

Study of Obstetric Admissions to the Intensive Care Unit of a Tertiary Care Hospital

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Received: 17 June 2015 / Accepted: 10 July 2015 / Published online: 26 August 2015
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About the Author



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Abstract

Purpose To analyze obstetric admissions to intensive care unit and to identify the risk factors responsible for intensive care admission.

Methods This is a retrospective study of all obstetric cases admitted to the intensive care unit over a period of

3 years. Data were collected from case records. The risk factors responsible for ICU admission were analyzed.

Results There were 765 obstetric admissions to ICU accounting for 1.24 % of all deliveries. 56.20 % were in the age group of 20–25 years. 38.43 % were in their first pregnancy. 36.48 % of cases were at 37–40 weeks of gestation. Postpartum admissions were 80.91 %. Major conditions responsible were obstetric hemorrhage in 44.05 %, hypertensive disorders of pregnancy in 28.88 %, severe anemia in 14.37 %, heart disease in 12.15 %, and sepsis in 7.97 % of ICU cases. 40.39 % cases required high dependency care. Maternal mortality was seen in 15.55 % of ICU cases. Commonest cause of mortality was hemorrhagic shock (26.89 %) and multiorgan dysfunction syndrome (26.05 %).

Conclusion Commonest risk factors for ICU admissions are obstetric hemorrhage and hypertensive disorders of pregnancy. Other major risk factors are severe anemia, heart disease, sepsis, more than one diagnosis on admission, and the need for cesarean delivery.

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Keywords Intensive care unit · High dependency unit · Critical care · Obstetric medicine · Maternal mortality · Obstetric hemorrhage · Hypertensive disorders

Introduction

Obstetric emergencies are a challenge to the obstetrician because of the unique nature of obstetric medicine. The altered physiology of pregnancy, the presence of the fetus, the rapid deterioration of maternal and fetal condition in case of a complication, and the simultaneous management of two lives with different physiologies are a challenge [1]. These emergency conditions should be managed in a well-equipped, dedicated obstetric intensive care unit (ICU) for better maternal and fetal outcomes [2]. The percentage of obstetric population requiring admission to the ICU is different in different countries based on the socioeconomic status, criteria for ICU admission, availability of ICU beds, and availability of a high dependency unit. It ranges from 0.08 to 0.76 % of deliveries in developed countries [3–7] and 0.13 to 4.6 % in developing countries [1, 8–15]. The mortality in these patients is high and ranges from 0 to 4.9 % of ICU admissions in developed [4–7] and 2–43.63 % in developing countries [8–11, 13, 15, 16]. Hypertensive disorders and obstetric hemorrhage are the two the commonest risk factors for ICU admission [7]. The other risk factors are sepsis, cardiac disease, and severe anemia [7, 13, 14, 17, 18]. The present study was done to analyze all the obstetric admissions to the intensive care unit of a tertiary care referral hospital for a period of 3 years and to identify the risk factors responsible for admission.

Materials and Methods

It is a retrospective study of obstetric cases admitted to the intensive care unit over a period of 3 years from July 2010 to June 2013. All the pregnant and postpartum (<42 days) patients admitted to the intensive care unit of Vanivilas hospital attached to Bangalore Medical College and Research Institute, Bangalore were included the study. The admissions were identified from the ICU register, and the case records of the patients were studied in detail. The parameters noted were the age, parity, diagnosis on admission, associated medical and surgical condition, the ward from which the patient was shifted to ICU, reason for ICU admission, any surgical procedure performed, antenatal or postnatal admission, details of treatment given like ventilator support, blood and blood component transfusion, ionotropic support, and dialysis. The neonatal outcome was noted in terms of death and neonatal intensive care admissions. The total duration of stay was noted. The

maternal mortality and its cause were noted. Vanivilas hospital is a medical college-attached hospital. Cases from all over the state and also some places of nearby states are referred to this institute. The ICU of the hospital is a six-bedded obstetric ICU managed by the anesthetist and obstetrician. 24-h laboratory and blood-bank facilities are available. The ICU does not have dialysis facility for which we have to shift the patient to adjacent nephrourology block. Cardiologists, nephrologists, neurologists, hematologists, pulmonologists, and gastroenterologists are available as and when required for consultation. In this hospital, all the services for pregnant women and women in puerperium including ICU admission and investigations are free of cost.

