

Original Article

Management of Critically Ill Obstetric Patients Admitted in Intensive Care Unit of Enam Medical College Hospital, Savar, Dhaka

Easnem Khanum¹, Gulshan Ara², Md. Ashraful Islam³

Received: 31 July 2021 Accepted: 15 September 2021

doi: <https://doi.org/10.3329/jemc.v12i1.71686>

Abstract

Background: Pregnancy-related complications are more observed in developing countries than in developed countries and sometimes need intensive care support to reduce both morbidity and mortality. Any critical condition with acute respiratory failure or hemodynamic insufficiency is the main cause of admission. The management is a great challenge as it is a little bit different from other critically ill patients: it needs emphasis on several factors for the fetomaternal wellbeing and needs multidimensional approach. **Objective:** The aim of our study was to evaluate the indication of critically ill obstetric patients who needed intensive care support, to assess the fetomaternal outcomes and to observe the applications of different types of interventions needed for the management of these cases. **Materials and Methods:** A retrospective study was conducted at Enam Medical College Hospital in Bangladesh, with 105 critically ill obstetrics patient admitted in ICU during the period of June 2014 to December 2017. Patients requiring advanced respiratory or ventilator support or needed care of two or more organ system support were fulfilled the criteria for ICU admission. Data were collected from the medical records of Obstetric and Intensive care unit in a preformed sheet, analyzed by SPSS 20.0. 'p' value of ≤ 0.05 is considered as statistically significant. After admission to the ICU primary resuscitation was done at first then several types of interventions were done immediately as per ICU protocol. Management was done by multidisciplinary approach. **Results:** Total 105 critically ill obstetric patients were admitted which is 2.66 % of the total ICU admissions. Referral cases from outside of the hospital was found 60.95%. Postnatal cases were found 71.42% which is more than antenatal (28.58%). The most common indication for ICU admission was found as obstetric hemorrhage (50.47%) and hypertensive disorders (32.38%). 49.5% patients needed mechanical ventilation, 57.14% needed ionotropic supports, 85.05% needed transfusions of either blood or blood products, 7.02% needed hemodialysis. Most of the patients (46) were stayed up to 2 days, a few (10) stayed more than 7 days, 26 stayed 2–3 days and 23 stayed for 3 to 5 days. The maternal death was observed in 25.71% among them, most of the cases were due to delayed referral (77.7%). **Conclusion:** Obstetric hemorrhage is the most common cause of ICU admission. Early transfer to the ICU may reduce maternal death. Maternal death was more found in referral cases. High dependency unit may reduce ICU admission.

Key words: Critically ill obstetric patients; Intensive care; Ventilator support

J Enam Med Col 2022; 12(1): 9–16

1. Associate Professor, Department of Anesthesiology & ICU, Enam Medical College & Hospital, Savar, Dhaka
2. Professor, Department of Obstetrics & Gynecology, Enam Medical College & Hospital, Savar, Dhaka
3. Associate Professor, Department of Anesthesiology & ICU, Enam Medical College & Hospital, Savar, Dhaka

Correspondence Easnem Khanum, Email: eamnem@gmail.com

Introduction

Pregnancy is a normal physiological phenomenon; but sometimes critically ill obstetric cases need intensive care support for better outcomes. The common causes¹⁻³ of admission into the intensive care unit are hypertensive disorders obstetric hemorrhage (ante partum/post partum), abruptio placentae, puerperal sepsis, complications of unsafe abortion, anesthetic complications, valvular heart disease, peripartum cardiomyopathy, pulmonary embolism, amniotic fluid embolism, deep vein thrombosis, pneumonia, stroke, acute renal failure, multi-organ dysfunction etc. Among all these most common problems are obstetric hemorrhage and hypertensive disorders.⁴⁻⁷

In developed countries maternal mortality rate and maternal death risk are less than in developing countries. Sometimes maternal obstetric morbidity and near-miss (severe maternal obstetric morbidity) cases may lead to maternal death.⁸⁻¹² To prevent it critical care support is helpful.

