Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v30i16.2444

TRAUMA IN PREGNANCY: A SIX-YEAR RETROSPECTIVE ANALYSIS OF A TRAUMA CENTER IN A DEVELOPING COUNTRY

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Abstract

Background: Even though trauma in pregnancy is rare, trauma is one of the most common causes of morbidity and mortality in pregnant women. This study aimed to identify the leading causes of trauma in pregnant women and to evaluate the outcome of the pregnancy and the consequences of trauma in this critical period in a level 1 trauma center in a developing country.

Methods: We performed a retrospective study of pregnant women admitted to Shahid Kamyab trauma center, Mashhad, Iran, from 2011 to 2017. Clinical histories of trauma, hospital records, operative reports, Imaging studies, admission days, and Glasgow coma scale (GCS) score were assessed, and data related to trauma and pregnancy were collected. Pregnancy-related complications were recorded based on ultrasound reports. The pregnancy outcome and delivery type were recorded from health care data sets. Chi-square, Fisher exact, t-tests, and nonparametric tests were utilized for univariate and multivariate analysis. Potential confounders were controlled with a logistic regression model. Data analysis was performed by the SPSS software v.16.

Results: There were 5,617 women between 16-45 years of age; 330 (5.9%) were pregnant, and 284 patients (5 twin pregnancies) were eligible to include in this study. The mean age was 27.2, and the mean gestational age was 21.3 weeks. Blunt trauma accounted for the majority of cases (87%). The most common cause of trauma was motor vehicle accidents (72.8%), followed by falling (13.7%) and violence (9.8%). 48.1 % of patients were admitted for Head trauma, and 26.5 % were admitted to the hospital with polytrauma. Nineteen patients (6.6%) underwent non-obstetrical surgical operations. The most common pregnancy-related complication was placental abruption (8.2%). Three cases of maternal death occurred due to severe head and cervical spine injuries. 36 fetal death (12.4%) from 34 pregnancies were recorded as the outcome of pregnancies. Most cases of fetal death (88%) occurred during the first two trimesters. Higher fetal death rates were accompanied by placental abruption, surgery, and lower gestational age.

Conclusion: Trauma in pregnancy is related to high rates of fetal death. Placental abruption, surgery, and lower gestational age were associated with higher risks of unfavorable fetal outcomes.

Keywords: Trauma, Pregnancy**,** motor vehicle accidents, placental abruption, Abortion

Introduction

Although the current literature may underestimate the prevalence of trauma in pregnant women, traumatic injuries during pregnancy are a significant cause of maternal morbidity and mortality and are considered the leading non-obstetrical cause of mortality in pregnant women (1).

Various maternal physiological alterations happened to reach the metabolic mandataries of pregnancy. Some of these alterations have a remarkable effect on the management and presentation of trauma. During pregnancy, the blood volume elevates with a high volume further 50% of the volume of a non-pregnant adult. The whole body water content increases through about 6 to 8 Liter. Red blood cell (RBC) production is also stimulated by the enhancement in erythropoietin production at the renal level; meanwhile, the elevation of about 19% to 25% of RBCs is disproportionate in association with the increment of plasmatic volume. This dilution anemia supports the mother from blood loss regarding birth. Maternal heart rate and systolic volume increase, resulting in cardiac output of 30% to 50% above average. Blood flow toward the placenta and uterus makes up to 25% of cardiac output at the end of pregnancy (2).

Besides, minor and severe injuries during pregnancy are associated with adverse maternal outcomes (3). It was shown that the same kind of trauma could lead to worse outcomes in pregnant women (4). Besides, commonly used methods of assessing severity, such as “Injury Severity Score,” are not accurate enough to predict morbidity and mortality rates related to placental abruption and, thus, pregnancy outcomes (5). However, the increased severity of trauma escalates the frequency of admission, placental abruption, and fetal demise (6).

In addition to mentioned above, Motor vehicle accidents (MVAs) are also assumed to be the most common cause of injury in traumatic patients. It is estimated that 207 cases per 100/000 live births experience MVAs during pregnancy (7). As such, MVAs are responsible for 82% of fetal death in traumatic events during pregnancy (8), and the highest hospital admission rates are in women who are injured through MVAs. Other causes of trauma in pregnancy are falls, penetrating injuries, Domestic violence, and burns (9).

