

Maternal near miss morbidity: An analysis of 50 cases

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Abstract

Introduction: This study was conducted to analyse in detail about the Maternal Near Miss mortality (MNMM). The incidence of maternal near miss mortality, the adverse events leading to MNMM, sociodemographic factors, disorders underlying, patterns of near miss mortality and facilities and skills needed to handle this situation are studied in a local context. This is an open study conducted in KGH during the period of april 2013 to November 2013.

Materials and methods: maternal near miss cases which met the comprehensive criteria of WHO were included. All women with severe lifethreatening conditions who fulfilled the WHO criteria were identified and flagged. Their course of hospital stay was followed closely. A total of 50 cases were included. Each case was documented with respect to the adverse event, the disorder and organ dysfunction. Those who survived were included in this study as MNMM. Those who did not survive were not included in this study. All the data needed were collected from hospital records analyzed and master charted to statistical data.

Results: The MNMM incidence ratio in this study is 0.8 per 1000 live births. This is comparable to High income developed countries where it is between 0.6 and 1%. Hypertensive disorders and Hemorrhage and are the leading causes of near miss situations. The Mortality Index is low at 0.05, it reflects good quality of care. The causes of Near Miss reflect the causes of maternal death. Near miss analysis is worth presenting in national indices as a surrogate for maternal death.

Keywords: Maternal Near Miss Mortality, Hemorrhage, Hypertension

Introduction

“Childbirth is rebirth for the mother ”

“A pregnant woman has death on her head”

These ancient sayings summarize the unpredictable and dangers faced by pregnant women.

“Women are not dying because of diseases we cannot treat. They are dying because societies are yet to make the decision that their lives are worth saving.”

-Mahmoud Fathalla, WHO

Maternal mortality is described as "just the tip of the iceberg", implying that there is a base -maternal morbidity-which remains largely undescribed. For each woman who dies, many will survive but often suffer from life long morbidity. Since women are handicapped by the very same conditions which cause maternal deaths, when we reduce the risk factors for maternal deaths we can also reduce the number of women suffering from severe morbidities.

Aims and objectives

To analyse in a local context

- Incidence of MNMM
- Adverse events leading to MNMM(as per WHO criteria)
- Sociodemographic variables among MNMM
- contributing factors to near miss situations
- DISORDERS underlying MNMM (as per WHO criteria)
- Facilities and skills needed to handle these near miss situations.
- The patterns of maternal death and morbidity.

Maternal Death (MD) is the death of a woman while pregnant or within 42 days of termination of pregnancy. Live Birth (LB) refers to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breathes or shows any other evidence of life. Each product of such a birth is considered live born.

Women with life – threatening conditions (WLTC) refer to all women who were either maternal near miss or who died. It is the sum of maternal near miss and maternal deaths (WITC=MNM+MD).

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MNM incidence ratio refers to the number of maternal near miss cases per 1,000 live births. (MNM IR = MNM/LB).

Maternal near miss: mortality ratio refers to the proportion between maternal near miss cases and maternal deaths. Higher ratios indicate better care (MNM: 1MD)

Materials and methods

- Definition of near miss: A woman who survives a severe life threatening condition (either after receiving emergency medical or surgical intervention or otherwise) during pregnancy, abortion, childbirth or within 42 days of pregnancy termination.
- In this study, WHO comprehensive criteria was adopted for identification of MNMM. In this study, all the maternal near miss cases which met the comprehensive criteria of WHO[annexure 1] from April 2013 to November 2013 were included.
- All women with severe life threatening conditions who fulfilled the WHO criteria were identified and flagged. Their course of hospital stay was followed closely
- A total of 50 cases were included in the study. Each case was documented with respect to the adverse event, the disorder and organ dysfunction.
- Those who survived were included in this study as MNMM.. Those who did not survive were not included in this study.
- Patient characteristics including age, education level, parity, booking status, whether came directly or referred from outside, hospital where antenatal care received, whether in life threatening condition at arrival or became so later on, Gestational age at admission, h/o previous LSCS, adverse events, disorders, organ system dysfunction, surgical interventions, contributing factors, need for care in HDU setup, interventions needed in HDU, need for Blood and blood products, mode of delivery ,Neonatal outcome, need for other specialty intensive care ,duration of HDU stay and It was decided to study whether patients came directly or were referred from other hospitals to indicate the strengths of the referral system and any prehospital delay in seeking care

Whether they were near miss at arrival or became near miss after admission was analysed. Near miss at arrival (within 3 to 6 hrs of admission) would reflect the effectiveness of the referral system. Patient stable, with no disorder on admission but becoming near miss later on would reflect the quality of care in the institution.

Among the patients who were stable on admission, the presence of obstetric risk factors like previous LSCS, placenta previa would be noted to see whether these contributed to the stable cases becoming near misses later on.

It was desired to study whether regular antenatal care would contribute to preventing these MNMM situations. Hence, the booking status of these patients, whether they received AN care in Government or private hospitals were noted. In our Study, there was no indication to comment that government hospital AN care was found wanting. The quality of care in private and government hospitals were comparable. .On the whole, may be AN check up may not pickup and prevent near miss situations entirely.

Whether MNMM was common in early pregnancy(defined as gestational age less than 28 completed weeks) or late pregnancy(defined as gestational age greater than 28 completed weeks) or postnatally would throw light on the disorders specific to the various trimesters of pregnancy. Hence it was decided to study this.

The analysis of mode of delivery in this index pregnancy may reveal whether the pattern of mode of delivery in patients with MNMM is different from the normal patients.

Maternal care started as an offshoot of neonatal care. Based on fetio infant outcome. MNMM is divided into 3 phenotypes(1):

Class I MNMM : maternal near miss with healthy infant

Class II MNMM: infant requiring NICU ADMISSION in MNMM cases

Class III MNMM: maternal near miss with stillbirth or infant death.

Fetio infant morbidity would include all infants who need ICU care and are discharged from ICU alive.

It was decided to study these phenotypes because it would indicate how many of the maternal near misses extended into fetio infant near misses. Gestational age, birth weight of live births were noted.

Educational level was included in the study to see if any such association could be seen

Being single inflicts many social disadvantages to women and marital status was included to see if it was a risk factor for developing MNMM.