The management of a critically ill obstetric patient is a great challenge. To achieve better outcome we should follow guidelines according to the Intensive Care Society of London.¹³

In acute respiratory failure invasive positive pressure ventilation is relatively safe in pregnant patients to prevent aspiration¹⁴ though there is a risk of failed intubation. Non-invasive positive pressure ventilation can only be used in a poor resource setting or when invasive ventilator is unavailable.¹⁵

Management strategies regarding medications, nutrition, sepsis and other life-threatening conditions should be modified on the basis of physiological changes. Antibiotics should be used in an ICU according to US Food and Drug Administration (FDA) categories¹⁶ A to D and X. The tissue inflammatory condition, use of medication, use of inotropic agents (epinephrine) increase caloric requirement by 2.5 times; for each one degree centigrade fever the caloric demand increases by 10% and in sepsis basal need may increase by 1.9 times.^{17,18}

Sepsis is a leading cause of maternal mortality and morbidity worldwide.^{19,20} Major morbidity of obstetric

sepsis includes fetal demise, organ failure, chronic pelvic inflammatory disease, bilateral tubal occlusion and infertility.²¹ Management should be started immediately according to the guidelines of the Royal College of Obstetricians and Gynaecologists (RCOG) to prevent spreading of infection to the fetus.²²

Obstetric critical ill patients are more prone to develop thrombosis. To reduce its risk routine perioperative pneumatic compression devices and prophylactic low molecular weight heparin should be used.^{23,24} Sometimes sudden amniotic fluid embolism may occur, which has no prophylactic option to prevent it. So, only supportive treatment with aggressive resuscitative efforts should be started to ensure adequate tissue perfusion.²⁵

Worldwide obstetric hemorrhage, specially postpartum hemorrhage is the most common leading cause of maternal mortality and morbidity.^{26,27} To prevent hypovolumic shock, routinely vital signs assessment²⁸ is mandatory and management should be started from the administration of intravenous fluids preferably with crystalloids before transfusing frozen plasma, packed red blood cells, platelets, factor V, fibrinogen, along with tranexamic acid and uterotonic agents^{29,30} and in extreme cases uterine tamponade, compression suture, ligation of internal iliac arteries and even hysterectomy may be needed.³¹⁻³³

Hypertensive disorders of pregnancy and its complications³⁴ particularly preeclampsia/eclampsia, and HELLP syndrome are the leading causes of maternal and fetal morbidity and mortality. Its management includes organ system support, intensive monitoring, mechanical ventilation, treatment of the complications.³⁵

Usually 1–3% of the pregnant women present with cardiac diseases; among them death occurs in 10–15% cases.³⁶ Management in the ICU should be started with optimization of maternal hemodynamic status, maintenance of fetal perfusion, vasopressors according to fetal wellbeing³⁶ along with regular fetal monitoring every 4 hourly and arrangement of emergency cesarean section.

In case of development of maternal cardiac arrest³⁷ after 20 weeks gestation, cardio-pulmonary resuscitation

should be conducted according to Advanced Life Support (ALS) guidelines with left uterine displacement to prevent aortocaval compression³⁸ and perimortem cesarean section should be commenced within 4 minutes³⁹ and delivery within 5 minutes of the cardiac arrest.⁴⁰

The aims of our study were to evaluate the indication of critically ill obstetric patients who needed intensive care support, to assess the fetomaternal outcomes and to observe the applications of different types of interventions needed for the management of these cases.

Materials and Methods

This retrospective study was conducted at Intensive Care Unit of the Enam Medical College Hospital in Bangladesh, with 105 critically ill obstetrics patients who were admitted in ICU during the period of June 2014 to December 2017 under the Department of Anesthesiology and Intensive Care Unit and Obstetrics and Gynecology.

The critically ill life-threatening patients requiring advanced respiratory or ventilator support or needed care of two or more organ system support were account as the criteria for ICU admission. Critically ill obstetric patient following an accidental injury, poisoning cases were excluded from our study.

Data were collected from the medical records of Obstetric and Intensive care unit in a preformed sheet which include age, sex, para, gravida, perinatal status, the reason for ICU admission, primary diagnosis, uses of interventions, length of ICU stay, outcome. Data were analyzed by SPSS 20.0. ‘p’ value of ≤ 0.05 is considered as statistically significant.

