

Trauma in pregnancy

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ABSTRACT

Trauma is complicating 1 in 12 pregnancy and is considered to be the first cause of non-obstetrical maternal death. Frequently encountered complications are preterm delivery, placental abruption or spontaneous abortion.

Presence of the gravid uterus is a major contributor that increases the risk of the occurrence of possible wounds, and as the pregnancy progresses, multiple changes that occur can make the management of the pregnant patient harder.

Studies have shown that domestic abuse should not be overlooked.

First evaluation needed for pregnant trauma woman comprise complete blood count, coagulation profile, Rh factor determination, urine analysis, electrolytes and glucose, toxicology screening and the Kleinhauer-Betke (KB) test. Also, diagnostic imaging is not discouraged, and may raise and also confirm the suspicion for placental abruption or uterine rupture.

In case of cardiac arrest and unsuccessful resuscitation of the mother within 4 minutes, literature recommends a perimortem cesarean delivery, if gestational age is above 23 weeks and the fetus is potentially viable.

Keywords: trauma, pregnancy, uterine rupture, perimortem cesarean, motor vehicle accident, blunt abdominal trauma, domestic violence

INTRODUCTION

Trauma is the main cause of non-obstetrical maternal death, complicating 1 in 12 pregnancies. In terms of injuries, studies show that the most common are motor vehicle collisions, assaults, falls, and intimate partner violence. Regarding fetal implications in case of trauma, the incidence of spontaneous abortion, delivery, placental abruption, premature rupture of membranes and preterm birth is increased [1].

It is known that one in three pregnant women admitted in hospital for trauma will deliver throughout hospitalization. Nevertheless, the expertise of the interdisciplinary team, including maternal fetal medicine and obstetrics specialist, anesthesiologist, general surgeon, and intensive care specialist, will determine the outcome [1].

Although pregnancy by itself does not increase the morbidity and mortality as a consequence of trauma, the presence of gravid uterus, does change the type of injury [1].

Pregnant women and nonpregnant women are at equal risk of dying after traumatic injury, yet studies show that the fetus has a bigger probability for death than the mother. It is sometimes hard to predict the likelihood of adverse fetal outcomes, and often unintuitive when the stage of trauma is considered [2].

MATERIALS AND METHODS

We identified data in published literature, using the keywords "trauma" and "pregnancy" and for mechanism of injury "motor vehicle accident",

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“penetrating abdominal trauma”, “falls”, and “domestic violence”. In addition, we used randomized control trials and observational studies, and we included only English language publications. All the publications used can be found in the reference section.

EPIDEMIOLOGY AND ETIOLOGY

Although trauma remains a major cause for maternal and fetal death, a prospective study in 2002 showed that only 4 pregnant women of every 1,000 are hospitalized for injury. A study for medical records in Cook County, Illinois indicates that 46% of maternal deaths are because of trauma. Another published study shows that on second and third place for trauma are falls and assaults [3].

In terms of traumatic injury during pregnancy, the most common is blunt abdominal trauma and with increasing gestational age also the risk for fetal injuries is higher. Motor vehicle crashes are the main cause for blunt abdominal trauma, and it has been shown in multiple studies that the use of seat-belt can reduce the mortality and morbidity up to 84%, both on the fetus and the mother, compared with unbelted pregnant woman [4].

Because of weight gain and switching the center of gravity because of the expansion of the gravid uterus, pregnancy enhance the risk of falls furthermore in late second and third trimester [4].

Huls and Detlefs, using the National Vital Statistics Reports for 2015, described that a number between 159,109 and 318,219 pregnant women are impaired by domestic violence [5,6].

Another retrospective study in Massachusetts, including women presenting with abuse, found that 42.2% of injuries were to the head and neck and upper body injuries were identified in 21.5% of patients during pregnancy compared to 8.7% during the postpartum period [5].

