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INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/19101
DOI URL: http://dx.doi.org/10.21474/IJAR01/19101

RESEARCH ARTICLE

NEAR MISS MATERNAL MORTALITY IN A TERTIARY CARE CENTRE: A RETROSPECTIVE STUDY

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Manuscript Info

Manuscript History
Received: 19 May 2024
Final Accepted: 24 June 2024
Published: July 2024

Key words:-
Maternal Near Miss Mortality, Maternal Mortality**,** Cesarean Delivery (CS), Vaginal Delivery (Vd), Maternal Complication, Neonatal Complications

Abstract

Introduction: One of the most important metrics for evaluating the caliber of healthcare provided is maternal mortality. A near-miss register can provide insightful information on maternity care shortcomings, improving our healthcare system's capacity to recognize and resolve difficulties with staff, infrastructure, and detection. Both altered physiological and pathological circumstances that increase the risk of pregnancy set critical maternal patients apart from typical pregnant and puerperal women. Our study's goal was to assess the various near-miss incidents that mothers encountered in connection to maternal mortality.

Methods: Retrospective data were collected from March 2020 to April 2023 at Smt. Kashibai NavaleMedicalCollegeandGeneralHospital,Pune, over aspan of three-years.Everypatientwhorequiredintensivecare unit(ICU) admission or became critically ill in Operation theatre (OT) or Causality during pregnancy,childbirthwithinforty-twodaysoftheendof thepregnancy,wereincludedinthisstudy.Duringthisstudyperiod,therewereatotalof 5,950deliveries,outofwhich5,938resultedinlivebirths(LB).Outofatotalof these 5950 pregnancies 58cases had adverse abnormal outcomes, among these 58 cases,50 wereclassifiedasmaternalnearmissand8asmaternalmortality.

Results: The maternal mortality ratio (MMR) at our hospital was 134 per one lakh, which is marginallyelevatedduetodelaysinaccessingtimelymaternalhealthcareservices.Therewere 8/1000livebirths(LB),orthematernalnear-missratio(MNMR),whichisthenumberofmaternal near-misses per 1000 LB. Furthermore, 9/1000 LB was the severe maternal outcome rate (SMOR),whichmeasuresthenumberofseverematernaloutcomesforevery1000livebirths.

Ourfindingsshowedthathemorrhageandhypertensivedisorderduringpregnancywerethe primary contributors to illness and death, with sepsis and severe anemia serving as the secondary causes. Among organ dysfunctions, cardiac illness was the leading cause of morbidityaswellasmortality,followedbyrespiratorydysfunction.

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Conclusion: Throughthisresearch,ithasbeenestablishedthatimprovingindividualhealthcare facilitiescanpreventcasesofnearmiss.Moreover,quickreferralafterfirst-linetherapywould be vital in saving the lives of pregnant women. Hence, timeliness when managing cases of maternalnearmissisimportant.Ourexperienceindicatesthatthereshouldbe well-equipped peripheralreferralunitswithtrainedmanpowertohandleobstetricemergencies forinstance massive obstetrichemorrhages, sepsis and Eclampsia.

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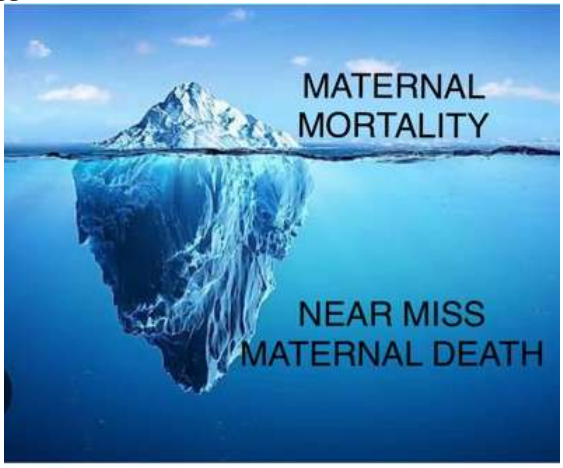
Introduction:-

"THEPROFILEOFTHEWOMENMIRRORTHESTATEOFTHENATION". The Maternal Near Miss woman remains on the verge of death during her pregnancy, childbirth,and up to forty-twodaysfollowingpregnancyterminationduetoalife-threatening illness, but fortunately she did survive. Maternalmorbidityaswellasmortalityratesarehighinthemajorityofdevelopingnations becauseofcomplicationsthatariseduringpregnancyandchildbirth.Globally,themajority of maternal fatalities have been reported in these subpopulations, including those in Sub- Saharan Africa and India [1].