Results

During the study period, there were 63,800 obstetric admissions and 61,615 deliveries. 765 obstetric patients were admitted to the intensive care unit. This is the largest number reported so far from a single center. ICU cases accounted for 1.19 % of all obstetric admissions and 1.24 % of all deliveries. 90 % of the cases in ICU were referred from outside hospitals. 56.20 % of the cases were in the age group of 20–25 years, followed by 22.61 % of the patients in age group 26–30 years (Table 1). 38.43 % of women were in their first pregnancy followed by 35 % of women who were in their second pregnancy (Table 2). Gestational age on admission to the hospital was calculated predominantly based on the date of last menstrual period. Majority of the women were of 37–40 weeks of gestation accounting for 36.48 % of cases. 13.59 % of women were in gestational age group of 29–34 weeks, and 12.49 % were of 35–36 weeks. 16.99 % of women were admitted to our hospital in puerperium (Table 3). Majority of patients admitted in ICU were postpartum admissions accounting for 80.91 % of cases. 8.8 % of the patients were antenatal admissions with more than 20 weeks of gestation. The rest of the cases were with ectopic pregnancy, abortion, and molar pregnancy contributing to 5.35, 4.70, and 0.13 % of admissions, respectively (Table 4). 50.72 % of admissions were from the emergency operation theater followed by 43 % of admissions from labor ward (Table 5). The different conditions diagnosed on admission to the hospital ranged from common conditions like preeclampsia to rare disorders like myasthenia gravis. There were 52 cases (6.79 %) which did not have any obstetric or medical risk factors on admission but still developed unexpected complications. Among the 52 cases, 42 were taken for emergency section, and 10 were vaginal deliveries. 122 (15.94 %) cases had more than one diagnosis on admission. Among them, 79

Table 1 Age distribution

Age in years	<i>N</i> = 765	Percentage
<20	85	11.11
20–25	430	56.20
26–30	173	22.61
31–35	50	06.53
36–40	26	03.39
>40	01	00.13

Table 2 Obstetric index on admission

Gravidity/parity	<i>N</i> = 765	Percentage
G1/P1	294	38.43
G2/P2	268	35.03
G3/P3	147	19.21
G4/P4	37	04.83
G5/P5	11	01.43
G6/P6	06	00.78
G7/p7	02	00.25

Table 3 Gestational age on admission

Gestational age in weeks	<i>N</i> = 765	Percentage
<14/14	64	08.36
15–28	53	06.92
29–34	104	13.59
35–36	95	12.49
37–40	279	36.48
41–42	40	05.22
Puerperium	130	16.99

Table 4 Timing of admission to ICU

Time	<i>N</i> = 765	Percentage
Antepartum (>20 weeks)	68	08.88
Postpartum	619	80.91
Ectopic	41	05.35
Abortion	36	04.70
Molar	01	00.13

(10.32 %) had two diagnosis, 30 (3.92 %) had three diagnosis, and 13 (1.69 %) had more than three diagnosis on admission. As shown in Table 6, obstetric hemorrhage (44.05 %) was the commonest condition requiring ICU admission followed by hypertensive disorder of pregnancy (28.88 %). The other major conditions were anemia (14.37 %), heart disease (12.15 %), and sepsis (7.97 %).