In a large prospective study made in California between 2007 and 2011, including 2,407,867 singleton pregnancies, only 0.05% suffered from trauma preceding delivery, but in the end the study concluded that trauma during pregnancy was correlated with a higher occurrence of severe birth outcomes, including fetal and neonatal death [5].

In terms of burn injuries, the mechanism of injury is considerably different than other forms of injury, and there is a direct thermal injury to tissue, lung injury because of inhalation, and toxic substances released by burning will accrue in the maternal blood stream. Management of these lesions are not well built up because of low number of cases reported [6,7].

PREGNANCY ANATOMY AND PHYSIOLOGY

Serious anatomical and physiological changes are sustained by pregnant woman so they can manage with the enhanced physical and metabolic requests during their pregnancies [8].

Direct injury to the gravid uterus in the first trimester is improbable because the uterus is situated in the pelvis, after that at 20 weeks the uterus attains the tier of the umbilicus, and around 36 weeks is near the costal margin. Due to these variations of the uterus, in the third trimester the fetus is more exposed to direct trauma [4].

The gravid uterus also brings changes to the heart, this being pushed upright and to the left, so electrocardiograms can be a little different in pregnant women, with a left axis variation, depressed ST segments, and inversion of the T wave. Also, after 20 weeks gestational age, inferior vena cava is compressed and that will result in diminished venous return and decreased cardiac output, that will explain episodes of hypotension [4].

Twin pregnancies bring at least 20% increased cardiac output than in those with singleton pregnancies. There is an increased cardiac compliance explained by the fact that end-systolic volume and end-diastolic pressure remain constant, and there is no lessening in ejection fraction even though pregnant woman have a physiologically dilated heart [9].

Numerous changes also occur in the respiratory system with an increasing edema of the upper respiratory airway making intubation in pregnant woman more difficult. Lessening of total lung capacity, reduction in residual volume, increased minute ventilation, and almost 20% increased oxygen consumption, are also consequences of pregnancy. For instance, physicians should always adapt ventilator setting to maintain respiratory parameter goal when a pregnant woman necessitate intubation [4].

During pregnancy gastric motion and esophageal anatomical sphincter tone are loosened, therefore risk of pulmonary aspiration is higher, so a nasogastric tube may be needed [8].

PATTERNS OF TRAUMA

Placental abruption

Is the main obstetric adverse event resulting in the majority of cases from straight abdominal trauma in pregnancy. Clinical symptoms like uterine sensibility, uterine contractions, vaginal bleeding, or alarming fetal heart rate may present a few hours after the primary traumatic event [4].

The most important evaluation for pregnant trauma patients is the use of tocometry for at least

2- 4 hours, studies revealing that only 14.3% of the women that have contractions at least 2 to 5 minutes have a clinically significant placental abruption. In case of placental abruption, pregnancy can end up with serious complications such as preterm delivery, premature rupture of membranes, fetal death, and also maternal disseminated intravascular coagulation (DIC) [4,9].

Uterine rupture

It is described in less than 1% cases of trauma during pregnancy, and the most important risk factor is the existence of previous cesarean section. Up to 10% of patients with uterine rupture will have a bad outcome and fetal mortality rate in these cases is almost 100%. Abdominal tenderness, vaginal blood loss, alarming fetal heart rate and an irregular shaped uterus, are some of the findings that can raise suspicion for uterine rupture [4].

Amniotic fluid embolism

Amniotic fluid embolism (AFE) is a rare event but possibly with ravage ending for both the mother and fetus. Traditionally, pathophysiology of embolism it is due to the break between maternal and fetal placental barrier called abruptio placentae and so amniotic fluid will pass into maternal blood stream [10]. Recent studies have shown that the AFE is a misnomer, representing not a true embolism, but an anaphylactoid reaction associated with pregnancy, characterized by sudden cardiovascular collapse, hypoxia and disseminated intravascular coagulation [11]. It is a life-threatening condition with a very poor prognosis, maternal death being up to 50% of cases [10].

