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Original Research Article

OBSTETRICS NEAR-MISS AS AN INDICATOR FOR MATERNAL HEALTH CARE: EXPERIENCED IN A MALAYSIAN TERTIARY HOSPITAL

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ABSTRACT

Background: Maternal near-miss known as severe maternal morbidity provides valuable information on obstetric care, hence allowing corrective action to be taken on the identified problems to reduce related morbidity and mortality. This study was conducted aiming to evaluate the maternal near-miss among women in a public tertiary hospital in Klang Valley, Malaysia.

Material and Methods: A retrospective study was conducted for two years (from January 2010 until December 2011). Data were retrieved from the labour room and intensive care registry using the World Health Organization (WHO) near-miss evaluation tools based on clinical and management criteria.

Results: There were 18 676 deliveries and 18531 live births with 160 near-miss cases and five maternal deaths during the study period. The prevalence of maternal near-miss morbidity was 0.86%, making maternal near-miss Ratio (MNMR) of 8.6 cases per 1,000 live births. Meanwhile, the Maternal Mortality Ratio (MMR) of 27/100 000 live births, the maternal near-miss mortality ratio (MNMMR) obtained was 32:1 and a relatively low mortality index of 3.03%. Hypertensive disorder (61.2%) and major obstetric haemorrhage (30.0%) were the two main causes of maternal near-miss morbidities followed by ICU admissions (20.6%). The hypertensive disorder primarily severe pre-eclampsia was found significantly associated with ICU utilisation (p=0.001).

Conclusion: The quality of obstetric care received by maternal near-miss patients in urban Malaysia was optimal with a relatively low mortality index and comparable prevalence of maternal near-miss and mortality worldwide. Hypertensive disorders and obstetrics haemorrhage are the most common maternal morbidities in Malaysia. On top of that, sepsis is also an essential entity that needs to be emphasised in the future.

Key words: Obstetrics near-miss, Maternal near-miss, Maternal Health, Maternal Mortalities, Severe Maternal Morbidity.

INTRODUCTION

For many years, the evaluation of maternal health care services aimed at improving the quality of obstetric care that traditionally relies on enquiries into maternal deaths. Lately, maternal near-miss or severe maternal morbidity has been proven to be useful in investigating maternal mortality and increasingly been used worldwide to measure the quality of maternal health.[1] According to the World

Health Organisation (WHO), maternal near-miss (MNM) refers to a situation where women experience a life threatening complication during pregnancy, delivery, or post pregnancy, which they survive either by chance or good care provided by a facility.[2]

Maternal near-miss data is used as maternal health indicators to evaluate the quality of obstetrical care, leading to an improved understanding on maternal death cases.[3] It is important for policymaker to recognize the essential obstetric care through clinical audit and to develop an adequate and efficient health care system to safe motherhood.

In 2009, WHO has developed standardized definition for maternal near miss criteria and internationally recognized across countries and regions.[4] Unlike developed countries, experience on the use of near-miss reviews as a tool for monitoring the quality of maternity services in developing countries is limited especially in the South East Asia (SEA) region. Maternal mortality worldwide are declining and globally dropped by 44% in between 1990 and 2015. Unfortunately, majority of these deaths occur in underdeveloped nations with most of them are preventable.[5]

Hence, this present study investigates the maternal near-miss events and calculate the maternal near miss indices including maternal near-miss Ratio (MNMR), Maternal Mortality Ratio (MMR), maternal near-miss mortality ratio (MNMMR) and mortality index (MI). These data will be beneficial for quality improvement on existing obstetrics facilities to reduce maternal morbidity and mortality in Malaysia.

MATERIAL AND METHODS

A retrospective descriptive study was conducted in the maternity unit of Hospital Serdang, Selangor between January,1 2010 and December,31 2011 (2-years). Hospital Serdang is the main referral centre for pregnancy and childbirth for public and private hospitals in the state of Selangor. Hospital Serdang delivers approximately 10 000 babies annually. Clinical information of all women with severe maternal morbidity or maternal near-miss were obtained from the registries. The informed consent was not obtained due to its retrospective study and the paucity of contact information. All the of maternal near-miss case whose diagnoses met the above WHO criteria were carefully reviewed and scrutinised by investigators. Data on maternal death was retrieved from the Medical Records Department. Prior permission is obtained from the hospital and information gathered is treated with confidentiality. All data were then transferred into a proforma.

