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Maternal and fetal outcome among patients requiring high-dependency unit admission: a five-year prospective study

Abstract

Objective: to test the hypothesis whether the cause of admission to high-dependency unit (HDU) could negatively affect the maternal and fetal outcome or not.

Methods: This five-year prospective study included 346 pregnant patients who were required admission to HDU. Patients were divided into two groups based on the cause of admission to HDU; group one with obstetric complications (n=204) and group two with medical complications (n=142). Obstetric outcome was the main outcome measure. Data was collected and analyzed.

Results: Patients in the medical group were more prone for preterm delivery ($p<0.001$), development of organ failure ($p<0.05$), persistent hypertension ($p<0.001$), persistent left ventricle dysfunction ($p<0.001$), pulmonary embolism ($p<0.05$), longer time of stay at HDU, more transfer to specialized ICU and longer time for recovery ($p<0.001$) with higher maternal mortality ($p<0.001$) compared to patients in the obstetric group. Neonates of patients in the medical group were more prone for development of fetal growth restriction ($p<0.001$), prematurity ($p<0.001$), intrauterine fetal demise ($p<0.05$), admission to NICU ($P<0.001$) and neonatal death ($p<0.05$) compared to those in the obstetric group.

Conclusion: Although more patients with obstetric complications required admission to HDU, yet they still experienced better obstetric outcome than those with underlying medical disorders.

Keywords: high dependency unit, maternal outcome, obstetric outcome, fetal outcome

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Abbreviations: HDU, high dependency unit; ICU, intensive care unit; SGA, small for gestational age; IUFD, intrauterine fetal demise

Introduction

Pregnancy and delivery have a potential for maternal life threatening complications which indicate the provision of a higher level of health care than that traditionally provided in standard wards.[1]

High dependency unit (HDU) was defined as a level of care which lies in between the general ward and an intensive care unit (ICU) and provides health care to patients with single organ failure or those who are at a high risk of developing severe maternal morbidity.[2,3]

The aim of this study was to test the hypothesis whether the cause of admission to high-dependency unit (HDU) could negatively affect the maternal and fetal outcome or not.

Materials and methods

This prospective observational study was conducted at the department of Obstetrics and Gynecology in collaboration with the Anesthesiology & Critical Care and Pediatrics departments at Menoufia University hospital, Menoufia governorate, Egypt during the period between September 2012 and September 2017. Menoufia University hospital is the biggest tertiary health care and referral hospital in Menoufia governorate with well equipped high dependency unit (HDU) containing 25 beds complying with the standard international recommendations.

Ethical approval was granted from Menoufia Faculty of Medicine ethical committee and an informed consent was obtained from all participants prior to commencement of the study.

Out of 21,364 parturients in the hospital during the five-year study period, 352 patients with single organ failure had required HDU admission during their course of treatment were included in this study. During the follow up period, six patients dropped out and 346 patients completed the study (Figure 1).

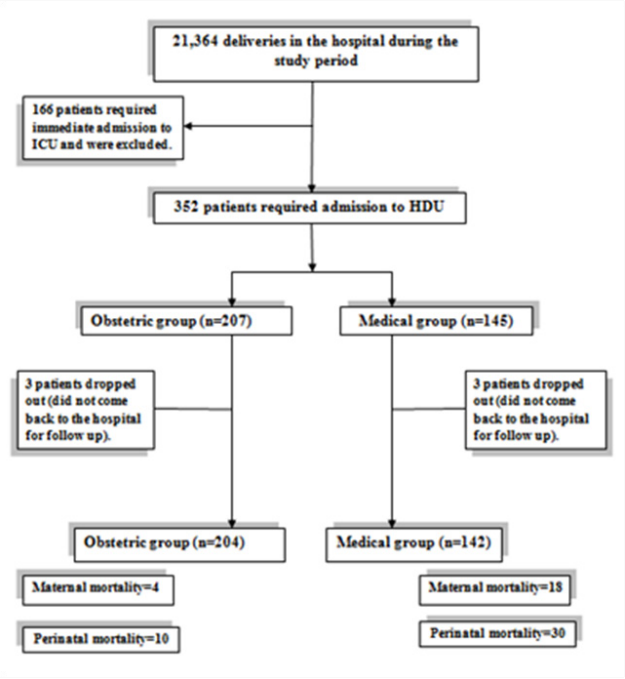

Figure 1 Flow diagram of recruitment and retention of patients in the study.