Rupture of membranes and preterm birth

As trauma occurs, preterm birth is the highest risk in case of rupture of the membranes. Vaginal bleeding or amniotic fluid leakage should raise the suspicion. It is known that a preterm birth is more probable in a pregnant patient who has suffered from trauma comparing with those with no record of it [10].

Although many previous recommendations claim against using of tocolytics in a case of a woman with uterine contractions, if membranes are unruptured and clinical wariness of a placental abruption is small, the temporary administration of indomethacin or nifedipine may be considered [4].

If there is a small suspicion of placental abruption and membranes are intact, administration of indomethacin or nifedipine on a short time, may be considered in trauma patients with uterine contractions, even if some guidelines discuss the use of tocolytics in trauma. Yet for women with high suspi-

cion for preterm birth, with serious contractions, a course of corticosteroids should be given [4].

In a review published in 1978 by Rothenberger et al., hemorrhagic shock was a hearty aspect in the mortality of 103 pregnant women who suffered from blunt trauma [12].

Pelvic fracture

Because this type of injury is relatively rare, there are few studies that have investigated the consequences of pregnant women that undergo pelvic fracture [12].

It has been demonstrated in a systematic review on 101 cases of pelvic fracture that even though institutions did not had experience in treating pelvic trauma in pregnancy, death for mother and the fetus was more probable to happen in a motor vehicle crash than with a fall [13,14].

LABORATORY AND IMAGING

First evaluation needed for pregnant woman with trauma comprises complete blood count, coagulation profile, Rhesus factor determination, urine analysis, electrolytes and glucose, toxicology screening and the Kleinhauer–Betke (KB) test. Also, physicians should be cognizant of the changes of laboratory values that take place in pregnancy such as increased white blood cell count, small elevation of the arterial pH and lower levels of serum bicarbonate and arterial PCO₂ [11].

In pregnant patients if needed, diagnostic imaging should not be discouraged, and may raise and also confirm the suspicion for placental abruption or uterine rupture. It has been proven by the American College of Obstetrics and Gynecology that radiation doses of maximum 5 rads are not related with an increased risk in pregnancy loss or fetal abnormalities [15,16].

Even so, if imaging diagnosis is necessary, uterus should be well protected, because some studies showed that there is a slightly elevated risk for leukemia during childhood, if the child had in utero exposure to radiations [12].

Kleihauer-Betke (KB) test detects into a maternal blood sample if there are fetal red blood cells, suggesting fetomaternal hemorrhage of at least 5 mL, therefore even after a minor trauma, American College of Emergency Physicians advise administration of immune globulin [13].

INITIAL EVALUATION OF PREGNANT TRAUMA PATIENT

Advanced Trauma Life Support protocols also apply in pregnant trauma patients, but it is required to take into consideration the cardiopulmonary alterations previously described [13]. ABC's (airway,

breathing, circulation) remains the initial intervention as in nonpregnant trauma patients. Airway and breathing: oxygen administration, continuous monitoring of oxygen saturation levels and if necessary early intubation; circulation: initial fluid replacement to support both the mother and the fetus, considering that the fetus is highly sensitive to maternal hypovolemia and fetal hypoxia and bradycardia can develop rapidly [3].

Physicians should have in mind that fetal well-being is secondary to resuscitation of the pregnant woman, but also fetal heart rate irregularities may be the first sign of maternal hypovolemia, fetal heart rate being described as “fifth vital sign” in obstetrics [14].

Considering the fact that pregnant women are susceptible for aspiration and desaturation, Sellick’s maneuver and proper preoxygenation, are necessary to avoid complications. The Sellick maneuver is executed by applying mild pressure to the front neck at the tier of the cricoid cartilage [13].

All Rh-negative trauma patient should receive, under 72 hours after the injury, one dose of 300 mg of Rho immunoglobulin [17].