The WHO (2009) maternal near-miss criteria was utilized to acquire information regarding characteristics of severe maternal morbidity.[3] There were three different entities have been used in WHO included clinical and laboratory based findings of organ/systems dysfunction as well as management based criteria requiring intervention (hysterectomy, blood products usage and involvement of interventional radiology) and intensive care unit (ICU) admission.

The maternal health indicator indices were measured included prevalence of maternal near-miss (MNM), Maternal Mortality Ratio (MMR), Maternal near-miss Ratio (MNMR), maternal near-miss mortality ratio (MNMMR), mortality index (MI). MMR refers to the number of maternal deaths (MD) caused by or related to pregnancy per one hundred thousand live births (LB). MNM ratio refers to the number of maternal near-miss cases per 1000 live births (MNMR =MNM/LB). Maternal near-miss mortality ratio (MNM: 1 MD) refers to the ratio between maternal near-miss cases and maternal deaths. The maternal mortality index (MI) is expressed as a percentage, which is the number of maternal deaths divided by the number of women with life-threatening conditions.[6] Higher ratios indicate better care. MI refers to the number of maternal deaths divided by the sum of women with life-threatening conditions and maternal deaths expressed as a percentage [MI =MD/ (MNM+MD)]. The lower the index the more women survived following the life-threatening conditions and a higher index means more women died than were expected to.

Statistical analysis was descriptive and results were calculated as frequencies and percentages. Proportions were compared between the categorical numbers by Chi Square testing. Data were analysed using Statistical Package for Social Science software, version 23 (SPSS-23). Ethical approval was obtained from MREC, the Ministry of Health Malaysia. NMRR-18-3175-44106 and ethic committees of the Universiti Putra Malaysia.

RESULTS

During the study period, there were a total of 18,676 deliveries in Hospital Serdang with 18.531 live births, 160 maternal near-miss cases and 5 maternal death cases identified.

Thus, making the prevalence of maternal near-miss was 0.85%. With regards to maternal mortality, only 5 cases were reported during the specified period, giving a prevalence of Maternal Mortality Ratio (MMR) of 27 cases per 100,000 deliveries. The Maternal near-miss Ratio (MNMR) was recorded as 8.6 cases per 1,000 live births. Hence, the maternal near-miss mortality ratio obtained was 32:1, making a relatively low mortality index of 3.03%. This means that for every 32 maternal near-miss cases, there is only one case of maternal death. [Table 1]

The mean age of patients with MNM events was 30.1 ± 0.6 years and almost half of them are from 20 to 29 years old (47.5%). Majority of these women were multiparous (48.8%) and most of them were delivered at 37-40 weeks of gestation (52.5%) during the occurrence of near-miss event. Almost two-thirds of the women with maternal near-miss were delivered

by caesarean section (59.4%). A large number of the women (71.9%) had at least one risk factor of maternal near-miss. Majority of hypertensive disorder patients (about 45%) were discovered with risk factor of hypertension during their antenatal check-up followed by a risk factor of gestational diabetes mellitus, which represents 18% of all near-miss cases. [Table 2]

The summary of maternal near-miss events is shown in Table 3. Majority of patients with near-miss condition fell under the clinical based criteria where hypertensive disorder was responsible for more than half of all near-miss cases (61.2%) including 10 cases of eclampsia (10.3%). The second most common near-miss event is obstetric haemorrhage with 30.0% cases followed by ICU admission criteria (20.0%). Among the commonest causes of obstetric haemorrhage include uterine atony, placenta praevia and genital tract trauma. Furthermore, the commonest cause of haemorrhage was uterine atony representing 41.7% of all cases followed by genital tract trauma (16.7%) and bleeding placenta praevia (14.6%). The emergency or post-partum hysterectomy for massive bleeding was not uncommon, which leads to maternal morbidity and accounts for two percent of reported patients with near-miss events. [Table 3]

Furthermore, since there was a higher rate of ICU utilisation, further analysis to assess the associated factor carried out as shown in Table 4. The findings show a significant association between hypertensive disorder and ICU utilisation ($p < 0.001$). [Table 4]

During the 2-year review period, there were five cases of maternal death. The causes of maternal mortality in each of the deaths were;

1) Septic shock with aortic dissection and pre-eclampsia;
2) Acute pulmonary oedema with hypertensive crisis;
3) Pneumonia with pulmonary haemorrhage;
4) Sepsis and multiorgan failure with underlying chronic rheumatic heart disease; and
5) Sepsis and multiorgan failure with infective endocarditis.

