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A Study on Epidemiology of Severe Acute Maternal Morbidity in a Tertiary Care Center

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Abstracts

Aims: Although maternal mortality is a good indicator of maternal health care services, it does not consider the near miss cases which would have otherwise ended in mortality if timely intervention and adequate services were not provided. Hence, the new concept of severe acute maternal morbidity (SAMM) emerged as a promising alternative to maternal mortality reviews.

Methods: It was a retrospective study of all pregnant women or those within 42 days of termination of pregnancy who fulfilled the modified WHO SAMM criteria 2009 and were admitted in the emergency and intensive care unit from January 2019 to June 2021.

Result: A total of 110 SAMM cases were included in the study. The maternal mortality ratio was 2.74 per 100000 live births. The incidence of SAMM was 7.55% and Mortality index was 3.63%. Hypertensive disorders of pregnancy accounted for 49 (44.45%) of SAMM, of which 14 (12.72%) had eclampsia, followed by hemorrhage including both antepartum and postpartum (N=29, 26.35%). Twenty three (20.90%) cases presented with ruptured ectopic pregnancy requiring laparotomy.

Conclusion: Maternal mortality and SAMM share similar spectrum of pathology and circumstances. Timely diagnosis and referral, and with aggressive multidisciplinary team involvement SAMM cases can be prevented to end as maternal mortality.

Introduction

Pregnancy, though a common physiological period, demands much more quality health care services as it may get complicated at any point from conception to postnatal period. Since ages, maternal mortality is being used as an indicator to assess the quality of health care service.

Globally, maternal mortality has declined by more than a third from 2000 to 2017. Yet, an estimated 810 women continue to die each day due to complications related to pregnancy and childbirth, mostly from preventable or treatable causes.[1] The maternal mortality ratio (MMR) declined in India by about 70% from 398/100,000 live births (95% CI: 378-417) in 1997-98 to 99/100,000 live births (95% CI: 90-108) in 2020. India could achieve the United Nations 2030 MMR goals, that is to reduce the global MMR to less than 70 per 100,000 live births, if the average rate of reduction is maintained.[2] Recently emphasis shifted to the concept of "severe acute maternal morbidity" (SAMM) as a promising alternative to maternal morbidity reviews as relying on maternal mortality alone would miss the preventable/treatable causes. Also known as maternal near miss, SAMM is defined as a very ill pregnant or recently delivered woman who would have died had it not been that luck and good care was on her side.[3]

Lakshmidevi M et.al Study on Epidemiology of Severe Acute Maternal Morbidity in a Tertiary Care Center. Jul-Dec. 2023;18(2):40-45

Original Article

It is a more sensitive and appropriate indicator as it draws attention in improvement of quality care for severely ill pregnant woman which will bring more impact in maternal care. There are no uniform criteria to identify the cause under SAMM and limited literature available on the pattern of SAMM.[4] Hence this study was done to identify SAMM cases based on WHO criteria 2009, to assess incidence, demographic factors, common preventable risk factors and to assess feto-maternal outcome.

Methods

It was a retrospective study which included all the pregnant women antenatally or within 42 days of termination of pregnancy, who fulfilled the modified WHO SAMM criteria 2009 and got admitted in the emergency and obstetrics intensive care unit (ICU) of Vydehi Institute of Medical Sciences and Research Centre from January 2019 to June 2021. Patients who were discharged against medical advice were excluded. After obtaining approval from Institutional Ethics Committee ECR/747/Inst/KA/2015/RR-21, the medical records of all critically ill obstetric patients admitted to ICU fulfilling the inclusion criteria were studied. Data were collected regarding age, parity, booking status, weeks of gestation at the time of admission, pregnancy-related and other medical diagnosis, treatment given, mode of delivery, fetal outcome and final outcome as maternal mortality or recovery. Maternal Mortality Ratio defined as ratio of maternal deaths among SAMM to 100000 live births was used to express the maternal outcome. Neonatal mortality rate was used to describe the neonatal outcome.

