Trends in Causes of Maternal Mortality in a Tertiary Care Centre in Kerala after Introduction of CRMD and Quality Standards Programme

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Abstract
Background: *Confidential review of maternal deaths of Kerala (CRMD) which was launched from 1ˢᵗ January 2004 puts in sincere efforts to discover major underlying causes of maternal deaths in the state. As a result of this process, Kerala initiated the quality standards programme. The Committee also work on a communication and training programme within the state (EMOCALS) to educate obstetricians of both Government and private sectors to manage these common causes of maternal deaths and steps to be taken to prevent them. They also invite the attention of State government to specific areas that require government led remedial measures, such as policy or legislative changes. The present study compares causes of maternal deaths that occurred in the study setting during a six year period 2004 – 2009 (group I) with that of 2012 – 2017(group II) - that is after introduction of CRMD and EMOCALS- to find out whether there is any change in trend regarding causes of death.*

Methods: *A descriptive a comparative study of maternal mortality cases was conducted at SAT hospital, Govt. Medical College, Thiruvananthapuram, a tertiary care centre in Kerala, India. The maternal mortality data of the study setting for a six year period from January 2004 to December 2009 was taken (group I) which was compared with that of January 2012 – December 2017(group II) of the same study setting. The data was recorded using structured proforma, entered in excel worksheet and compared between two groups. Data analysis was performed using SPSS version 16.*

Results: *Maternal mortality ratio in group I was 126/ 1 lakh live births where as in group II it was 157/ 1 lakh live births. Maximum number of deaths occurred in primigravidae in both the groups (41.4% in group I and 51.1% in group II) . Most of the deaths occurred in referred cases (70.7% in group I and 88.3% in group II) and cases belonging to low socio economic status (94% in group I and 77.7% group II). Regarding cause of death 59.6% of deaths occurred due to direct causes in group I whereas direct maternal deaths was reduced to 43.3% in group II which was found to be statistically significant. There is a statistically significant reduction in number of deaths due to postpartum hemorrhage (26.3% in group I and 14.4% in group II) which is still the leading cause of maternal death in India.*

Conclusion: *After initiation of quality standards programme there has been statistically significant reduction in direct maternal deaths in this study setting especially deaths due to postpartum hemorrhage.*

Keywords: *maternal mortality, CRMD, quality standards programme.*

Introduction

Maternal health reviews have been utilized in several countries as a means of identifying social health care quality issues affecting maternal survival[1]. The gold standard among them is the confidential enquiry on maternal deaths (CEMD) which is a National programme investigating maternal deaths in UK and Ireland. Since the first CEMD report which was published in UK in 1952, maternal deaths have fallen from 90/I lakh in 1952 to 10/1 lakh at present. Confidential enquiry is an enquiry designed to improve health and health care by collecting data, identifying any short falls in the care provided and devising recommendations to improve future care. The details of patient, hospital and involved clinicians remain anonymous to those conducting the enquiry. Overall aims of this enquiry include;

1. To save more lives of women and newborns, to reduce complications and to improve quality of maternity services for the benefit of all pregnant women, their infants and their families.
2. Through the use of guidelines and recommendations to help ensure that all pregnant and recently delivered women receive the best possible care, delivered in appropriate settings in a way that takes account of and meet their individual needs.

In 1991 Malaysian Government introduced National confidential enquiry into maternal deaths and since then their maternal mortality ratio began to fall and remain below 50/one lakh[2]. Audit of maternal deaths through CEMD appears to be effective in systematicallyidentifying remedial actions to which ministry of health responds with targetted budget allocations. Sustained political will and commitment have been instrumental in Malaysia's multi sectorial approach to reducing maternal mortality. In South Africa also such enquiries has been operational since 1997. They could reduce their maternal mortality ratio from 176.2/1lakh in 2008 – 2010 to 146.7 in 2011-12[3]. This process is currently being followed in Kerala with support from WHO from 2004. CRMD

committee consistently reviewed average 50% case sheets related to maternal deaths during 2004-2009. Upon review, the major causes were identified to be PPH and PIH.As a result of this process, Kerala initiated the quality standards programme. This programme consisted of a training based on a set of ten evidence based guidelines to reduce PPH and PIH related deaths. In April 2013 six public delivery points were provided with funds to purchase adequate medicines and equipment along with training on quality standards to tackle hemorrhage and hypertension as part of the emergency obstetric care and life support training programme (EMOCALS)[4].