After admission to the ICU primary resuscitation was done at first then detailed history was taken simultaneously then arterial blood gas analysis was done to identify respiratory failure, to assess the acid base status then several types of intervention were done immediately as per ICU protocol.

In case of respiratory failure endotracheal tube intubation was done for maintaining invasive positive pressure ventilation. Inotropic support was provided as per required along with insertion of central venous

line. Then other necessary laboratory investigations were sent and in case of need portable USG, ECG, X-ray was done.

Intense monitoring was done hourly, in case of antipartum cases fetal heart rate was observed every 4 hourly with routine continuous cardiotocography (CTG). Obstetric team was kept ready all the clock round for conduction of normal delivery or emergency cesarean section and pediatricians for managing the neonate, in case of need baby was shifted to Neonatal ICU.

Regular consultation was taken from Obstetrician, pulmonologist, cardiologist, nephrologists, neuromedicine, internal medicine specialist and compilation of all opinion were considered by the head of the ICU and definite treatment plan was taken as per primary diagnosis. All medications were advised as per the categories of fetomaternal wellbeing.

In case of hypovolumic shock management was done as per transfusion protocol. In case of hypertensive disorders emphasis was given to maintain organ system support and convulsion was controlled by magsulph and other anticonvulsant drug. Septicemic shock was managed as per RCOG guidelines, other critical conditions were managed as per treatment guidelines. In case of renal failure dialysis was given within the intensive care unit as per advise of nephrologists.

Regular follow up was done and treatment schedule was modified according to need. After improvement of the patients conditions all patients were shifted to step down ICU then finally to the obstetric ward.

Results

During the study period about 3,939 patients were admitted in the ICU. Among them 105 critically ill obstetric patients were selected for our study. It is 2.66% of the total ICU admission.

Among 105 subjects, 13 (12.38%) were found below 20 years of age, 52 (49.52%) were found between 20 to 25 years, 28 (26.66%) were found between 26 to 30 years of age and only 12 (11.42%) were above 30 years (Fig 1).

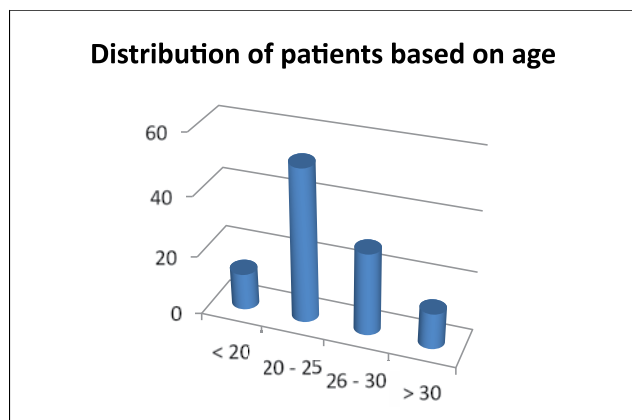


Fig 1. Distribution of the critically ill obstetric patients according to age

Regarding gestational age, most of the patients presented within 36 weeks. Forty one (39.0%) were found below 35 weeks of gestation and 64 (61%) were found above 35 weeks of gestation (Table I) and mean gestational age was found 35.6±2.5 weeks.

Table I: Distribution of patients according to gestational age

Gestational age	Frequency	Percentage
<35 weeks	41	39.0
>35 weeks	64	61.0
Total	105	100

Majority of the patients admitted to the ICU were found as referral cases from outside of the hospital. Sixty four (60.95%) were referred cases and 41 (39.05%) were from the Obstetrics and Gynecology ward of our hospital. During admission, most of the patients (71.42%) were postnatal cases (75/105) and antenatal cases were 28.58% (30/105) (Table II).

Table II: Perinatal status of the critically ill obstetric patients to the ICU

Obstetric cases	Frequency	Percentage
Antenatal	30	28.58
Postnatal	75	71.42
Total	105	100

The most common reason for ICU admission was obstetric hemorrhage (50.47%) followed by hypertensive disorders (32.38%) which include preeclampsia, eclampsia, HELLP syndrome and

medical complications (17.15%) such as puerperal sepsis, peripartum cardiomyopathy, valvular heart diseases, DIC, anesthetic complications, stroke, acute renal failure etc. (Table III).

