Comparative Study of Maternal Mortality between General and University Hospitals

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Abstract: Background: *Reducing the maternal mortality rate in the third world countries is a challenge the approach of reducing maternal mortality has to be global, so the developed countries have a major role to play.* ***Aim of the Work:*** *to determine, outline, and assess the factors contributing to maternal mortality, especially the avoidable factors, and to evaluate the possibility of prevention of such factors to decrease the incidence of maternal mortality to the least possible value, and finally to make some recommendations to achieve this goal.* ***Patients and Methods:*** *this study is retrospective descriptive hospital based study that utilized all maternal deaths data which occurred at Embaba General Hospital and Bab El Shaarya university hospital during the period between "January 1, 2013" to "December 31, 2017".* ***Results:*** *The main causes of maternal mortality, are antepartum hemorrhage (28.2%), postpartum hemorrhage (12.8%), Accidental hemorrhage (5.1%), hypertensive disorders in pregnancy (usually eclampsia) (10.38%), organ failure (10.3%) and cardiac arrest (12.8%).* ***Conclusion:*** *Most common causes are postpartum hemorrhage, cardiac disorders and severe hypertensive disorders during pregnancy. Maternal mortality can be effectively avoided and prevented through improving antenatal care, emergency obstetric services and reform of internship training program.*
Key words: *maternal mortality, general, university hospitals*

I. Introduction

The definition of maternal mortality is "death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes" **(World Health Organization, 2015).**

Historically deaths from childbirth were all too common. Indeed, in 19th-century, in America the mortality rate approached nearly 700 out of every 10,000 births, and in England in the same period, it was estimated that 11 women died every day in childbirth. After 1940, the maternal mortality rate plummeted in the developed western countries. Even for poor black women in the American South, the chances of dying in childbirth fell dramatically by 1950 to 19 per 10,000 births **(Irvine Loudon, 1993).**

In 2005, there were an estimated 536000 maternal deaths worldwide. Most of these deaths occur in the developing world and most of them are avoidable. The incidence of maternal death is inequitably spread throughout the world reflecting the gap between rich and poor. A woman's lifetime risk of maternal death is one in 75 in the developing regions, compared to one in 7300 in developed regions **(World Health Organization, 2007)**.

Women die of a wide range of direct or indirect causes in pregnancy, childbirth or the postpartum period. Globally, about 80% of maternal deaths are due to direct causes. The three major killers are: severe bleeding (mostly postpartum haemorrhage), infections (mostly sepsis), and hypertensive disorders in pregnancy (usually eclampsia). Complications after unsafe abortion cause 13% of maternal deaths. Among the indirect causes (20%) of maternal death are diseases that complicate pregnancy or are aggravated by pregnancy, such as malaria, anemia, HIV/AIDS, and cardiovascular diseases **(World Health Organization, 2005).**

One of the most important contributing factors to maternal death is substandard care. Substandard care is defined as underlying factors which may have produced a low standard of care for the patient. Most of these factors are usually avoidable, where solving them would have a deep impact on the whole problem. These may include patient related problems (The woman and her environment), administrative problems, and standard of health care and missing information **(CMDE, 1998).**

In Egypt, the image is not that different. Maternal mortality ratio reached 55 per 100000 live births in year 2008. Major direct causes of death include postpartum hemorrhage, hypertensive disorders and antepartum

hemorrhage and sepsis. Indirect causes include cardiovascular diseases, anemia and infectious diseases **(Ministry of health, 2010).**

Main components in prevention and reducing maternal mortality include parenteral antibiotics, oxytocics, and anticonvulsants made available, facilities for blood transfusion, assisted vaginal delivery (for example, using vacuum extraction) available, facilities for caesarean section, facilities for manual removal of the placenta if necessary, and facilities for removal of retained products of conception if necessary **(Jowett M, 2000).**

Indeed, maternal mortality is considered one of the challenging issues that face the world, and that's why in September 2000 the largest-ever gathering of Heads of State ushered in the new millennium by adopting the Millennium Declaration. The Declaration was endorsed by 189 countries and was translated into eight Millennium Development Goals (MDGs) to be achieved by 2015.Millennium Development Goal 5 (MDG5) aims to improve maternal health and to reduce maternal mortality by three quarters between 1990 and 2015 **(WHO, 2005).**

For this goal to be reached, maternal mortality should be studied and observed closely. Reviewing mortality cases and trying to not to find just causes, but any contributing factor that lead to maternal death and this will help to decrease maternal mortality rates to the least limit.