Each MNMM patient was documented separately based on the ADVERSE EVENT as given by WHO eg- hypertension, hemorrhage, cardiac disease(annexure)

Each MNMM patient was classified based on the DISORDERS as given by WHO(eg-eclampsia, severe pre eclampsia, pph, placenta previa, placenta accreta, ectopic pregnancy).This would give an idea about the frequency and morbidity patterns prevalent in this area.

All emergency surgical interventions to control hemorrhage including B Lynch suturing, Bilateral uterine artery ligation, Bilateral internal iliac artery ligation, caesarean hysterectomy was documented in the study because this would indicate the skill level and quality of care required in the management of these patients.

Any underlying medical disorder in these patients such as anemia, diabetes, hypertension was included to study their possible contributory role in the near miss situation. The reason for being classified as near miss, the indications for shifting to HDU, the interventions done in HDU and the organ system which failed/dysfunctioned was noted because this can give important information with regard to identifying skills and health care resources and needed to manage these cases effectively.

For example, if respiratory dysfunction, is identified as a common form of organ dysfunction, then Oxygen saturation monitors, arterial blood gas analysers etc, intubation skills and ventilator facilities would be needed to manage these patients in the hospital.

Duration for which HDU care was needed and duration of hospital stay was documented.

Prolonged hospital stay was defined as hospital stay lasting for more than 7 days

The other specialties involved in the care of each patient , the number of patients shifted to specialty ICU for further care and the blood components needed were documented and analysed because it may reveal any felt needs that can be addressed.

Observations & results

During the study period,19185 number of patients received care in the OP[obstetrics alone] of whom 11465 were new OP patients and 7720 were old OP patients. 7592 patients were admitted and treated;

There were 5713 deliveries of which 2512 were Labour Natural,205 were Assisted Vaginal deliveries and 2996 were Caesarean Sections. There were 5570 live births.

Table 1

CATEGORY	NO. OF PATIENTS
OUT PATIENTS(OBS)	19185
IN PATIENTS(OBS)	7592
LIVE BIRTHS	5570
NEAR MISS	50
MATERNAL DEATHS	3

- Total no. of near miss cases: 50
- Total no. of maternal deaths =3
- Women with life threatening conditions=MNMM+MD=53
- Maternal near miss incidence ratio=MNM/LB=0.8976
- Severe maternal outcome ratio=MNM+MD/LB=0.9515
- Maternal near miss: mortality ratio =MNM:1 MD=16.6:1
- Mortality index=MD/(MNMM+MD)=0.0566
- No. of Maternal Deaths during the study period=3 [causes: Jaundice complicating pregnancy=1 Sepsis/Type1 Respiratory failure=1 Pulmonary edema/Severe Preeclampsia=1]

- No/of pregnancy specific causes = 47
- No. Of Pre existing disorders aggravated during pregnancy =3
- No. Of pregnancy specific disorders =0
- No. Of incidental and accidental causes in pregnancy = 0

Reason for being classified as near miss

- Cerebral dysfunction=20
- Hypovolemia necessitating >5 units of transfusion of blood & blood products=14
- Emergency hysterectomy =8
- Heart failure=3
- Pulmonary edema=2
- Impending hypovolemia which was avoided due to emergency surgical intervention =3

Near miss on arrival [n=33]

- Eclampsia n=12
- Imminent eclampsia n=4
- Pulmonary edema due to severe pre eclampsia n=2
- Abruption placentae + couvelaire uterus n=2
- Postpartum hemorrhage n=5
- Rupture uterus n=1

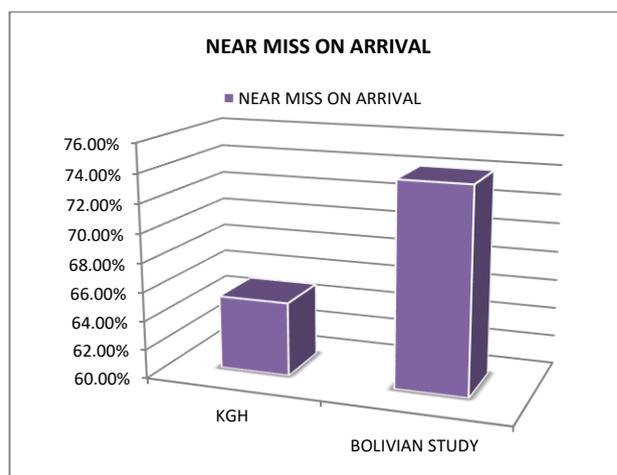


Chart 1 Cardiac failure n=3; Ruptured ectopic pregnancy n=4

Near miss after admission n=17

Had disorder on admission and became near miss n=4

- Severe pre eclampsia n=4
- Developed postpartum eclampsia n=2
- Developed signs and symptoms of imminent eclampsia n=1
- Developed DIC and PPH n=1

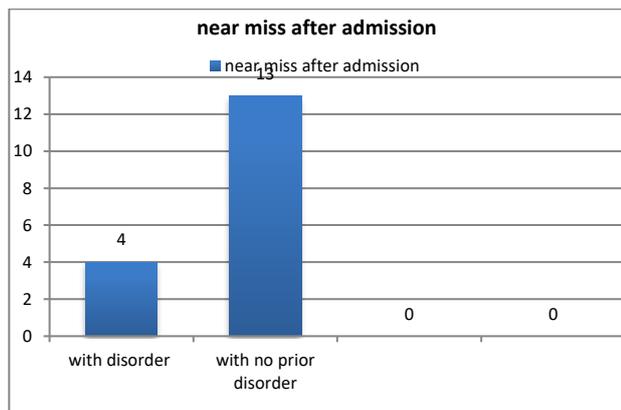


Chart 2 Near miss after admission

Had no disorder on admission but became near miss n=13

Normal BP & urine albumin nil on admission but developed Postpartum eclampsia n=2

Repeat LSCS proceeded to emergency cesarean hysterectomy = n=4

Admitted for repeat LSCS; relaparotomy done due to internal bleeding = 4% [n=2]

Admitted for repeat LSCS;required surgical procedures to control Hemorrhage n=1

Placenta previa /accreta proceeded to cesarean hysterectomy= n=5

• **Organ system which has failed**

Hematological system=20

Central nervous system=11

Respiratory system=2

Cardiovascular system=3

Cns+ hematological system=10

Cns+ respiratory system=1

Respiratory+ hematological system=4

- MNMM with only one organ system involvement =36
- MNMM with more than one organ system involvement=14
- A minimum of 3 specialties were involved in the care of each patient.
- Average duration of hospital stay=mean 14.95 days(range 3 days 21 hrs to 44 days 8 hrs)
- Average duration of HDU stay=mean 94.18 hours(range 1 hour to 336 hours)
- No. of cases referred from KGH to RGGGH = 3
For Neurological care -- 1
No.of cases referred for CCU care =2
- Most common investigations for which pt. Referred to RGGGH =
CT BRAIN = 6
MRI 1
EEG 1

The majority of cases 66% were near miss on arrival;

Of the 15 cases which became near miss after admission,4 had underlying preeclampsia which rapidly flared up- 2 developed postpartum eclampsia,one developed imminent signs with a persistently very high BP which necessitated i.v Nitroglycerine drip,and one went into DIC and atonic PPH.That all 4 survived reflects the quality of care in the hospital.