Patients with multiple organ failure and those required primary admission to intensive care unit (ICU) were excluded from the study.

For better interpretation of results, patients were divided into two groups regarding the cause of admission to HDU as follows:

a. **Obstetric complications group (n=204):** Obstetric complications were defined as maternal morbidity originating from any cause related directly to pregnancy or its management during pregnancy, delivery or postpartum till the end of the puerperium.

b. **Medical complications group (n=142):** Medical complications were defined as maternal morbidity arising from any pre-existing medical disorders.

Patients were followed from the time of admission to HDU throughout delivery till three months after discharge from the hospital. All patients were managed individually with standard invasive or non-invasive measures as indicated.

Outcome measures

Maternal outcome: included interventions at HDU (cause of admission, investigations, length of stay, eventual outcomes as transfer to specialized intensive care unit, ICU), mode of delivery, posptpartum hemorrhage, defective lactation, venous thromboembolism and maternal mortality.

Fetal and neonatal outcome: small for gestational age (SGA) defined as a birth weight < 5th percentile, preterm labour (delivery<37 weeks), intrauterine fetal demise (IUFD), admission to neonatal intensive care unit (NICU) and neonatal death (defined as death during the first four weeks after delivery).

Statistical analysis

Data was analyzed by SPSS (statistical package for the social science software) version 22. Quantitative data was analyzed by applying student t- test or Mann-Whitney test as required while qualitative data was analyzed by applying Chi-square test and Fisher's exact test as required. P-value less than 0.05 are significant and P-value less than 0.001 are highly significant.

Results

There was no significant difference between the two groups regarding maternal age, parity and body mass index (p>0.05) with more patients in the medical group booked for antenatal care (p<0.05) as depicted in Table 1.

Table 2 reveals clinical features, investigations and interventions at HDU. Patients in the obstetric group were more commonly presented with pallor, pyrexia and tachycardia (p<0.001) while patients in the medical group were more commonly presented with cyanosis, dyspnea, hypertension and splenomegaly (p<0.001). Patients in the obstetric group required more blood gases and blood cultures performed (p<0.001) while patients in the medical group required more ECG, Echocardiography, CT brain, Chest X ray and Angiography (p<0.001). During their course of treatment, patients in the obstetric group received more antibiotics, magnesium sulfate and blood products transfusions (p<0.001) while those in the medical group received inotropic drugs, central venous line insertion, hemodialysis and mechanical ventilation (p<0.001).

Table 1 Maternal characteristics and indications of admission to HDU

	Obstetric group (n=204)	Medical group (n=142)	Student t-test	P-value
Age (years)	31.4±4.3	30.9±4.6	1.03	>0.05
Parity	2.4±1.3	2.2±1.2*	1.45	>0.05
Body mass index (Kg/m²)	26.2±3.3	25.8±3.6	1.07	>0.05
Booking for antenatal care	168	102†	4.81	<0.05
Indications of admission to HDU: n(%)	Pre-eclampsia: 36(17.6%). Eclampsia: 6(2.9%). Placenta previa/accreta: 38(18.6%). Abruptio placentae: 4(16.6%). Postpartum hemorrhage: 28(13.7%). Uterine rupture: 8(3.9%). HELLP syndrome: 8(3.9%). Puerperal sepsis: 22(10.7%). Pyelonephritis: 26(12.7%). Chorioamnionitis: 6 (2.9%). Acute fatty liver: 2(0.9%)	Chronic hypertension: 40(28.4%). Rheumatic heart disease: 24(16.8%). SLE: 8(5.6%). Epilepsy: 6(4.2%). APS with DVT: 4(1.4%). Bronchial asthma: 10(7.1%). Active viral hepatitis: 18(12.7%). Chronic nephropathy: 22(15.5%).	-	-

*Mann Whitney test, †Chi square test, HELLP, Hemolysis, elevated liver enzymes and low platelets; SLE, systemic lupus erythematosus; APS, antiphospholipid syndrome; DVT, deep venous thrombosis.

