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A Review of Severe Acute Maternal Morbidity (SAMM) through "Three Delays Model"

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Abstract
Introduction: *Every mother should live beyond pregnancy and childbirth. Why do women die, what could have been done, where did we missed out answers to these and many other questions related to maternal mortality are hidden in the details of the morbidity, because maternal mortality is just the tip of the iceberg with a vast base of near miss morbidity. These situations are much more common than maternal deaths and give more reliable information as women herself can be interviewed. Review of these cases has potential to highlight the deficiencies as well as positive elements in health care system.*
Aim: *To identify and study SAMM/Near miss cases to assess the reason behind delay in receiving appropriate medical care by using "Three delays model" and to propose an action plan to overcome these problems.*
Methods: *It is a Cross sectional study conducted at Department of obstetrics and gynaecology, Government Medical College, Thiruvananthapuram over one year period from July 2014 to June 2015. Data collection was done by in-depth interview of patients and relatives, through pretested questionnaire.*
Results: *Total 74 Near miss cases and 16 maternal deaths were identified during study period. Mortality index for this study is 0.17 and Maternal Near Miss Mortality Ratio is 4.6:1. More than one delay was involved in most of the cases and multiple factors were involved in most of these delays. Most common delay observed is Type one seen in 54 cases (48.6%). Among this isolated Type one delay in 36 cases, Type one associated with Type two in 16 cases and Type one associated with Type three in 2 cases. Isolated Type two delay observed in 9 cases (12%). Most common cause of Type one delay was inability to judge seriousness of the problem and so that waiting for problem to resolve by itself. Another important cause was lack of deciding person. Most common cause of second delay was lack of deciding or accompanying person. Other important causes were fear of cost and distance, late referral and financial issues. Third delay seen in only 2 cases associated with type one delay were operation theatre was engaged with some other emergency case.*
Keywords: *Near Miss, Severe Acute Maternal Morbidity (SAMM), Three delays model.*

Introduction

Pregnancy and childbirth is time of joy for women and their family. Each year in India roughly 28 million women experience pregnancy and 26 million have live births. Every ten minutes one woman dies in India from pregnancy and complications of childbirth[1] and for every mother who dies 20-30 more others suffer morbidity.[2]

WHO defines severe acute maternal morbidity[3, 4] (SAMM) "A severe life threatening complication necessitating an urgent medical intervention in order to prevent death of the mother which can occur during pregnancy, delivery or within 42 days of post partum period". Women who survive severe complications during pregnancy, delivery and postpartum period could serve as surrogates to help us in better understanding of the conditions and preventable factors that together contribute to maternal death. Stones and colleagues[5] used term "Near Miss" for these women. WHO defines Near miss as "a woman who nearly died but survived a complication that occurred during pregnancy, child birth or within 42days of termination of pregnancy." [3, 4]

Maternal morbidity is much more complex than mortality and it is result of many conditions of varying duration and severity. Time has an important role as obstetric complications are notoriously fast and furious, every single minute matters and can make difference between life and death. Concept of "Three delays model" given by Thaddeus and Maine[6] helps in better understanding of these various factors and their relation with the time.

- **Phase 1 delay:** Delay in deciding to seek medical care.
- **Phase 2 delay:** Delay in identifying and reaching appropriate care.
- **Phase 3 delay:** Delay in receiving appropriate care in the hospital.

First two delays can be defined as "delay in demand." Third delay is "delay in supply." Socioeconomic and cultural factors are mainly responsible for first and second delay while supply side barriers are responsible for third delay.[7] Increasing availability of services does not always increases utilization of services. Before deciding to seek treatment people need to recognize that they have a condition requiring specialized attention.[8] Factors responsible for first phase delay are the barriers in utilization of medical care services. Once a decision to seek medical care has been made, other obstacles have

to be overcome in reaching medical facility. Cost, distance, transportation difficulties, referral system all plays an important role. In developing countries about 75% of women with severe obstetric morbidity are in critical condition upon arrival itself. Once a woman has actually reached an appropriate health facility many economic and sociocultural barriers have already been overcome but even than arriving at facility may not lead to the immediate commencement of treatment. Institutional factors, cost, fear for procedure can result in further delay. All these delays are related to each other. Objective obstacles encountered in phase two and three feed back into the subjective decision making in phase one.