Among the remaining 13 cases which became near miss after admission,the most common cause was hemorrhage.5 of them had placenta Previa/accreta;5 had h/o previous LSCS which went in for atonic PPH ;all 10 necessitated emergency surgical procedures to PREVENT and manage hemorrhage. This probably reflects the knowledge and skill level of the care giving team and the supply of blood and blood products by the blood bank.

2 cases had normal BP and U/Alb on admission but subsequently developed eclampsia postpartum. This probably underscores the fact that normal BP readings may be deceptive ;it should not lull our watchful eyes into complacency. Effectively, MNMM after admission reflects the performance of obstetric services.

The majority of cases 64% n=32 came directly to the hospital .32%[n=16] had one referral between health facilities and 4.%[n=2]had two referrals between health facilities

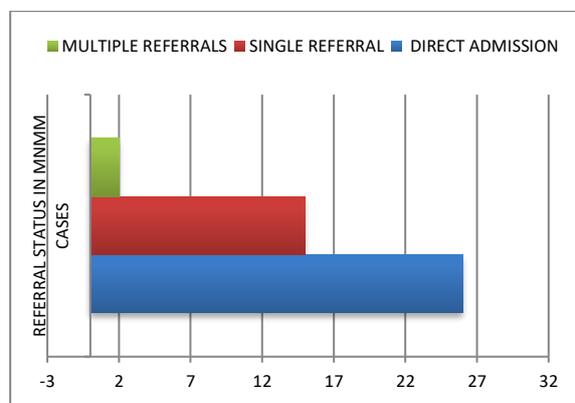


Chart 3

Majority52% [n=26] of the MNMM were multigravida ;40%[n=20] were primigravida and 8% [n=4]were postnatal mothers.

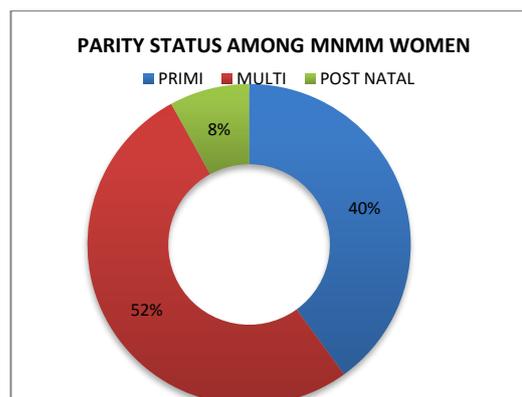


Chart 4

Of the 4 mothers who became MNMM postnatally, 3 were due to PPH and one was PP eclampsia

12%[n=6] of MNMM were unbooked and unimmunised; 4 of these were ectopic pregnancy where the women themselves were not aware of their pregnancy status;all the others were booked and immunised, either in Government[70%] or private[18%] hospitals. Probably even regular AN care may not pick up all the risk factors and prevent near misses.

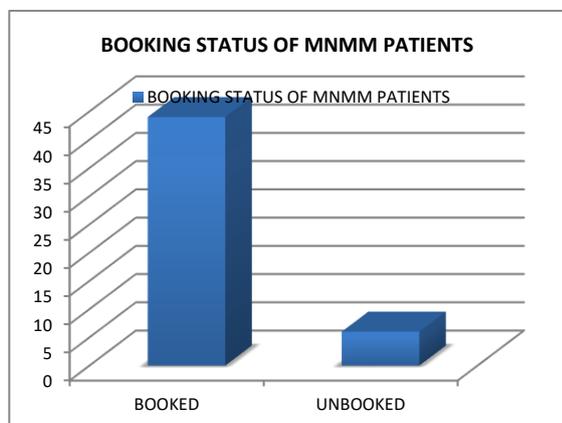


Chart 5

Among the multigravida with MNMM, only (n=10) had previous vaginal delivery.

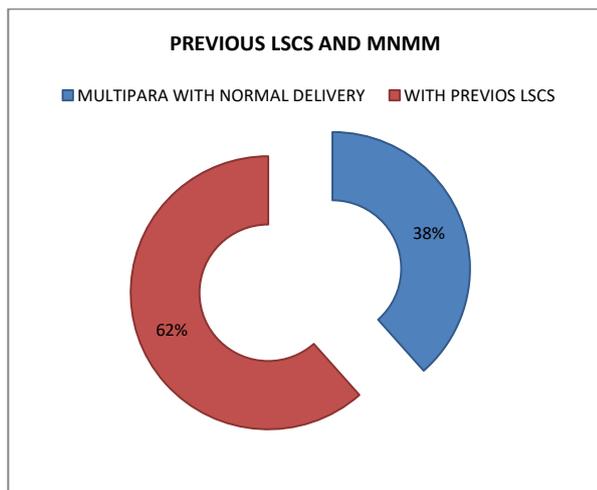


Chart 6

The majority n= 16 had a previous caesarean section. Of this ,(n=12)had previous 1 LSCS and (n=4) had previous 2 LSCS

Association of previous LSCS and MNMM

Table 2

STUDY	KGH	DUTCH STUDY	ALL BIRTHS NETHERLANDS STUDY
Previous LSCS	32%	19.3%	6%

Among the multigravida,the vast majority [n=24] had an interpregnancy interval more than 18 months. n=2 had an interpregnancy interval less than 18 months.