All the data was entered into Microsoft excel data sheet and was analyzed using Statistical Package for Social Sciences (SPSS) version 22 (IBM SPSS Statistics, Somers NY, USA) software. Categorical data was presented as frequencies and proportions. Chi-square test or Fischer's exact test was used as test of significance for ordinal data. Continuous data was represented as mean and standard deviation. A p value of <0.05 was considered as statistically significant.

Results

A total of 110 SAMM cases were included in the study during which there were 1456 total number of live births. Out of 110 cases, there were four maternal deaths; hence maternal mortality ratio was 2.74 per 100000 live births. The incidence of SAMM was 7.55% and the mortality index was 3.63%. The neonatal mortality rate was 29.5%.

In our study, majority (69.1%) were in the age group of 20-29 years, belonging to the urban area (65.5%) with class 3 socioeconomic status by modified Kuppuswamy classification (54.5%). Many (52.7%) were un-booked and presented mainly (36.4%) in early pregnancy (<12 weeks) as depicted in table1.

Table 1: Demographic characteristics of Severe Acute Maternal Morbidity cases (N=110)

Characteristics		Frequency	Percentage (%)
Age group (years)	<19yrs	9	8.2
	20-29yrs	76	69.1
	>30yrs	25	22.7
Area	Urban	72	65.5
	Rural	38	34.5
Booking status	Booked	52	47.3
	Unbooked	58	52.7
Education	Illiterate	14	12.7
	Schooling	59	53.6
	Graduate	30	27.3
	Postgraduate	7	6.4
Socioeconomic status	Class 1	0	0
	Class 2	11	10.0
	Class 3	60	54.5
	Class 4	27	24.5
	Class 5	12	10.9
Parity	1	45	40.9
	2	28	25.5
	>2	37	33.6
Stage of pregnancy	<12weeks	40	36.4
	13-28weeks	17	15.5
	29-36weeks	32	29.1
	37-40weeks	12	10.9
	Postpartum	9	8.2

In the present study, 76.7% of cases with favourable outcome and 23.3% with unfavourable outcome all belonged to class 3 socioeconomic status and was statistically significant as shown in table 2. Favourable outcome was defined as no morbidity and mortality in both mother and fetus while unfavourable outcome was defined as morbidity and mortality in either/both mother and fetus present.

Lakshmidevi M et.al Study on Epidemiology of Severe Acute Maternal Morbidity in a Tertiary Care Center. Jul-Dec. 2023;18(2):40-45

Original Article

Table 2: Comparison of variables among favorable and unfavorable outcomes of SAMM cases (N=110).

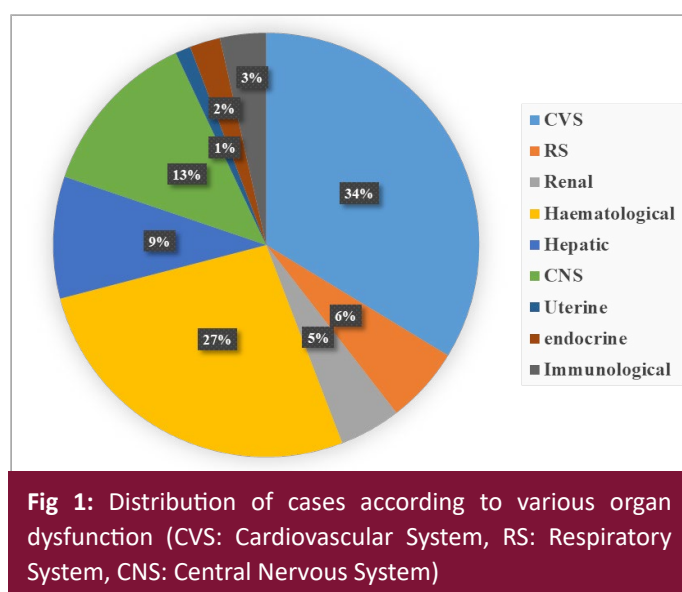| Variables		Outcome				p value*
		Favourable (n=89)		Unfavourable (n=21)		
		Frequency	%	Frequency	%	
Age group	<19yrs	7	77.8%	2	22.2%	0.890
	20-29yrs	61	80.3%	15	19.7%	
	>30yrs	21	84.0%	4	16.0%	
Area	Urban	56	77.8%	16	22.2%	0.313
	Rural	33	86.8%	5	13.2%	
Booking status	Booked	38	73.1%	14	26.9%	0.055
	Unbooked	51	87.9%	7	12.1%	
Education	Illiterate	10	71.4%	4	28.6%	0.654
	Schooling	47	79.7%	12	20.3%	
	Graduate	26	86.7%	4	13.3%	
	Postgraduate	6	85.7%	1	14.3%	
Socioeconomic status	2	8	72.7%	3	27.3%	0.028
	3	46	76.7%	14	23.3%	
	4	27	100.0%	0	.0%	
	5	8	66.7%	4	33.3%	
Birth order	Primi	36	80.0%	9	20.0%	1.00
	Multi	53	81.5%	12	18.5%	