Material and Methods

This cross sectional study was carried out at Department of obstetrics and gynaecology, Government Medical College, Thiruvananthapuram over one year period from July 2014 to June 2015 with the aim to assess the reasons behind delays and to propose an action plan to overcome them. Ethical clearance was obtained from The Human Ethics Committee Medical College, Thiruvananthapuram IEC.No.01/74/2014/MCT.

A total of 74 women of different age groups were included in this study. Data collection was done by in depth interview of patients and their relatives through pretested questionnaire. WHO Near Miss Criteria (2011) is the inclusion criteria used in this study that includes mainly five severe maternal complications and life threatening conditions associated with them. Eligibility was not restricted by gestational age at which complication occurs. These five severe maternal complications are severe post partum haemorrhage, severe pre eclampsia, eclampsia, sepsis or severe systemic infections, ruptured uterus and severe complications of abortion. Life threatening conditions associated with these conditions are:

Cardiovascular dysfunction: Shock, cardiac arrest (absence of pulse/heart beat and loss of consciousness), use of continuous vasoactive drugs, cardiopulmonary resuscitation, severe hypoperfusion (lactate >5 mmol/l or >45 mg/dl), severe acidosis (pH <7.1)

- **Respiratory dysfunction:** Acute cyanosis, gasping, severe tachypnea (respiratory rate >40 breaths pe rminute), severe bradypnea (respiratory rate <6 breaths per minute), intubation and ventilation not related to anaesthesia, severe hypoxemia (O_2 saturation <90% for≥60 minutes or PAO_2/FiO_2 <200)

- **Renal dysfunction:** Oliguria non-responsive to fluids or diuretics, dialysis for acute renal failure, severe acute azotemia (creatinine ≥300 μmol/ml or ≥3.5 mg/dl)

- **Coagulation/haematological dysfunction** Failure to form clots, massive transfusion of blood or red cells (≥5 units), severe acute thrombocytopenia (<50 000 platelets/ml)

- **Hepatic dysfunction:** Jaundice in the presence of pre-eclampsia, severe acute hyperbilirubinemia (bilirubin >100 μmol/l or >6.0 mg/dl)

- **Neurological dysfunction:** Prolonged unconsciousness (lasting≥12 hours)/coma (including metabolic coma), stroke, uncontrollable fits/status epilepticus, total paralysis

- **Uterine dysfunction:** Uterine haemorrhage or infection leading to hysterectomy

Women that develop these conditions unrelated to pregnancy (i.e. not during pregnancy or 42 days after termination of pregnancy) and morbidity from accidental or incidental causes like morbidity from automobile accidents or suicide were not included in this study.

Results

Total 74 near miss cases were identified. Maximum number of patients belongs to 26-30 year of age group (37%). Out of these 74 patients 65 women (88%) were in antenatal period and 9 (12%) were in postpartum period at the time of admission. Among these antenatal patients 27 (36%) were primigravida and 47 (64%) were multigravida. Only 2 patients were booked patient at our hospital and rest 72 patients (97%) were referred from different hospitals. Majority of patients i.e. 64 women (86.5%) had regular antenatal check-up. Out of these 72 referred patients 67 (91%) were referred from one referral center, 4 patients (5%) came after being referred from two centers and 1 patient came after being referred from 3 centers. Only 15 patients (20%) had some medical complication during previous pregnancy.

Multisystem dysfunction seen in most of the patients. Over all coagulatory dysfunction was the most common cause for near miss seen in 60 patients (81%). Second most common cause was uterine dysfunction seen in 12 patients (16%). Cardiovascular dysfunction in 6 cases (8%), respiratory dysfunction in 6 cases (8%), hepatic dysfunction in 6 cases (8%) and renal dysfunction in 3 cases (4%).

