Original Article

DOI: 10.7860/JCDR/2019/41609.13102

Contributory Factors for Obstetric ICU Admission: A Prospective Cross-sectional Study

Obstetrics and Gynaecology Section

HIMSWETA SRIVASTAVA[1], SHILPA SINGH[2], SUSHIL SRIVASTAVA[3], NEERJA GOEL[4]

ABSTRACT

Introduction: The physiological changes of pregnancy can turn pathological leading to Intensive Care Unit (ICU) admission of mother. The contributory factors to these ICU admissions need to be properly identified so that quality of obstetric services could be improved.

Aim: To identify contributory factors to obstetric ICU admission.

Materials and Methods: A prospective observational study was conducted in a multidisciplinary ICU of a tertiary care hospital of East Delhi, India. Maternal characteristics of women requiring ICU admission as well as contributory factors to ICU admission were observed and analysed. 'Contributory factor' was defined as modifiable component of health system and quality of care covering organisational, personnel and social factors. Descriptive data was tabulated as absolute figures and percentages.

Results: Hypertensive disorder of pregnancy was most common primary diagnosis of ICU admission. Massive intraperitoneal haemorrhage leading to Disseminated Intravascular Coagulation (DIC) and multiorgan failure was major cause of death in ICU admitted patients. Delay in referral and lack of transportation were found to be most contributory (84%) in obstetric ICU admission.

Conclusion: Social factors are major hurdle in achieving safe motherhood in India. There is a strong need of sensitisation regarding primary obstetric care among illiterate and poor women to decrease obstetric ICU admissions.

Keywords: Maternal intensive care unit admissions, Maternal morbidity, Obstetric critical care

INTRODUCTION

In majority of pregnant women, pregnancy and labour usually progresses uneventfully. Pregnancy leads to physiological changes in cardiovascular, endocrine, urinary and respiratory systems. These changes can sometimes turn pathological leading to complications in antenatal period, intrapartum period and puerperium necessitating ICU admission [1]. The spectrum of factors contributing to obstetric ICU admission in developed countries is radically different to those in developing countries. Hence there is a need to critically assess each "contributory factor" [2] that leads to ICU admission in developing countries, so as to formulate specific guidelines to prevent such morbidity and mortality. Despite several published reports [1-4] on the contributory factors responsible for the obstetric intensive care admissions contributing to the maternal morbidity and mortality, very few studies [5-7] have been done in India to identify such factors.

In view of above, we conducted a prospective observational study to evaluate contributory factors that lead to obstetric ICU admissions. This study also looked additionally into the organisational factors and social factors besides factors such as personnel factors and factors related to barriers to accessing care, as they are also significant contributors to the overall quality and effective delivery of obstetric services.

MATERIALS AND METHODS

A prospective observational study was conducted in a 14-bedded multidisciplinary ICU at a tertiary care teaching hospital of East Delhi from February 2016 to January 2017 after obtaining clearance from institutional ethics committee and informed consent from all patients. This hospital is a referral centre for all East Delhi Hospitals and adjoining states. The data was collected from the medical records of the pregnant women and women in postpartum period (upto 42 days) requiring admission to ICU. Maternal characteristics of women including demographic characteristics, diagnosis, mode of delivery, interventions done in ICU, and maternal outcome were noted and analysed. All patients, transferred to ICU were included in the study and were managed by the ICU team comprising of anaesthesia consultant, anaesthesia resident and nursing staff. The admitting obstetric unit provided consultations on daily basis.

All critically ill patients who did not require mechanical ventilation or inotropic support and were not admitted to ICU were excluded.

The causes were reviewed to identify "contributory factors" that lead to morbid condition of mother. "Contributory factor" was defined as modifiable component of health system and quality of care covering organisational, personnel and social factors. The contributory factors were categorised in: (A) organisational factors; (B) personnel factors; (C) social factors; and (D) barrier to accessing care. Each of the above contributory factors [8] comprised of two checklist items as mentioned.

A) Organisational factors
   i) Availability of operation theatre/blood
   ii) Lack of equipment
B) Personnel factor
   i) Lack of human resources
   ii) Lack of expertise/training/education
C) Social factors
   i) Lack of transport from home to Health Care Facility (HCF) and lack of transport between HCF
   ii) Delay in referral
D) Barriers to accessing care
   i) Delay in woman seeking help
   ii) Refusal of treatment

All included patients were followed till final outcome (discharge/death). Primary outcome measure was factors commonly implicated in obstetric ICU admission. Secondary outcome measures were indication of ICU admission, ICU interventions and causes of maternal death.