Aim of the work

The aim of this study is to determine, outline, and assess the factors contributing to maternal mortality, especially the avoidable factors, and to evaluate the possibility of prevention of such factors to decrease the incidence of maternal mortality to the least possible value, and finally to make some recommendations to achieve this goal.

II. Patient and Methods

Study design: -

this study is retrospective descriptive hospital based study that utilized all maternal deaths data which occurred at Embaba General Hospital and Bab El Shaarya university hospital during the period between "January 1, 2013" to "December 31, 2017".

Objectives of the study: -

Study setting: -

This study was conducted at Embaba General Hospital and Bab El Shaarya university hospital.

Study population: -

The study population was composed of women who were pregnant or had recently delivered their babies by cesarean section and then died in Embaba General Hospital and Bab El ShaaryaUniversity hospital.

Sample size and selection: -

All cases of maternal deaths that occurred Embaba General Hospital and Bab El Shaarya university hospital from 2013 to 2017 and met the inclusion criteria.

Inclusion criteria: -

1. Maternal death that occurred after cesarean section.
2. Maternal deaths that occurred in health facility (Embaba General Hospital & Bab El Shaarya university hospital).
3. Maternal deaths that occurred between the period of 2015 to 2017.
4. Maternal deaths that identified according to ICD_10 definition of WHO.

Exclusion criteria: -

1. Maternal deaths that occurred out of the study area and period.
2. Maternal deaths that not met WHO definition of maternal deaths.

Data collection tools: -

Data were collected by reviewing the cases' files in the department of obstetrics and gynecology in Embaba General Hospital and Bab-Alshaarya university hospital reviewing the Database records of the department of obstetrics and gynecology in both hospitals and reviewing the database records of maternal deaths in Ministry of health and population

Data entry: -

Collected data were coded and were entered Microsoft excel sheet.

Data analysis: -
Statistical analysis was performed using the Statistical Package for the Social Sciences (Release 16 SPSS Inc., Chicago, IL, USA). Paired t-tests were used for normally distributed data. Correlation was estimated using Pearson's correlation coefficient. Proportions were compared using the chi-square test. A P-value (two-tailed) of <0.05 was considered significant.

Ethical considerations and administrative regulations: -
This study was carried out after being approval by the ethical and research committee of council of obstetrics and gynecology department, Al-Azhar university. All data were collected under complete confidentiality and following administrative regulations by reviewing the files and the database after agreement of the general manager of Embama general hospital and Bab-Alshaarya university hospital and agreement of the chairman of the database department in both hospitals.

Source of funding: -
Self-funding

Study time table (Gantt chart): -

Years/Months	2017				2018									2019					
Phases of study	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6
Preparatory phase																				
Pilot study																				
Data collection																				
Data entry																				
Analysis of data																				
Interpretation of data																				
Final phase																				

III. Results

Table (1): The age and parity distribution of the studied sample:

The variable	The sample (N=39)	
	Frequency	**%**
Age: (year)		
< 30	13	33.3
30 - < 35	14	35.9
35 - < 40	8	20.5
40 +	4	10.3
Mean ± SD (year)	31.9 ± 5.7	
Range (year)	22 – 45	
Number of previous deliveries		
0	4	10.3
1	6	15.4
2	12	30.8
3	9	23.1
4	6	15.4
5	1	2.6
6	1	2.6
previous abortion		
Yes	17	43.6
No	22	56.4

Table (1) shows that the age range of included females was (22-45). The high percent of cases were between 35y & 40y and low percent of cases was over 40y with mean age of all cases (31.9 ±5.7). As regard number of previous deliveries, the range was (0-6). The high percent of cases have (2) previous deliveries. Regarding previous abortions (43.6%) of cases have previous abortion and (56.4%) have no previous abortion.

Table (2): Distribution of number and timing of vaginal and caesarean deliveries between the two studied hospitals:

Year	Bab-Alshaarya hospital			Embaba hospital		
	NO of vaginal delivery	No of caesarean delivery	Total number	NO of vaginal delivery	No of caesarean delivery	Total number
2013	5613	6311	11924	3028	2946	5974
2014	5036	6749	11785	2468	2656	5124
2015	4383	6505	10888	2910	3213	6123
2016	3839	6186	10025	2750	2975	5725
2017	3472	5898	9370	2242	2261	4503

Table (2) shows that, the highest number of deliveries at Bab-Alshaarya hospital was in 2013 and the lowest number of deliveries was in 2017 and the highest number of deliveries at Embaba hospital was in 2015 and the lowest number of deliveries was in 2017 and also shows that total number of patients in Bab-Alshaarya hospital twice the number of patients in Embaba hospital.