Criticallyillobstetricpatientsmakeupadistinctgroupofpeoplewhosetreatmentisdifficult due to the presence of altered maternal physiology and diseases making their pregnancies risky.Severalfactorshavecontributedtothisgapwhichincludelowliteracylevels,verylittle research on obstetrical care, poverty, lack of knowledge and awareness, and behavioral factors common among third-world countries [2].

Thedataonmaternalmortalitystatisticsarejustthetipofanicebergwhilethatonefor maternal near miss though invisible is an extremely crucial tool for reducing maternal mortality. Presently severe maternal morbidity or MNM has been suggested to be a better indicator



TheapplicationoftheWHO'snear-missstrategyinatertiaryteachinghospitalsetupserves as the foundation for this study. Additionally, the department adopts a multidisciplinary approach to maternal wellbeing. making use of all available infrastructure and resources, including a fully stocked blood bank, an ICU, and a high-dependency unit (HDU) [3].The objective of our study was to evaluatedifferentnear-misseventsexperiencedbymothersinrelationtomaternalmortality.

Material and Methods:-

Thisretrospectiveobservationalstudywasundertakenatatertiary care hospital at Smt. Kashibai NavaleMedical College and General Hospital, Narhe Pune. Period ofstudywastakenbetweenMarch2020toApril2023.Pregnancy-related life-threatening illnesses were covered, and the majority of cases that met the WHO 2011 near-miss criteria were selected [4]. Prior clearance from the Ethics Committee was acquired before the study commenced. The data was

collected from the intensive care unit (ICU), the labor ward delivery register, the operating theater, and the patient medical records maintained by the hospital's records department. To identify NM instances, the MoHFW, MNM review operating guidelines [8] criteria were consulted. Three categories make up these guidelines: any single criterion that indicates maternal cardiorespiratory collapse, investigations, and interventions (at least one from each category).

Inclusion criteria:
Based on operational standards and criteria provided by the Ministry of Health, all critically ill pregnant women admitted to the labor ward for delivery, as well as postnatal, intrapartum, and post-abortion women up to 42 days after pregnancy termination, were segregated into MNM. These criteria have been further subdivided by these operational guidelines into causes that are directly related to pregnancy, causes that existed prior to pregnancy, and accidental and incidental causes.

Exclusion criteria:
All uneventful pregnancies, abortions, deliveries and postnatal patients up to 42 days of delivery.

5,950 deliveries were made during the study period, with 5,938 of those being live births (LB). Of the 58 cases that fulfilled the eligibility criteria, 50 resulted in maternal near misses and 8 in maternal deaths

Statistical Analysis
Data entry was completed on a Microsoft Excel sheet, and SPSS software (Version 21.0) was used to analyze the data by computing means, ratios, and proportions. The following formulas can be used to calculate different ratios.

1. MNM incidence ratio, or the quantity of MNM instances divided by 1000 live births
2. The MNM to death ratio, or the quantity of MNM cases The mortality index, calculated by dividing the total number of cases with a severe maternal outcome by the number of maternal deaths (MI=MD/ MNM+MD)

Severe Maternal outcome (SMO) is defined [13] as, Total number of cases including MNM and Maternal deaths (SMO=MNM+MD).

Results:-

In our study total number of Near miss cases were 58 and the total Mortality was 08. Womenwithlife-threateningconditions=MNM+MD=58.Maternalnear-miss:mortalityratio=MNM:MD-6.25:1. TheMortalityindex was=MD/(MNM+MD)–1:0.14(Table-1)

Table 1:- Near Miss and Maternal Mortality Indices.