It is apparent that the causes for maternal death are always multiple rather than single either directly or indirectly related to pregnancy. Four of the maternal deaths (80%) were due to sepsis or infection with some underlying medical disorders in which two deaths were caused by pre-existing cardiac problems and related to hypertensive disorder complications respectively. Thus, this study demonstrated that the maternal mortality rate related to hypertensive disorder in pregnancy was 2.1%.

Table 1: Summary of deliveries and maternal health indicators in women delivering at Hospital Serdang of 2-years (2010-2011)

Maternal Health indicator parameter	Results
Total deliveries	18,676 deliveries
Total live births	18.531 live births
Total maternal near miss	160 cases
Prevalence of maternal near miss	0.85%
Maternal mortality	5 cases
Maternal near-miss Ratio (MNMR)	8.6 /1000 live births
Maternal Mortality Ratio (MMR)	27/100 000 live births
Maternal near-miss mortality ratio (MNMMR)	32:1
Mortality index	3.03 %.

Table 2: Sociodemographic and obstetrics characteristics among women with MNM

Characteristics	Frequency (n)	Percentage (%)
Age (mean ± SD)- 30.1 ± 0.652		
Less than 20	3	1.9
20-29	76	47.5
30-39	70	43.8
More than 40	11	6.9
Race		
Malay	116	72.5
Chinese	78	48.8
India	20	12.5
Others	25	15.6
Parity		
Primid	62	38.8
2-5	78	48.8
More than 5	20	12.5
Gestational Age (week)		
24 and below	5	3.1
25-28	6	3.8
29-32	16	10.0
33-36	49	30.6
37 and above	84	52.5
Presence of risk factors (medical disorder)		
None	45	28.1
Presence	115	71.9
Anemia status		

Heamoglobin ≥ 11	55	34.4
Haemoglobin < 11	105	65.6

Table 3: Causes contributing maternal near-miss conditions

Maternal Near Miss Cases	Accompanying criteria for nearmiss cases	Frequencies(n=160)	Percentage (%)
Severe maternal complication: Clinical criteria related to a specific disease entity			
	Major obstetric haemorrhage	48	30.0
	Hypertensive Disorder	98	61.2
Organ dysfunction: Organ system dysfunction based criteria			
	Renal dysfunction	2	1.3
	Acute respiratory dysfunction	2	1.3
	Massive pulmonary embolism	1	0.6
Management based criteria (intervention and intensive care use):			
	Emergency hysterectomy for any reason	4	2.5
	Intensive care admission	32	20.6

Table 4: The association between near miss events and ICU utilization

Factors	ICU Utilization		χ^2	P-value
	Yes, n (%)	No, n (%)		
Age ≤ 35,y > 35.y	24(19.5) 8(22.2) 3(23.1)	99 (80.5) 28(77.8)		0.721
Parity ≤ 5 > 5	29(19.8)	117(80.1) 10(76.9)		0.726
Hypertensive disorder Yes No	7 (7.2) 25(40.3)	90 (92.8) 37 (59.7)	25.788	**0.001**
Haemorrhage Yes No	11(22.9) 21 (18.9)	37 (77.1) 90 (81.1)	0.333	0.564
Hysterectomy Yes No	1(25.0) 31(20.0)	3(75.0) 124(80.0)	-	1
*Anemia status Hb ≤ 11 Hb < 11	9(16.7) 23(21.7)	45(83.3) 83(78.3)	0.609	0.435

DISCUSSION

In the new millennium, investing in maternal health is essential for the development of a country. Malaysia, currently a middle-income country is endeavouring to be a developed nation in near future. It is consistent with Sustainable Development Goals (SDG) adopted by Member States of the United Nations in 2015 concentrating on maternal health in the development of a country. SDGs focus on developing more comprehensive and excellent strategies to reduce both maternal and neonatal mortality.[7] The maternal mortality ratio was reported at 44 per 100,000 live births in 1990 and declined to 29 deaths per 100,000 live births in 2007. Since 2000, the MMR in Malaysia has remained relatively stagnant at around 28-30 per 100,000 live births.[8] The identification of severe acute maternal morbidity cases has emerged as a promising alternative strategy to reduce maternal mortality. In particular, obstetrics maternal near-miss is recognised as a useful outcome measure for evaluating and improving obstetric care especially in developing countries.