Table 5 Type of ward

Admissions	Number = 765	Percentage
Direct	29	03.79
From operation theater emergency	388	50.72
Elective	15	01.95
From Labor ward	329	43.00
From post natal ward	02	00.26
From post operative ward	02	00.26

Table 6 Major obstetric and medical conditions requiring ICU admission

Conditions	<i>N</i>	Percentage
Obstetric hemorrhage	337	44.05
Hypertensive disorders of pregnancy	221	28.88
Severe anemia	110	14.37
Heart disease	93	12.15
Sepsis	61	07.97

Numbers do not add up to 765 because patients had more than one condition

Table 7 Duration of ICU stay

Duration of stay	<i>N</i> = 765	Percentage
<= 6 h	64	08.37
7 h to 2 days	354	46.27
>2 days to 4 days	237	30.98
>4 days to 7 days	67	08.75
>7 days to 10 days	30	03.92
>10 days	13	01.16

46.27 % of patients stayed for 2 days, 30.98 % of patients stayed for a duration of 2–4 days, and the maximum duration of stay in ICU was 25 days (Table 7). 40.39 % of women did not require ICU admission and could be managed in an HDU. Our hospital does not have an HDU so the cases were admitted in ICU. The commonest therapy given (Table 8) was the blood (51.37 %) and blood component (26.93 %) transfusion, followed by inotropic support (45.75 %), and followed by ventilator support (40.50 %). 60.78 % of women underwent surgical procedures (Table 9). The commonest surgical procedure performed was the cesarean section (37.12 %) followed by peripartum hysterectomy (9.67 %). The number of maternal deaths was 119 which accounts for 15.55 % of obstetric patients admitted in ICU and 18.42 % of deliveries among ICU patients. The commonest causes of maternal mortality (Table 10) were hemorrhagic shock (26.89 %) and multiorgan dysfunction syndrome

Table 8 Therapy in ICU

Therapy	N	Percentage
Ventilator support	318	40.50
Inotropic support	350	45.75
Blood transfusion	393	51.37
Blood components	206	26.93
Dialysis	24	03.13

Table 9 Surgical procedures: 465(60.78 %) underwent the following procedures

Surgical procedures	N = 765	Percentage
Peripartum hysterectomy	74	09.67
Cesarean delivery	284	37.12
Laparotomy		
Ectopic—40	54	07.06
Septic abortion—10		
Pelvic hematoma—03		
Inversion—01		
Repair of rupture uterus	09	01.18
Hysterotomy	04	00.52
Isthmic cervical opposition stitch	05	00.65
Bilateral internal iliac artery ligation	03	00.39
Uterine artery ligation	05	00.65
B-Lynch suture	19	02.48
Cervical tear suturing	02	00.26
Uterine packing	01	00.13
Evacuation of products of conception	02	00.26
Internal podalic version	01	00.13
Manual removal of placenta	02	00.26

Numbers do not add up because only 465 underwent surgical procedures and percentage of each surgical procedure calculated reflects the percentage of total (765) ICU admissions

(26.05 %). There were 646 deliveries among ICU patients. 74.61 % were live births, and 20.43 % were neonatal intensive care admissions.

Discussion

Obstetric medicine is unique and complicated. Obstetric medicine is different from the general medicine because of the various physiological changes occurring in pregnancy, and only an experienced obstetrician who has good knowledge of obstetric medicine can interpret and understand complex conditions in pregnancy. The threshold of an insult required for ICU admission is low in obstetric patients compared to nonpregnant population. We have seen women developing disseminated intravascular coagulation very rapidly with obstetric complications like

Table 10 Causes for maternal mortality

Causes	N = 119	Percentage
Hemorrhagic shock	32	26.89
Multiorgan dysfunction syndrome	31	26.05
Sepsis 08		
HELLP 18		
AFLP 05		
Acute pulmonary edema	19	15.97
Congestive cardiac failure	16	13.44
Uremia	05	04.20
Intracranial hemorrhage	05	04.20
Septic shock	05	04.20
Pulmonary thromboembolism	03	02.52
Hepatic encephalopathy	02	01.68
Acute pneumonia	01	00.84

AFLP acute fatty liver of pregnancy

hemorrhage and hypertensive disorders. The threshold for ventilator support also is low in pregnancy. These are just observations and experiences, and further study is needed to validate the same.