Table III: Reasons for ICU admission of study population

Reason for admission	Frequency	Percentage
Obstetric hemorrhage	53	50.47
Hypertensive disorders (preeclampsia, eclampsia, HELLP syndrome)	34	32.38
Medical complications	18	17.15
Total	105	100

During managing the critical cases several interventions such as arterial blood gas analysis, endotracheal intubation, artificial respiration with the aid of mechanical ventilation, central venous line insertion, uses of vasopressors or inotropic agents, transfusion of blood and blood products, dialysis in cases of acute renal failure, evacuation of hematoma from the uterus, uterine artery ligation, uterine tamponade, obstetric hysterectomy etc. were done (Table IV).

Table IV: Interventions needed in ICU

Interventions	Frequency	Percentage
Mechanical ventilation	52	49.50
Vasopressors or inotropic agents	61	58.09
Blood and blood products	88	83.80
Evacuation of hematoma from the uterus	22	20.95
Uterine tamponade	06	5.07
Uterine artery ligation	04	3.08
Obstetric hysterectomy	16	15.23
Dialysis	08	7.02

Maximum number of the patients (46/105) were discharged from the ICU within 2 days, 26 needed to stay 2–3 days, 23 needed to stay 3–5 days and a few number of patients (10/105) stayed more than 7 days (Table V). Twenty seven patients died and most of them (21) were due to delayed referral.

Table V: Distribution of patients according to length of stay in ICU

Length of ICU stay	Survival group (n=78)	Death group (n=27)	Total (n=105)	Percentage
< 48 hours	34	12	46	43.80
>48–72 hours	20	6	26	24.76
>72–120 hours	18	5	23	21.90
>120–240 hours	6	4	10	9.52

Discussion

Management of critically ill obstetric patients is a great challenge in the ICU of a tertiary care hospital as most of the patients are admitted in a critical condition from the low resource setting health complex, maternity center, clinics as a delayed referral cases due to lack of good transport facilities, poor socioeconomic condition even sometimes for taking delay in decision about transfer as our male-dominated society does not want to spend more money. During the study period, the total 105 patients were admitted which was about 2.66% of total ICU admission (105/3939). This result is almost similar to a study done by Demirkiran et al⁴ where they found 2.6% of all ICU admission.

Most of the patients in our study were admitted as postnatal cases (71.42%) whereas antenatal cases (majority came during third trimester) were 28.58%. Leung et al⁴¹ found 78% (n=39) postnatal cases which is slightly higher than our study on the other hand Bhat et al⁴² found 70.80% postnatal cases which is almost similar to our study.

The most common indication for Intensive Care Unit admission of our study was found as obstetric hemorrhage 50.47% which is almost similar to a study by Ashraf et al² where they found 51% hemorrhagic patients. Obstetric hemorrhage also found the number one leading cause of ICU admission in several other studies like the study by Dasgupta et al¹⁰, Leung et al⁴¹, Bhat et al⁴², Qureshi et al⁴³. In our study for managing obstetric hemorrhage besides medical management sometimes surgical intervention was also needed such as peripartum hysterectomy (15.23%), uterine artery ligation (3.08%), uterine tamponade (5.07%) and evacuation of hematoma (20.95%).

Pregnancy-related hypertensive disorders were found

as the second most common cause of admission 32.38%. several other studies like Dasgupta et al¹⁰ (26.83%), Leung et al⁴¹ (14%), Bhat et al⁴² (26.2%), Ashraf et al² (18%), Orsini et al⁷ also found hypertensive disorders as the second most common cause like our study whereas several others studies found it as the most common cause of ICU admission such as study by Roksana et al⁹ (59.6%), Yel Manchili et al⁴⁴ (68%), Saha et al⁴⁵ (42%), Aldawood⁴⁶ (28%).

