Short Communication: Causes of Maternal Mortality in Tehran, Iran

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ABSTRACT

Maternal mortality is a woman's death during pregnancy or postpartum period due to direct or indirect causes. Its direct causes are related to obstetrical issues. The indirect cause of it refer to an underlying disease, i.e. aggravated during pregnancy and leads to death. A routine data-based study conducted at the Legal Medicine Organization of Tehran City, Iran, the autopsy findings of maternal mortalities during April 2017-2019 were reviewed. During the study period, 53 cases were autopsied of which 29 (54.7%) and 24 (45.3%) died due to direct and indirect causes, respectively. , The prevalent direct causes of death, were bleeding (22.6%), eclampsia/preeclampsia (13.2%), and ectopic pregnancy (5.7%). Frequent indirect causes were cardiac diseases (20.7%) and nervous system and infectious diseases (both: 7.5%). This study revealed the considerable share of indirect causes in maternal mortalities in Tehran. Moreover, we outlined the importance of early detection of non-obstetrical medical conditions during pregnancy care to reduce preventable maternal mortalities.

1. Introduction

According to the International Classification of Diseases-10 (ICD-10), "pregnancy-related death" refers to a woman's death during pregnancy or 42 days after childbirth due to many causes, except accidents. The primary subgroup of pregnancy-related deaths is "maternal mortalities." Maternal mortalities are due to obstetrical causes or underlying health conditions that are complicated or aggravated by pregnancy [1]. ICD-MM (ICD-Maternal Mortality) regards the causes of maternal mortalities and classifies them into direct or indirect types. Direct causes relate to obstetrical issues, and indirect causes refer to underlying diseases or medical conditions that are aggravated during pregnancy, leading to fatal outcomes [2].

Reducing Maternal Mortality Rate (MMR) is a global public health priority; several international programs have focused on this issue [1]. For example, reducing MMR by 75% during 1990-2015 was set as the 5th Millennium Development Goal (MDG). In addition, decreasing MMR to <70 per 100000 live births in 2030 is targeted as a Sustainable Development Goal (SDG) [3]. The surveillance of maternal mortalities provides evidence on the current magnitude of maternal health and the effectiveness of the ongoing preventive programs;

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thus, it is crucial for planning best measures to reduce MMR [3].

National Maternal Mortality Surveillance System (MMSS) has been implemented in Iran since 2001 [4]. Iran has successfully achieved the 5th MDG by 79.7% reduction of MMR during 1990-2015 [3]. However, national MMSS still suffers from shortcomings in several aspects, such as data gathering, quality control, and information communication [4]. To sustain our achievements in maternal health and MMR reduction, the surveillance cycle of maternal mortalities must be continued and improved [4]. Autopsy reports are the gold standard for the ascertainment of the cause of pregnancy-related deaths [2] and compose the leading data resource of NMSS. Thus, investigating autopsy findings in pregnancy-related deaths could provide accurate data about death causes.

We investigated the available autopsy records of pregnancy-related deaths during April 2017-2019 in the Central Legal Medicine Organization of Tehran City, Iran. These records were reviewed by three experts of forensic medicine, and death causes were adapted to ICD-10 and ICD-MM. Based on the accepted definitions, term 'pregnancy' in this study refers to 37-42 weeks of gestational age [5]. To observe the ethical issues, decedents' identities were concealed and coded for studying.

During the study period, 53 pregnancy-related deaths were referred to the Central Legal Medicine Organization of Tehran and were autopsied. Mean±SD age of cases was 31.9±6.2 years (age range: 19-50 years). Reported gestational age at the time of death varied from 7 to 40 weeks with median (interquartile range) of 39 (28-40). According to autopsies and considering ICD-10 and ICD-MM, all studied decedents were cases of maternal mortality, of which 29(54.7%) deaths were directly due to obstetrical cases, and 24(45.3%) deaths were due to non-obstetrical medical conditions. Detailed causes of deaths are summarized in Table 1. Considering gestational age, 22(41.5%) cases were preterm, 31(58.5%) were term, and none were post-term at the time of death. In 9(17%) cases, death occurred in the postpartum period. The characteristics of postpartum deaths are presented in Table 2.

A recent comprehensive meta-analysis suggested that 20.6% of pregnancy-related deaths in Iran have been due to direct causes [6]. Another national study also demonstrated that indirect causes accounted for 36.7% of maternal mortalities during 2009-2012 [7]. Therefore, the rate of indirect causes of maternal mortality in our study

(45.3%) is more significant than the average national level. This finding may be attributed to better obstetrical care of women in Tehran or better detection and referral of pregnancy-related deaths. However, diversities in the classifications of death causes, as well as the methodology of various studies complicate the comparison of their findings. Due to the focus of health care providers on the prevention of direct death causes (e.g. the significant improvement of obstetrical care), many fatal underlying diseases in pregnant women are neglected; consequently, the share of deaths due to indirect causes is increasing. Thus, monitoring pregnant women to identify and control their underlying diseases could remarkably reduce MMR [8].