The rate of ICU admissions in this study was 1.19 % of all obstetric admissions and 1.24 % of all deliveries. Studies done in the past 10 years report an incidence which varies between developed and developing countries. It ranges from 0.08 to 4.6 % of deliveries. The rate in this study is higher than other studies [1, 3–7, 9, 15, 18] because 90 % of the ICU cases included in this study were booked elsewhere and referred to our institute for tertiary care. However, the rate is lower compared to some studies [8, 10, 19].

Gestational age The commonest gestational age was term gestation indicating that complications are common at term and around the time of delivery followed by women in gestational age group of 29–34 weeks and 35–36 weeks, explaining the high-risk cases requiring early termination. The mean gestational age reported in other studies ranges from 31 to 36 weeks [9–11, 15]. 16.99 % of women were admitted to our hospital in puerperium. These were the cases which delivered in outside hospitals. This can be used as an indicator of care in peripheral hospitals especially the management of third stage of labor. Hence, there is a need for education in peripheral hospitals for the nurses and junior doctors in active management of third stage of labor and also to identify at-risk cases and for timely referral.

Postpartum admissions accounted for 80.91 %. The reasons can be the following: postpartum complications were more especially postpartum hemorrhage, patients requiring cesarean section were shifted to the ICU after cesarean, some patients with risk factors were already in

active labor and were shifted to the ICU after delivery, cases were referred from outside after delivery, and some patients developed complications during cesarean section. Postoperative admissions were not out of complications related to surgical skills but because of the antenatal morbidity for which cesarean was done. For example, conditions like placental abruption, obstructed labor, HELLP syndrome, severe preeclampsia, and eclampsia that require operative delivery, as such, are more prone for postpartum hemorrhage and disseminated intravascular coagulation. The severe preeclampsia patients are more prone for pulmonary edema after cesarean section. Operative delivery in the presence of medical or obstetric complication can be a potential risk factor for ICU admission.

Antenatal admissions were 8.8 %. These patients were either severely ill or remote from term gestation. Patients who were ill and required delivery were shifted to the labor room and admitted to ICU after delivery unless they required ventilator support. There should be facilities for conducting labor in ICU because these patients can need ventilator support any time, and time will be unnecessarily wasted in shifting them later. Studies done so far report postpartum admissions as the majority. Some studies have reported a majority of antepartum admissions [13, 20], and delivery admissions (on the day of delivery) [6, 21], some studies have reported a high rate, though not the majority [10, 15]. Epidemiology of antepartum admissions needs further research.

Previous cesarean delivery There were a total of 101 delivery cases with one previous cesarean and 14 cases with two previous cesarean both accounting for 15 % of all the cases. Among them, 94 cases had associated obstetric and medical risk factors. Scar on the uterus adds to the risk for ICU admission. Cases like severe preeclampsia and heart diseases which could be delivered vaginally were taken for emergency cesarean because of the scar, an additional factor contributing to the morbidity. Minimizing primary cesarean sections will reduce the ICU admissions and the morbidity. Zwart JJ has reported previous cesarean in 14.7 % cases, which is the same figure as found in our study. One study reports a high percentage of 35.36 % [10].

Low-risk patients 52 cases (6.79 %) belonged to the low-risk group. They had no medical or obstetric disorders. Among them, 42 were taken for emergency cesarean, and ten were normal deliveries. Should the need for an emergency cesarean delivery in a low-risk pregnancy be considered a risk factor for ICU admission is a question here, which needs further study. If we exclude them, then it can be said that 1.30 % (10 cases) of cases without risk factors can develop complications requiring ICU admission.

The number of comorbid conditions 15.94 % cases had more than one diagnosis on admission. Any obstetric or

medical risk factor is a potential predictor of ICU admission. The risk increases with the number of conditions diagnosed on admission.