Near-missandmortalityindices	
INDICES	**NUMBERS**
Totaldeliveries	5950
Totalno.oflivebirths(LB)	5938
Numberofnear-misscases(MNM)	50
Numberofmaternalmortalitycases(MM)	8
Maternalnearmissincidenceratio(MNMIR=MNM/LB)	8/1000LB
Maternalmortalityratio(MMR=MM/LB)	134/1lakhLB
Maternalnearmiss:maternalmortalityratio(MNM:MD)	6.25:1
Mortalityindex(MD/MNM+MD)	1:0.14
Severematernaloutcomeratio(SMOR=MNM+MD/LB)	9/1000LB

Distribution of period and pattern at the time of Near Miss:-
Among50near-misscases,46patientshadriskfactorsatthetimeofadmissionand4patients wereadmittedwithoutanyriskfactors.Ahigherincidenceofmorbidityandmortalitywasnotedinmultigravidawithhigherincidenc ein un-booked patients.Religiousbeliefsthepatientbelongedtohadlittlebearingonthematernalnear Misscases,but

mortalitywasslightlyhigherinMuslimpatients.
Patientsbelongingtohighersocioeconomicbackgroundwithhighereducationhadahigher incidence of near miss maternal mortality and a subsequent lower incidence of maternal mortality(Table-2)

Table 2:- Socio demographic Characteristics.

Socio-demographiccharacteristicsofwomen		
CHARACTERISTIC	**MNM(n=50)**	**MM(n=8)**
1.AGE		
<20y/o	11	0
20-24	7	1
24-34	10	3
>35	22	4
2.PARITY		
Primipara	22	1
Multipara	28	7
3.RELIGION		
Hindu	21	2
Muslim	29	6
4.BOOKINGSTATUS		
Booked	46	3
Unbooked	4	5
5.SOCIO-ECONOMICSTATUS(MODIFIEDKUPPUSWAMYSCALE)		
Lowermiddle	16	4
Uppermiddle	34	4
6. Education Status		
Literate	39	3
Illiterate	11	5

Adverse Events
TheleadingcausesofadmissionsincludedObstetrichemorrhage,Pre-eclampsiaandSepsis (Table-3). **Obstetrics Haemorrhage** types and subdivision is as given in Table No-4.PIH Patients severity Profile given in Table -5. Details of fetal outcome among Near Miss and Mortality cases given in Table-6. Organ Dysfunctions & Life-threatening conditions among Near Miss Mortality Cases is illustrated in Table-7. Details of Pregnancy outcomeandclinicallifesavinginterventions are depicted in Table No.8

Table 3:- Adverse Events in Near Miss Mortality.

Complications (adverse events)	**ofcases**	**percentage**
Obstetrichemorrhage	24	48%
Hypertension	17	34%
Sepsis	4	8%
Neurological dysfunction	1	2%
Cardiacdysfunction	2	4%
Surgical Complications	2	4%

Table 4:- ObstetricHemorrhage Cases sub division (24Case).

Nature of Obstetric Hemorrhage	Numbers
Atonic Post PartumHemorrhage	6
Placentaprevia	5
Abortion	4
Adherentplacenta	3
Retainedplacenta	3
TraumaticPost PartumHemorrhage	3

Table 5:- PIH SeverityProfile.

Pregnancy Induced Hypertension 17 Cases Distribution	
Pre- Eclampsia	9
SeverePre - Eclampsia	5
Eclampsia	3

Table 6:- Fetal Outcome.

Intra uterine Fetal demise	10
NICU admission	33
Baby with Normal APGAR and rooming in with Mother	7

Table 7:- Organ Dysfunctions & Life-threatening conditions among Near Miss Mortality Cases.