In addition to maternal injuries, trauma during pregnancy can cause unfavorable obstetrical outcomes, including preterm labor, premature rupture of membranes, Placental abruption, and uterine rupture (10). The most significant obstetrical risk following MVAs is abruption which could complicate up to 40 % of severely injured patients (11). Abdominal ultrasound imaging is an accessible and reliable way to assess abdominal trauma in pregnant patients and diagnose injuries to pregnant patients with minimal diagnostic delay and without radiation risk (12). Acute and subacute hematomas might be isoechoic to placental tissue. Thus, it causes low sensitivity of ultrasound for diagnosing placental abruption. However, ultrasound findings are particular for placental abruption (13).

Medical management for women during pregnancy and the fetomaternal outcome of the pregnancy has significant importance for healthcare and healthcare-related organizations (14). Although many studies have been conducted on this topic, few studies evaluated pregnancy outcomes following traumatic injuries in developing countries (15, 16). This study was carried out to estimate the leading causes of trauma during pregnancy and following fetomaternal outcomes in the developing world.

2. Material and methods

2.1. Type of study

This cross-sectional study was conducted at Shahid Kamyab university hospital, an active trauma center in Mashhad, Iran.

2.2. Exclusion criteria

Patients with corrupted datasets or uncertain pregnancy documentation were excluded from the study.

2.3. Inclusion criteria

Our objective was to assess the most common mechanisms of trauma in pregnancy and evaluate pregnancy outcomes. We enrolled all pregnant women voluntarily in Shahid Kamyab Hospital due to any trauma during this period. Pregnancy was confirmed with ultrasound imaging or qualitative β-HCG in all participants.

2.4. Number of Study Participants:

Among the patients, 284 were eligible to include in this study.

2.5. Participants' demographic

All patient data, including demographic data, clinical histories, operative reports, imaging studies, and the outcome of pregnancy and type of delivery, were collected respectively by reviewing patient datasets at Shahid Kamyab Hospital and reviewing childbirth information in the local healthcare database: "comprehensive system of health information" STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines were followed to improve reporting quality.

2.6. Variable parameters

Fourteen variables, including age, education, job, admission and discharge dates, GCS level, gestational age, history of previous abortion, mechanism of trauma, injured organs, ultrasound reports, surgical operations, type of delivery, and pregnancy outcomes, were collected. Patients' ages were categorized based on quartiles, and Gestational ages were categorized into trimesters. We collected the level of education and job to indicate patients' socioeconomic status that might affect the results. We gathered the patients' ultrasound reports and categorized them into normal, placental abruption, fetal death (divided into before and after 20 weeks gestational age), and uterine rupture. The pregnancy outcome and delivery type were recorded from the local database.

In fetal death cases, fetal death and gestational age at the time of fetal death were confirmed through phone calls. The institutional review board of Mashhad University of medical science, Mashhad, Iran approved this project.

2.8. Statistical analysis

All data were analyzed using SPSS v.16. Mean, standard deviation, and median were calculated for descriptive analysis. Chi-square, Fisher exact, t-tests, and nonparametric tests were performed as appropriate to compare between groups. $P < 0.05$ was considered statistically significant in all tests. Parameters with significant Pvalues in the univariate analysis were selected for multivariate analysis in a logistic regression model.

3. Results

The total number of women admitted to Shahid Kamyab trauma center during 20112017 aged 16-45 was 5617, and 330 (5.9%) were pregnant women. Of 330 admitted pregnant women, 284 were included in this study, and 5 had twin pregnancies. The mean age was 27.2 ±5.8 (median:26, min. 16, and max. 45). Demographic data is drawn in Table 1. The mean hospital stay was 3.49 (±10.44) days with a median of 2 days. 37 (13%) cases were traumatized following penetrating traumas, and 247 (87%) following blunt traumas. In 207 patients (72.8%) MVAs were responsible for the trauma; thus,

