



ORIGINAL RESEARCH PAPER

Obstetrics & Gynaecology

PROFILE OF OBSTETRIC PATIENTS REQUIRING INTENSIVE CARE UNIT ADMISSION

KEY WORDS: Intensive Care Unit (ICU), Severe Acute Maternal Morbidity (SAMM)

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ABSTRACT

AIMS & OBJECTIVE: To evaluate the incidence of ICU admission and fetomaternal outcome of such patients.
MATERIALS & METHODS: A prospective observational study conducted in the Department of Obstetrics and Gynaecology, Calcutta National Medical College, Kolkata, during the period MARCH 2018 to FEBRUARY 2019. A total number of 55 patients were taken for the study.
RESULTS: In one year there were 15000 total obstetric admission, of which 55 women were admitted to the ICU. So the ICU referral rate is 0.37%. Hypertensive disorder (25 women, 45.45%) was the commonest indication for ICU admission. A significant number of women had associated with Renal failure followed by coagulopathy and Respiratory dysfunction. Most of the maternal deaths was due to multiorgan dysfunction.
CONCLUSION: Majority of the complications and deaths are preventable by essential antenatal care at all levels. Care of the critically ill pregnant patient requires a true multidisciplinary approach. Early referral to a tertiary care centre coupled with invasive hemodynamic monitoring and ventilator support may reduce maternal mortality.

INTRODUCTION

Pregnancy and childbirth is a physiological process and in the majority of the women, proceeds uneventfully, However, in a small proportion, it can pose major health risks, the most extreme of which is maternal mortality. Death only represents the tip of the morbidity iceberg. There are approximately 118 life threatening events of "near miss mortality" or severe acute maternal morbidity (SAMM) for each maternal death. (2)

Obstetric patients are generally young and healthy However, the potential for catastrophic complications is real, because Pregnancy itself induces a multitude of rather profound physiologic hemodynamic alterations. Among these are substantive increases in total blood volume, cardiac output, and uterine blood flow and altered cell mediated immunity. The major cardiovascular and hematologic changes of pregnancy, the particular pathologies unique to pregnancy, most importantly, pre eclampsia, eclampsia contribute additional challenges and require additional understanding. In addition, there are several acute circumstances, such as massive obstetric haemorrhage, specific to pregnancy that require a high degree of expertise for effective management. These mothers need ICU admission. Care of such critically ill parturients is a unique challenge in obstetrics, particularly because of its unpredictability, it is now believed that between 0.1 to 0.9% of pregnant women have complications requiring intensive care unit (ICU) admission. Haemorrhage, hypertensive disorder, anaemia and septicemia are common causes of ICU transfer. This may be related to the pregnancy itself, aggravation of a pre-existing illness, or complications of the (operative) delivery. (1)

Increasing number of women with underlying chronic medical conditions are now able to conceive and carry a fetus to term. For instance, a women with long standing diabetes mellitus or complex congenital cardiac defects are now counselled much more liberally when they present with the desire to raise a family, Such women obviously require a greater degree of medical care through out the antepartum, Intrapartum and postpartum periods. Management of such women throughout labour and delivery may require a period of observation in an intensive care unit (ICU). Knowledge of the special circumstances in which these women may present is essential for both the obstetrician and intensivists who are responsible for their care.

It was reported that before the early nineties, there was a paucity of research work on the need for intensive care management of the critically ill obstetric patient. (1) In earlier times, the concept of management of critically ill patients were obscured. Since then however, there has been increased research for better management of these patients. This is often because of the need for organ support and the higher level of medical care available in the unit. Despite better treatment and better support system, there is increased risk of maternal mortality even in a developed world. Maternal mortality is still on the higher side in developing countries like India in spite of so much of advancements in obstetrical critical care over the last few years. (1) Maternal mortality in developed countries like UK and USA is 7-8 per 100,000 live births as compared to more than 700 maternal deaths in most of the African countries. The figures for most of the South Asian countries are higher than 250 maternal deaths per 100,000 live birth. (2) Among these nations, India leads with an astounding statistics and accounts for MMR 254 per 1 lac live birth. A major drawback in developing countries like India is the severe shortage of intensive care facilities as compared to the number of critically sick population. Obstetricians nowadays are facing new challenges, especially at tertiary care hospitals and at higher referral centers. This acquires all the more important dimensions in the background of extremely low ratio of Intensive care Unit (ICU) specialists doctors/staff to manage such high risk patients. In most of the developing countries like India, majority of the population is distributed in the rural areas. The intellectual level of such rural patients and their relatives, their customs and traditions, lack of tertiary care facilities at villages, lack of transportation modes, as well as their financial status are the main contributory factors that account for the late admission and inability to get admitted in critical care units. (3,4) By the time these patients receive the intensive care services, it becomes quite late, and their condition gets deteriorated to a large extent. Some unfortunate patients are never able to receive the services of these higher centers, which adds to the already higher figures of maternal mortality and morbidity.