Organdysfunction and lifethreateningconditions:		
Condition	**MNM(n=50)**	**MM(n=8)**
Severeanemia	20	2
Septicemia	4	2
Cardiovascularshock/cardiac arrest)	2	1
Respiratorydysfunction	7	2
Renalcauses	4	1
Hematologicaldysfunction	12	0
Centralnervoussystem	1	0

Table 8:- Pregnancyoutcomeandclinicallifesavinginterventions.

Pregnancyoutcomeandclinicallifesavinginterventions		
Pregnancyoutcome	MNM(n=50)	MM(n=8)
Cesarean Section	34	5
Vaginaldelivery	16	3
Clinicallife-savingintervention		
1.Internaliliacarteryligation	7	2
2.Exploratorylaparotomy	4	3
3.Hysterectomy	2	2
4.Repairofgenitalinjuries	2	1
5.ICU admissions	40	5
6.Bloodtransfusion	36	8
7.Useofcardiotonic/vasopressor	10	8

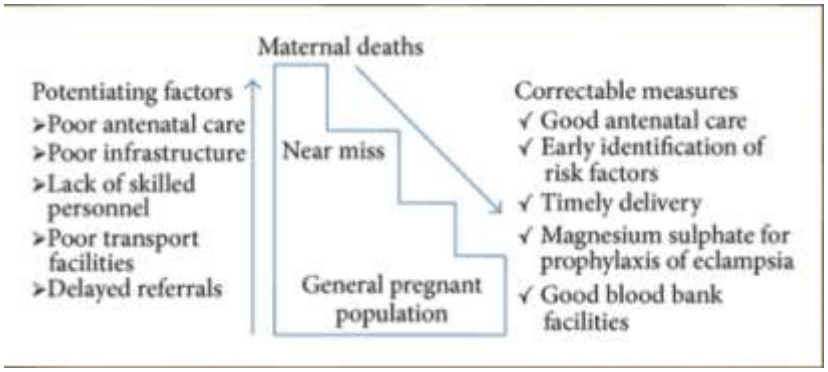
Discussion:-

Maternal mortality is one of the most important indicators of maternal health. Although the ratio remains high, maternal deaths are rare in absolute terms in the community [5]. This problem can be solved by adding the near death of the mother. In developing countries, maternal emergencies are more common than maternal deaths for similar reasons. Studies conducted on maternal emergency patients provide valuable information about maternal health care. Our hospital had a maternal mortality ratio (MMR) of 134 per lakh, which is slightly higher due to delayed maternal treatment. The live birth rate was 8/1000 (LB) or the maternal emergency ratio (MNMR), which is the number of maternal emergency cases per 1000 LB. Furthermore, 9/1000 LB was the severe maternal outcome rate (SMOR),whichmeasuresthenumberofseverematernaloutcomesforevery1000livebirths. Ourfindingsshowedthathemorrhageandhypertensivedisorderduringpregnancywerethe primary contributors to illness and death, with sepsis and severe anemia serving as the secondary causes. Among organ dysfunctions, cardiac illness was the leading cause of morbidityaswellasmortality,followedbyrespiratorydysfunction. Our data are comparable to other studies conducted in Indian subcontinent.

The near-miss approach has been put forth as a means of enhancing the standard of care that the healthcare system offers by examining and evaluating near-miss events and discovering the inadequacies and protocols of the ones that

are currently in place for the treatmentofpregnantwomen.Asaresult,theavailableinterventionswouldbe usedleading to improvements in maternal health conditions and subsequently reducing morbidity and mortality [6].

Causes



Therearedifferencesinthecausesofnearmissesbetweencountriesaswellasthroughout differentregionsoftheworld.Thetwomostsignificantcausesinourstudyarehypertensive disorders and bleeding. In poorer nations, however, infection and obstructed labor may be other factors [7],[8].

Delaysinmaternalhealthcare

Thedelayshavebeenfoundtoberesponsibleforthegapsinaccesstotimelyandeffective obstetricemergencycare,whichcanresultinseriousdifficultiesformothersandevendeath [9][10].