In our study total 49.5% (52/105) patients were required mechanical ventilation which is almost similar to a study Ashraf et al², they required about 47% mechanical ventilation, another study by Lapinsky et al⁴⁷ found 42% requirement of mechanical ventilation. Several other studies showed higher percentage of mechanical ventilation requirement such as study by Dasgupta et al¹⁰ (81.95%;168/205), Leung et al⁴¹ (58%;29/50), Bhat et al⁴² (63%; 41/65). Several studies also showed lower percentage than our studies such as study by Yel Manchili et al⁴⁴ (6%), Saha et al⁴⁵ (12%).

Maternal death is never expected to a family rather it accounts as a tragic event as pregnant women are usually young healthy and their death leads to several problems for the family, society and also for the newborn baby.⁴⁸ The majority of pregnancy-related death can be prevented by immediate management of life threatening complications and effective obstetric critical care support although many are unpredictable, many are attributed to pre-existing diseases.⁴⁹ In our study maternal mortality was observed about 25.71% (27/105.). Our result is almost closer to a study by Bhadade et al⁸ (30.3%). Several studies reported higher percentages of maternal mortality like Bhat et al⁴² (33.8%, 22/65) and Dasgupta et al¹⁰ (33.66%, 69/205). Study report of Qureshi et al⁴³ (21.64%,

42/194), Ashraf et al² (13%, 7/55), Saha et al⁴⁵ (6%, 3/50) found lower percentages which may be due to most of the cases were admitted as delayed referral cases.

The need for admission into the Intensive Care Unit for critically ill obstetric patients is unpredictable. The need for ionotropic and ventilator support are the main cause of admission and multi-organ failure is the main cause of maternal death. Early detection of the critical condition, health education, awareness, regular antenatal check-up, establishment of well-organized eclampsia ward and high dependency unit, recruitment of expert staff may reduce both the maternal and fetal morbidity and mortality.

References

1. Fawole AA, Bolaji BO, Oyedepo OO, Adeniran AS. Critically ill obstetric admissions into a tertiary hospital's intensive care unit. *J Med Investigating Pract* 2015; 10(1): 16–19.
2. Ashraf N, Mishra SK, Kundra P, Veena P, Soundaraghavan S, Habeebullah S. Obstetric patients requiring intensive care: a one year retrospective study in a tertiary care institute in India. *Anesthesiology Research and Practice* 2014; 2014(789450): 1–4.
3. Rani A, Singh K, Parkash S. Outcome of obstetric patients admitted to the intensive care unit: a one year retrospective. *BMR Medicine* 2014; 1(2): 1–5.
4. Demirkiran O, Dikmen Y, Utku T, Urkmez S. Critically ill obstetric patients in the intensive care unit. *Int J Obstet Anesth* 2003; 12(4): 266–270.
5. Bajwa SK, Bajwa SJ. Delivering obstetrical critical care in developing nations. *Int J Crit Illn Inj Sci* 2012; 2(1): 32–39.
6. Monsalve GA, Martínez CM, Gallo T, González MV, Arango G, Upegui A et al. Maternal critical care: outcomes and patient characteristics in a combined obstetric high dependency unit in Medellín, Colombia. *Columbian Journal of Anesthesiology* 2011; 39(2): 190–205.
7. Orsini J, Butala A, Diaz L, Muzylo L, Mainardi C, Kastell P. Clinical profile of obstetric patients admitted to the medical-surgical intensive care unit (msicu) of an inner-city hospital in New York. *J Clin Med Res* 2012; 4(5): 314–317.
8. Bhadade R, de' Souza R, More A, Harde M. Maternal outcomes in critically ill obstetrics patients: a unique challenge. *Indian Journal of Critical Care Medicine* 2012; 16(1): 8–16.
9. Roksana H, Rahman MM, Jahan S, Begum K. Critically ill obstetric patients treated in intensive care unit: a study in a tertiary care institution. *Delta Medical College Journal* 2017; 5(1): 15–19.
10. Dasgupta S, Jha T, Bagchi P, Singh SS, Gorai R, Choudhury SD. Critically ill obstetric patients in a general critical care unit: a 5 years' retrospective study in a public teaching hospital of eastern India. *Indian Journal of Critical Care Medicine* 2017; 21(5): 294–302.
11. Mhyre JM, Bateman BT, Leffert LR. Influence of patient comorbidities on the risk of near-miss maternal morbidity or mortality. *The Journal of the American Society of Anesthesiologist* 2011; 115(5): 963–972.
12. Kilpatrick SK, Ecker JL, Collagen WM. Severe maternal morbidity: screening and review. *ACOG. OBSTETRIC CARE CONSENSUS* 2016; 5(128): e54–60.
13. Connolly P, Gannon M, Godfrey MM, Golden B, Greene R, King G et al. Guidelines for the critically ill woman in obstetrics. *AWS Obstetric & Gynaecology, Anaesthetic and Critical Programmes Clinical Strategy & Programmes Division Health Service Executive* 13th August 2014; Version 1.1.
14. Al-Ansari MA, Hameed AA, Al-jawder SE, Saeed HM. Use of noninvasive positive pressure ventilation during pregnancy: case series. *Ann Thorac Med* 2007; 2(1): 23–25.
15. Mohapatra PR, Dutt N, Khanduri S, Mishra B, Janmeja AK. Noninvasive ventilation in acute respiratory failure due to H1N1 influenza. *Lung India* 2011; 28(1): 49–51.
16. Nahum GG, Uhl K, Kennedy DL. Antibiotic use in pregnancy and lactation: what is and is not known about teratogenic and toxic risks. *Obstet Gynecol* 2006; 107(5): 1120–1138.

