
Occasional Review

Critical care management of the obstetric patient

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Purpose: To review a series of critically ill obstetric patients admitted to a general intensive care unit in a Canadian centre, to assess the spectrum of diseases, interventions required and outcome.

Methods: A retrospective chart review was performed of obstetric patients admitted to the intensive care unit of an academic hospital with a high-risk obstetric service, during a five-year period. Data obtained included the admission diagnosis, ICU course and outcome. Daily APACHE II and TISS scores were recorded.

Results: Sixty-five obstetric patients, representing 0.26% of deliveries in this hospital, were admitted to the ICU during the study period. All had received prenatal care. Admission diagnoses included obstetric (71%) and non-obstetric (29%) complications. The mean APACHE II score was 6.8 ± 4.2 and mean TISS score was 24 ± 8.1 . Twenty-seven patients (42%) required mechanical ventilation. No maternal mortality occurred and the perinatal mortality rate was 11%.

Conclusions: A small proportion of obstetric patients develop complications requiring ICU admission. The outcome in this study was excellent, in contrast to that reported in other published studies with similar ICU admission rates. The universal availability of prenatal care may be an important factor in the outcome of this group of patients. The lack of a specific severity of illness scoring system for the pregnant patient makes comparison of case series difficult.

Objectifs : Revoir les dossiers d'une groupe de parturientes sérieusement malades admises à l'unité des soins intensifs (USI) généraux d'un centre hospitalier canadien, évaluer l'éventail des affections, les interventions nécessaires et les résultats obtenus.

Méthodes : Revue rétrospective de dossiers de parturientes admises à l'USI d'un hôpital universitaire canadien doté d'un service d'obstétrique pour patientes à risques élevés pendant une période de cinq ans. Les données obtenues comprenaient le diagnostic à l'admission, l'évolution à l'USI et les résultats. Les scores APACHE II et TISS étaient enregistrés quotidiennement.

Résultats : Soixante-cinq parturientes représentant 0,26% des accouchements de l'hôpital ont été admises à l'USI pendant la période étudiée. Toutes avaient bénéficié des soins prénataux. Les patientes étaient admises pour des complications obstétricales (71%) ou autres (29%). Les scores APACHE et TISS moyens étaient respectivement $6,8 \pm 4,2$ et $24 \pm 8,1$. Vingt-sept patientes (42%) ont été ventilées mécaniquement. Il n'y a pas eu de mortalité maternelle et le taux de mortalité périnatale était de 11%.

Conclusions : Une faible proportion des parturientes développent des complications nécessitant des soins intensifs. Pour cette étude, les résultats sont excellents, contrairement à d'autres publiés ailleurs comportant des taux d'admission aux soins intensifs identiques. L'universalité de l'accès aux soins prénataux pourrait influencer considérablement les résultats dans ce groupe de patientes. L'absence d'un système de score spécifique à la gravité des affections de la grossesse rend la comparaison entre séries difficile.

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THE critically ill obstetric patient poses a number of management problems to the intensive care physician. The physiological changes of pregnancy, diagnoses specific to the pregnant state and the presence of a fetus complicate their assessment and management. Outcome is influenced by the precipitous deterioration which can occur and the equally rapid recovery which may follow delivery. Several studies have recently characterized obstetric admissions to the ICU,¹⁻⁸ in terms of ICU utilization rates, management and outcome. High mortality rates are reported, and considerable variation exists in the complications necessitating ICU admission. Comparison of the severity of illness between studies is difficult.

The Intensive Care Unit at Mount Sinai Hospital, Toronto, is a 15-bed tertiary care combined medical/surgical/cardiac intensive care unit. Intensive care patients are managed by a critical care staff physician with medical and surgical housestaff. The hospital has a tertiary care obstetric unit with a level three neonatal ICU and is one of six referral centres for high-risk pregnancies in Ontario. All critically ill pregnant patients are managed in the ICU. The decision to transfer a patient is made by the attending obstetrician, maternal-fetal medicine fellow or anaesthetist, in consultation with the ICU staff. Subsequent care is primarily in the hands of the ICU team in close consultation with the Maternal-Fetal Medicine unit.