This study is an attempt to find out the trends in causes of maternal mortality at SAT hospital, Government Medical College, Thiruvananthapuram after introduction of confidential review on maternal deaths in 2004. For this the six year maternal mortality data of the study setting form 2004-2009 is compared with that of 2012-2017 to find out any change in trend regarding causes of death.

Methods

Clearance from institutional research committee and Ethics committee were obtained before starting the study.

Study Design: This is a descriptive comparative study between maternal mortality cases that occurred for a period of six years from 2004 to 2009(group I) with that of 2012 to 2017 (group II) in the same study setting, that is SAT Hospital, Govt. Medical College, Thiruvananthapuram. Maternal mortality is defined as death of a women while pregnant or within 42 days of termination of pregnancy due to any cause direct related to pregnancy or aggravated by pregnancy or its management irrespective of duration or site of pregnancy but not from accidental or incidental causes. Maternal mortality cases as per this definition are identified from mortality registers maintained in this hospital. Cases that occurred from January 2004 – December 2009 (six years)-

group I were identified and deatails regarding baseline socio demographic data, co morbidities, booked or un booked case, immunized or not, what were the obstetric complications, whether referred at the right time, delivered or not, any surgical intervention needed, whether ICU care given, the cause of death were identified and entered in a structured proforma year wise . The same proforma was used to collect same deaths, regarding maternal mortality cases that occurred from 2012 January to 2017 December (Six years)- group II in the same study setting.

Inclusion criteria

1. Maternal mortality cases as per the definition that occurred at SAT hospital, Govt. Medical College, Thiruvananth-apuram for January 2004 to December 2009 and from January 2012 to December 2017 were included as the study subjects.
2. Seriously ill patients during antenatal or postnatal period who due to any systemic disease like cardiac disease and are later referred to MCH, Trivandrum or SCIMST, Trivandrum for continued care and died whether 42 days of delivery within the study period were also included in this study.

Exclusion criteria

All deaths after 42 days of termination of pregnancy were excluded from the study.

The total number live births from January 2004 to December 2009 and from January 2012 to December 2017 were found out from hospital statistics department. The mean maternal mortality ratios for a six year period for these two groups were also. calculated.

Statistical Analysis

The data was entered in excel worksheet and compared between group I and group II. Qualitative variables were expressed in frequency distribution. Comparison of qualitative data between two groups was analyzed by chi square test. A P value of <0.05 was considered as statistically significant. Data analysis was performed using SPSS version 16.

Results

Group I consisted of maternal mortality cases of the study setting for a period of six years from Jan 2004 to Dec 2009. In this group the total number maternal deaths was 99. Group II consisted of maternal mortality cases of the study setting for a period of six years from January 2012 to December 2017. Ninety maternal deaths occurred during this time period. The total number of live birth in group I was 78430 and that of group II was 57109. Maternal mortality ratio in group I was 126/1 lakh live births, where as in group II it was 157/ 1 lakh live births (Table-I)

Comparing the basic socio demographic details among the two groups, maximum number of deaths occurred among 25-29 year age group in group I (n = 37, 37.4%) whereas in group II it was in 20-24 year age group (n = 27, 30%). There was a marked increase in number of deaths in 30-34 year age group in the second group when compared to first (14.1% in group I and 28.8% in group II). This difference was found to be statistically significant. (P <0.001) In number of deaths in extremes of age group (< 19 years and > 35 years) there were not much difference between the groups. Regarding socio economic status majority in group I (n = 94, 95%) belonged to low socio economic group and medium socio economic group was minority (n= 5, 5.1%). But in groupII less number 77.7% (n= 70) belonged to low socio economic group and (22.2%) (n = 20) belong to medium socio economic group. This difference was also found to be statistically significant (p = 0.001). No maternal mortality subjects belonged high socio economic status in both the groups. Regarding registration status, 70 (70.7%) group I and 75 (83.3%) in group II were referred from peripheral institutions after identification of complications. There was one un booked case in group I (1%), and was none in group II. Primigravidaemet with maximum number of deaths in both the groups - n = 41, 41.1% in group I, n = 46, 51.1% in group II. Third gravidae constituted 15.1% in group I, where as it was reduced to 6.6% in group II. This

difference was not found to the statistically significant (p = 0.393). The number of mortalities among gravida four and five were almost identical in both the groups.There were none more than gravida five in birth the groups. Maximum number of deliveries were by way of caesarean section in both the groups n= 40, 40.4% in group I, n = 41, 45.5% in group II. Deaths associated with abortion were 2% in group I and 10% in group II. Seventeen (17.2%) in group I and eleven (12.2%) in group II died undelivered (table II).