The majority76% [n=38]of MNMM cases presented in the third trimester; 8% (n=4)presented in the IInd trimester- 3 were hypertensive disorders of pregnancy, 1 was abruptio placentae with couvelaire uterus. One baby of a mother with hypertensive disorder of pregnancy survived ; all others were still born. 8%(n=4) of cases presented in the first trimester-all were ruptured ectopic pregnancy.

Trimester wise distribution of MNMM patients

Table 3

	% IN KGH	%IN MANIPAL STUDY
I TRIMESTER	8	12.9
II TRIMESTER	8	4.5
III TRIMESTER	76	57.2
POSTNATAL	8	27.3

12 cases belonged to CLASS III MNMM. Of the 12,one baby was a preterm low birth weight (1.7kg) of a mother with AP eclampsia,who was admitted in NICU and died later due to sepsis.All the rest were still births.

9 were due to hypertensive disorders of pregnancy(4 abruptio placentae;4 eclampsia;1 imminent eclampsia)2 were cases of placenta previa.

16 cases belonged to CLASS II MNMM.13 of these were infants of mothers with hypertensive disorders of pregnancy;2 were infants of mothers with heart disease;1 was infant of a mother who underwent Repeat LSCS - proceeded to hysterectomy due to post partum hemorrhage.

Of the term livebirths 3 had birth weight <2.5 kg; one was infant of a mother with RHD; one was infant of a mother with previous LSCS and placenta accreta; one was infant of a mother with anemia and previous 2 LSCS.

18 cases belonged to CLASS I MNMM;15 were term babies;3 were preterm babies;Both the preterms were infants of mothers with Hypertensive disorders of pregnancy.

Hypertensive disorders of pregnancy are a major cause of mortality and morbidity among infants.

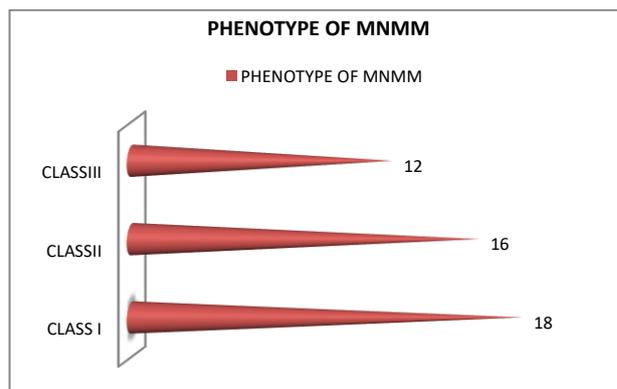


Chart 7

Most ie,78%[n=39] of the MNMM cases were in the age group of 20-29 yrs; 18%(n=9) were in the age group of 30 - 40yrs;4.%(n=2) were in the age group of <20yrs; There were only 6.%(n=3) over 35 years of age. The lowest age was 19 years

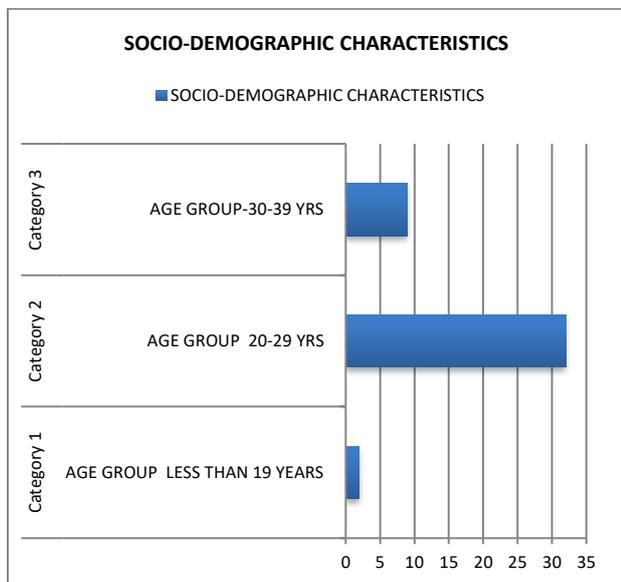


Chart 8

* The majority of MNMM 90% (n=45) were educated. 10%(n=5) were illiterate. 56%(n=28) were educated upto secondary level (upto class 10th) 16%(n=8) were graduates.18%(n=9) were educated upto primary level (upto class 7th)

* All the MNMM mothers were married; all were singleton pregnancies. The most common adverse event associated with MNMM was hypertensive disorders of pregnancy (52%) followed by hemorrhage (42%) and cardiac dysfunction.(6%)

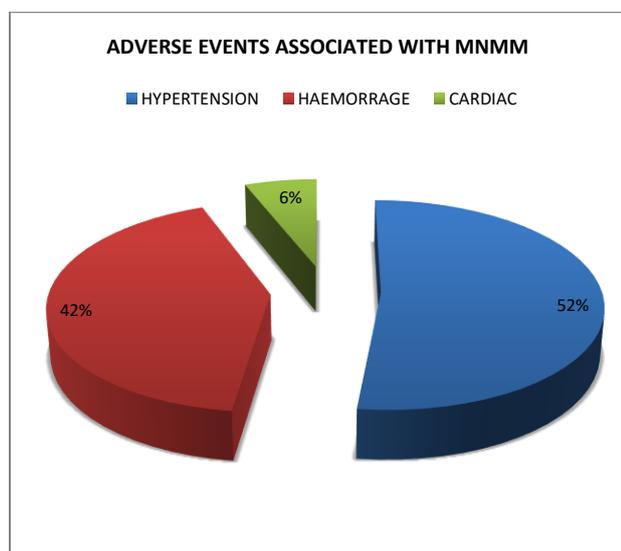


Chart 10

No. of MNMM with hypertensive disorders with h/ o preeclampsia in previous pregnancy = 3(6%)

The most common disorders associated with MNMM were:

- ECLAMPSIA 32%
- PPH 28%
- SEVERE PREECLAMPSIA 20%
- RUPTURED ECTOPIC PREGNANCY 8%
- PLACENTA PRAEVIA /ACCRETA 6%
- CONGENITAL HEART DISEASE 2.%
- RHEUMATIC HEART DISEASE 2.%
- CARDIOMYOPATHY 2.%