We have reviewed obstetric admissions to our ICU, and compared our experience with published data from other medical, surgical and obstetric ICUs. The primary goal was to document our ICU utilization rate, severity of illness, and outcome of these patients.

Patients and Methods

The records of all obstetric patients admitted to the ICU from January 1990 to December 1994 were reviewed. Data obtained included (i) clinical information: demographic data, obstetric history, details of the current pregnancy, past medical history and the presenting problem; (ii) ICU data: indication for ICU admission, length of stay and procedures performed; (iii) laboratory data: on admission to ICU and during ICU stay; (iv) maternal and fetal outcome, and (v) daily APACHE II scores⁹ and Therapeutic Intervention Scoring System (TISS) scores.¹⁰ Patients were stratified further into two groups: those with a medical condition (Medical group) or an obstetric complication (Obstetric group), to assess the role of the precipitating condition on severity of illness scoring, ICU procedures and outcome.

Data are presented as the mean \pm standard deviation. The data collection protocol was approved by the Institutional Review Board at Mount Sinai Hospital.

Results

Sixty-five obstetric patients were admitted to the ICU during the period reviewed, representing 0.26% of deliveries at Mount Sinai Hospital. The mean age was 30.7 ± 6.1 yr with a mean gestation at presentation to hospital of 31.7 ± 6.0 wk. The majority of patients were admitted post-partum (91%) of whom 48 (81%) were delivered by caesarean section. All patients had received prenatal care.

Obstetric complications accounted for 71% of obstetrical ICU admissions, the remaining 29% had medical conditions not related to pregnancy but which may have been aggravated by pregnancy (Table I). The

TABLE I Diagnoses responsible for ICU admission

<i>Medical complications</i> (n = 19)		<i>Obstetric complications</i> (n = 46)	
ulcerative colitis (acute flare)	2	preeclampsia	7
seizure disorder	2	HELLP syndrome	11
diabetic complication	2	eclampsia	5
<i>One each of the following:</i>		pulmonary oedema	2
myasthenia gravis		placental abruption	6
spinal muscular atrophy		haemorrhage	11
scleroderma		sepsis	2
sickle cell anaemia		hyponatraemia	1
pneumonia		foetal arrhythmia	1
lymphoma			
pancreatitis			
phaeochromocytoma			
thrombotic thrombocytopenic purpura			
renal artery stenosis			
essential hypertensive crisis			
post cholecystectomy hemorrhage			
systemic lupus erythematosus			

most common obstetric diagnosis was preeclampsia and its complications, accounting for 40% of all ICU transfers. The reasons for ICU transfer were predominantly haemodynamic instability (52%), respiratory failure (9%) or both (32%). The mean length of stay in the ICU was 2.9 ± 2.1 days with a range of 0.8 to 9 days. Twenty-seven patients (42%) required mechanical ventilation, but 17 of these received ventilation only for a short period (<24 hr) post-operatively. No maternal deaths occurred in the ICU or before hospital discharge and perinatal mortality was 11%.

Analysis of the patient subgroups (Medical, Obstetric) demonstrated no differences in terms of patient age, TISS score, length of ICU stay or maternal outcome (Table II). Perinatal mortality was restricted to the obstetric complication group. The admission APACHE score was higher in the Medical group (8.9 ± 4.9) compared with the Obstetric group (6.0 ± 3.6), but the values in both groups were low and the differences were not clinically significant.

Discussion

This study documents that 0.26% of deliveries in a Canadian tertiary obstetric referral centre developed complications requiring maternal ICU admission. Transfer to the ICU was necessitated by obstetric

complications, predominantly preeclampsia and related complications, as well as a variety of medical conditions. No differences were noted between the patients admitted with medical or obstetric complications. Intensive Care Unit stay was short and few ICU procedures, such as pulmonary artery catheterization and acute dialysis, were required. Admission APACHE scores were low, and no maternal mortality occurred in this series.