RESCUE THERAPIES

In case of maternal cardiac arrest, rescue team will pursue Advanced Cardiac Life Support resuscitation guidelines, without modification of hand positioning for compressions, and for avoiding the compression of inferior vena cava, manual uterine displacement should be applied [6].

Perimortem cesarean section should be considered if cardiopulmonary resuscitation is not successful within 4 minutes. It is important to mention that there should be no postponement with trying to move the patient to an operating room or to sterilize the abdomen. [12]

In 1986, Katz and colleagues first described this procedure due to the idea that cardiopulmonary resuscitation in the third trimester is ineffective. Evacuation of the uterus discharge the pressure from inferior vena cava and improves venous return and cardiac output [10,11].

The role of perimortem cesarean delivery is still being debated whether it really benefits pregnant women in cardiac traumatic arrest. Nevertheless, this procedure should consider saving the fetus, after 5 and maximum 10 minutes of unsuccessful maternal resuscitation, if gestational age is above 23 weeks and the fetus is potentially viable [10].

PREVENTION STRATEGIES

Even if many times trauma is unforeseeable, the best way for having better results for the woman

and the infant is prenatal care, with proper education, especially the proper use of the seat belt [12].

Pregnant women should be taught the proper seat belt use, and that is the inferior belt should be placed low on the pelvic area and the shoulder belt among the breasts and on top of the center part of the clavicle. Incorrect use substantially heighten the pressure that is transmitted to the uterus, and so the risk for uterine and fetal injury is increased [18].

When is necessary antitetanic vaccination should be given, considering the fact that administration of tetanus vaccine is safe in pregnancy [9].

Recent studies show that physical abuse happen between 17% and 32% of pregnancies, and as many of 60% of women have reported multiple domestic abuses, so every woman who suffer from trauma should be asked about domestic or intimate violence [12].

DISCUSSION

Trauma remains one of the most considerable non-obstetric causes for maternal morbidity and mortality and in pregnancy is a real challenge for the rescue team. Vital for managing in a skillful manner and assure optimum results for the mother and the fetus, is awareness of the anatomical and physiological changes that take place in pregnancy [13].

It is well known that best conduct for the fetus is an aggressive and prompt resuscitation of the mother. In attempt to avoid hypotension given by the compression of the inferior vena cava, a left lateral decubitus position of the patient should be kept [14].

Using of imaging studies for diagnosis in a pregnant trauma patient should not be discouraged. All Rhesus D-negative patients who suffered from trauma should receive a dose of Anti-D immunoglobulin [9].

For a viable pregnancy over 23 weeks gestational age, in cases of maternal cardiac arrest, perimortem cesarean delivery should be consider after 4 minutes of unsuccessful resuscitation. Different studies demonstrated survival rates of 45% and up to 72%, for fetus respectively for mother [13].

Rescue team should first focus on the mother evaluation and resuscitation, because fetal survival is directly proportional to the mother’s survival [19].

CONCLUSIONS

Studies showed that the most common types of injury are motor vehicle collisions, assaults, falls, and intimate partner violence. During pregnancy

the most common type is blunt abdominal trauma, and as pregnancy progresses the risk for injury increases.

There are many changes in anatomy and physiology of a pregnant woman, and trauma team should always acknowledge physiological alterations, for a better maternal and fetal outcome.

Physician should always have in mind that when a trauma pregnant woman is admitted in hospital, there is a high risk for a preterm delivery and many other complications related to pregnancy, and team

should be multidisciplinary with qualified staff consisting of an obstetrician, intensive care specialist and neonatologist.

Continuous fetal heart monitoring and, if needed, emergency cesarean should be done in cases of uncertain fetal status.

In the attempt of trying to reduce trauma in pregnancy, all women should be informed about the importance of seat belt and the proper way of using it. Also, prenatal care screening for domestic abuse must not be forgotten.

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