Table 4

DISORDER	FREQUENCY n (%)
ECLAMPSIA	16(32%)
SEVERE PRE ECLAMPSIA	10(20%)
POSTPARTUM HAEMORRHAGE	14 (28%)
PLACENTA PRAEVIA	3(6%)
RUPTURED ECTOPIC	4(8%)
CONGENITAL HEART DISEASE	1(2%)
RHEUMATIC HEART DISEASE	1(2.%)
CARDIOMYOPATHY	1(2.%)

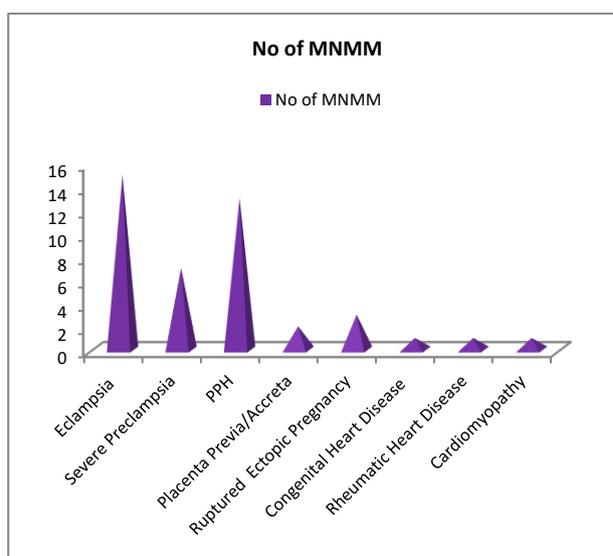


Chart 9

Though the most common causes of MNMM were hypertensive disorders of pregnancy and hemorrhage, there was low mortality for both these conditions. This implies that treatment for both these conditions was effective in the hospital..

Life saving Surgical interventions to control hemorrhage were required in 20 cases; step wise devascularisation was done.

B LYNCH suturing(n=2),bilateral uterine artery ligation (n=6), bilateral internal iliac artery ligation(n=4)emergency hysterectomy(n=8).

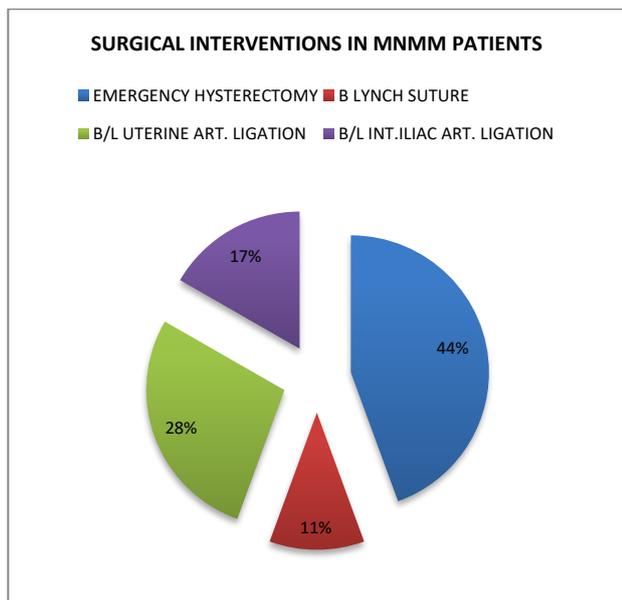


Chart 10

- 7 CASES had anemia;2 were DM on insulin;1 was GDM on insulin;1 was hypothyroid on treatment. These could have contributed to the maternal morbidity.
- All but 4 cases[severe preeclampsia with imminent signs-1,atonic PPH -3] were shifted to HDU and managed. The major indications for transfer to HDU were cerebral dysfunction (convulsions) and circulatory collapse needing massive transfusion.

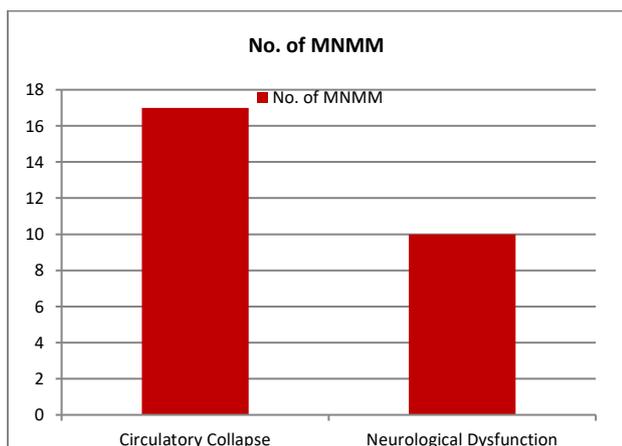


Chart 11

The most common indications for HDU care were:
 Circulatory collapse = 42%
 Neurological dysfunction = 26%
 Need for intravenous antihypertensives = 6% spo2 desaturation = 6%
 For anti failure measures = 6%

- Most common interventions in hdu: transfusion of blood and blood products to correct circulatory collapse = 40%

Ventilatory support = 14%
 Both the above = 8%
 Anti failure measures = 6%

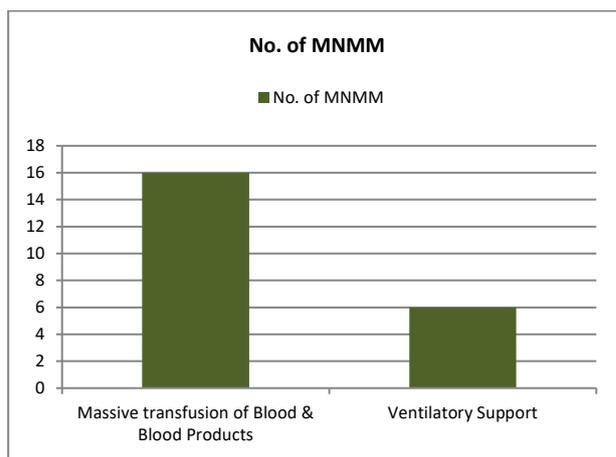


Chart 12

Intravenous Antihypertensives = 6% . The most common intervention in HDU, apart from transfusion of blood and blood products, was ventilatory support. Eclampsia drills and training sessions in intubation skills need to be conducted on a regular basis.

- 94% (n=47) were pregnancy specific causes;6.%(n=3) were pregnancy aggravated causes;14% of MNMM with preeclampsia had h/o high BP in previous pregnancy. Early detection of preeclampsia would go a long way in preventing these near miss cases.