MVAs are the most common mechanism of trauma, followed by falling (39 cases; 13.6%) and violence (28 cases; 9.8%). Hospital stay was significantly higher in the patients with trauma due to MVAs (P=0.01). Table 4 represents the mean age of patients, gestational age, surgical operations, ultrasound report, and pregnancy outcome based on the trauma mechanism. 75 (26.4%) patients were admitted following polytrauma, whereas 209 (73.5%) were admitted because of isolated trauma. Isolated head trauma was the most crucial reason for admission. (136 cases; 47.8%) 20% of pregnancies with polytrauma ended up with fetal death, and there was a statistically significant difference(correlation) between injured organs and the outcome of pregnancy (P=0.048) (Table 2). Nearly half of the patients experienced trauma in the second trimester of pregnancy (1st trimester: 28.1, 2nd trimester: 48.3%, and third trimester: 23.6%). Comparing means showed a statistically significant difference of means in gestational age between fetal death and successful pregnancy (P=0.001). 19 (6.6%) patients underwent surgical operations other than a cesarean section; the most common type of surgery was orthopedic surgery. 119 (42%) of patients who needed surgery had unsuccessful pregnancies, and there was a significant relationship (P=0.001). Abdominal ultrasound was evaluated in 273 (96.1%) patients (some patients did not consent to ultrasound imaging). Results of sonography demonstrated pregnancy-related pathologies in 34 cases (12.4%). All twin pregnancies had routine imaging during the admission period. 11 cases of fetal death were confirmed at the time of sonography, the gestational age of 6 fetuses was less than 20 weeks, and 5 of them had a gestational age of more than 20 weeks. The most common complication was placental abruption (22 cases; 8.0%). 10 (45%) of placental abruption cases experienced fetal death as the outcome of pregnancy, which was statistically significant (P<0.001) (table 2).

There were 3 cases of maternal death, all in the first trimester following MVAs. Two maternal deaths also occurred following severe head injury, and another one occurred because of severe injury to the cervical spine. Thirty-six cases of fetal deaths occurred from 34 pregnancies. 88% of cases of fetal death occurred during the first and second trimesters. Five fetuses (50%) out of twin pregnancies died (P<0.001). One hundred seven cases (37.6%) terminated their pregnancy with the cesarean section, but 46 of them (42.9%) reported elective cesarean sections (table 3). As it seems in univariate analysis, there was a significant difference in the type of delivery between different trimesters (P<0.001). There was no significant difference between the proportions of injuries in different years or seasons. The outcome of pregnancy did not show any statistically significant relationship with maternal age (P=0.88) or previous history of abortion in patients (P=0.20)

Based on the criterion P<0.05 in the univariate analysis, four factors that might associate with the pregnancy outcome were included in the logistic regression model. After adjustment, three factors (gestational age, placental abruption, and surgical procedures) were associated with fetal death. The odds ratio for placental abruption was 23.64 (95% confidence interval, 6.39-87.40), for the surgical procedures 8.37 (95% confidence interval, 1.80-38.95), and 0.91 (confidence interval, 0.85-0.97) for the gestational age (table 5).

Table 1. Patients demographics

		frequency	Percent
Age	16 – 22	88	31.2%
	23 – 26	55	19.5%
	27 – 31	74	26.2%
	32 – 45	65	23.0%
	Total	282	100%
Education	illiteral	5	1.8%
	non academid education	231	81.3%
	academic education	48	16.9%
	Total	284	100%
Job	House wife	254	89.4%
	Clerk	25	8.8%
	Self employed	5	1.8%

	Total	284	100%
History of previous abortion	Yes	27	9.5%
	no	257	90.5%
	Total	284	100%
Season	Spring	79	27.8%
	Summer	72	25.4%
	Fall	71	25.0%
	Winter	62	21.8%
	Total	284	100%
Year	2011	37	13.0%
	2012	52	18.3%
	2013	56	19.7%
	2014	25	8.8%
	2015	46	16.2%
	2016	42	14.8%
	2017	26	9.2%
	Total	285	100%
Trimester	1st	79	27.9%
	2nd	137	48.4%
	3rd	67	23.7%
	Total	283	100%