Comparison of our data with published series of obstetric ICU admissions demonstrate considerable differences (Table III). While ICU utilization (in terms of admission per 1000 deliveries) is similar in our study to other non-obstetric ICUs, maternal mortality in other studies was high, ranging from 4.5% to 20%. The percentage of patients requiring mechanical ventilation was also higher in these studies, as was the duration of ventilatory support. Our patients appear less severely ill, in terms of our shorter mean ICU stay and absent maternal mortality during the period studied. Socio-economic status and prenatal care have considerable effects on obstetric complications and outcome,^{11,12} and may well have differed in our patient population where access to health care is universal. In order to compare our data with other centres, an objective assessment of disease severity is necessary.

TABLE II Comparison of data between the patient subgroups and total group (mean \pm SD)

	<i>Medical complications</i> (<i>n</i> = 19)	<i>Obstetric complications</i> (<i>n</i> = 46)	<i>All patients</i> (<i>n</i> = 65)
Maternal age (yr)	29.7 \pm 5.1	31.1 \pm 6.5	30.7 \pm 6.1
Gestation (wk)	30.9 \pm 7.4	32.0 \pm 5.4	31.7 \pm 6.0
Delivery:			
pre-ICU transfer	15 (79%)	44 (96%)	59 (91%)
Caesarean section	13 (87%)*	35 (80%)*	48 (74%)*
ICU stay (days)	2.9 \pm 1.7	2.9 \pm 2.2	2.9 \pm 2.1
Procedures:			
ventilation	6 (32%)	21 (46%)	27 (42%)
PA catheter	1 (5%)	6 (13%)	7 (11%)
dialysis	2 (11%)	2 (4%)	4 (6%)
plasmapheresis	1 (5%)	1 (2%)	2 (3%)
hysterectomy	0	4 (9%)	4 (6%)
Admission APACHE	8.9 \pm 4.9	6.0 \pm 3.6	6.8 \pm 4.2
Highest TISS	22 \pm 9.7	25 \pm 7.4	24 \pm 8.1
Mortality:			
maternal†	0	0	0
perinatal	0	7 (15%)	7 (11%)

ICU, intensive care unit; PA, pulmonary artery; APACHE, Acute Physiology, Age and Chronic Health Evaluation; TISS, Therapeutic Intervention Scoring System.

* percentage of deliveries

† maternal deaths before discharge from hospital

TABLE III Comparison of data among reported series of critically ill obstetric patients.

	<i>Graham et al. 1989¹</i>	<i>Mabic et al. 1990⁵</i>	<i>Kilpatrick et al. 1992³</i>	<i>Collop et al. 1993⁴</i>	<i>Monaco et al. 1993⁶</i>	<i>Present study</i>
Type of ICU	general	obstetric	med-surg	medical	medical	med-surg
No. of patients	23	200	32	20	38	65
Duration (yr)	5	3	5	3.3	8	5
ICU utilization per 1000 deliveries	1	9	4	3	2.5	2.6
Diagnoses (medical: obstetric complication)	1:2.3	1:2.7	1:1.9	1:0.43	1:0.59	1:1.44
Maternal mortality per 100 obstetric ICU admissions	8.6	4.5	12	20	18	0
Mean length of ICU stay (days)	4.1	2.5	5.4	8	5.4	2.9
Mechanical ventilation (% of total)	60	12	59	60	50	42
Mean duration of ventilation (days)	2.7	-	6.8	10	6.2	1.6

Assessment of disease severity using the APACHE II score has been reported in some studies of critically ill obstetric patients, and mean scores are higher than in our series^{7,8} (Table IV). The APACHE scoring system is a commonly used measure of severity of illness in the ICU, but has not been validated in an obstetric population.^{13,14} In these patients, the normal values for some of the measured physiological variables are altered (e.g., heart rate, respiratory rate, haematocrit). Furthermore, certain variables of predictive value in the pregnant patient are not included in the APACHE score (e.g., platelet count, liver enzymes).¹⁵ It is, therefore, not surprising that some controversy exists concerning the applicability of this score as a predictor of illness severity in the pregnant patient: a lower than predicted mortality, higher than predicted mortality and appropriate mortality have been reported.^{7,8} Interpretation of our low APACHE II scores is difficult, but it does correlate with our low maternal mortality rate. We believe this to be an indicator of good obstetric care, and the availability of prenatal care may be an important factor in successful outcome in critically ill obstetric patients.