More than one delay was involved in most of the cases and multiple factors were involved in most of these delays. Most common delay observed is Type one seen in 54 cases (48.6%), among this isolated Type one delay in 36 cases, Type one associated with Type two in 16 cases and Type one associated with Type three delay in 2 cases. Isolated Type two delay observed in 9 cases (12%). Third delay seen in only 2 cases which was associated with type one delay. No delay was found in 11 near miss cases (15%).

Table 1: Types of delay

Time lost due to first delay	Frequency	Percent
2-6 hours	16	30
7-12 hours	12	22
13-24 hours	13	24
25-48 hours	8	15
49-72 hours	5	9
Total	54	100

Husband was the decision maker to seek for medical care in 47 cases (63%), in laws took the decision in 16 cases (22%), patient's parents were the decision maker in 6 cases (8%) and some other relatives in 5 cases (7%).

Time lost due to first delay varies from 2 hours to three days. Most common cause of Type one delay was inability to judge seriousness of the problem and so that waiting for problem to resolve by itself. Another important cause was lack of deciding person.

Table 2: Time lost due to first delay

Time lost due to second delay	Frequency	Percent
2 hours	11	44
3 hours	5	20
4 hours	3	12
6 hours	1	4
8 hours	1	4
12 hours	1	4
24 hours	2	8
48 hours	1	4
Total	25	100

lost due to second delay varies from 2 hours to two days. Most common cause of second delay was lack of deciding or accompanying person. Other important causes were fear of cost and distance, late referral and financial issues.

Table 3: Time lost due to second delay

Types of delay	Frequency	Percent
Type I	36	48.6
Type I + Type II	16	21.6
Type II	9	12
Type I + Type III	2	2.7
No delay	11	15
Total	74	100

Time lost due to third delay was one hour seen in 2 cases were theatre was engaged with some other emergency case. In both of these cases Type one delay was already present.

Discussion

Total 74 Near miss cases and 16 maternal deaths were identified during study period. So Mortality index for this study is 0.17 and Maternal Near Miss Mortality Ratio found is 4.6:1. That indicates one woman died for almost every 5 women who survived severe morbidity. This study reflects good quality of antenatal care in Kerala as, 86.5% patients had regular antenatal checkups and >4 antenatal visits, only 12.2% patients had severe anaemia while for 48.6% patients haemoglobin level was >10gm% at the time of admission. Viral screening was done for all the patients and it was negative. Only 7 patients (9.5%) were unbooked patients and only 10 patients (13.5%) had irregular antenatal check-up.

More than one delay was involved in most of the cases. Most common delay observed is Type one seen in 54 cases (48.6%).Similar results were obtained in another study that was done in Wayanad district of Kerala[9].A Study done in Myanmar shows most common type of delay observed in near miss cases was type one followed by type three and type two delay.[10] Various studies shows high prevalence of maternal mortality among the women with multiple delays.

Factors responsible for Type 1 delay are the barriers in utilization of medical care services. It is commonly seen that patient and her relatives are not able to judge graveness of situation. Before deciding to seek treatment people need to recognize that they have a condition requiring specialized attention.[11] Pregnancy is seen as a natural phenomenon and insists on ignoring minor ailments and discomforts. Folk etiologies of problems and home remedies for the same deprive the woman to seek appropriate medical care. Many times treatable beginning of a major problem is ignored this way. Financial cost is

another big barrier in seeking medical care. Most of the women do not travel to alone to the health facility, they are accompanied by other adults and children who cannot be left alone at the home and all these people increases the cost of travelling, staying at the town where health facility is available. In many countries women do not decide on their own to seek medical care, the decision belongs to spouse or senior members of the family. In such cases lack of encouragement from family members or unavailability of deciding person can result in timely access to health facility. Time spent for getting to, waiting for receiving health service is the time lost from other activities and responsibilities. As women carry out large majority of tasks so it can be an important deciding factor in seeking heath care. Lack of satisfaction with available health care, fear of hospital and health providers, and distance from the nearest health facility all plays an important role in decision making.