Table 2. Frequency distribution based on final outcome of pregnancy

		Successful pregnancy Frequency (Percent)	Failed pregnancy Frequency (Percent)	Total Frequency (Percent)	P.value*
Trimester	1st trimester	61 (24.6%)	18 (52.9%)	97 (28.0%)	
	2nd trimester	124 (50.0%)	12 (35.3%)	136 (48.2%)	0.002
	3rd trimester	63 (25.4%)	4 (11.8%)	67 (23.8%)	
	Total	248 (100%)	34 (100%)	282 (100%)	
Surgery	Yes	11 (4.4%)	8 (23.5%)	19 (6.7%)	
	No	238 (95.6%)	26 (76.5%)	264 (93.7%)	0.001
	Total	249 (100%)	34 (100%)	283 (100%)	
Placental Abruption	Placental abruption	11 (4.7%)	10 (50.0%)	21 (8.2%)	≤0.001
	Normal	225 (95.3%)	10 (50.0%)	235 (91.8%)	
	Total	236 (100%)	20 (100%)	256 (100%)	
Injured Organ	Head and neck	128 (51.4%)	8 (23.5%)	136 (48.1%)	
	Spinal column	4 (1.6%)	1 (2.9%)	5 (1.8%)	
	Extremities	34 (13.7%)	4 (11.8%)	38 (13.4%)	
	Pelvic	4 (1.6%)	1 (2.9%)	5 (1.8%)	0.048
	Abdomen	19 (7.6%)	5 (14.7%)	24 (8.5%)	
	Polytrauma	60 (24.1%)	15 (44.1%)	75 (26.5%)	
	Total	249 (100%)	34(100%)	283 (100%)	
Type of Delivery	NVD	152 (61.0%)	23 (67.6%)	175 (61.8%)	
	CS	97 (39.2%)	11 (32.4%)	108 (38.2%)	0.457
	Total	249 (100%)	34 (100%)	283 (100%)	

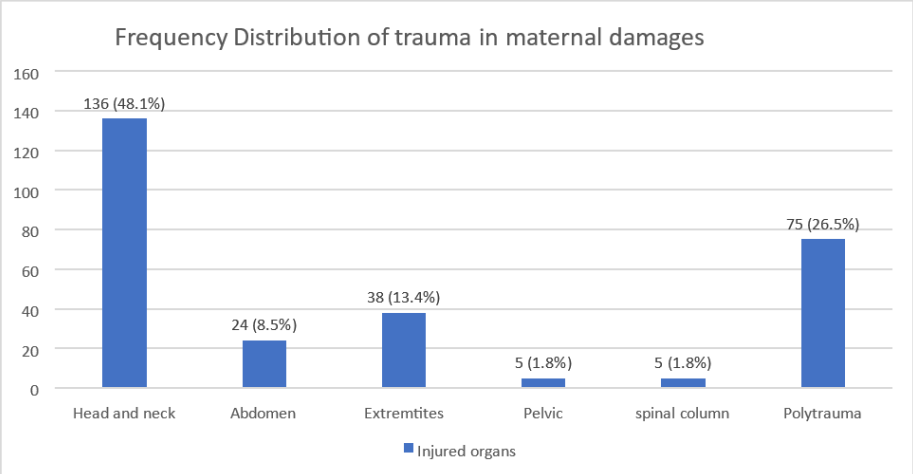

Figure 1. Frequency Distribution of trauma in maternal damages. This chart indicates that the highest frequency distribution of trauma in maternal damages is related to Head and neck with 48.1% and the lowest frequency distribution is related to Pelvic and Spinal column with 1.8%.

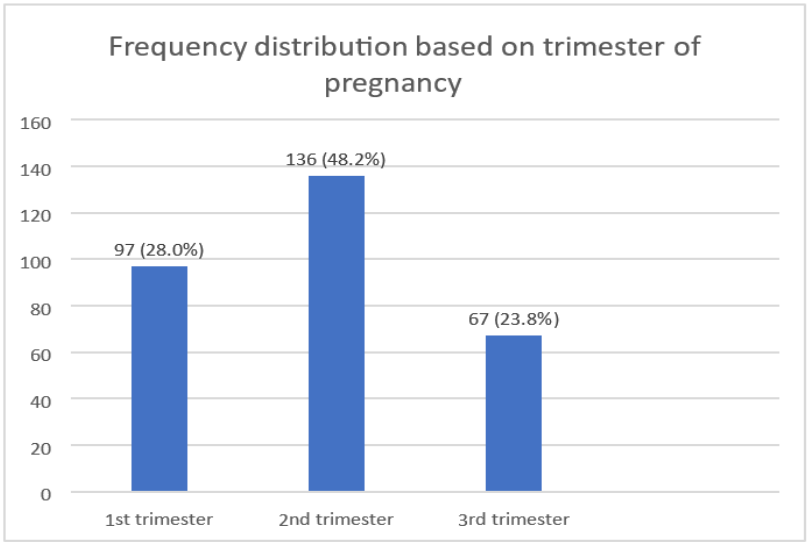

Figure 2. Frequency distribution based on trimester of pregnancy. As the chart illustrates, the highest Frequency distribution based on trimester of pregnancy is associated to 2nd trimester with 48.2% and 3rd trimester has the lowest frequency distribution with 23.8% of pregnancy.