These factors, combined with some structural and functional health problems, do not allow the developing countries to achieve targets in obstetrical critical care as those in developed countries. (5,6,7) The higher admission rates of obstetric patients to critical care units are largely confined to urban population which is mainly due to their education level, awareness, realization of value of human life, changing social

attitudes and sound financial condition. The increased awareness about the criticality of certain obstetric conditions among urban masses has further propelled the early admission of patients to tertiary care centers. With increasing load of critical obstetric patient, the role of obstetrician has become all the more challenging and dynamic and they have to keep themselves well acquainted with the ever changing needs of critically ill obstetric patients. (8) As a result, the role of obstetrician has extended beyond the boundaries of labour room and operation theatre to the world of intensive care. One big reason for this involvement in critical care settings is the fact that obstetricians are well versed with the physiology of pregnancy and as well as the effects of various treatment regimens and interventions on these.

The ICU of our institute is 6 bedded and well equipped with all modern gadgets and state of the art ventilators. The hospital is being run by the Government, free of cost. The hospital has synchronized its obstetric and other health services with National Programs to provide free services to the rural obstetric patient, which has come as a boon for these poor patients.

This study is aimed at a prospective review of the obstetric patients who were admitted to ICU, the primary causes for their admission, the presence of co-morbid diseases, outcome of such patients, the types of various treatment regimens, their survival rate as well as the factors which contribute to the maternal mortality. In our study, we had tried to assess the utility of ICU in management of obstetric patients in a tertiary care government medical college in Kolkata, India.

AIMS AND OBJECTIVES

- The study is design to evaluate the incidence of ICU admission
- To evaluate the primary causes of the admission
- Characteristics of antepartum, intrapartum, postpartum patients requiring admission.
- Evaluate presence of co- morbid disease, organ involvement.
- Management given
- Fetomaternal Outcome of such patients
- Survival rate of the patients
- Factors which contribute to the maternal mortality

MATERIALS & METHODS

STUDY AREA: The present study was conducted on patients attending to either the emergency or OPD of department of Obstetrics and Gynaecology of Calcutta National Medical College & Hospital, Kolkata. Total 6 ICU bed (obst & Gynae Dept.) catering all critically ill patients.

STUDY POPULATION: ICU admission of obstetrics patients covering women antenatal, intrapartum, postpartum.

STUDY PERIOD : One Year (March 2018 to Feb 2019)

SAMPLE SIZE: 55

SAMPLE DESIGN: Prospective Study

STUDY DESIGN: Observational study.

PARAMETERS STUDIED:

- 1) Primary indication of admission in ICU
- 2) Type of patients: antepartum, intrapartum, postpartum
- 3) Duration of pregnancy (in antenatal cases)
- 4) Obstetric profile of women (age, gravid, parity, educational level)
- 5) Associated co-morbid condition of the patient
- 6) System or organ involvement
- 7) Type of management provided in the ICU
- 8) Duration of stay in the ICU
- 9) Fetomaternal outcome
- 10) Recovery

- 11) Death-factors contributing to death

STUDY TOOLS:

- I] All the equipments requiring evaluation of the patient in the general obstetric ward. (Stethoscope, BP machine, Hand held Doppler, CTG machine, USG machine).
- II] Equipments also required for evaluation of a critically ill patient in an ICU set up. (Ventilator, Monitor, Endotracheal Intubation set, Pulse Oximeter, Capnometer & ABC machine).

INVESTIGATIONS:

General obstetric ward- Routine blood investigations, ECG, CXR, CT, MRI.

In ICU- Blood pH, Blood Gas Analysis, PaO₂, PaCO₂.