The short ICU stay and duration of ventilation in this study highlight the fact that the majority of obstetric patients recover rapidly after delivery. Apart from post-operative ventilation, few patients required ICU procedures such as pulmonary artery catheter insertion, dialysis, and plasmapheresis. While it may be suggested that many such patients can be managed on the labour and delivery floor, the Therapeutic Intervention Scores (TISS) suggest a nursing load requiring ICU care. A

TABLE IV Comparison of APACHE II scores and mortality in reported series of critically ill obstetric patients

	<i>Lewinsohn et al. 1994⁷</i>	<i>El-Sohl & Grant 1996⁸</i>	<i>Present study</i>
No. of patients	58	93	65
APACHE II score (mean)	10	14.7	6.8
Maternal mortality per 100 obstetric ICU admissions	6.9	10.5	0

TISS score >20 suggests a level of therapeutic intervention requiring ICU nursing, an ICU nurse being capable of managing about 40 to 50 TISS points.¹⁰ The excellent maternal and perinatal outcome support our multidisciplinary approach to ICU admission and management. However, the development of a pregnancy-specific risk assessment tool would be of value to compare different centres and optimize ICU admission and management policies.

References

- 1 *Graham SG, Luxton MC.* The requirement for intensive care support for the pregnant population. *Anaesthesia* 1989; 44: 581-4.
- 2 *Kirshon B, Hinkley CM, Cotton DB, Miller J.* Maternal mortality in a maternal-fetal medicine intensive care unit. *J Reprod Med* 1990; 35: 25-8.
- 3 *Kilpatrick SJ, Matthay MA.* Obstetric patients requiring critical care. A five-year review. *Chest* 1992; 101: 1407-12.

- 4 Collop NA, Sahn SA. Critical illness in pregnancy. An analysis of 20 patients admitted to a medical intensive care unit. *Chest* 1993; 103: 1548–52.
- 5 Mabie WC, Sibai BM. Treatment in an obstetric intensive care unit. *Am J Obstet Gynecol* 1990; 162: 1–4.
- 6 Monaco TJ Jr, Spielman FJ, Katz VL. Pregnant patients in the intensive care unit: a descriptive analysis. *South Med J* 1993; 86: 414–7.
- 7 Lewinsohn G, Herman A, Leonov Y, Klinowski E. Critically ill obstetrical patients: outcome and predictability. *Crit Care Med* 1994; 22: 1412–4.
- 8 El-Solh AA, Grant BJB. A comparison of severity of illness scoring systems for critically ill obstetrical patients. *Am J Resp Crit Care Med* 1996; 153: A362.
- 9 Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: a severity of disease classification system. *Crit Care Med* 1985; 13: 818–29.
- 10 Keene AR, Cullen DJ. Therapeutic intervention scoring system: update 1983. *Crit Care Med* 1983; 11: 1–3.
- 11 Koonin LM, Atrash HK, Lawson HW, Smith JC. Maternal mortality surveillance, United States, 1979–1986. *MMWR CDC Surv Summ* 1991; 40: 1–13.
- 12 Greenberg RS. The impact of prenatal care in different social groups. *Am J Obstet Gynecol* 1983; 145: 797–80.
- 13 Knaus WA, Draper EA, Wagner DP, Zimmerman JE. An evaluation of outcome from intensive care in major medical centers. *Ann Intern Med* 1986; 104: 410–8.
- 14 Knaus WA, Wagner DP, Draper EA, *et al.* The APACHE III prognostic system. Risk prediction of hospital mortality for critically ill hospitalized adults. *Chest* 1991; 100: 1619–36.
- 15 National High Blood Pressure Education Program Working Group report on high blood pressure in pregnancy. *Am J Obstet Gynecol* 1990; 163: 1689–712.