*Chi-Square/Fisher's Exact test.

In the present study 49 (44.45%) of SAMM cases had hypertensive disorders out of which 12.72% had eclampsia, followed by 29 (26.35%) who had hemorrhage which included antepartum hemorrhage, postpartum hemorrhage and incomplete abortions. Twenty three (20.90%) cases presented with ruptured ectopic pregnancy which required laparotomy as shown in Table 3.

Table 3: Distribution of cases according to individual clinical insult.

Clinical insult	Frequency	Percentage (%)
Hypertensive disorders	49	44.54
Ruptured ectopic	23	20.90
Haemorrhages	29	26.35
Labour complications	15	13.65
Systemic causes	19	17.27
Shock	12	10.9

About 34% cases had CVS dysfunction, followed by 27% haematological and 13% had CNS dysfunction as shown in figure 1.

Fig 1: Distribution of cases according to various organ dysfunction (CVS: Cardiovascular System, RS: Respiratory System, CNS: Central Nervous System)

Various interventions like ICU admissions, laparotomy, transfusion of blood and blood products and interventional radiological interventions were required to improve the outcome as shown in table 4.

Lakshmidevi M et.al Study on Epidemiology of Severe Acute Maternal Morbidity in a Tertiary Care Center. Jul-Dec. 2023;18(2):40-45

Original Article

Table 4: Comparison of interventions needed among favorable and unfavorable outcomes in SAMM cases.

Interventions	Maternal outcome					p value
	Favourable		Unfavourable			
	Frequency	%	Frequency	%		
ICU admissions	Yes	35	79.5	9	20.5	0.808
	No	54	81.8	12	18.2	
Laparotomy	Yes	25	96.2	1	3.8	0.023
	No	64	76.2	20	23.8	
Interventional Radiology	Yes	18	90.0	2	10.0	0.353
	No	71	78.9	19	21.1	
Need of blood and products	Yes	40	81.6	9	18.4	1.00
	No	49	80.3	12	19.7	

The following table depicts the comparison of pregnancy and fetal outcomes.

Table 5: Distribution of cases according to fetal outcome.

Characteristics		Frequency	Percentage
Gestational age	Term	26	23.6%
	Preterm	33	30.0%
Pregnancy outcome	Abortions	50	45.4%
	Alive	48	43.6%
	Still born	3	2.7%
	IUD	9	8.1%
NICU Admission	Yes	26	23.6%
	No	22	20.0%
Mode of delivery	NVD	16	14.5%
	LSCS	43	39.1%
	Abortion	26	23.6%
Maternal outcome	Alive	106	96.4%
	Dead	4	3.6%
Fetal outcome	Alive	43	39.1%
	Dead	17	15.4%

Discussion

Severe acute maternal morbidity reviews are emerging as a superior tool for the evaluation of quality of healthcare provided, in place of mortality reviews.[5] It is because they both share the common underlying etiology where with prompt identification and intervention there will be a decrease in maternal mortality.

In the present study, 69% cases belonged to the age group 20-29 years, 52.7% cases were un-booked which was in comparison with the study done by Ganvir P et al.[6] The incidence of severe maternal morbidity ranges from 0.07 to 8.23%.[7] There is a huge difference between the incidence of SAMM between the developed and developing countries. The quality of care clearly defines the mortality risk. The incidence of SAMM in this study was 7.55% which was higher when compared with the studies done by Kaur N et al. (1.02%), Upadhaya et al. (2.23%).[3,8] It is higher in our study because many cases were referred from primary health care centers and majority were unbooked.