STUDY TECHNIQUES:

History taking, through examinations (General, Systemic, P/A, P/V), fetal status evaluation, confirmation of mode of delivery, critical care requires a multidisciplinary approach to achieve the best outcome, patient & relative communication on regular basis.

STATISTICAL ANALYSIS

The data collected on the basis of above parameters- tabulated and analyzed by standard statistical method in consultation with Department of Community Medicine.

RESULTS

In one year study period (March 2018 to February 2019) total number of obstetrics cases were 15000 of which 55 women were admitted to the ICU. So the ICU admission rate was 0.37%. Of the 55 admission, 40 (72.73%) were emergency referral and 15 (27.27%) were booked cases in our obst. & Gynae Department. 25 (45.45%) were antepartum and the rest were i.e, 30 (54.55%) either intrapartum, postpartum or postabortal. Among 25 antepartum cases, 5 cases (20%) were below 28 weeks gestation and 20 cases (80%) were above that gestation.

Considering the educational level 25 (45.45%) were above 8th standard and 30 (54.55%) were below 8th standard. Mean maternal age was 26.5 years, the youngest being 18 and the eldest 36 years. 22 women (40%) were primigravida. Majority of the women who were admitted postpartum and most of them delivered at home by dais.

The maximum number of patients had length of stay in the ICU from (2 hour to 120 hour). 9 women (16.36%) stayed for 2 hours. 7 women (12.73%) for >5 days, rest were between 2 to 120 hours. Hypertensive disorder was the commonest indication for ITU admission. Out of 25 women (45.45%) 8 patients (14.55%) admitted due to PPH and 5 patients (9.09%) were shifted to ITU due to septic shock. Other causes are heart disease, IUFD, hepatic encephalopathy, after CS delivery, H.Mole, ectopic pregnancy, seizure disorder, pulmonary embolism. A significant number of women had associated with organ dysfunction. Majority of patients i.e, 18 patients (32.72%) had renal failure. Coagulopathy and Respiratory dysfunction were the next common. Multiorgan dysfunction seen in 7 patients (12.73%).

Out of 35 patients requiring ventilator support, there were 30 survivors & 5 non survivors. Majority number of patients required specialized interventions like blood transfusion & blood products, dialysis. 1 women had surgical intervention- exploratory laparotomy done in septic abortion suspecting gut injury. Most of the maternal death in our study were due to multiorgan dysfunction. Sepsis was the next common cause, followed by DIC, 2 patients died due to hepatic encephalopathy. Total 18 women died out of 55 admission. So the maternal mortality was 33%.

Regarding perinatal outcome, only 9 babies survived, rest died in utero or after birth. Among 9 survived baby, 4 were low birth weight, 3 were preterm & 2 were above 2.5 kg. Among 11 dead baby, 6 shifted to NICU after birth (CS/VD), due to HIE and MAS and died thereafter. Among rest 5, 3 were stillborn and 2 were IUFD.

The complexity of these cases was reflected by the fact that consultants in 8 different specialities were involved with these cases. Anaesthesiology n=18, Medicine n=12, General Surgery n=2, Cardiology n=2, Haematology n=2, Neurosurgery n=3, Nephrology n=16.

Table:- 1 Distribution Of Patients According To Age:

AGE	NUMBER	PERCENTAGE
<19 YRS	3	5.45%
20-25 YRS	17	30.9%
26-30 YRS	26	47.27%
31-34 YRS	7	12.73%
>35 YRS	2	3.64%

Table:- 2 Distribution Of Patients According To Parity:

PARITY	NUMBER	PERCENTAGE
P0	22	40%
P1	20	36.36%
P2	11	20%
P3	2	3.64%

Table:- 3 Distribution Of Patients Need Icu Admission:

DISEASE(S)	NUMBER	PERCENTAGE
ECLAMPSIA	25	45.45%
PPH	8	14.55%
SEPSIS	5	9.09%
ECTOPIC	3	5.45%
HEART DISEASE	2	3.64%
AFTER CS DELIVERY (IMMEDIATE POST OPERATIVE)	2	3.64%
HEPATIC ENCEPHALOPATHY	2	3.64%
IUFD	2	3.64%
H.MOLE	2	3.64%
SEIZURE DISORDER	1	1.82%
PULMONARY EMBOLISM	1	1.82%
ABRUPTIO PLACENTAE	2	3.64%