This study showed that in urban Malaysia, the prevalence of maternal death and maternal near-miss events is relatively low with maternal near-miss Ratio (MNMR) of 8.6 /1000 live births and the MMR of 27/100 000 live births, as well as a relatively low mortality index of 3.03%. This finding is comparable to a study conducted in Malaysia year 1999 by N.Sivalingam,[9] and in year 2014 by Norhayati et al.[10] The MNMR in this study is within the wide range of ratios reported in studies from other developing countries (12.3 - 82.3 per 1,000 deliveries).[11] However, the mortality index and maternal near-miss mortality ratio in this present study have demonstrated a better result, which is lower compared to that conducted in other developing countries; Roopa et al,[12] identified a ratio of 5.6:1, Jabir et al,[13] found a ratio of 9:1 and Oladapo et al,[14] presented a ratio of 4.8:1. A systemic review published in 2019 by Abdollahpour S et al reveals the maternal near miss of more than

18.67 per 1000 live births of the general population of the world which is tremendously higher than our study.15 These findings may indicate that the overall standard of obstetric care is optimal but yet far from developed western countries where the maternal near- miss fatality ratio is ranging from 117 - 223:1.[16-17]

The leading clinical conditions most commonly responsible for near-miss events in this study is hypertensive disorder in pregnancy. This is in agreement with that reported by other researchers in developing countries.[12,18-19] Hypertensive disorder primarily pre-eclampsia was found accounted for approximately 60% of obstetric maternal near-miss cases in the present study. High proportion of hypertensive disorder identified in the obstetric maternal near-miss cases reflexed the potential progress of hypertensive complications to maternal death. Globally, severe pre-eclampsia/ eclampsia is the most prevalence cause of maternal death from hypertensive disorder in pregnancy even though the trend is declining. The main reason for this is due to systemic endothelial dysfunctions such as eclampsia, multi-organ failure, respiratory distress syndrome and acute pulmonary oedema. The mortality rate in severe pre-eclampsia/ eclampsia in developing countries is as high as 15% with its prevalence in developed countries of only 0 – 1.8%.[20-21] In this study, the maternal death related to severe hypertensive disorder is only 2.1%, which is comparable with that recorded by developed countries. This result suggests an increase in effective management of hypertensive disorder with high level of care and adequate use of ICU.

Among various types of life-threatening obstetric complication, major obstetrics haemorrhage constituted the greatest danger to women's lives. Obstetrics haemorrhage specifically postpartum haemorrhage (PPH) was the second highest cause for maternal maternal near-miss cases. In this present study, the common cause of haemorrhage was uterine atony, which represents at least 40% of all cases supported by many low-resources conutries.[19] Other causes contributed to postpartum haemorrhage (PPH) were placenta previa, placenta abruption, genital tract trauma, retained product of conception and thromboembolism. Apart from PPH, early pregnancy haemorrhagic complication following miscarriage and ectopic pregnancy was also documented. Despite the high prevalence of obstetric haemorrhage cases, no contribution to maternal mortality cases suggested adequate preventive measure of irreversible consequences leading to death. This exposes an optimised management by health care professionals and proper access to health care services in managing obstetrics haemorrhage.

Hysterectomy is generally advocated as a life saving measure for major obstetrics haemorrhage following the failure of conservative management. Increasing maternal age and parity are the risk factors for both placenta praevia (PP) and PPH.[22-23] Many studies reported that PPH and PP were significantly associated with peripartum hysterectomy.[24-26] Thus, for cases with advanced maternal age and higher parity, hysterectomy should be timely performed as the future pregnancy may be be an issue.