Descriptive data was tabulated as absolute figures and percentages.

RESULTS

All obstetric patients admitted to ICU over a duration of one year were included and analysed. There were a total of 19869 deliveries in the hospital during this period. Obstetric patients admitted to the ICU were 138 patients which constituted 0.69% of total deliveries. The total admissions to ICU were 730 and obstetric patients represented 18.9% of the total ICU admissions. The mean maternal age was 24.4 years. Most of the patients were from lower socioeconomic background (n=135, 97.8%) as per Modified BG Prasad Classification [9]. About half of the patients admitted to ICU were primigravida. About 55.8% (n=77) of obstetric patients admitted to the ICU were illiterate and 73.9% (n=102) had received no previous antenatal care [Table/Fig-1]. Considering gestational age, most of our patients (n=105, 76.1%) were admitted to hospital in the third trimester (29-42 weeks). Also, 89.9% (n=124) patients were admitted to ICU in postpartum state.

Characteristics		No. of cases (%)
Literacy	Educated	61 (44.2%)
	Illiterate	77 (55.8%)
Antenatal care	Provided	36 (26.1%)
	Not provided	102 (73.9%)
Parity	P1	69 (50%)
	P2	46 (33.3%)
	≥P3	23 (16.6%)

[Table/Fig-1]: Maternal characteristics of ICU admitted women.

Focusing on primary outcome measure, among the contributory factors resulting in the need for ICU admission, social factors were seen in majority of patients. However barrier to accessing care was present in nearly half of the patients, personnel factor in 44 (31.9%) and organisational factor in 19 (13.8%) patients [Table/Fig-2].

Contributory factor	Number of cases (%)
Social	116 (84%)
Barriers to access care	75 (54.3%)
Personnel	44 (31.9%)
Organisational	19 (13.8%)

[Table/Fig-2]: Contributory factors to ICU admission.

Among secondary outcomes, most of the patients (n=124, 89.9%) were admitted to ICU for obstetric indication. Hypertensive disorder of pregnancy and its complication were the most common primary diagnosis for ICU admission (n=69, 50%). Other causes leading to ICU admissions were obstetric haemorrhage (abruption, postpartum haemorrhage, rupture uterus) in 30 (21.7%) followed by anaemia in 14 (10.1%) [Table/Fig-3].

With respect to the mode of deliveries, 58 patients (42%) delivered vaginally while 80 (58%) were delivered by caesarean section.

Indication	No. of cases (%)
Hypertensive disorder	69 (50%)
Obstetric haemorrhage	30 (21.7%)
Anaemia	14 (10.1%)
Sepsis	11 (8%)
Others	
a) Neurological causes	5 (3.6%)
b) Organophosphorus poisoning	3 (2.2%)
c) Hepatic causes	3 (2.2%)
d) Chronic kidney disease	3 (2.2%)

[Table/Fig-3]: Indications for ICU admission.

Laparotomy for postpartum haemorrhage was done in 14 (10.1%) patients while three patients underwent peripartum hysterectomy [Table/Fig-4].

Interventions	No. of cases (%)
Interventions done in hospital	
Caesarean section	80 (58%)
Obstetric hysterectomy	3 (2.2%)
Laparotomy	14 (10.1%)
Evacuation of vulval haematoma	3 (2.2%)
Instrumental delivery	3 (2.2%)
Manual removal of placenta	3 (2.2%)
Hydraulic reduction of uterus	3 (2.2%)
Interventions done in ICU	
Mechanical ventilation	124 (90%)
Blood and blood product transfusion	104 (75.4%)
Inotropes	41 (29.7%)
Antihypertensives	69 (50%)
Dialysis	11 (8%)
Tracheostomy	3 (2.2%)

[Table/Fig-4]: Interventions done in hospital.

Of the ICU interventions, 124 (90%) patients required ventilator support, 41 (29.7%) required inotropic support. Blood and blood products transfusion was required in 104 (75.4%), dialysis in 11 (7.9%) and antihypertensives in 69 (50%) patients. Tracheostomy was done for 3 (2.2%) patient [Table/Fig-4]. Of all the maternal cases transferred to the ICU, 44 (32%) patients were referred either from district hospitals or private nursing home.