Major risk factors Obstetric hemorrhage (44.05 %) was the commonest condition requiring ICU admission followed by hypertensive disorder of pregnancy (28.88 %). The other major conditions were severe anemia (14.37 %), heart disease (12.15 %), and sepsis (7.97 %). Some studies report hypertensive disorders as the commonest condition [2, 4, 9, 10, 16]. Some studies report obstetric hemorrhage as the commonest condition [5, 7, 14, 22]. For hypertensive disorders, the range is 7–73.6 % from 24 studies [1–24], and the mean is 34.85 %. For obstetric hemorrhage, the range is 11–62.5 %, and the mean is 27.90 % from 23 studies [1–12, 14–24].

Small MJ has reported cardiac dysfunction in 36 % cases and as the commonest condition [18]. Mirghani also reports a high percentage (21.6 %) of cardiac disease compared to this study [22]. The percentage of cardiac disease ranges from 3.5 to 18.3 in other studies [5–8].

Sepsis was seen in the range of 2.4–18.3 in other studies [10, 13, 16, 24, 25]. Three studies reported sepsis rates similar to our study [6, 7, 14]. Yuel reports a high rate of 30.9 % [13].

One study done in India reports a high rate of anemia (38.18 %) and also as the commonest risk factor [13].

40.39 % of women could be managed in an HDU. There should be a HDU in all tertiary obstetric care hospitals. It will minimize the burden on ICU staff.

Cesarean delivery 60.78 % of women underwent surgical procedures. The commonest surgical procedure performed was the emergency cesarean section (37.12 %). Other studies report a high percentage of cesarean sections among ICU patients, 78.5 % [10], 50.7 % [4], 52.9 % [5], and 67.27 % [20], compared to this study. This indicates that most of the women needed operative delivery. Cesarean delivery, especially in the presence of obstetric and medical comorbidities, can be a potential risk factor for ICU admission and needs further research. According to Zwart, cesarean delivery is an adjusted risk factor for ICU admission [5].

The number of maternal deaths was 119 which accounts for 15.55 % of obstetric patients admitted in ICU and 18.42 % of deliveries among ICU patients. The commonest causes of maternal mortality were hemorrhagic shock (26.89 %) and multiorgan dysfunction syndrome (26.05 %). Mortality in this study is high compared to other studies [1, 4–7, 9, 10, 14, 16, 18, 21, 22, 24] but low compared to studies done in India [11–13, 15, 19, 23]. Multiorgan dysfunction has been reported as the commonest cause of mortality in some studies [1, 10, 24]. Irrespective of the primary disease, multiorgan failure commonly occurs in pregnancy as an end result [15]. The

commonest cause is the hypertensive disorder of pregnancy. The causes for multiorgan failure in this study were HELLP syndrome, sepsis, and acute fatty liver of pregnancy.

Conclusion

In conclusion, 1.24 % of deliveries required intensive care in our hospital. There is a need for HDU in tertiary care hospitals. Obstetric hemorrhage and hypertensive disorders of pregnancy are the major risk factors for ICU admission. Majority of complications occurred in women with gestational age of 37–42 weeks. 1.30 % patients with low-risk factors required ICU admissions. There is a need to train obstetricians in obstetric medicine and critical care to do justice to these critically ill pregnant women. Commonest cause for maternal mortality was hemorrhagic shock and multiorgan dysfunction. There is a need for training in emergency obstetrics so that the complication can be managed right at the time of occurrence. Training is also required for the junior doctors working in peripheral health centers in identifying at-risk cases and for timely referral. Severe anemia, cardiac disease, sepsis, need for a cesarean delivery, and more than one diagnosis on admission are the other risk factors for ICU admission.

Compliance with Ethical Standards

Conflict of interest Dr Ashakiran T R and Dr Malini K V declare that they do not have any conflict of interest.

Ethical approval The present study was approved by the ethical committee of our institute. Informed consent from patients was not taken because data collection was retrospective.

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