Table (3): Distribution of resources of the two studied hospitals:

Hospital / Resources	Bab-Alshaarya hospital	Embaba hospital
Emergency unit	5 beds	One bed
Pre-delivery unit	7 beds	4 beds
Vaginal delivery unit	2 beds	2 beds
Caesarean delivery unit	5 operation rooms	3 operation rooms
Post-delivery unit	33 beds	22 beds
ICU	Available	Available
Blood bank	Available	Available
Ambulance	Available	Not available

Table (3) shows that, the capacity of Bab-Alshaarya hospital is bigger than that of Embaba hospital as regarding emergency, pre-delivery, post-delivery units and operation rooms. There is ICU and blood bank in both hospitals. Ambulance is only existed in Bab-Alshaarya hospital.

Table (4): Distribution of number and timing of maternal death of the studied sample between the two studied hospitals:

Year	Bab El Sharyia hospital		Embaba hospital		Test value	P-value
	No of pregnant	No of deaths. (%)	No of pregnant	No of deaths. (%)		
2013	11924	6 (0.05%)	5974	2 (0.03%)		
2014	11785	3 (0.03%)	5124	2 (0.04%)		
2015	10888	3 (0.03%)	6123	2 (0.03%)	0.83	0.081
2016	10025	5 (0.05%)	5725	3 (0.05%)		
2017	9370	9 (0.10%)	4503	4 (0.09%)		
Total	53992	26 (0.048%)	27449	13 (0.047%)		

Table (4) shows that, total number of patients in Bab-Alshaarya hospital twice the number of patients in Embaba hospital and the same as regard number of deaths and the high percent of deaths occur in 2017 in the two hospitals and the low percent of deaths occur in 2014, 2015 in Bab-Alshaarya and was in 2013, 2014 ,2015 in Embaba hospital, there was no statistically significant difference found between the two studied hospitals regarding number and timing of deaths.

Table (5): The situation analysis of the last pregnancy and labor of the studied sample

The variable	The sample (N=39)	
	Frequency	%
Gestational age: (weeks)		
< 28	3	7.7
28 - < 32	3	7.7
32 +	33	84.6
Mean ± SD (weeks)	34.5 ± 4.8	
Range (weeks)	8 – 39	
Mode of delivery		
Vaginal delivery	10	25.6
Cesarean delivery	29	74.4
Medical history		
No medical history	14	35.9
Associated medical history	25	64.1
Surgical history		
No surgical history	18	46.2
Previous 1 C.s	3	7.7
Previous 2 C.s	10	25.6
Previous 3 C.s	3	7.7
Previous 4 C. s	5	12.8

Table (5) shows that the range of gestational age of all cases were (8-39) weeks and with mean ± SD (34.5 ± 4.8). As regard mode of delivery (25.6%) of cases were vaginal delivery and (74.4%) of cases were cesarean delivery. Regarding medical history (35.9%) of cases were with no medical history and (64.1%) were associated with medical history. Regarding surgical history (46.2%) were with no surgical history and (53.8%) have surgical history.

Table (6): Distribution of intervention for the studied sample among the studied hospitals:

The variable	The hospital				X2	P value
	Bab Alsharya Hospital N=26		Embaba Hospital N=13			
	No	%	No	%		
The intervention						
ICU admission	18	69	6	46	6	0.3
Hysterectomy	3	11.5	3	23		
Blood transfusion	1	3.8	2	15.4		
Tracheostomy	2	7.7	0	0		
Medical treatment	0	0	1	7.7		
Abdominal exploration	2	7.7	1	7.7		

Table (6) shows that majority of cases admitted to ICU in both hospitals (69%) at Bab –Alshaarya hospital and (46%) at Embaba hospital followed by hysterectomy (11.5%) at Bab-Alshaarya hospital and (23%) at Embaba hospital. The minority of cases received medical treatment (0%) at Bab-Alshaarya and (7.7%) at Embaba hospital. There was no statistically significant difference found between the two studied hospitals regarding intervention with p-value (0.3).