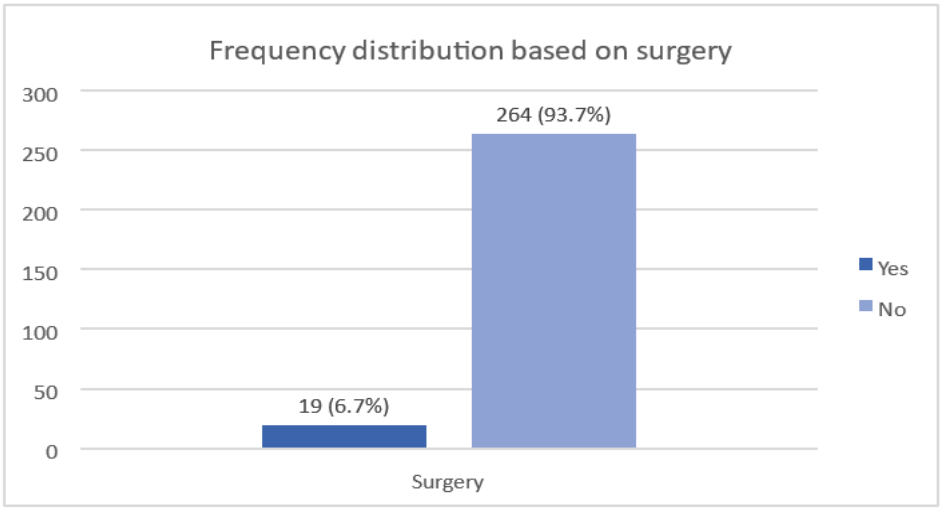

Figure 3. Frequency distribution based on surgery. Surgery has the lowest frequency distribution with 6.7% and the most patients have no experience surgery (93.7%).

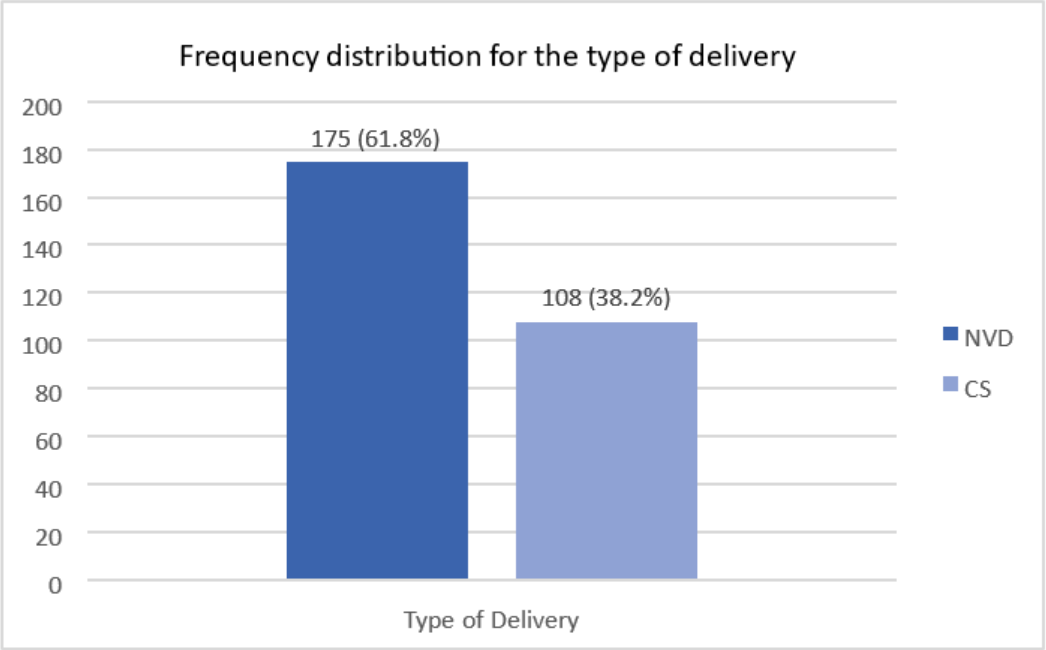

Figure 4. Frequency distribution for the type of delivery. The figure indicates that more than 60% of pregnant people had NVD type of delivery.