Table:- 4 Associated Organ Dysfunction

RENAL FAILURE	18	32.72%
PULMONARY OEDEMA	10	18.18%
LIVER FAILURE	2	3.64%
COAGULATORY DYSFUNCTION	4	7.27%
NEUROLOGICAL DYSFUNCTION	3	5.45%
MODS	7	12.73%
NIL	11	20%

Table:- 5 Treatment Given In Icu

VENTILATORY SUPPORT	35	63.64%
BLOOD TRANSFUSION	26	47.27%
F F P TRANSFUSION	22	40%
DIALYSIS	15	27.27%
PLATELET TRANSFUSION	14	25.45%
SURGICAL INTERVENTION	1	1.82%
IONOTROPIC SUPPORT	22	40%

DISCUSSION

Clinical recognition of the unique needs of the critically ill obstetric patients have received much attention in an attempt to assess the need for dedicated critical care facilities.(7,8) Since, in general, for most obstetric patients, rapid recovery follows correction of the acute insult. it is now believed that between 0.1% and 0.9% of parturients have complications requiring ICU admissions.(9)

On analysis of the critically ill obstetric patients in our hospital for a year(March 2018 to Feb 2019), ICU utilization rate(n=55, 0.37%) in spite of the high maternal mortality(n= 31 in one year /15000 delivery). Since ,most of the deaths occurred in wards or in the emergency immediately after admission.The major causes of such high mortality are,

- a) Delay in recognising the problem and deciding to seek care.
- b) Delay in reaching the health Facility, due to non-availability of transport & referral facility.
- c) Delay in receiving treatment at the centre due to lack of ICU bed vacancy. As the 6 bedded ICU caters all the department, often the beds are filled up, patients with dire requirement of ICU facility could not be shifted because of non availability of bed.

A higher utilization of ICU services in the developed countries has been observed (0.70, 0.76, 0.90, 1.40). In this present study, 15 patients are booked. i.e. only 27.27%, rests are unbooked 40(72.73%). Lack of education, low socioeconomic status, poor transportation facilities, poor rural health infrastructure and customs and traditions of local community are responsible for this. In this study, majority of women admitted in the ICU in postpartum period, that is (n=30, 54.55%), rests are during antepartum (n=25,45.45%). Most of the authors have reported a higher incidence of postpartum admission to the obstetric ICU.(16)

In India 52.3% of birth take place at home and of these just 5.7% of births are attended by skilled person. Presence of a SBA at every birth, along with availability of an effective referral system, can reduce maternal morbidity & mortality to a considerable extent. Evidence based practices have demonstrated that presence of skilled birth attendant can effectively reduce maternal mortality. To reduce MMR, Govt. Of India launched JSY scheme, in 2005. Under JSY, ASHA works as an effective link between the health care system at the Govt. level & poor pregnant women in the village. Though our national programs are continuously laying stress on the policies and urgency of decreasing maternal mortality & morbidity, especially in the rural population of our country, the established targets have not been achieved till now, despite the care given at tertiary care centre. In this present study, as maximum number of patients are coming from rural area, due to lack of education, poor socioeconomic status, late referral, lack of transportation system ,these poor unfortunate mothers are never able to reach this health care services in time .Which adds to the already higher figures of maternal mortality & morbidity. In this study, among total 25 antepartum mothers, 20 women(80%) were admitted with more than 28 weeks of gestational age, and 5 women less than that.

Regarding educational level, only 25 women(45.45%) are above 8th standard. Sukhwinder kaur bajwa et al. and Osinaike B et al. also reported that lack of education & poor antenatal care have a considerable effect on obstetric complications & outcome. Some studies (5, 11, 13) show lack of antenatal care has not been associated as a risk factor for ICU admissions. Obstetric patients are usually young but the gestational age of critically ill parturients shows a variance in different studies (11,13) .In this study Mean maternal age 26.5 years, the youngest was 18 years and eldest was 36 years. Sheela et al. Yuel veronica Irene et al have reported mean maternal age 24 years & 26.89±8 years respectively, which is comparable to this study.

Majority of women, in this study were primigravid , (n=22,40%), , which is not similar with sheela et al., they majority number of women admitted in ITU were multigravida, The maximum number of patients stay in the ICU ranged from 2 hrs to 120 hrs (5 days). Mean stay in the hospital is 48.65 hr . It has been reported (14, 15) that the most common reasons for ICU admission for obstetric patients are hypertensive disorders and massive obstetric haemorrhage.