Table (7): Distribution of associated medical and surgical history of the studied sample between the studied hospitals:

The variable	The hospital				X2	P value
	Bab Alsharya Hospital N=26		Embaba Hospital N=13			
	No	%	No	%		
Medical history						
No surgical history	10	38.5	4	30.8	0.2	0.6
Associated medical history	16	61.5	9	69.2		
Surgical history						
No surgical history	14	53.8	4	30.8	8.8	0.06
Previous 1 C.s	3	11.5	0	0		
Previous 2 C.s	6	23	4	30.8		
Previous 3 C.s	0	0	3	23		
Previous 4 C. s	3	11.5	2	15.4		

Table (7) shows that majority of cases in both hospitals were associated with medical history (61.5%) at Bab-Alshaarya hospital and (69.2%) at Embaba hospital. There was no statistically significant difference found between the two studied hospitals regarding associated medical history with p-value (0.6) and associated surgical history with p-value (0.6).

Table (8): Distribution of causes of death and its timing between the studied hospitals:

The variable	The hospital				X2	P value
	Bab Alsharya Hospital N=26		Embaba Hospital N=13			
	No	%	No	%		
Cause of death						
Antepartum hemorrhage	9	34.6	2	15.4	6.5	0.4
Postpartum hemorrhage	2	7.7	3	23		
Accidental hemorrhage	1	3.8	1	7.7		
Cardiac arrest	5	19.2	0	0		
Organ failure	2	7.7	2	15.4		
Eclampsia	2	7.7	2	15.4		
Other causes	5	19.2	3	23		
Year of death						
2013	6	15.4	2	15.4	0.5	0.9
2014	3	7.7	2	15.4		
2015	3	7.7	2	15.4		
2016	5	12.8	3	23		
2017	9	23.1	4	30.8		

Other causes: Disseminated intravascular coagulation, HELP syndrome, Acute kidney injury, Disturbed Conscious level.

Table (8) shows that antepartum hemorrhage was the major cause of death (34.6) at Bab-Alshaarya hospital and (15.4%) at Embaba hospital followed by postpartum hemorrhage (7.7%) at Bab-Alshaarya hospital and (23%) at Embaba hospital. There was no statistically significant difference between two studied hospitals regarding causes of death with p-value (0.4) and year of death with p-value (0.9).

IV. Discussion

In Egypt, maternal mortality is one of the important and major problems, as reported in a study done by the Ministry of Health and population in 2008 and published in 2010, the mortality rate decreased to half, from 174/100.000 live births in 1992 to 84/100, 000 live births in 2001 to reach about 55/100000 live births in 2008 to 33 per 100000 live births in 2015. (WHO, 2015).

The results of this study showed that the mean age of included women was (31.9±5.7) this agreeing with Enhancing equality for girls' education, and accordingly improve the overall quality of education, by adopting a Girls Improved Learning Outcomes (GILO) initiative, in collaboration with USAID andascertain Changes in fertility patterns among adolescents using information from retrospective birth histories in the twenty years period preceding the 2008 EDHS confirmed this marked reduction in the fertility level for the 15-19 age groups. Overall adolescent fertility rate decreased from 80 births per 1000 woman to 50 births during the 15-19 years before 2008 EDHS (Abdel-Aziz et al, 2010).

In the present study comparison between the median of the gravidity and parity showed significant difference, this agreeing with the national study conducted by (MOHP) in year 2010, which stated that contraceptive use had reached 60% in 2008(Abdel-Aziz et al, 2010).

This study results showed that the main causes of maternal mortality, are antepartum hemorrhage (28.2%), postpartum hemorrhage (12.8%), Accidental hemorrhage (5.1%), hypertensive disorders in pregnancy (usually eclampsia) (10.38%), organ failure (10.3%) and cardiac arrest (12.8%) which is similar to the global statistics.

According to global statistics, 80% of cases of death, maternal is the result of direct causes are hemorrhage (often PPH) represents 25%, and infection (often sepsis) 13%, unsafe abortion 13%, hypertensive disorders in pregnancy (usually eclampsia) 12%, obstructed labor 8%, and 20% of cases of maternal death is the result of indirect causes include malaria, anemia, AIDS and heart disease.

In the present study, direct causes of death represented 22 cases (56.41%) and indirect causes represented 17 cases (43.58%), that agreeing with a study in Ain Shams university that studied number of maternal deaths (41cases), with direct causes represented 90.2%and Indirect causes represented 9.8, while this was differ from the national study where is direct causes represented 69%and Indirect causes represented 31% (Abdel-Aziz et al, 2010).

