matuszkiewicz-Rowińska J, Małyszko J, Wieliczko M. Urinary tract infections in pregnancy: old and new unresolved diagnostic and therapeutic problems. Arch Med Sci. 2015; 11: 67-77.
3. Farkash E, Weintraub AY, Sergienko R, et al. Acute antepartum pyelonephritis in pregnant: a critical analysis of risk factors and outcomes. Eur J Obstet Gynecol Reprod Biol. 2012; 162:24–7.
4. Pazos Otero N, Fuentes Ricoy L, Ferrandez Perez B, Martinez Vazquez C, Martinez Poch M, Osuna Diaz JL. [Pyelonephritis and pregnancy. Our experience in a general hospital]. An Med Interna. 2007; 24(12): 585-7
5. Rahiman F, Balasubramanian T, Shejina M, Musambil M. A Review on Urinary Tract Infection in Pregnancy. Int J Pharma Res Rev. 2015; 4:26–33.
6. Hill JB, Sheffield JS, McIntire DD, Wendel GD Jr. Acute pyelonephritis in pregnancy. Obstet Gynecol. 2005; 105: 18-23.
7. Wing DA, Fassett MJ, Getahun D. Acute pyelonephritis in pregnancy: an 18-year retrospective analysis. Am J Obstet Am J Obstet Gynecol. 2014; 210:219
8. Vazquez JC, Abalos E. Treatments for symptomatic urinary tract infections during pregnancy. Cochrane Database Syst Rev. 2011; CD002256.
9. Nicolle LE, Bradley S, Colgan R, Rice JC, Schaeffer A, Hooton TM.Infectious Diseases Society of America guidelines for the diagnosis and treatment of asymptomatic bacteriuria in adults. Clin Infect Dis.2005; 40: 643–654
10. Widmer M, Gülmezoglu AM, Mignini L, Roganti A. Duration of treatment for asymptomatic bacteriuria during pregnancy. Cochrane database Syst Rev. 2011.
11. Berard A, Santos F, Ferreira E, Perreault S. Urinary tract infections during pregnancy. 2011; 113-32.
12. Hooton TM. Urinary tract infections and asymptomatic bacteriuria in pregnancy. UpToDate.com; updated 2017.

It is extremely difficult to make complex things simple whereas it is easy to make simple things complex

- Steve Jobs

Brain Teasers

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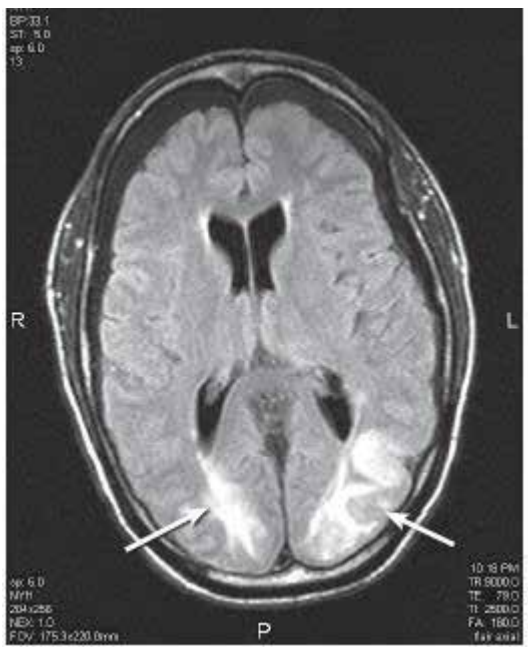
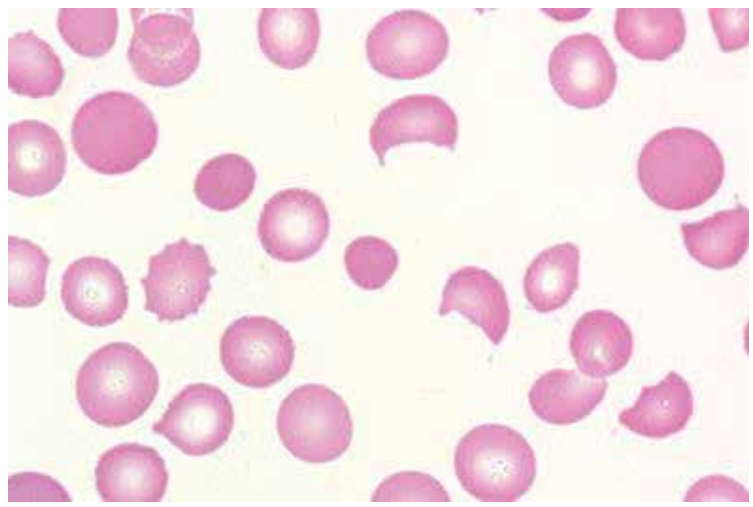
Chairperson Quiz Committee FOGSI (2015-2017)

Q. 1. Name the condition diagnosed with the help of the findings seen in this MRI



Q. 2. Name the condition in which this blood picture is seen



Q. 3. Which scoring system is used for regular observation of vital signs in an obstetric patient to grade the severity of her illness ?

Q. 4. Why dextran containing fluids should be avoided in hypovolemic resuscitation?

Q. 5. What is the Investigation of choice for diagnosis of DVT in obstetric patients ?

ANSWERS TO BRAIN TEASERS – AUGUST ISSUE

1. Ovarian cortical strips transplanted in the forearm
2. Cobble stone appearance of tube (indicative of intraluminal adhesions) in Genital tuberculosis
3. C. Zona Pellucida Thickness
4. A. Long arm of X chromosome
5. Hypo-osmotic swelling test

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A novel drug delivery with Polycarbophil base

Susten VT 200

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For Successful Pregnancy Outcomes

Labebet Tab / Inj 4 ml / 2 ml

(Labetalol 100 mg Tab) (Labetalol Injection 5 mg/ml)

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NICE and **ACOG** guidelines recommend **Labetalol** as **1st** line treatment therapy for **PIH**[1,2]

- Selective α_1 and non-selective β blocker.[3]
- More effective in **BP** control in **PIH** patients compared to **methyldopa & nifedipine.**[4]
- Significant decrease in **proteinuria in PIH patients**.[5]
- Lower side effects compared to **methyldopa and nifedipine.**[4]

REF: 1. ACOG Women's health care physicians, committee opinion, ACOG Women's health care physicians, committee opinion,2015;623:1-5. / 2. NICE clinical guideline 107; Hypertension in pregnancy: the management of hypertensive disorders during pregnancy; 2010: 1-47. / 3. Labebet Tablet [Prescribing information], Mumbai, MH; Sun Pharmaceutical Lab Ltd; 2009. / 4. Patel NK, et al. Int J Basic Clin Pharmacol. 2012 Dec;1(3):174-177. / 5. Thakur V, et al. Int J Reprod Contracept Obstet Gynecol. 2016 Jan;5(1):17-22.

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