It was emphasized that early detection and prompt referral to tertiary centres with intensive care facilities to provide optimum care of circulation, blood pressure and ventilation could minimize the prevalence of multiple organ failure and mortality in critically ill obstetric patients. In this study, preeclampsia & eclampsia represented the main cause of ICU admission (45.45%). At the same time, in comparison with other authors(4,5,10,13,17),they reported that the obstetric age was the major cause for ITU admission(62.5%).

Preeclampsia, eclampsia, PPH, sepsis, ruptured ectopic, DIC, IUFD, hepatic encephalopathy were the common primary indications for admission to the ICU. Other studies(4,5,10,17) have reported almost similar reasons for admission of obstetric patients to ITU. A significant number of patients had associated organ dysfunction; renal failure being present in 32.72% (18patients). Respiratory dysfunction were the next common dysfunction ie 18.18% (10 patients). 12.73% (7patients) had multiorgan dysfunction (MODS).

Maternal morbidity was much more than mortality and consisted of need for ventilatory support, inotropic support, dialysis, multiple transfusions of blood and blood products and surgical interventions as per the indications. Various studies have also observed these organ dysfunctions requiring similar therapeutic measures(1,3,5,6). It has been observed that hemodynamic and respiratory complications needing inotropic & ventilator support remain the most common reasons for ICU admissions (12,13) and the need for support may predict poor outcome (5). In the present study 22 patients(40%) required inotropic support and 35 patients (63.64%) required ventilatory support.

The number of organs failed directly reflects on the mortality. As the number of organs failed increases so does the mortality. This is reflected in the present study, where all patients with MODS died (N=7,31,82%) while mortality was less in women who had less number of organs involved. This is also highlighted in different studies.(3,5)

Maternal mortality in this study was 33% which was high as compared to that reported from the developed countries. This is because majority of our patients belongs to the rural areas from where timely hospitalizations and intervention is delayed. This have been attributed to treatment by quacks, low socioeconomic status, non existent antenatal care, low hematocrit and undernourishment in obstetric patients(6). While analysing the cases in the present study, it was observed that limitations in our health care infrastructure was responsible for such huge maternal deaths. But maximum (73%) number of mother are unbooked & unsupervised. This study also observed the patients who died were the ones who came very late to this hospital. In spite of all the resuscitative available, they died due to their irreversible clinical stage due to late arrival & inappropriate treatment at health centre. Patients undergone ultrasonographic examination at appropriate health centre, few disorder like placenta praevia, ruptured ectopic could have been timely diagnosed and can be prevented by proper treatment been started during pregnancy.

It has been observed that if antepartum patients have viable foetus and delivered or underwent caesarean section, while under intensive care there would not be higher incidence of neonatal mortality(12). In the present study, out of 20 antenatal mother, 9 baby survived i.e. survival rate 45%.

The major limitation of this study(being a single centre study) was that it was not feasible to validate our conclusions as the sample size was small(n=55). A potential selection bias in this study could have been avoided, if demographic detail and cause of mortality that occurred outside the ICU during the period of study had been identified.

SUMMARY

Pregnant women may require intensive care because of complications of the pregnancy itself or as a result of nonobstetric conditions. In either setting, care of the critically ill pregnant woman requires knowledge of the primary disease process and its treatment in nonpregnant patients and a thorough understanding of maternal physiologic adaptations to pregnancy. With all this views, the present study was carried out in the department of obs & gynaec, CNMC&H, Kolkata, during the period of one year().The results have thrown light on some very significant aspects in this study.

- Total admission in ICU 0.37% during the said year. (55 per 15000 deliveries)
- According to gestational age most antepartum women were above 28weeks (80%)
- Unbooked cases 72.73% and booked cases 27.27%
- Majority women were postpartum 54.55%
- According to educational level majority 55% were below 8th standard
- In this study, majority were primigravida 40%
- Mean maternal age 26.5 years, youngest 18yrs and eldest 36yrs.
- Mean duration of stay 48.65hrs. Maximum number of patients stay between 7hrs to 120 hrs (5days)
- Hypertensive disorders(45.45%) was the commonest indications for ICU admission. Next was PPH (14.55%)
- A significant number of patients had organ dysfunction, majority (32.72%) had renal failure.
- out of 55 women 35 women (63.64%) required ventilatory support
- Most of the maternal deaths were due to MODS (multi organ dysfunction) (38.89%)
- Out of 55women, 18 women died (33 %).
- Regarding perinatal outcome only 9 babies survived (40.9%)
- The complexity of these cases is reflected by the fact that consultants in 8 different specialities were involved With this cases, Anaesthesia(32.73%) Medicine(21.82%), Surgery(3.64%), Cardiology(3.64%), Hematology (3.64%), Neurosurgery(5.45%) Nephrology (27.27%), Radiology (1,82%).