Sixty (43.5%) patients stayed for <48 hours in ICU and only 8 (5.8%) patients, (one with severe anaemia and other two with hypoxic ischemic encephalopathy and chronic kidney disease) stayed for >10 days. Almost half of the patients (n=72, 52.2%) were shifted to ICU in less than 12 hours of hospital admission.

There were 30 (21.8%) maternal deaths in the study period and majority of deaths were due to DIC and multiorgan failure following massive obstetric haemorrhage [Table/Fig-5]. Among the patients who died, the major contributory factor was barrier to accessing care (n=20, 66.6%) followed by social factors (n=12, 40%). Among the 30 patients who died, 11 (36.6%) patients were referred from peripheral hospitals.

Primary cause of death	No. of cases (n) (%)
Haemorrhage followed by DIC	17 (56.6%)
HELLP syndrome	6 (20%)
Meningoencephalitis	3 (10%)
Hepatic encephalopathy	2 (6.7%)
Pulmonary oedema	2 (6.7%)

[Table/Fig-5]: Maternal mortality and its causes (maternal death N=30).

DISCUSSION

The study clearly highlights the contributory factors to obstetric ICU admissions. The most common contributory factor leading to ICU admission was delay in referral and lack of transport system for patients. Hypertensive disorders of pregnancy and obstetrics haemorrhage was the most common indication for ICU admission in our study, while obstetric haemorrhage followed by DIC was the most common cause for maternal mortality.

Pregnancy induces a series of physiological alterations that usually proceeds without any complication; but a few women develop life threatening morbidity that requires intensive care interventions. In our study 0.69% of total obstetric patients required ICU care which represented 18.9% of total ICU admissions in the study period. This

is similar to various other studies, where it has been seen that the frequency of obstetric admission to ICU lies between 0.1% and 0.9% of all deliveries [10-13]. Almost half of the obstetric patients (n=72, 52.8%) were admitted to the ICU within 12 hours of hospital admission, indicating that these patients were brought in clinically deteriorated condition and hence indicating a delay in reaching tertiary centre.

A total of 105 (76%) patients were admitted to hospital in third trimester (29-42 weeks) and subsequently shifted to ICU in postpartum state. A similar observation was seen in studies by Vasquez DN et al., and Lapinsky SE et al., where patients were admitted at 29 weeks and 32 weeks respectively [14,15]. This could be because majority of obstetric complications are present in the third trimester. In our study majority of admissions were due to obstetric indications as compared to non-obstetric indications, as also reported by Vasquez DN et al., [14].

Osinaike B et al., Okafor UV et al., have reported 100% [16,17] and Lapinsky SE et al., has also reported 91% postpartum ICU admission [15]. Similarly, a high incidence of postpartum ICU admission 124 (89.9%) was observed in our study. This could be due to major haemodynamic changes like increase in cardiac output, acute blood loss occurring in the immediate postpartum period. Termination of pregnancy constitutes an important management intervention in complicated third trimester pregnancy. Hence almost all such cases were first managed by obstetrical team in labour room and after delivery were transferred to ICU.

Hypertensive disorders in pregnancy and major obstetric haemorrhage were the most common diagnosis for ICU admission in our study. Madan I et al., also reported preeclampsia, abruption and acute renal failure to be the most common indication for ICU admission [18]. Similarly, preeclampsia and obstetric haemorrhage were the most common indications for ICU admission by, Sadler LC et al., Chawla S et al., and Keizer JL et al., [2,5,19].

In the ICU, 124 (89.9%) of our patients required ventilatory support while 41 (29.7%) patients required inotropic support. Mechanical ventilator requirement was found in 61% of ICU patients by Sriram S et al., [20]. As regards for inotropic support Sriram S et al., found 38% of patients required inotropic support while Bibi S et al., [21] found inotropic support requirement in 40% of ICU admitted patients. This was because most of the haemodynamic complications were effectively managed in the labour room and only those patients who required ventilator support or were in impending respiratory failure, were transferred to ICU.