17. Gariballa S, Forster S. Energy expenditure of acutely ill hospitalized patients. *Nutrition Journal* 2006; 5(9): 1–5.
18. Trikha A, Singh PM. The critically ill obstetric patient- recent concepts *Indian J Anaesth* 2010; 54(5): 421–427.
19. Bamfo JE. Managing the risks of sepsis in pregnancy. *Best Practice & Research Clinical Obstetrics & Gynaecology* 2013; 27(4): 583–595.
20. Elton RJ, Chaudhuri S. Sepsis in obstetrics. *Continuing Education in Anaesthesia Critical Care & Pain* 2015; 15(5): 259–264.
21. Lucas DN, Robinson PN, Nel MR. Sepsis in obstetrics and the role of the anaesthetist. *Int J Obstet Anesth* 2012; 21(1): 56–67.
22. RCOG Green- top Guideline No. 64b April 2012. Bacterial sepsis following pregnancy. Available at: <https://www.rcog.org.uk/en/guidelines-research-services/guidelines/gtg64b/>. Accessed July 2019.
23. Palmerola K, D’Alton M, Brock C, Friedman A. A comparison of recommendations for pharmacologic thromboembolism prophylaxis after caesarean delivery from three major guidelines. *BJOG Int J Obstet Gynaecol* 2016; 123: 2157–2162.
24. Lindqvist PG, Hellgren M. Obstetric Thromboprophylaxis: The Swedish Guidelines. *Adv Hematol* 2011; 2011: 157483. Available at: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3226316/>. Accessed July 2019.
25. Thongrong C, Kasemsiri P, Hofmann JP, Bergese SD, Papadimos TJ, Gracias VH et al. Amniotic fluid embolism. SYMPOSIUM: EMBOLISM IN THE INTENSIVE CARE UNIT. *Int J Crit Illn Inj Sci (IJCHS)* 2013; (3): 51–57.
26. Butwick AJ, Goodnough LT. Transfusion and coagulation management in major obstetric hemorrhage. *Current Opinion in Anaesthesiology* 2015; 28(3): 275–284.
27. WHO Guidelines for the management of postpartum haemorrhage and retained placenta. Geneva: World Health Organization; 2009. (WHO Guidelines Approved by the Guidelines Review Committee). Available at: <http://www.ncbi.nlm.nih.gov/books/NBK148662/>. Accessed July 2019.
28. El Ayadi AM, Nathan HL, Seed PT, Butrick EA, Hezelgrave NL, Shennan AH et al. Vital sign prediction of adverse maternal outcomes in women with hypovolemic shock: the role of shock index. *PloS One* 2016; 11(2): e0148729.
29. Sentilhes L, Lasocki S, Ducloy-Bouthors AS, Deruelle P, Dreyfus M, Perrotin F et al. Tranexamic acid for the prevention and treatment of postpartum haemorrhage. *BJA: British Journal of Anaesthesia* 2015; 114(4): 576–587.
30. Bonnet MP, Benhamou D. Management of postpartum haemorrhage. *F1000 Research* 2016; 1(5): 1514.
31. James AH, McLintock C, Lockhart E. Postpartum hemorrhage: When uterotonics and sutures fail. *American Journal of Hematology* 2012; 87(S1): 16–22.
32. Collis RE, Collins PW. Haemostatic management of obstetric haemorrhage. *Anaesthesia* 2015; 70 (Suppl 1): 78–86.
33. Gilmandyara D, Lorelei L. Thornburg surgical management of postpartum hemorrhage. *Seminars in Perinatology* 2018; 43(2019): 27–34.
34. Lam MT, Dierking E. Intensive care unit issues in eclampsia and HELLP syndrome. *Int J Crit Illn Inj Sci* 2017; 7(3): 136–141.
35. Imarengiaye CO, Isesele TO. Intensive care management and outcome of women with hypertensive diseases of pregnancy. *Niger Med J* 2015; 56(5): 333–337.
36. Hu H, Pasca I. Management of complex cardiac issues in the pregnant patient. *Critical Care Clinics* 2016; 32(1): 97–107.
37. Lavonas EJ, Drennan IR, Gabrielli A, Heffner AC, Hoyte CO, Orkin AM et al. Part 10: Special circumstances of resuscitation: 2015 American Heart Association Guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 2015; 132(18 Suppl 2): S501–518.