In regard to maternal outcome, patients in the medical group were more prone for preterm delivery (p<0.001), development of organ failure (p<0.05), persistent hypertension (p<0.001), persistent left ventricle dysfunction (p<0.001) and pulmonary embolism (p<0.05). Also, patients in the medical group have longer time of stay at HDU, more transfer to specialized ICU and longer time for recovery (p<0.001) with higher maternal mortality (p<0.001) compared to patients in the obstetric group. The most common causes of maternal mortality in the obstetric group were obstetric hemorrhage and sepsis while rheumatic heart disease and chronic liver disease were in the medical group as shown in (Table 3).

Table 4 revealed fetal and neonatal outcome. Neonates of patients in the medical group were more prone for development of fetal growth restriction (p<0.001), prematurity (p<0.001), intrauterine fetal demise (p<0.05), admission to NICU (P<0.001) and neonatal death (p<0.05) compared to those in the obstetric group.

Discussion

During the five-year period of the study, 21,364 patients delivered at our hospital with 352 of them required admission to HDU. Thus obstetric admission in HDU at our institution was 16.5 per 1000 deliveries.

The incidence varies widely among developing and developed countries with range of 10.2 in four years in Dublin in Ireland (3), 11.2 per 1000 deliveries over four years in India (5), and 26.7 in 23 years in UK.[4]

In this study, about half of the admitted patients in the obstetric group suffered major obstetric hemorrhage (52.8%) followed by sepsis which constitutes 26.3%. On the other hand, cardiovascular disease (chronic hypertension and rheumatic heart disease) was the most common cause of maternal admission to HDU in the medical group (45.2%).

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Table 2 Clinical features, investigations and interventions at HDU

	Obstetric group (n=204)	Medical group (n=142)	Chi square test	P-value
Clinical features:				
Pallor.	104	26	36.7	
Jaundice.	14	18	2.71	
Cyanosis.	6	24	18.8	
Dyspnea.	8	28	20.7	<0.001 >0.05 <0.001 <0.001
Pyrexia (>38°).	56	12	17.9	<0.001 <0.001
Tachycardia.	110	48	12.8	>0.05
Bradycardia.	6	8	0.95	<0.05
Hypertension (>160/100 mmHg).	44	48	5.8	>0.05 <0.001 <0.05
Hypotension (<90/60mmHg).	34	28	0.34	
Splenomegaly.	6	22	16.1	
Abnormal bleeding.	28	32	3.9	
Investigations:				
Blood gases.	42	12	8.5	
Blood culture.	44	8	15.4	
ECG.	22	78	77.2	
Echocardiography.	10	46	44.6	<0.05 <0.001 <0.001 <0.001
CT brain.	6	18	10.8	<0.001 >0.05 <0.001 <0.001
CT abdomen.	12	8	0.02	
Chest X ray.	24	56	34.5	
Angiography.	14	38	24.4	
Interventions:				
Antibiotics.	112	36	28.6	
Inotropics.	22	48	26.1	
Magnesium sulfate.	50	14	10.9	<0.001 <0.001 <0.001
Central venous line.	54	98	59.8	<0.001 <0.001 <0.001
Blood products transfusion.	92	28	22.7	<0.001
Hemodialysis.	8	26	17.9	
Mechanical ventilation.	12	32	19.4	

Table 3 Maternal outcome

	Obstetric group (n=204)	Medical group (n=142)	Chi square test	P-value	Odd's ratio at 95% Confidence interval
Gestational age at delivery	36.5±2.3	34.3±3.4	7.18†	<0.001	-
Organ failure:					
Heart failure.	5	26	23.9	<0.001	0.11(0.04-0.3) 0.16(0.04-0.58) 0.2(0.09-0.46) 0.26(0.08-0.86)
Respiratory failure.	3	12	8.2*	<0.05	
Renal failure.	8	24	15.3	<0.001	
Hepatic encephalopathy.	4	10	4.34*	<0.05	
Disseminated intravascular coagulopathy.	18	10	0.16	>0.05	1.28(0.57-2.86)
Persistent hypertension	14	58	56.6	<0.001	0.11(0.06-0.2)
Persistent left ventricle dysfunction.	3	19	17.9*	<0.001	0.1(0.03-0.3)
Pulmonary embolism	6	16	8.4	<0.05	0.24(0.09-0.63)
Outcome at HDU:					
Duration of stay (days).	5.6±4.3	10.4±4.2	10.31†	<0.001	0.17(0.07-0.38)
Transfer to specialized ICU.	8 10.	28	20.7	<0.001	
Time to recovery (days).	4±2.6	16.8±4.8	15.9†	<0.001	
Maternal mortality	4 Obstetric hemorrhage=3 Sepsis =1	18 Pulmonary edema=5 Pulmonary embolism=5 AF=3 Stroke=1 Hepatic encephalopathy =2 Bleeding varices=2	14.4*	<0.001	0.14(0.05-0.42)