So, the present study suggests that every tertiary care centre should have one ICU, exclusively for such critically ill pregnant women.

CONCLUSION

In spite of limitations, some careful conclusions can be drawn. Pre eclampsia / eclampsia remains the leading cause of ICU admission. Inotropic support ventilator support are the main interventions provided in the ICU which is associated with better outcome. Duration of ventilation and stay in the ICU were significantly more in the survivors.

Majority of the complications and deaths are preventable by essential antenatal care at domiciliary and peripheral levels. Presence of skilled health care staff and trained birth attendant at deliveries result in early referrals in cases of complications and thus prevention of most of the maternal deaths.

Care of the critically ill pregnant patient requires a true multidisciplinary approach for optimal outcomes. Early referral to a tertiary care centre coupled with invasive hemodynamic monitoring and ventilatory support improves the outcome of such patients. Maternal-fetal medicine specialist is a step towards the betterment of such obstetric patients. Improving quality of care before and after admission to ICU may reduce maternal morbidity.

REFERENCES

1. Martin SR, Foley MR. Intensive care in obstetrics: an evidence based review. Am J of Obstet and Gynecol 2006;195:673-679

2. Kuklina EV, Meikle SF, Jamieson DJ, Whiteman MK, Barfield WD. Severe obstetric morbidity in the united states: 1999-2006. *Obstet Gynecol* 2009; 113:293-299
3. American College of Obstetricians and Gynaecologists: Critical care in pregnancy practice bulletin 100, February 2009
4. Gillbert TT, Smulian JC, Martin AA, Ananth CV, Scorza W. Obstetric admission to the intensive care unit: Outcomes and Severity of illness. *Obstet Gynecol* 2003; 102:897-903
5. Zeeman GG, Wendal GD Jr. A blueprint for obstetric critical care. *Am J Obstet Gynecol* 2003; 188:532-6
6. Stevens TA, Carrol MA. Utility of acute physiology, age and chronic health evaluation (APACHE III) score in maternal admission to the intensive care unit. *Am Obstet Gynecol* 2006; 194:e13
7. Keizer JL, Zwatt JJ. Obstetric intensive care admission: a 12 year review in a tertiary care hospital. *Euro J Obstet Gynecol Reprod Biol* 2006; 128:152-156
8. Mattar F, Sibai BM. Eclampsia VIII. Risk factor for maternal morbidity. *Am J Obstet Gynecol* 2000; 182:307-12
9. Hough ME, Katz V. Pulmonary edema, a case series in a community hospital. *Obstet Gynecol* 2007; 109:1155
10. Katz VL, Farmer R. Preeclampsia into eclampsia: toward a new paradigm. *Am J Obstet Gynecol* 2000; 182:1389-96
11. Sibai BM. Diagnosis, prevention and management of eclampsia. *Obstet Gynecol* 2005; 105:402
12. Munnur U, Karnad DR. Critically ill obstetric patients in an American and an Indian public hospital: comparison of case mix, organ dysfunction, intensive care requirements and outcomes. *Intensive Care Med* 2005; 31:1087-94
13. Gibbs RS. Clinical risk factors for puerperal infection. *Obstetric and Gynecology* 1980; 55 (5 suppl):S178-S183
14. Mabie WC, Barton JR. Septic shock in pregnancy. *Obstet Gynecol* 1997; 90: 553
15. 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 (level II-2)
16. Lapinsky SE, Kruczynski K, Seaward CR, Farine D, Grossman RF. Critical care management of the obstetric patient. *Can J Anaesth* 1997; 44:325-9 (level III)
17. Selo-Ojeme DO, Omosaiye M, Battacharjee P, Kadir RA. Risk ractors for obstetric admissions to the intensive care unit in a tertiary hospital: a case control study. *Arch Gynecol Obstet* 2005; 272:207-10 (Level II-2)