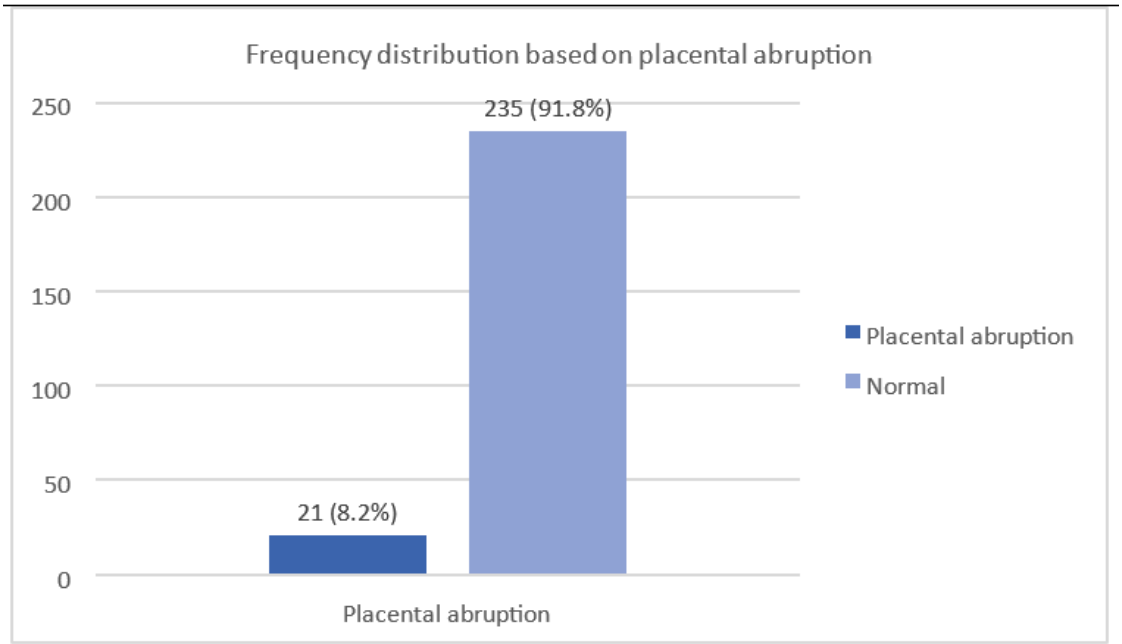

Figure 5. Frequency distribution based on placental abruption. The diagram show that 91.8% is related to normal status based on placental abruption.

Table 3. Type of delivery based on gestational age

	CS	ND	P value
Trimester 1	25 (23.4 %)	54 (30.7%)	
Trimester 2	43 (40.2%)	94 (53.4%)	≤0.001
Trimester 3	39 (36.4%)	28 (15.9%)	
Total	107 (100%%)	176 (100%)	

Table 4. Frequency distribution based on mechanisms of injury

		MVAs	Fall	Assault	Other	total	P value
Mean age		27.1±5.7	28.8±6.2	25.2±5.8	26.5±5.7	27.2±5.8	-
Trimester	1st	57 (27.7%)	10 (25.6%)	11 (39.3%)	1 (10%)	79 (27.9%)	0.331
	2nd	97 (47.1%)	21 (53.8%)	14 (50.0%)	5 (50%)	137(48.4%)	
	3rd	52 (25.2%)	8 (20.5%)	3 (10.7%)	4 (40%)	67 (23.6%)	
	Total	206 (100%)	39 (100%)	28 (100%)	10 (100%)	283 (100%)	
Surgery	Yes	15 (7.2%)	1 (2.6%)	2 (7.1%)	1 (10.0%)	19 (6.7%)	
	No	192 (92.8%)	38 (97.4%)	26 (92.9%)	9 (90%)	265(93.3%)	0.652
	Total	207 (100%)	39 (100%)	28 (100%)	10 (100%)	284 (100%)	
complications	Without pathology	168 (86.2 %)	35 (92.1%)	23 (85.2%)	9 (100%)	235(87.4%)	
	Placental Abruption	16 (8.2%)	3 (7.9%)	3 (11.1%)	0 (0%)	22 (8.2%)	
	Abortion	6 (3.1%)	0 (0%)	0 (0%)	0 (0%)	6 (2.2%)	
	Demise	4 (2.1%)	0 (0%)	1 (3.7%)	0 (0%)	5 (1.9%)	0.728
	Uterine rupture	1 (0.7%)	0 (0%)	0 (0%)	0 (0%)	1 (0.4%)	
	Total	195 (100%)	38 (100%)	27 (100%)	9 (100%)	269 (100%)	
Outcome	Successful pregnancy	179 (86.8%)	34 (87.2%)	26 (92.8%)	10 (100%)	249(87.5%)	
	Fetal death	27 (13.1 %)	5 (12.8%)	2 (7.1%)	0 (0%)	34 (12.5%)	0.317
	Total	206 (100%)	39 (100%)	28 (100%)	10 (100%)	283 (100%)	