In this study 24 cases (61.53%) in both hospitals needed ICU admission as a part of their management, this reflects the bad condition on arrival to the hospital.

In the present study, surgical interference was part of management in 11cases (28.20%) in both hospitals this again reflects the bad condition on arrival to the hospital.

In the present study, (92.30%) of maternal deaths occurred during late pregnancy and labor while deaths during early pregnancy accounted for only (7.6%) of maternal deaths. Obstetric hemorrhages were the commonest causesof maternal mortality (46.15%). Hypertensive disorders with pregnancy accounting for (10.38%).

In a study in China shows that obstetric hemorrhage being the leading cause of maternal mortality followed by pregnancy-induced hypertension then Amniotic fluid embolism, Cardiac disorders and Puerperal infection. (Liang J. et al., 2011).

In a study in India, hemorrhage was the most common cause of death accounting for (24%) followed by sepsis (20%) whereas hypertensive disorder was responsible for (6.4%) mortalities. Among the indirect causes, fulminant hepatic failure was the leading cause of death (17.6%) followed by rheumatic heart disease (8.6%) and burns was an important associated cause of maternal mortality in (9%) cases. (Archana Bhosale et al., 2011).

Another study in Ghana, hemorrhage (22.8%) was the highest cause of maternal mortality. The other top causes were infectious diseases (13.9%), abortion (13.7%), miscellaneous (13.6%) and other non-infectious diseases (12.4%). (Asamoah O. et al., 2011).

On the contrary, the leading cause of maternal death in United Kingdom remains cardiac diseases; the second is neurological diseases. Most worryingly, the number of maternal deaths due to indirect causes has significantly increased over the past 20 years.Maternal death rate in the United Kingdom has decreased dramatically; this has been due to an impressive fall in deaths with direct obstetric causes, including obstetric hemorrhage, ectopic pregnancy, and venous thromboembolism. This has partly been achieved through better understanding of obstetric complications, advances in medical treatments, and the use of evidence based guidelines that implement recommendations made in previous reports(Nelson-Piercy C. et al., 2011).

In the present study, hemorrhage in latepregnancy (18 cases out of 39) carried morerisk for maternal mortality and most of them (13 cases out of 39) were due to Antepartum hemorrhage and (5 cases out of 39) were due to postpartum hemorrhage.

Obstetric hemorrhage was the main type of pregnancy associated bleeding with higher risk of maternal mortalities (17 cases out of 39). This is also true for other studies which showed that postpartum hemorrhage is

the main cause for maternal mortality. (Liang et al., 2011),(Archana Bhosale et al., 2011) and (Asamoah et al., 2011).

Also, we noticed that postpartum hemorrhage was more associated with previous cesarean sections (3 cases), ante partum hemorrhage (6 cases). This is in agreement with findings from French study. (Bonnet MP. et al., 2011).

In the present study, severe PIH was the second cause for maternal mortality (10 cases) and we noticed that sever PIH was associated with a risk for maternal mortality and we found that the risk is more if it is associated with HELLP syndrome (4 cases) and eclampsia (5 cases) and No maternal mortalities was associated with mild PIH, these findings suggest that lack of antenatal care and delayed referral contributed to a high rate of eclampsia, HELLP syndrome and maternal mortality.Proper antenatal care with diagnosis and proper management of mild PIH cases should reduce mortalities from pre-eclampsia and eclampsia.

Hypertensive disorders of pregnancy are major causes of maternal and fetal morbidity and mortality all over the world. Eclampsia is a well-recognized complication of hypertensive disorders of pregnancy. In the developed countries like UK, eclampsia is rare; complicating about one – in – two thousand pregnancies; But in developing countries the prevalence has been estimated to be up to 20 times higher. (Tabassum N. et al., 2010).

In the present study, the total number of patients over the study period in Bab-Alshaarya university hospital was (53992) with number of deaths was (26) compared with (27449) patients in Embaba general hospital with number of deaths was (13), this is due to the fact that the Bab-Alshaarya university hospital is a tertiary and referral hospital.

As regard frequency of maternal mortality in the two hospitals, in Bab-Alshaarya hospital was (6) in 2013, (3) in 2014, (3) in 2015, (5) in 2016, (9) in 2017 which means that the number of maternal deaths start to decline over the first half of the study period and then increased in the last two years which is the same in Embaba hospital the number of maternal deaths increased in the last two years as follows (2) in 2013, (2) in 2014, (2) in 2015, (3) in 2016, (4) in 2017. This is may be due to increase number of complicated cases and may be an indicator of decreasing quality of medical service.