Women with severe obstetric complications may necessitate a higher level of care involving ICU utilisation and multidisciplinary team approach. It would be more appropriate for management of such cases to provide optimum care and reduce further deterioration of diseases.[27] It is presented by this study that ICU admission is the most common near-miss event by management based criteria. Almost one-fifth (20.6%) of the maternal near-miss cases studied were admitted to ICU with various reasons especially life-threatening obstetric condition. Similar result was found in a study by Das KK et al which found that 20.33% patients of the near miss cases got admission in ICU.[28] In comparison to the ICU admissions in Kamal S et al and Sujata P et al,[29-30] the figures are less in our study but certain factors such as number of beds and having a separate obstetrics ICU could be a contributing to figures. The most frequent obstetric cases transferred to ICU in our study were post-hysterectomy following massive obstetrics haemorrhage, eclampsia/severe pre-eclampsia with multi-organ dysfunction, and severe heart disease in pregnancy. Criteria for admission to ICU vary depending on the availability and capacity of intensive care units and institutional guidelines for ICU admission.[31]

In the present analysis, there is an association between hypertensive disorder with ICU utilisation (p=0.001). The main reasons for ICU admission basically due to ventilation assistance and high level of medical care in eclampsia and severe pre-eclampsia with acute pulmonary oedema. Similarly, a study conducted in Sudan has also recorded the same result.[23] In contrast, there is no significant association found in obstetrics haemorrhage in relation to ICU utilisation. This differs from a previous study conducted by Ali et al, where significant association between these two factors existed.[23] Moreover, this reflects that obstetric haemorrhage events were timely managed with essential interventions carried out appropriately. The use of oxytocin or any other uterotonic agents and blood transfusion for the prevention and treatment of PPH is crucial. Besides, adequate timely surgical interventions such as uterine compression, internal iliac artery ligation and last resort of hysterectomy are paramount. Generally, effective interventional measures play pivotal roles in preventing maternal death.[2]

From this study, the anemic status was found highly prevalence with the occurrence of maternal near-miss. At least two-thirds of near-miss women are in an anaemic state during presentation. In a study conducted by Liyew et al, it was found that women with a history of anemia have a higher chance of maternal near-miss than those without a prior history.[32] In addition, haemorrhage was found statistically associated with anaemia, which is

consistent with a study conducted in Tanzania.33 It has been stated that anaemia could weaken uterine vascular strength, which contributes to postpartum haemorrhage. This study showed an association between anaemia and eclampsia. This is consistent with several studies have shown the association between severe anemia and preeclampsia and thus considers anemia as one of the main and treatable risk factor for preeclampsia and this includes Enaruna et al which revealed that severe anemia was 7.7-fold more associated with maternal mortality in severe preeclampsia cases than no anemia.[34]

Sepsis was identified as the leading cause for maternal mortality in the hospital under study even though it was not documented in obstetrics near–miss events (table 4). The vast majority of maternal mortality caused by sepsis involved multi-organ failure with underlying medical disorders such as heart and chronic diseases.[12] However, sepsis is a very important maternal near-miss event that needs further improvement in the quality of its management. This includes the appropriate use of prophylactic antibiotics for caesarean section, use of potent antibiotics for treatment of sepsis, utilisation of intensive care management and multi-disciplinary approach. It constitutes a significant threat to the survival of affected patients even though it is the least frequent cause of obstetric maternal near-miss events.[2]

Quality of care in a hospital is recognised as a major contributor in the reduction of maternal and perinatal mortality.[5] This involves the active participation of consultant obstetricians, anaesthesiologists, and adequate backup from blood bank as well as early surgical intervention.[11] The level of care received by patients at the time of admission depends on professional expertise available at the point of time and the availability of good facilities. Majority of near-miss cases are usually attended by an experienced medical officer followed by a specialist obstetrician at the time of initial contact. This therefore suggests that early specialist or consultant involvement in anticipating severe obstetrics conditions and an efficient referral system are the two solutions toward reducing maternal morbidity and mortality. Hence, efficient and comprehensive training of obstetrics care providers as well as system management in all levels could further improve the situation and ultimately change the results.

CONCLUSION

As a developing country, there is still a large space for improvement in MMR. This can be achieved by enhancing the resources in managing severe morbidities especially due to hypertensive disorder and haemorrhage. Sepsis, which has a high mortality index, is also a very essential entity that needs more attention in the future. Thus, obstetric conditions related to infection and inflammation should be highlighted and require early intervention and multi-disciplinary team involvement. In the other words, effective interventional measures are paramount in averting maternal death. It will be a very valuable entity to increase the knowledge on maternal health in our country. It will give some impact on our health service to be improved and develop preventive measures to reduce maternal morbidity and mortality.

Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

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