Table 5

No. of pregnancy specific causes	47
No. of pre existing disorders aggravated during pregnancy	3
No. of pregnancy specific disorders	0
No. of incidental and accidental causes in pregnancy	0

Reason for being classified as near MISS

Cerebral dysfunction=40%. Hypovolemia necessitating >5 units of transfusion of blood & blood products=28%. Emergency hysterectomy for any reason=16% . Heart failure=6%. Pulmonary edema= 4%. Impending hypovolemia which was avoided due to emergency surgical intervention = 6%

Table 6

REASON	MNMM n (%)
Cerebral dysfunction	20(40%)
Hypovolemia necessitating >5 units of transfusion	14(28%)
Emergency hysterectomy	8(16%)
Heart failure	3(6%)
Pulmonary edema	2(4%)
Impending Hypovolemia ,avoided due to emergency surgical intervention	3(6%)

- A minimum of 3 specialties [maximum of 7] were involved in the care of these patients in HDU. That Specialty opinions were sought from the departments of Internal Medicine, General Surgery, Medical gastroenterology, Anesthesia, Ophthalmology, ENT, Chest medicine, Cardiology, Neurology, Radiology & Nephrology in the management of MNMM reveals the complexity of these cases. In the Canadian study (7) 20 different specialties were involved in the care of MNMM patients.
- On an average, these patients required 14.95 days of hospital stay and 94.18 hours of care in High Dependency Unit setting.
- 72%(n=36) of cases had one organ system involvement while 28%(n=14) had more than one organ system involvement. Since HDU is a place for intensive care when one organ system is involved and ICU is the place for intensive care when more than 1 organ system is involved, probably upgrading the HDU to ICU may be considered to give better care to these rare but very ill patients.
- Since KGH is predominantly a specialty hospital for Obstetrics & Gynecology, cases requiring superspecialty care like cardiology or neurology were transferred to RGGGH (2 cases –one with RHD and the other with OS ASD operated were transferred to CORONARY CARE UNIT after obstetric intervention was completed)

Table 7

Speciality to which transfer of MNMM cases occurred	No. of cases
CORONARY CARE UNIT	2
NEUROLOGY	1

- A case of Eclampsia who developed Posterior Reversible Encephalopathy Syndrome in the postpartum period was transferred for expert neurology care.
- All 3 patients survived.
- The most common investigations for which patients were referred to RGGGH were CT SCAN, MRI & EEG. Probably availability of these investigations inside the hospital campus may further improve the quality of care.

Table 8

Investigation for which transfer of MNMM cases occurred	No. of cases
CT SCAN	3
MAGNETIC RESONANCE IMAGING	1
ELECTRO ENCEPHALOGRAM	1

- During the Study Period, The Cesarean Section Rate in KGH was 52.52% Of All Hospital Deliveries. The Cesarean Section Rate Among Near Miss Women Delivering At KGH Was 88.%

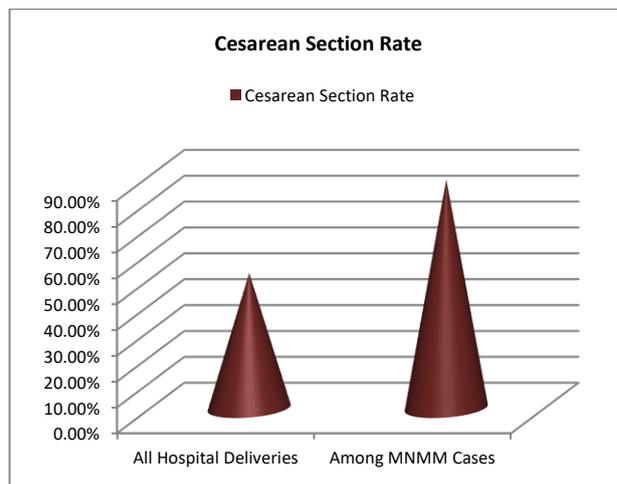


Chart13

- Anaemia & Previous caesarean section seem to be risk factors for MNMM. Of the 21 women who had life threatening hemorrhage, 16 had h/o previous LSCS; 7 had anemia. Both cases of Rupture Uterus and all 3 cases of Placenta previa/accreta had h/o previous LSCS. Perhaps a more restrained approach to primary caesarean section will prevent MNMM due to hemorrhage.

The Blood Bank in KGH is a WHOLE BLOOD storing unit; Still, apart from 163 UNITS OF WHOLE BLOOD / PACKED CELLS (mean 3.7units) it has issued 107 UNITS OF FRESH FROZEN PLASMA (mean 2.4units) AND 31 UNITS OF PLATELETS (mean 0.72units) through its tie-ups with other hospitals during the care of these patients.

Table 9

Blood component used	No. of units
Whole blood / packed cells	163
Fresh frozen plasma	107
Platelets	31

Discussion

- The majority of cases 66% in KGH were near miss on arrival; This same pattern- 74% near miss on arrival- was observed in the Bolivian study[3]

This may be attributed to failure of recognition of the seriousness of the condition [as in the case with c/o pain lower abdomen who was treated in a private hospital for gastritis and sent home; she landed up 4 hrs later in KGH as near miss with ruptured ectopic pregnancy or delayed decision to seek medical assistance [as in the case of a home delivery with PPH.

Addressing this ‘first delay’ needs research to understand the health seeking behaviour of the women and regular updating of knowledge and skills among the medical fraternity. However, MNMM on arrival also reflects the effectiveness of emergency referrals.