†Student t-test, *Fischer's exact test, ICU, intensive care unit; AF, atrial fibrillation.

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Table 4 Fetal and neonatal outcome

	Obstetric group (n=204)	Medical group (n=142)	Chi square test	P-value	Odds ratio at 95% confidence interval
Small for gestational age	12	38	27.8	<0.001	0.17(0.09-0.34)
Prematurity	10	26	14.7	<0.001	0.23(0.11-0.49)
Intrauterine fetal demise	4	14	9.05*	<0.05	0.18(0.06-0.57)
Admission to NICU	12	34	22.2	<0.001	0.2(0.1-0.4)
Neonatal sepsis	8	8	0.24	>0.05	0.68(0.25-1.87)
Neonatal death	6	16	8.4	<0.05	0.24(0.09-0.63)

*Fischer's exact test, NICU, neonatal intensive care unit.

Previous studies ranked obstetric hemorrhage and hypertensive disorders as the most common causes of admission to HDU.[5–8]

At our institution, the rate of PPH as recently reported was 2.4% [9] while chronic hypertension affected 7%[10] and rheumatic heart disease complicates pregnancy in 2.5% of patients attended our antenatal care clinic.[11]

In the current study, patients in the medical group were more prone for poorer obstetric outcome in terms of preterm delivery, development of organ failure, persistent hypertension, persistent left ventricle dysfunction, pulmonary embolism, longer time of stay at HDU, more transfer to specialized ICU and longer time for recovery with higher maternal mortality with their neonates developed fetal growth restriction, intrauterine fetal demise, admission to NICU and neonatal death compared to patients in the obstetric group.

Maternal mortality among patients admitted to HDU in this study was 6.4% and perinatal mortality was 11.6%.

A previous Indian studies reported maternal and perinatal mortality of 12.3% and 12.3% among patients required admission to HDU[5] and 52% and 21.6% among patients admitted to ICU respectively,[12] while in developed countries maternal mortality of HDU admissions was nil and prenatal mortality was 1.05% to 8%.[3,7]

The poorer obstetric outcome among patients admitted to HDU was mostly attributed to the underlying medical disorders[10,11,13,14] rather than obstetric complications which were readily responded to proper treatment strategies for obstetric hemorrhage and sepsis.[5]

Maternal mortality in this study was secondary to rheumatic heart disease and chronic liver disease. In the presence of maternal heart disease, the circulatory changes of pregnancy may result in decompensation or death of the mother and/or the fetus secondary to development of pulmonary edema or atrial fibrillation particularly in patients with severe mitral stenosis.[15–17]

The physiological increase in plasma volume during pregnancy can worsen portal hypertension in pregnant women with chronic hepatitis, resulting in increased risk of variceal bleeding and maternal mortality in up to 18% with higher fetal loss rate.[18]

Emphasis on the importance of multidisciplinary preconception and antenatal care of patients with medical disorders can minimize the incidence of maternal and fetal compromise as well as the need for HDU admission.

The large sample size and the prospective nature of this study constituted the meaningful importance of its results.

Inability to recruit and report the obstetric outcome among patients with multiple organ failure who were primarily admitted to ICU was unintended limitation of this study.

Future research should explore new strategies to improve the obstetric outcome among mothers with medical disorders.

Conclusion

Although more patients with obstetric complications required admission to HDU, yet they still experienced better obstetric outcome than those with underlying medical disorders.

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Conflicts of interest

Authors declare there is no conflict of interest in publishing the article.

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