1. Thewomanand/orherfamilymustfirstdecidewhethertoseekmedicalattentionbecausethewarningsymptomsgounnoti ced.
2. Thesecondisgettingtoamedicalfacilitysincecertainservicescouldnotbeavailable owingtosocioeconomiclevel,lackoftransportation,orfinancialdifficulties.
3. Thethirdisnotgettingpropercareatthemedicalcentreasaresultofstaffavailabilityandashortageofmedicalsuppliesforhand lingobstetriccrises.

However,wedidnotseesuchdelaysinourinvestigation.

QualityofCareandMaternalNearMiss

Thepercentageofbirthscarriedoutbytrainedbirthattendantsincreasedfrom58%in 1990 to68%in2008, accordingtoWHO statisticsfrom 2011[11].Afinancial incentiveprogram called the JSY scheme was launched in India to encourage institutional delivery. This leads to increasedidentificationofhigh-riskcasesandimprovedcarequality,whichultimatelylowers maternal morbidityand mortality [12]. WHO Criteria for Maternal Near Miss cases are given in Table-9.

Table 9:- WHO criteria of near Miss Cases.

WHO CRITERIA FOR MATERNAL NEAR MISS CASES:

Clinical criteria	Laboratory criteria	Management criteria
✓ Acute cyanosis	✓ Oxygen saturation < 90% for > 60 min	➢ Use of continuous vasoactive drugs
✓ Gasping	✓ pH < 7.1	➢ Intubation and ventilation for > 60 min not related to anaesthesia
✓ Loss of consciousness lasting > 12 h	✓ PaO2/FiO2 < 200mmHg	➢ Hysterectomy following infection or haemorrhage
✓ Loss of consciousness and absence of pulse/heart beat	✓ Lactate > 5	➢ Dialysis for acute renal failure
✓ Respiratory rate > 40 or < 6/min	✓ Creatinine > 300 mmol/l or > 3.5 mg/dl	➢ Transfusion of ≥5 units red cell
✓ Stroke	✓ Acute thrombocytopenia (< 50,000 platelets)	➢ Cardio-pulmonary resuscitation (CPR)
✓ Shock	✓ Bilirubin > 100 mmol/l or > 6.0 mg/dl	
✓ Uncontrollable paralysis	✓ Loss of consciousness and the presence of glucose and ketoacids in urine	
✓ Oliguria non-responsive to fluids or diuretics		
✓ Jaundice in the presence of preeclampsia		
✓ Clotting failure		

Conclusion:-

The study comes to theconclusion that by raising the standard of care provided in some medicalfacilities, near-missincidentscan beavoided. Furthermore,promptreferralfollowing first-linetherapywouldbeessentialtopreservingthelivesofexpectant mothers.Asaresult, it's critical to handle maternal near-miss instances promptly [14]. We suggest the following measuresbeimplemented in order tolowermaternal near-missandfatalityratesbasedon our observations.

1. EarlydetectionofpreeclampsiaandPIHriskfactors andtimely orearly therapy beginning.
2. Enhancingprenatalcaretoavertpreeclampsiaandsevereanaemia.
3. Thepresenceofabloodbank.
4. Firstreferralunitsshouldrequireventilatorsupport.

The frequency of maternal near misses is high in developing countries. It is imperative to establishproficient,fullystockedreferralfacilitiesattheperipherythatarestaffedbyskilled labor.Theprimarycausesofnear-missincidentsareobstetrichemorrhageandpregnancy- related hypertension. The establishment of obstetrical HDUs, rapid access to blood as well asbloodsupplies,stafftraining,andtheavailabilityofmultidisciplinaryteamscanallhelpto lower maternal mortality and morbidity [15]. Demand will determine whether the current infrastructure needs to be continuously evaluated and improved. Enhancing tertiary care should be paired with a multimodal approach that addresses foundational health system barriers, increases literacy, and heightens social awareness.

Fundinginformation:
Nospecificfunding wasacquired.

Data availability statement:
As the data were acquired from hospital registersandincludesensitiveinformation,albeitanonymized,theethical board didnotinclude theright tosharethedatathat madethispaperpossible.

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