- The MNMM incidence ratio ranged from 3.8 to 12 per 1000 livebirths in developed countries(5);In the MANIPAL study in India (4) it was 17.8 /1000 live births. In the KGH study, it was 0.89/1000 live births. This is comparable to the incidence in high income countries where it is between 0.5 and 1% (5)(10)

Table 10

Study	KGH	Manipal Study	High Income Countries
MNMM Incidence Ratio	0.89	17.8	0.5

- THE MNM: mortality ratio in Western Europe was 117-223 : 1. It was 5.6:1 in the Manipal study and16.6:1 in the KGH study

Table 11

Study	KGH	Western Europe	Manipal
MNMM : Mortality Ratio	16.6 : 1	117-223 : 1	5.6 : 1

- Mode of delivery in the index pregnancy in MNMM by caesarean section was 43.6% in the Dutch survey (5) and 13% in the Netherlands study(5) ;63% in the Bolivian study(3);it was 88% in the KGH study. (27)

Table 12

Study	Dutch Survey	Bolivian Study	KGH Study	All Births Netherlands Study
Delivery by Caesarean in MNMM	43.6%	63%	88%	13%

- During the study period, the cesarean section rate in KGH was 52.52% of all hospital deliveries. The cesarean section rate among NEAR MISS women delivering at KGH WAS 88%.In the Bolivian study, the caesarean section rate among hospital deliveries was 28%;in MNMM cases it was 63%.In the Canadian study ,about 50% of MNMM patients required CESAREAN SECTION
- Mode of delivery was assisted vaginal delivery in 12.7% in the the Dutch study(5) and 8.6% in the Netherlands study(5) ;it was 4% in the KGH
- Home delivery complicated by MNMM was 6.3% in the Dutch study(5) and 31.6% in the Netherlands study(5) and 9.5% in the Bolivian study ;it was 4% in the KGH study. Probably this reflects the institutionalisation of births in India which favours the early identification and management of peripartum complications.

Table 14

Study	Dutch Survey	Bolivian Study	KGH Study	All Births Netherlands Study
Home Delivery	6.3%	9.5%	4%	31.6%

- Risk factors of MNMM: Being older than 35 years, not having a partner, being a primipara or para > 3, and having had a Caesarean section in the previous pregnancy were factors independently associated with the occurrence of severe maternal morbidity. (11)

Age >35 was a significant risk factor in both the dutch [29.3%] and the Netherlands study[24.7%].(5)It was not significant in the KGH study [6%]probably because of the early age of marriage and social pressure not to postpone childbirth in India.

Previous LSCS: In the Dutch study,19.3% of MNMM had a h/o previous Cesarean section; In the Netherlands study,6% had h/o prior caesarean section;In the KGH study,32% of MNMM had h/o previous Cesarean section In the Dutch study, primiparity, diabetes, hypertension and prior caesarean section were identified as risk factors for developing MNMM. In the KGH study, multiparity, anemia ,diabetes and previous caesarean section seem to be risk factors for developing MNMM. In the Abbotabad study (8)anemia 37% and diabetes 10% were identified as risk factors.

Referral patterns in MNMM

In the KGH study, the majority of cases 64% came directly to the hospital 32% had one referral between health facilities; and 4% had two referrals between health facilities. This pattern of health seeking behaviour is comparable to the pattern in the BOLIVIAN study (3) where the majority58% of cases came directly to the hospital, 36%had one referral between health facilities and 6%had two referrals between health facilities.

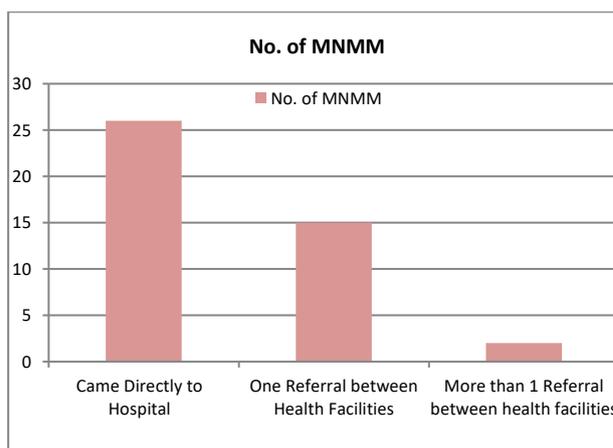


Chart 15

Distribution of MNMM in early and late pregnancy

In the Bolivian study, 26% of MNMM presented in early pregnancy. Most of them were related to pregnancy termination-which is a sensitive, legally restricted issue in Bolivia. In the KGH study only 16% of MNMM presented in early pregnancy (<28 wks). They were due to hypertensive disorders of pregnancy (in 1st trimester) and ruptured ectopic pregnancy (in 1st trimester). Probably because of the MTP act and legalisation of abortion in India, there were no MNMM attributable to pregnancy termination in the KGH study.

Table 16

MNMM	KGH study	Bolivian study
Most common cause in early pregnancy	Hypertension disorders of pregnancy	Hemorrhage
Percentage of MNMM in early pregnancy	16%	26%

In the KGH study, majority 76% of MNMM were in late pregnancy (> 28 weeks). This pattern is similar to the Manipal study(4) where 57.2% of MNMM presented in late pregnancy.

The proportion of MNMM who presented in the postnatal period was higher (27.3%) in the Manipal study(4) than in the KGH study where it was only 8%(n=4). The most common cause(n=3) of MNMM in the postnatal period in the KGH study was PPH ; the other cause (n=1) was Postpartum eclampsia following a preterm home delivery.

- In the Bolivian study, sepsis(1.4/1000) and obstructed (0.4/1000)labour were uncommon causes of MNMM. These causes are not to be found in the KGH study, probably due to the widespread use of partographs in monitoring labour.
- Socio demographic characteristics: In the KGH study, most of the MNMM cases 78% were in the age group of 20-30 yrs; there was no one younger than 19 yrs; 6% were aged > 35 yrs.
- In the Bolivian study mean age was 28 yrs(SD=7.1). In the Manipal study, the mean age was 27.0+/-4.7. All over the world a vast majority of women in the prime of youth are exposing themselves to the risk of pregnancy and its attendant morbidities.

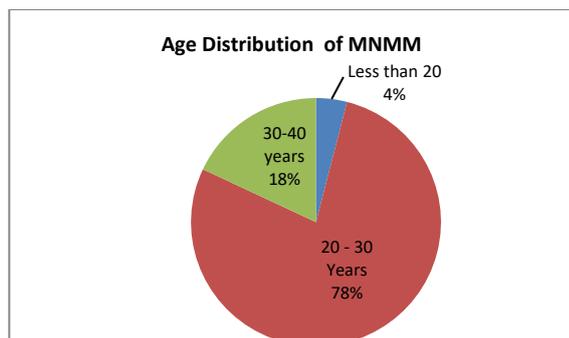


Chart 16

- In the KGH study, majority of MNMM patients 90%(n=45) were educated. 10%(n=5) were illiterate. 56%(n=28) were educated upto secondary level(upto class 10th); 16%(n=8) were graduates; 18%(n=9) were educated upto primary level(upto class 7th).

This pattern is similar to the Bolivian study where 3.5% were illiterate, 38% had primary education, 44.5% had secondary education and 14% had higher education.