Table 5. Multivariate analysis of the clinical factors associated with pregnancy outcome

Clinical factors	P Value	Odds Ratio	Confidence Interval
Placental abruption	<0.001	23.643	6.395 - 87.407
No surgeries procedure	<0.001	8.377	1.801 - 38.952
Gestational age	0.006	0.910	0.850 - 0.974
Injured Organ	0.491	1.503	0.471 - 4.794

Table 6. List of operated surgeries and the following outcome of pregnancy

No.	Mechanism of injury	Injury sustained/ Type of surgery	Fetal Death?
1	MVAs	Soft tissue debridement	No
2	Violence	Epidural hematoma/ Craniotomy	No
3	Falling	Tracheostomy	Yes
4	Others	Tibia Fx. / ORIF	No
5	MVAs	Left hand contusion/ fingers 2-4 amputated Left radius Fx.	No
6	MVAs	Left foot Fx. / calcaneal pin insertion fasciotomy	No
7	MVAs	Right femur and Double Fx of right leg + ulnar Fx / ORIF	No
8	MVAs	Right hand injury/ fingers 2-5 amputated	Yes
9	MVAs	Fx. Of right femur/ ORIF laparotomy	Yes
10	MVAs	Right malleolus Fx / ORIF	Yes
11	MVAs	Tibia Fx. / Pin insertion	Yes
12	Violence	Left hand Fx. Pin insertion	Yes
13	MVAs	Rupture of the lower lip/ lip reconstruction	No
14	MVAs	Mandibular Fx. / ORIF	No
15	MVAs	Left Tibia Fx. / ORIF Left calcaneal Fx. / CRIF	No
16	MVAs	Radius Fx. / ORIF Maxillary Fx. / Open surgery	Yes
17	MVAs	Diagnostic laparotomy	No
18	MVAs	Urgent laparotomy	Yes
19	MVAs		Yes

Table 7. List of unsuccessful pregnancies and their details.

Mean GA at the time of injury	Mean GA at the time of death	Mean maternal age	Maternal Death	Mechanism of Trauma	Injury sustained	Abdominal ultrasound	Surgery	Fetal death after discharge?
15.7	17.75	28.5	In 34 cases there was no maternal death, and in 2 cases we had maternal deaths because of C4 dislocation, and SAH.	27 MVAs, 6 fallings, and 3 violences.	13 M.Ts, 3 extremities, 13 H.Ts, 5 Abdomen traumas, 1 spinal trauma ,and 1 pelvic trauma.	10 F.Ds, 15 normals, 8 abruptions, 1 uterine rupture, and in 2 cases there were no abdominal ultrasounds.	In 8 cases yes and in 28 cases no.	In 23 cases no and in 13 cases yes.

Discussion

In developing countries, pregnancy trauma could occur due to high rates of accidents as one of the leading causes of morbidity and mortality for both mother and fetus. The mean age of patients in this cross-section study was 27.2 years which was higher than in other studies. In an American epidemiologic study, the mean age of injured pregnant women was 24.9 (17). Here, 136 (48.1%) patients were admitted owing to isolated head injuries that were mild to moderate in most cases. Additionally, 75 patients had multiple trauma, and 62 (82.6%) cases of multiple trauma were a consequence of MVAs.

Our studies demonstrated that the most common mechanism of injury was motor MVAs. The present study showed that MVAs were responsible for 73.5% of injuries. This is much higher compared to other studies in different countries. Thus, MVA has the central portion in Iran. In some studies with 60.000 subjects in Taiwan, it has been reported that only 47.4% of inpatients were traumatized by MVAs. A review by *Mattox et al*. has reported that MVAs account for more than 50% of all trauma during pregnancy and 82% of fetal death occurring during these accidents (18). MVAs seem to depend primarily on traffic policies and accident ratios in each country. Additionally, cultural issues could also affect the mechanism of injury. For instance, an article by *Wall SL et al.* indicates that 52% of trauma to pregnant women in South Africa was intentional, and violence was the most common type of injury. In the mentioned study MVAs were responsible for 10 (90.9%) out of 11 fetal deaths that occurred before any hospital care, which might be relevant to the high intensity of accidents compared to other mechanisms of injury. Falls and violence were the other common mechanisms of injury (19). However, this might be an underestimation. *Dunning K et al*. have reported that only ten percent of pregnant women who experienced falling seek medical attention (20). On top of that, medical services in our setting are accessible for people who are traumatized during MVAs and are much more expensive for people traumatized during fights and domestic violence. Thus, financial expenses could affect the patients looking for medical care.