In the present study, the distribution of interventions for the studied sample among the two studied hospitals shows that ICU admission percentage in Bab-Alshaarya hospital was (69%) and was (46%) in Embaba hospital, this is due to high capacity and quality of ICU in Bab-Alshaarya hospital. The percentage of hysterectomy was (11.5%) in Bab-Alshaarya and (23%) in Embaba hospital and the percentage of abdominal exploration was (7.7%) in both hospitals, this means that there is highly qualified staff in both hospitals. The percentage of blood transfusion was (3.8%) in Bab-Alshaarya and (15.4%) in Embaba, this means that there is well equipped blood bank in both hospitals.

In the present study, the distribution of cause of death for the studied sample among the two studied hospitals shows that antepartum hge percentage was (34.6%) in Bab-Alshaarya hospital and (15.4%) in Embaba hospital and cardiac arrest percentage was (19.2%) in Bab-Alshaarya hospital and (0%) in Embab hospital, this is due to the fact that the Bab-Alshaarya hospital is a tertiary and referral hospital for complicated cases. The percentage of postpartum hemorrhage was (7.7%) in Bab-Alshaarya hospital and (23%) in Embaba hospital, this means that staff of Bab-Alshaarya hospital is more qualified in managing cases of postpartum hemorrhage.
Maternal mortality can be effectively avoided and prevented through improving the following:

Medical Staff
Attendance:
Senior staff must be involved in the case from the start as obstetric emergencies require experienced management from the start which is only available at the senior staff level. Application of this policy will prevent as much as possible a reasonable percentage of avoidable maternal deaths.

Also, senior anaesthetic staff should be available in the ward for 24 hours to manage complications as difficult intubation, fluid therapy, resuscitation of shocked patients, intra operative arrest and complications of recovery.

Training:
It is a must for the doctors to be properly trained to manage any emergencies and this can be achieved by training on the first aid and lifesaving skills.

The junior staff doctors should be learned to respect the reporting line and to let the senior staff to be involved in management from the start in order to minimize the iatrogenic factor in maternal morbidity and mortality.

House officers should get training programs so that they can spot high risk cases during antenatal care program for referral to well-prepared hospitals, apply active management of third stage of labor, use ecbolic drugs properly during the fourth stage of labor and can timely refer postpartum hemorrhage cases, was essential as they will work as primary health care providers after completing their internship year in hospitals.

Nurses should be trained to administer blood and blood product transfusions and provide other comprehensive emergency obstetric services without delay.

Providing written protocols that describe the actions and the steps that could be followed at each level of the service providers, so everyone involved in the care of the pregnant women can operate on a common basis of understanding each level of capabilities, responsibilities and limitations.

Intensive care unit

Development of an intensive care obstetric unit or a high-risk pregnancy unit with continuous maternal and fetal monitoring under the supervision of a well-trained medical and nursing staff and a 24 hours laboratory services will markedly decrease the incidence of maternal morbidity and mortality. This also well improve the progress of many high-risk pregnancies like cardiac and diabetic cases, also it will allow proper management of many complicated cases like eclampsia and others.

On the other hand, involvement of senior staff physicians in other specialities like Cardiac, Renal, Haematological and others will be needed and will be of a great help.

Registration system

Although every effort was done to include all the relevant statistical information, the inefficiency of the current registration system proved to be difficult in obtaining complete and accurate information about the incidence and causes of maternal mortality.

Ideally for every admitted pregnant woman, there should be a file prepared and including a detailed information about her history and antenatal care together with all the services she received during her admission period (investigations, medications, blood transfusion and surgical interventions), this file allows easy and accurate follow up of the case together with measuring the quality of care she had received.

Modern solutions like computer-based systemscan also have a tremendous positive impact on the efficiency of the registration process. Computer- based systems will allow easy, rapid and accurate retrieval of data about each patient making the statistical work easier and more accurate.

Health care centers

Equipping the existing basic health units and rural health centres with basic obstetric care, ensuring availability of health professionals trained and experienced in obstetric complications which may significantly reduce the incidence of maternal mortality.

In hospitals, programs attracting pregnant women to get good and cheap antenatal care, complete their pregnancy safely until delivery in well-equipped hospitals and give birth with no complications should be frequent to attract large number of the surrounding areas.