Common direct obstetrical death causes in the present study were bleeding, eclampsia/preeclampsia, and Ectopic Pregnancy (EP), respectively. Consistently, bleeding and eclampsia have been the frequent direct reasons for maternal mortality during 1990-2016 in Iran [9]. Rates of bleeding and eclampsia/preeclampsia in our study are comparable to developed countries [10]; this finding is indicative of the effectiveness of our healthcare system in the management of pregnant women [7]. In the broad spectrum of hypertensive gestational disorders, preeclampsia and eclampsia are uncommon; however, their fatality rates are high in the absence of appropriate interventions [11]. EP was the death cause in 5.7% of cases. EP-induced mortality rate is also high -even in developed countries- which may be in part due to recent growing tendency toward conservative outpatient treatments of EPs [12]. In addition, the rate of malpractices in the management of EPs in Iran is considerable [13]. Thus, we recommend that physicians be more cautious during EP management.

Among non-obstetrical death causes in our study, cardiac diseases were the most prevalent ones; 1 out of 5 deaths were due to cardiac disease. Previous reports also recognized cardiac diseases as the most frequent indirect cause of death in pregnant women [6, 7]. Commonly, cardiovascular diseases are disregarded during the routine care of pregnant women (even in developed countries), and screening programs for cardiac diseases are strongly recommended during pregnancy [14].

After cardiac diseases, other indirect contributors to death were nervous system conditions, infectious diseases, internal hemorrhage, diabetes ketoacidosis, and underlying anemia. Deaths due to such causes are preventable by timely diagnosis and appropriate management. Such findings reveal the necessity for the collaborative care of pregnant women to halt preventable deaths

Table 1. Causes of maternal mortality in the study

Causes of Death		N (%)	Description (N)
Direct obstetrical causes: 29 (54.7)	Uterine bleeding	12 (22.6)	Placental decollement PROM[1] Atony Uterine rupture During cesarean
	Preeclampsia and eclampsia	7 (13.2)	Preeclampsia Eclampsia
	Ectopic pregnancy	3 (5.7)	-
	Amniotic emboli	1 (1.9)	-
	Sagittal sinus thrombosis	1 (1.9)	-
	Uterine inertia	1 (1.9)	-
	Respiratory arrest during CV line application	1 (1.9)	-
	Cardiac arrhythmia due to pregnancy	1 (1.9)	-
	Cardiac arrest due to anesthesia of cesarean	1 (1.9)	-
	Portal vein thrombosis due to pregnancy	1 (1.9)	-
Indirect causes (underlying diseases): 24(45.3)	Cardiovascular diseases	11 (20.7)	-
	Nervous system diseases	4 (7.5)	-
	Infectious diseases	4 (7.5)	-
	Internal hemorrhage	2 (3.8)	-
	Leukemia	1 (1.9)	-
	Diabetes ketoacidosis	1 (1.9)	-
	Anemia due to autoimmune disease	1 (1.9)	-

1. Premature Rupture Of Membranes (PROM)

Table 2. Characteristics of postpartum deaths in the study

Maternal Age (Years)	Gestational Age (Weeks)	Cause of Death	Time From Delivery to Death (Days)
34	40	Bleeding due to decollement	1
34	40	Preeclampsia	26
37	40	Amniotic emboli	5
32	40	Cardiac diseases	5
24	35	Cardiac disease	4
36	40	Leukemia	25
27	40	Meningitis	31
30	40	Underlying anemia	20
32	40	Hepatic insufficiency due to portal vein thrombosis	30

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among them [15]. Complications of cesarean accounted for death of 5(9.4%) cases. Before commenting on this rate, we need to understand the prevalence of cesarean in the study population which could not be extracted from available records.

This study was associated with limitations. The classification of death causes was ambiguous in some cases. We tried to correctly classify such cases by thoroughly reviewing their records. Some information, such as parity, demography and past medical history of cases was unavailable to make a more accurate classification. Condition of the fetus, type of delivery, and indications for pregnancy termination could not also be extracted from records; however, such information is crucial for surveillance and should be investigated in further studies. All proved or suspicious of pregnancy-related deaths should be referred for autopsy and the ascertainment of cause of deaths. The majority of healthcare providers refer such cases; however, missed or neglected cases are inevitable, especially in postpartum deaths.

2. Conclusion

In conclusion, indirect obstetrical causes accounted for near half of maternal mortalities in Tehran during the study period; this rate reflects success in reducing direct obstetrical causes which is mainly attributed to national maternal care programs. After uterine bleeding, the most prevalent cause of death was cardiovascular diseases. Results of this study show the severity of indirect causes of maternal mortalities and reveal the necessity for attention toward non-obstetrical medical conditions (especially cardiovascular diseases) during pregnancy care. Further comprehensive studies on MMSS data are recommended.

Ethical Considerations

Compliance with ethical guidelines

Study was approved by Ethics Committee of Legal Medicine Organization, Tehran, Iran.

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Conflict of interest

There were no conflicts of interest to be declared.

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