The maternal mortality in our study was 21.7% (n=30). This is similar to other studies done in India [6,7]. Obstetric haemorrhage followed by DIC was found to be major cause of ICU mortality. A systematic review done by WHO found that, postpartum haemorrhage is the leading cause of maternal mortality in Africa and Asia responsible for half of total number of deaths in these areas [22]. Overall postpartum haemorrhage accounts for 25% of maternal mortality worldwide [23]. Mortality due to obstetric haemorrhage is an index of degree of accessibility of quality health care. This study showed that in about two-thirds of obstetric ICU deaths; the contributory factor was delay in seeking help and refusal of treatment (barrier to accessing care). This was further proved by the fact that only 11 out of 30 maternal deaths had received some treatment earlier. There is a major role of increasing awareness and sensitisation programs at community level regarding primary essential obstetric care and availability of health care facilities.

The most common contributory factor leading to ICU admission was delay in referral and lack of proper transport system for patients. Adequate training and skill transfer for early identification of high risk cases is important for timely referral to tertiary centers. Easy availability of ambulance services is required. The second common contributory factor was barriers to access care (comprising of delay in woman seeking help and refusal of treatment) probably due to lack of health education in women. Sadler LC et al., found personnel factors as the most common contributory factor in causing ICU admissions while we found delay in referral and lack of proper transport system to be the most contributory [2].

STRENGTH

The main strength of our study is that it not only focusses on maternal spectrum of obstetric ICU admission but also highlights the contributory factors that lead to that admission. Secondly, being a tertiary care hospital with all facilities freely available, the patients had good survival rate. They were near misses and were able to communicate the contributory factor that led to their morbidity.

LIMITATION

Majority of the patients included in the study belong to low socioeconomic strata, a multicentric study with more diverse social background would address other factors that lead to obstetric ICU admissions. Most of the included patients were near misses, detailed analysis and interpretation of this data should be the next step to decrease the high rate of obstetric ICU admission.

CONCLUSION

Delay in referral and lack of proper transport services were found to be most contributory in obstetric ICU admission, emphasising the need to develop credible transport (ambulance) services and efficient obstetric referral system. Health education and sensitisation regarding primary obstetric care among women (especially illiterate and low socio-economic status) will go a long way in preventing morbidity and mortality. For early detection and prompt referral of complicated obstetric cases, emergency obstetric drill and continuing medical education should be arranged for all obstetric care providers in peripheral health centres. Standard operative protocols should be prepared and strictly followed for the management of all obstetric high risk cases.

REFERENCES

[1] Lin L, Chen YH, Sun W, Gong JJ, Li P, Chen JJ, et al. Risk factors of obstetric admissions to the intensive care unit: An 8-year retrospective study. Medicine (Baltimore). 2019;98(11):e14835.
[2] Sadler LC, Austin DM, Masson VL, McArthur CJ, McLintock C, Rhodes SP, et al. Review of contributory factors in maternity admissions to intensive care at a New Zealand tertiary hospital. Am J Obstet Gynecol. 2013;209(6):549.e1-7.
[3] Barry Y, Deneux-Tharaux C, Saucedo M, Goulet V, Guseva-Canu I, Regnault N, et al. Maternal admissions to intensive care units in France: Trends in rates, causes and severity from 2010 to 2014. Anaesth Crit Care Pain Med. 2018 Dec 21. pii: S2352-5568(18)30316-13. doi: 10.1016/j.accpm.2018.12.007. [Epub ahead of print].
[4] Ogunyemi D, Hage N, Kim SK, Friedman P. A multidisciplinary model for reviewing severe maternal morbidity cases and teaching residents patient safety principles. Jt Comm J Qual Patient Saf. 2019 Mar 20. pii: S1553-7250(18)30542-47. doi: 10.1016/j.jcjq.2019.02.003. [Epub ahead of print].
[5] Chawla S, Nakra M, Mohan S, Nambiar BC, Agarwal R, Marwaha A. Why do obstetric patients go to the ICU? A 3-year-study. Med J Armed Forces India. 2013;69(2):134-37.
[6] Gupta S, Naithani U, Doshi V, Bhargava V, Vijay BS. Obstetric critical care: A prospective analysis of clinical characteristics, predictability, and fetomaternal outcome in a new dedicated obstetric intensive care unit. Indian J Anaesth. 2011;55:146-53.
[7] Poornima B, Bhat R, Navada MH, Rao SV, Nagarathna G. Evaluation of obstetric admissions to intensive care unit of a tertiary referral center in coastal India. Indian J Crit Care Med. 2013;17(1):34-37.
[8] Mangal A, Kumar V, Panesar S, Talwar R, Raut D, Singh S. Updated BG Prasad socioeconomic classification, 2014: A commentary. Indian J Public Health. 2015;59(1):42-44.
[9] National Rural Health Mission. Maternal Death Review: Guidebook. Available from: http://nhsrcindia.org/sites/default/files/MDR%20Handbook%20Dec%209.pdf. Accessed on 8th June 2019.
[10] Richa F, Karim N, Yazbeck P. Obstetric admissions to the intensive care unit: An eight year review. J Med Liban. 2008;56:215-19.
[11] Muench MV, Baschat AA, Malinow AM. Analysis of disease in the obstetric intensive care unit at a university referral centre: A 24-month review of prospective data. J Reprod Med. 2008;53:914-20.
[12] Quah TC, Chiu JW, Tan KH, Yeo SW, Tan HM. Obstetric admissions to the intensive therapy unit of a tertiary care institution. Ann Acad Med Singapore. 2001;30:250-53.