Medical convoys should be done in areas with less medical care centers to explain the danger of not getting good antenatal care, early diagnosis of complications and giving births outside well equipped hospitals.

Transportation

Once a decision had been made that a complication that needs medical intervention existed, transportation should be rapidly available and easy accessible as any lateness in the transportation will endanger the woman's life. Also, transportation facility should be a well-equipped one mainly to offer the first aid measures to the women until reaching the proper health facility. So, availability of emergency transportation is a crucial element of a strong referral system.

Supplies and Equipment

Each health facility should be provided with essential supplies and equipment needed for all obstetric operations including drugs, gloves, suture materials and anesthetic agents at the facility. Also, establishment of a local blood bank in the obstetric emergency unit is mandatory to avoid the lack of blood and much delay in obtaining blood for cases with severe bleeding. A 24 hours laboratory should be present to provide all investigations needed for rapid diagnosis and management of emergency obstetric cases. Moreover, availability of ultrasound which should be done by senior staff, is now of great importance and should not be ignored.

Health education
Maternal health education:

Females should be learned where and when to seek medical advice, this can be achieved through mass media (television, radio and newspapers) and going towards achieving the following:
o Antenatal care is the right of every pregnant lady. Provision of antenatal care should be uniform and optimal.

o Nutritional status of reproductive age group should be improved to reduce maternal morbidity and mortality.

Repeated and closely spaced pregnancies should be discouraged and contraceptive prevalence needs to be increased in culturally conservative areas. The role of men regarding knowledge and use of contraceptive measures should be encouraged.

Community health education:
Timing and place for seeking medical advice in case of complications is usually not the decision of the women herself, but it is the decision of her family which is always affected by many factors including the severity of the case from their point of view, so one of the most important steps is to learn the people about the warning signs and severity of cases.
Another drawback in the community is that the concept of home delivery still practiced by many people and greatly affects the increased incidence of maternal mortality so, encouraging delivery in well-equipped hospitals is very important.

V. Conclusion
From the findings of the present study, we may conclude that: Maternal deaths occurred in most of cases in late pregnancy and labor.
Most common causes are postpartum hemorrhage, cardiac disorders and severe hypertensive disorders during pregnancy.
Maternal mortality involves a complex mixture of clinical, infrastructural and social causes and requires a multifaceted approach.
Maternal mortality can be effectively avoided and prevented through improving antenatal care, emergency obstetric services and reform of internship training program.

VI. Recommendations
From the results obtained from the present study the following recommendations would be helpful regarding improving services to the pregnant females; therefore, decreasing the avoidable causes of maternal mortalities.
1. All pregnant women should receive proper antenatal care.
2. Nutritional status of reproductive age group should be improved to reduce maternal morbidity and mortality.
3. Females should be learned where and when to seek medical advice, this can be achieved through mass media (television, radio and newspapers).
4. Equipping the existing basic health units and rural health centres with basic obstetric care.
5. Each health facility should be provided with essential supplies and equipment needed for all obstetric operations.
6. Establishment of a local blood bank in the obstetric emergency unit is mandatory.
7. Development of an intensive care obstetric unit or a high-risk pregnancy this also well improve the progress of many high-risk pregnancies.
8. It is a must for the doctors to be properly trained to manage any emergencies and this can be achieved by training on the first aid and lifesaving skills.
9. House officers should get training programs so that they can spot high risk cases during antenatal care program for referral to well-prepared hospitals.
10. availability of emergency transportation is a crucial element of a strong referral system. Transportation facility should be a well-equipped one mainly to offer the first aid measures to the women until reaching the proper health facility.
11. Repeated and closely spaced pregnancies should be discouraged and contraceptive prevalence needs to be increased in culturally conservative areas.
12. Computer- based systems should be available to allow easy, rapid and accurate retrieval of data about each patient making the statistical work easier and more accurate.

VII. Conclusion
From the findings of the present study, we may conclude that:
– Maternal deaths occurred in most of cases in late pregnancy and labor.
– Most common causes are postpartum hemorrhage, cardiac disorders and severe hypertensive disorders during pregnancy.
– Maternal mortality involves a complex mixture of clinical, infrastructural and social causes and requires a multifaceted approach.

– Maternal mortality can be effectively avoided and prevented through improving antenatal care, emergency obstetric services and reform of internship training program.

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