When we analyze causes of death among the two groups, direct causes accounted for 59.6% of deaths in group I which reduced to 43.3% in group II. Indirect causes of death amounted to 31.3 in group I which increased to 50% in group II. This difference was found to be statistically significant (p = 0.026). Incidental causes remained same in both the groups (table III)

When we analyze individual causes of death in detail among the groups, hemorrhage claimed maximum number of maternal deaths in both the groups. But the number of deaths due to hemorrhage decreased drastically from 26(26.3%) in group I to 13 (14.4%) in group II which was found to be statistically significant (p = 0.045). The second leading cause of maternal death in group I was hypertensive disorders (n = 18, 18.2%) which also reduced markedly in group II (n=8, 8.8%). But this difference was not found to be statistically significant. The second leading cause of maternal mortality in group II was

maternal cardiac diseases (n = 12, 13.3%). This was the leading in direct cause among group II also. Regarding other indirect causes of death, there was a significant rise in central nervous system causes of death in group II (n = 8, 8.9%) where as it was 0% in group I. This was also found to the statistically significant (P= 0.002). There was a statistically significant rise in thrombo embolism as a cause of maternal death in group II (n = 4, 4.4%) when compared to group I (0%) (p = 0.034).Sepsis as a cause of maternal death increased from group I (4.1%) to group II (6.6%) which was not statistically significant. Amniotic fluid embolism remained almost same in both the groups (6.1% and 6.6% respectively). Maternal inter current infections claimed nine lives in group I. This constituted three cases of H1N1, three cases of Dengue fever, one case each of viral myocarditis, leptospirosis and pyrexia of unknown origin. In group II there were seven deaths due to maternal fever – three due to viral myocardites, two cases of dengue fever and ARDS with saturation fall in two (table IV).

When we go in detail regarding the leading direct causes of maternal death there is marked reduction in number of deaths due to atonic PPH, abruptio placenta, placenta praevia, HELLP syndrome, hypertensive encephalopathy and eclampsia. But there is a marginal rise in the number of deaths due to sepsis which was not statistically significant (table V).

Table 1

	2004-2009	2012-2017
Total maternal death	99	90
Total live birth	78430	57109
Maternal mortality ratio	126	157

Table-II Baseline socio demographic details

	Type	2004-2009		2012-2017		
		n	%	n	%	p
Age	<19	4	4	9	10	<0.001
	20-24	36	36.4	27	30	
	25-29	37	37.4	23	25.6	
	30-34	14	14.1	26	28.8	
	>35	8	8.1	5	5.5	
Socio economic status	Low	94	94.9	70	77.8	0.001
	Medium	5	5.1	20	22.2	
Registration status	Referred	70	70.7	75	83.3	0.096
	Booked	28	28.3	15	16.7	
	Unbooked	1	1	0	0	
Gravidity	Primi	41	41.4	46	51.1	0.393
	G2	36	36.4	31	34.4	
	G3	15	15.2	6	6.7	
	G4	6	6.1	6	6.7	
	G5	1	1	1	1.1	
Mode of delivery	Vaginal	39	39.4	28	31.1	0.128
	Caesarean	40	40.4	41	45.6	
	Abortion	2	2	9	10	
	Ectopic	1	1	1	1.1	
	Undelivered	17	17.2	11	12.2	

Table-III Cause of death

Cause of death	2004-2009		2012-2017		
	n	%	n	%	p
Direct causes	59	59.6	39	43.3	0.026
Indirect causes	31	31.3	45	50.0	
coincidental	6	6.1	6	6.7	
Brought dead (cause not known)	3	3.0	0	0.0	