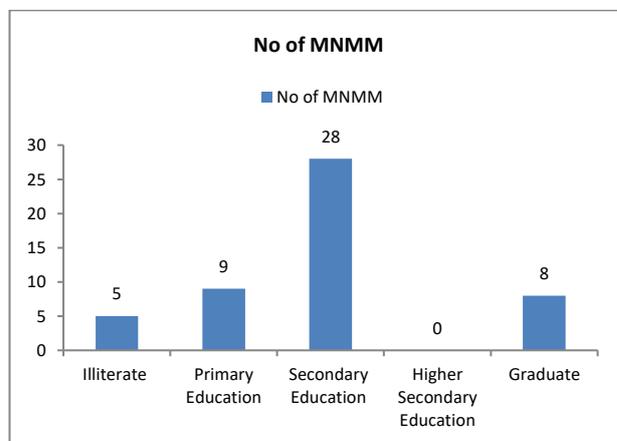


Chart 17

Primary - upto class 7th
 Secondary - upto 10th

- IN the KGH study, 52% of MNMM were multigravida(26) while 34% were primigravida(n=17). This pattern reflects the Bolivian study where 56% were multipara but differs from the Dutch study where the higher occurrence of nulliparity seems to be a risk factor for developing MNMM.
- In the KGH study, [n=6] of MNMM were unbooked and unimmunised; 4 of these were ectopic pregnancy and the women were not aware of their pregnancy; only n=2 antenatal mothers were unbooked; all the others were booked and immunised, either in Government or private hospitals. This is in contrast to the Kathmandu study where 75% of cases were unbooked in the hospital. In the Abbotabad study, 96% of the mothers were unbooked(8).

Table 17

Study	KGH Study	Kathmandu Study	Abbotabad Study
No. of Unbooked MNMM	4.%	75%	96%

- In the Bolivian study(3) 88% of MNMM were either married or cohabiting while 12% were single. All MNMM were married in the KGH study; This probably reflects the universality of marriage in this part of the world.

• Analysis of the causes of MNMM (adverse events)

In the Netherlands, the most frequent cause of MNMM (5) was Major Obstetric Hemorrhage(4.5 per 1000 births) while the most frequent cause of maternal deaths was (pre-)eclampsia.

In Pretoria, Obstetric hemorrhage, Hypertension and sepsis account for 26%,26% and 20% of MNMM(6)

In the Manipal study, obstetric Hemorrhage 44.2%,Hypertensive disorders 23.6%,sepsis 16.3%,cardiac 4.5% were the most common causes.

In the Abbottabad study(8),the most frequent cause was Hypertension 50%,sepsis 17% and Hemorrhage 13%.

In the KGH study, Hypertensive disorders of pregnancy(52%) , Major obstetric Hemorrhage(42%) and Cardiac causes (6%) were the common causes.

The incidence of obstetric hemorrhage in KGH was 3.77 per 1000 live births which is comparable to the Netherlands National study(5)

- Analysis of the causes of MNMM-is there any difference between MNMM on arrival and MNMM after admission

In the KGH study,34.% became near miss after admission to hospital. The most common adverse event in this group of patients was Hemorrhage.

In the KGH study,66% were near miss at the time of arrival; majority of them had Hypertensive disorders of pregnancy as the adverse event.

This pattern is also reflected in the Bolivian study where 59% of near miss on arrival were due to Hypertensive disorders of pregnancy and 85% of near miss after admission were due to Hemorrhage.

• Organ System Dysfunction

In the Pretoria study(6), the most common organ system dysfunction was vascular dysfunction (hypovolemia) 37%;the same was true of the Kathmandu study;

Table 18

Study	KGH	Pretoria Study	Kathmandu Study
Most Common Organ System Dysfunction	Hematological System	Vascular Dysfunction	Vascular Dysfunction

In the KGH study also, the most common organ system dysfunction was the haematological system(both vascular and coagulation system were included under the same head)

Obstetric hemorrhage, though not an important cause of maternal mortality, is still a main cause of MNMM .Preventive measures, protocols and resources for the management of APH and PPH and Skill training in management of obstetric emergencies on a regular basis is important to keep this ground won.

A strategy to provide access to good **quality and up-to-date information to the entire team should be in place. Obstetric haemorrhage is not an important cause of maternal mortality, but is still present as a major cause of severe maternal morbidity.**

Preventive measures, protocols and resources for the management of ante or postpartum haemorrhage must not only be maintained, but improved, despite the fact that haemorrhage is not a major cause of mortality

- More than 1 organ system was involved in 28% of MNMM patients in the KGH study ; this was similar to the Kathmandu study where 26.92% had more than 1 organ system involvement
- The MNMM cases required hospital care for 13 days [mean 13 days ; range 3 to 92 days] in the study by Baskett et al.
- In the KGH study, the MNMM cases required hospital care for a mean of 14.9 days[range 3 days 21 hours to 44 days 8 hours]
- HDU care was required for a mean of 94.18 hrs[range 1 hour to 336 hours]
- 53% of MNMM required blood and blood products; of these 26 received red cells[mean=8 units];4 cryoprecipitate[mean 10 units]12 albumin[mean 4 units]15 platelets [mean=14 units]14 fresh frozen plasma[mean 8 units].In the KGH study, apart from 163 UNITS OF WHOLE BLOOD / PACKED CELLS(mean3.7units) 107 UNITS OF FRESH FROZEN PLASMA (mean 2.4units) AND 31 UNITS OF PLATELETS (mean 0.72units) have been used during the care of these MNMM patients.
- Numerically, haemodynamic compromise was the most common system dysfunction.

The limitation of the study is that it is done over a relatively short period; when done over a span of years it can be useful to assess the efficacy of improvement measures implemented and the long term effects of MNMM.

Summary and Conclusions

- The MNMM incidence ratio in this study is 0.8 per 1000 live births. This is comparable to High income developed countries where it is between 0.6 and 1%.
- Hypertensive disorders and Hemorrhage and are the leading causes of near miss situations .
- Previous LSCS and Anaemia seem to be risk factors for developing MNMM.
- The Mortality Index is low at 0.05,it reflects good quality of care
- The causes of Near Miss reflect the causes of maternal death. Near miss analysis is worth presenting in national indices as a surrogate for maternal death.

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