38. Palmer CM. Tilting at aortocaval compression. *Anesthesiology* 2015; 122(2): 231–232.
39. Pandya ST, Mangalampall K. Critical care in obstetrics. *Indian J Anaesth* 2018; 62(9): 724–733.
40. Girotra V, Mushambi M. MATERNAL CRITICAL CARE. ANAESTHESIA TUTORIAL OF THE WEEK 310. ATOTW 310 – Maternal Critical Care. Sept. 2014. Available at: https://www.wfsahq.org/components/com_virtual_library/media/96819dd58a48eb5a8cf73880df0e3e89-310-Maternal-Critical-Care.pdf. Accessed April 2019.
41. Leung NY, Lau AC, Chan KK, Yan WW. Clinical characteristics and outcomes of obstetric patients admitted to the Intensive Care Unit: a 10-year retrospective review. *Hong Kong Med J* 2010; 16: 18–25.
42. Bhat PB, Navada MH, Rao SV, Nagarathna G. Evaluation of obstetric admissions to intensive care unit of a tertiary referral center in coastal India. *Indian Journal of critical Care Medicine* 2013; 17(1): 34–37.
43. Qureshi R, Ahmed SK, Raza A, Khurshid A, Chishti U. Obstetric patients in intensive care unit: prespective from a teaching hospital in Pakistan. *Journal of the Royal Society of Medicine Open* 2016; 7(11): 1–8.
44. Yelamanchili A, Cherukuri K, Priyanka K. Study of obstetric patients admitted to intensive care unit (icu) in a high volume tertiary care center. *IOSR Journal of Dental and Medical Sciences* 2018; 17(01): 08–11.
45. Saha R, Shakya A. Study of obstetric patients admitted to Intensive Care Unit (ICU) at Kathmandu Medical College teaching. *Journal of Kathmandu Medical College* 2013; 2(4): 196–200.
46. Aldawood A. Clinical characteristics and outcomes of critically ill obstetric patients: a ten-year review. *Ann Saudi Med* 2011; 31(5): 518–522.
47. Lapinsky SE, Kruczynski K, Seaward GR, Farine D, Grossman RF. Critical Care management of the obstetric patient. *CAN J ANAESTH* 1997; 44(3): 325–329.
48. Panchal S, Arria AM, Labhsetwar SA. Maternal mortality during hospital admission for delivery: A retrospective analysis using a state-maintained database. *Anesth Analg* 2001; 93: 134–41.
49. Sailaja KB, Mk Renuka. Critically ill obstetric admissions to an Intensive Care Unit: a prospective analysis from a tertiary care university hospital in South India. *Indian J Crit Care Med* 2019; 23(2): 78–82.