More than one factor was responsible in most of the cases for type one delay but overall, inability to judge the seriousness of the problemwas the most common cause for Type one delay which was present in 80% cases. Another important cause was lack of awareness about the danger signs of pregnancy so that waiting for problem to resolve by itself seen in 57% cases.Similar results were found in a study conducted in selected districts of four Indian states in May 2012. [12]

Table 4: Causes of first delay

Cause of first delay	Frequency	Percent
Inability to judge seriousness of problem	43	80
Waiting for problem to resolve by itself	31	57.4
Lack of deciding person	10	19
Lack of companion to go to hospital	7	13
Lack of money	6	11
Fear of hospital and health providers	4	7.4
Too sick to travel	2	3.7
Lack of encouragement from family members	2	3.7
Waiting for results of informal treatment	2	3.7

Once a decision to seek medical care has been made, other obstacles have to be overcome in reaching medical facility. Transportation difficult-ties such as poor roads conditions, lack of readily available transport or inadequate means of transportation are reasons behind delay. Transportation difficulties may be experienced even after reaching the first medical facility, as health facility may not have an ambulance or it may not be available at that time. Poor road conditions often make the journey even longer and difficult. Second delay is also very intimately related to the number of referrals through which a woman has to pass until she receives definite treatment ultimately. Lack of proper communication either telephonic or written; between referring hospitals regarding condition of patient at arrival, procedures performed or treatment given can cause further delay. Lack of awareness of existing services, fear of cost and distance, lack of deciding or accompanying person, financial problems are some other important issues.

More than one factor was responsible in most of the cases for type two delay but overall, most common cause of second delay was lack of deciding or accompanying person seen in 40% cases. Other important causes were fear of cost and distance (20%) and late referral (20%). In other studies from developing countries, most common cause for second delay was difficulty in transportation, referral issues and financial issues.[13]

Table 5: Causes of second delay

Cause of second delay	Frequency	Percent
Lack of deciding or accompanying person	10	40
Fear of cost and distance	5	20
Late referral	5	20
No specific cause	4	16
Lack of money	3	12
Fear of hospital and health providers	2	8
Lack of transportation	2	8
Multiple referral	1	4
Poor condition of roads	1	4

Once a woman has actually reached an appropriate health facility many economic and sociocultural barriers have already been overcome but even than arriving at facility may not lead to the immediate commencement of treatment. Insufficient staff, unavailability of blood, shortage of essential drugs and equipments plays an important role in third delay. Woman or her family may ill afford the prescribed treatment, may not have money to get blood or medicines, and may refuse consent for essential and emergency procedures fearing pain, long term fall outs or expenses. This can cause further delay in proper management. Cause for third delay in this study was non availability of theatre as some other emergency case was going on.

Conclusion and Recommendations

Pregnant females and their family members should be educated regarding pregnancy, various normal physiological changes in pregnancy and "Danger Signs" in pregnancy, "Antenatal Classes" should be taken for them so that they can assess seriousness of the problem and seek for medical care when needed without any delay. Involvement of husband and other family members is very important as in many cases husband and other family members play an important role in decision making process. Basic antenatal care should be provided at periphery level through physicians, nurses and traditional birth attendants.Antenatal care should aim to segregate women into low risk and high risk pregnancies, low risk pregnancies can be managed at periphery level with regular ANC but high risk pregnancies should be managed by a multidisciplinary team at a tertiary centre.

Standard referral protocols should be madewith clear guidelines regarding which cases should be referred and when and where. Referral ticket should be in a standard format and should include all the necessary information. If necessary referring doctor should inform the next referral centre regarding patients condition, so that any further delay in the treatment can be avoided.

Tertiary care centers should ensure availability of more than one emergency theatre and anesthetist that will help in handling multiple emergencies parallelly. Blood bank facility should be available round the clock. "Obstetric high dependency unit (HDU)" is a new concept that can help in better management of these patients. It is a critical care facility that is between a normal ward and ICU in terms of level of care. It strikes a balance between minimum care in a normal ward and too much care in the ICU.

This study has tried to identify the pitfalls in the management of near miss cases. We need a multi disciplinary approachfor overcoming these pitfalls,so that every woman can get her right of safe motherhood.

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