Table-IV Details of cause of death

	Cause of death	2004-2009		2012-2017		
		n	%	n	%	p
1	Hemorrhage	26	26.3	13	14.4	0.045
2	Hypertensive disease	18	18.2	8	8.9	0.064
3	Maternal infection	9	9.1	7	7.8	0.746
4	Respiratory disease	9	9.1	7	7.8	0.746
5	Heart disease	8	8.1	12	13.3	0.241
6	Amniotic fluid embolism	6	6.1	6	6.7	0.864
7	Sepsis	4	4	6	6.7	0.421
8	Hepatic disease	3	3	4	4.4	0.607
9	CNS causes	0	0	8	8.9	0.002
10	Thromboembolism	0	0	4	4.4	0.034
11	Poisoning	3	3	2	2.2	0.730

12	Auto immune disease	2	2	1	1.1	0.617
13	Malignancy	2	2	4	4.4	0.342
14	Ruptured ectopic	1	1	1	1.1	0.946
15	MTP perforation	1	1	0	0	0.339
16	Ruptured Ovarian cyst	1	1	0	0	0.339
17	Diabetes	1	1	0	0	0.339
18	Burns	1	1	2	2.2	0.505
19	Hematologic disease	1	1	0	0	0.339
20	Snake Bite	0	0	1	1.1	0.293
21	RTA	0	0	1	1.1	0.293
22	Cellulitis, Sepsis	0	0	1	1.1	0.293
23	Ruptured Uterus	0	0	1	1.1	0.293
24	a/c Nephritis	0	0	1	1.1	0.293
25	Brought dead	3	3	0	0	0.096

Table-V Details of leading direct causes

	Type	2004-2009		2012-2017		
		n	%	n	%	p
Hemorrhage	Atonic PPH	16	16.2	9	10	0.212
	Traumatic PPH	3	3	3	3.3	0.906
	Abrutpion	4	4	0	0	0.054
	Placentalprevia	2	2	1	1.1	0.617
	DIC	1	1	0	0	0.339
Hypertensive disease	HELLP	7	7.1	4	4.4	0.441
	Eclampsia	6	6.1	2	2.2	0.191
	Preeclampsia	3	3	1	1.1	0.360
	Hypertensive encephalopathy	2	2	0	0	0.175
	Sub Hemorrhage	0	0	1	1.1	0.293

Discussion

According to V P Paily et al[5] clinical causes of maternal deaths have followed a fairly constant trend in the years for which data are available. Hemorrhage and hypertensive disorders continue to be the main causes of death and this reflect the sub optimal standard of obstetric care received in many cases. Protocols and guidelines for active management of third stage of labour were not followed. Lack of protocol in many centres for hypertensive diseases led to sub optimal care in these cases. Although most mothers died in tertiary hospitals their problems and initial management often started in smaller district hospitals and peripheral maternity units that may have had problems in providing round the clock good quality obstetric care. The present study also agrees these observations. Cardiac disease was the leading medical cause for maternal deaths in the present study which aggress with V P Pailey et al [5]. Indirect maternal deaths out number direct deaths due to obstetric causes in the present study which aggress with a study from UK by Manisha Nair et al[6] Cardiac disease was the single largest cause according to that study also. The major issue identified in care of women who died from an indirect cause was a lack of clarity about which medical professional should take responsibility for care and overall management[6] .Quality of services in FRU are greatly compromised due to deficiency of skilled man power. A total of 30% of FRUs and 50% CHCs do not have anesthetists. The

quality and coverage of emergency obstetric care (EMOC) is thus adversely affected in many parts of the country.[7] A recent comprehensive review demonstrated the effectiveness of EMOC by combination of quasi experimental, observational, historical and ecological studies plus analysis of trends in MMR in relation to introduction of EMOC. This raised the level of evidence supporting the strategy. EMOC is an integral component of skilled attendance[8,9]. Studies do suggest that EMOC can be effective even in the absence of delivery by a skilled attendant[10]. The present study agrees to all these observations.

Conclusion

EMOCALS and quality standards programme has brought about measurable and statistically significant reduction in direct maternal mortality in our study set up. Indirect maternal deaths are still a problem in tertiary care centres which needs to be addressed in further reviews. Intensivists and super specialists in cardiology, neurology, nephrologyetc should be available in peripheries also to tackle these cases.

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