[13] Wheatley E, Farkas A, Watson D. Obstetric admissions to an intensive therapy unit. Int J Obstet Anesth. 1996;5:221-24.
[14] Vasquez DN, Estenssoro E, Canales HS, Reina R, Saenz MG, Das Neves AV, et al. Clinical characteristics and outcomes of obstetric patients requiring ICU admissions. Chest. 2007;131:718-24.
[15] Lapinsky SE, Kruczynski K, Seaward GR, Farine D, Grossman RF. Critical care management of the obstetric patient. Can J Anaesth. 1997;44:325-29.
[16] Osinaike B, Amanor-Boadu S, Sanusi A. Obstetric intensive care: A developing country experience. Internet J Anesthesiol. 2006;Vol. 10.
[17] Okafor UV, Efetie ER. Critical care obstetrics in a developing country. J Turkish-German Gynecol Assoc. 2008;9:09-13.
[18] Madan I, Puri I, Jain NJ, Grotegut C, Nelson D, Dandolu V. Characteristics of obstetric intensive care unit admissions in New Jersey. J Matern Fetal Neonatal Med. 2009;22(9):785-90.
[19] Keizer JL, Zwart JJ, Meerman RH, Harinck BI, Feuth HD, van Roosmalen J. Obstetric intensive care admissions: A 12-year review in a tertiary care centre. Eur J Obstet Gynecol Reprod Biol. 2006;128:152-56.
[20] Sriram S, Robertson MS. Critically ill obstetric patients in Australia: a retrospective audit of 8 years' experience in a tertiary intensive care unit. Crit Care Resusc. 2008;10(2):124.
[21] Bibi S, Memon A, Sheikh JM, Qureshi AH. Severe acute maternal morbidity and intensive care in a public sector university hospital of Pakistan. J Ayub Med Coll Abbottabad. 2008;20(1):109-12.
[22] Khan KS, Wojdyla D, Say L, Gülmezoglu AM, Van Look PF. WHO analysis of causes of maternal death: A systematic review. Lancet. 2006;367(9516):1066-74.
[23] World Health Organization. Maternal mortality in 2005 estimates developed by WHO, UNICEF, UNFPA and the World Bank. Tech Rep. World Health Organization, Geneva, Switzerland, 2007.

PARTICULARS OF CONTRIBUTORS:
1. Assistant Professor, Department of Obstetrics and Gynaecology, UCMS and GTB Hospital, New Delhi, India.
2. Assistant Professor, Department of Obstetrics and Gynaecology, UCMS and GTB Hospital, New Delhi, India.
3. Associate Professor, Department of Paediatrics, UCMS and GTB Hospital, New Delhi, India.
4. Director Professor, Department of Obstetrics and Gynaecology, UCMS and GTB Hospital, New Delhi, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Shilpa Singh,
Assistant Professor, Department of Obstetrics and Gynaecology, UCMS and GTB Hospital, New Delhi-110095, India.
E-mail: sshilp83@gmail.com

FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Mar 24, 2019**
Date of Peer Review: **Apr 24, 2019**
Date of Acceptance: **Jun 24, 2019**
Date of Publishing: **Aug 01, 2019**