The MMR in our study was 2.74 per 1000 live births, comparable to Kaur N et al.[3] The maternal mortality index in this study was 3.63% which was less than other studies done by Archana et al. (29.07%), Roopa et al. (14.9%) and Jamal et al. (12.64%).[9,10,11] This may be due to the quality and timely multi-disciplinary health care provided to the study cases.

In our study, hypertensive disorders were more common obstetric complication (44.54%) in which 12.72% had eclampsia, 6.36% had HELLP, 25.45% had severe preeclampsia followed by haemorrhagic causes (26.25%) which included antepartum haemorrhages (8.18%), postpartum haemorrhages (4.54%) and incomplete abortions (13.63%) requiring blood transfusions and evacuation procedure. It was consistent with the study of Upadhaya et al. in which hypertensive disorders (50%) were most common obstetric cause for SAMM.[8] The studies done by Kaur N et al. and Shrestha et al. showed that the haemorrhage, 46.42% and 41.66% respectively was the leading cause for SAMM.[3,12] The present study was in par with the study done by Yelikar et al. in which they concluded that the leading cause of SAMM was changing from haemorrhagic to hypertensive disorders.[13] This shift in the cause of SAMM may be due to extensive training and involvement of primary health care centers in the management of postpartum hemorrhage (PPH) with better availability of oxytocics and early/antenatal recognition of high risk cases for PPH and timely referral of the such patients to higher centers for better management and prevention of PPH. In the present study, cardiovascular system dysfunction was the major organ function based event leading to SAMM which was 34%. It included shock, peripartum cardiomyopathy and other valvular heart diseases with heart failure requiring ICU admission and

Original Article

care. It was followed by hematological dysfunction (27%) in whom blood and blood products transfusion of >4 units were required. It was comparable to the study done by Kaur N et al. where there was 35.71% of cardiovascular dysfunction followed by 25% respiratory dysfunction and 14.28% of hematological dysfunction.[3]In our study 2.72% cases had severe COVID disease due to COVID SARS-19 pandemic which had started around December 2019 globally.

Severe maternal morbidity should be considered internationally as a new indicator of the quality of obstetric care. Substandard care was found in the majority of assessed cases which may be due to limited resources available in the country. Reduction of severe maternal morbidity is a mandatory challenge. Therefore, auditing of severe maternal morbidity at local or regional level should be encouraged to improve the quality of obstetric care and decrease the incidence of maternal morbidity and maternal mortality.[14,15] As it was believed that the underlying diseases causing SAMM were the same as those causing maternal death, studying the circumstances surrounding a woman with SAMM will act as a complement to analysis of maternal mortality and will allow for a rapid assessment of maternal care. Including the clinical cause, the social, cultural, economic and political determinants of health should also be considered. These factors can operate at three levels leading to delay in getting appropriate treatment. There may be delay in decision to seek and reach care from patient side or may be delay in referral and appropriate care from health system.[16,17,18]In the present study one interesting near miss antenatal case presented to our hospital with bleeding manifestation and low platelets falling up to 7,000/cmm. With timely referral and appropriate multidisciplinary care, she delivered at 34 weeks. Both the mother and baby were discharged on 14th post- operative day in good health. It was a good index case to prove how maternal mortality can be prevented with prompt intervention and multi-disciplinary involvement.

Conclusion

In the present study, the most common obstetric cause of SAMM was hypertensive disorders followed by haemorrhages. Hence, the present study supported the change in trend from haemorrhagic causes to hypertensive disorders. As the SAMM and maternal mortality share same circumstances, with prompt antenatal care including screening for preeclampsia, placenta previa, cervical incompetence etc., preventive treatment for preeclampsia, early detection and referral to higher center, aggressive treatment with involvement of the team including obstetrician, anesthetic and other specialist when there is a need, can reduce the maternal mortality.

Conflict of Interest: The authors declare that there are no competing interests.

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Original Article

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