In another study in a developing country, the authors reported that 73% of fetal deaths occurred in the first two trimesters of pregnancy (19). Our results showed that most cases of fetal death (88%) occurred in the first two trimesters of pregnancy. Another literature suggests that the pregnancy outcome is related to gestational age, surgical procedures, and obstetrical consequences such as placental abruption, which is compatible with our study (21). In the present study, eight percent (8%) of patients were diagnosed with placental abruption and at increased risk for fetal death. Only 4.7% of pregnant patients who have experienced placenta abruption also led to successful delivery. In this regard, a retrospective cohort study in the US reported that people traumatized during pregnancy had a nine-fold higher risk for placental abruption. In another study in Kuwait, 58 percent of patients

experienced placental abruption (22). However, the study of *Chibber et al*. was carried out in a tertiary center for patients with significant trauma.

A cohort study was conducted by Dr. Seyedzadeh and their colleagues in Kermanshah from 2012 to 2020. The object of this study was the outcome of maternal and fetal pregnancy. The analysis of fetal and maternal complications and demographic data demonstrated that thirty-seven patients with a mean age of 32 years and a mean gestational age of 19 years participated. 40.5% of patients had undergone less than 25% total burn surface area (TBSA), and 16 (43.2%) maternal mortality. Fetal complications included premature labor in 4, abortion in 14, and intrauterine fetal death in 7 cases. There is a high rate of fetal and maternal mortality during pregnancy. These complications are highly related to the severity of burn and TBSA. Preventive measures have an essential role in decreasing complications (23).

In an American study by *Schiff et al*. (5), Their findings indicated that people with trauma in MVAs present at increased risk of placental abruption, which is compatible with our study. In addition, authors have reported that MVAs are related to higher rates of Cesarean sections. In contrast, our study could not demonstrate any significant relation between the trauma mechanism and type of delivery. In the present study, patients who sustained trauma in the third trimester had a higher chance of terminating a pregnancy by cesarean section. We could interpret that cesarean type of delivery could be an index of unstable conditions such as MVAs. In Finland, *Ansa Aitokallio-Tallberg et al*. studied MVA during the second or third trimester of pregnancy. Their results showed that most pregnant individuals exposed to MVA with less speed could lead to less trauma, and some of these pregnant patients who experienced high speed (80km/h) showed placenta abruption (24).

Mustafa Salis et al. evaluated pregnant individuals in Turkey, a developing country. Their results demonstrated that the most common factor of traumas were MVAs (49%), 25% falls, 22% violence, and 1% burn (25).

In our study, it has been reported that NVD type of delivery was more than 60% in pregnant people. We also found that 92% of pregnant people have not been a placental abruption. Furthermore, our findings from MVA complications indicated 8.2% of placental abruption and 3.1% of abortion, which is higher than fall and assault complications. Notably, the critical point here is related to the study population in which MVAs had shown much more than fall and assault. Although this result could not show a meaningful relation statistically, this outcome indicated MVAs are a hallmark occurrence in Iran. Our study shows MVAs have more share in operated surgery than falling and assaulting incidences. This finding represents the undeniable role of MVAs in pregnant Iranian people exposed to challenges.

Tania Azar et al., in Iran, a developing country, has conducted some studies on the MVAs occur during pregnancy. They reported that pregnant women had an increased surgery rate following the collision of MVAs, and the cesarean type of delivery was adopted for these women (26).

Conclusion

In an environment with a high incidence of motor vehicle accidents, MVAs can involve pregnant women and cause unfavorable pregnancy outcomes. It has been concluded that some strategies that can decrease the chance of pregnant women to involve in MVAs will reduce the unfavorable feto-maternal outcomes in this population. Thereby, it seems that culture learning should be considered a priority for Motorcycle riders. Also, gestational age, placental abruption, and surgical procedures were risk factors for unfavorable fetal outcomes.

Acknowledgments

All authors would like to thank all individuals who assisted in the scientific project.

Conflict of interest

Authors declare that they have no conflict of interest

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