Newsletter March 2023: Is there a good recipe for management of pregnant trauma patient?

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Regardless of underlying aetiology, massive haemorrhage is a significant cause of maternal mortality and morbidity worldwide. According to health statistics, the maternal mortality rate (MMR) in Turkey is 13.1 in 100,000 live births (https://sbsgm.saglik.gov.tr/Eklenti/44131). Hopefully, evidence-based management to improve patient care could play an important role in decreasing MMR. However, massively bleeding trauma patients is challenging even in expert centres. Therefore management of pregnant trauma patients based on the recent literature, current guidelines and algorithms has been addressed by revisiting the history, incidence, pathophysiology, and definitions, including massive transfusion (MT) and damage control resuscitation (DCR) and evolving transfusion strategies as well.

History

After the 1st whole blood transfusion in 1667, 1st allotransfusion was performed in 1825 by James Blundell, a British obstetrician. Later, 1st separation of whole blood into blood components was made by Elliott and Strumia to produce dried plasma for traumatic shock resuscitation.[1]

Incidence

Trauma affects 6 to 7% of pregnancies in the USA. Blunt trauma is the most common in pregnant women accounting for 69% of the total number of traumas, whereas penetrating trauma accounts for only 1.5% during pregnancy. Regarding blunt trauma, motor vehicle accidents are the most frequent (80%) cause of injury, followed by falls, physical assault, gunshot, and stab wounds.[2]

After blunt uterine trauma, placental abruption is the most common complication (1-5% of minor/6-35% of major injuries). The MMR is less than 1%, but fetal mortality is 20-30%. Clinical signs include uterine tenderness, vaginal bleeding, tetany/irritability that may end up hypofibrinogenemia, DIC and hemorrhagic shock. Besides uterine trauma, a pregnant patient has a different pattern of abdominal injury. Splenic/hepatic/retroperitoneal injuries and hematomas are more common, but bowel injury is less common due to the protection of the gravid uterus. Fortunately, the fetus is well protected by the bone pelvis, amniotic sac and surrounding soft tissues in the 1st trimester. However, severe fetal consequences occur mostly during the 2nd or 3rd trimester.[3]

Pathophysiology

In the presence of pre-existing conditions (age, genetics, co-morbidities and pre-injury medications), tissue damage/haemorrhage results in traumatic shock and hypoperfusion. Subsequently, systemic epitheliopathy develops as a result of sympathoadrenal activation, inflammation, glycocalyx shedding, endogenous heparinisation, platelet activation/dysfunction, reduced clotting factor activity and hyperfibrinolysis.[4] Finally, trauma-induced coagulopathy due to trauma-associated factors, consumption and loss of coagulation factors and resuscitation-associated factors; coagulation factor dilution due to excessive fluid resuscitation and acidosis related to shock and hypothermia develop.[5]

Definitions

Historically, MT has been defined as the use of 10 units of red blood cells (RBC) within 24 hours during the Vietnam war. According to transfusion guidelines MT, which may be considered a major haemorrhage, is defined as either substitution/loss of half a total blood volume less than 3 hours or replacement/loss of complete blood volume (70 ml/kg) in 24 hours or bleeding in excess of 150 ml/min.[6]

The DMC is a concept of early-aggressive bleeding control, including permissive hypotension to keep mean arterial pressure at 65 mmHg or systolic blood pressure between 80-90 mmHg until bleeding controlled, restrictive IV fluid resuscitation to avoid dilutional coagulopathy. Additionally, early use of blood products at predefined/fixed ratio RBC: FFP (Fresh Frozen Plasma): PLT (Platelet)/1:1:1 and hemostatic agents such as; tranexamic acid (TXA) and fibrinogen and off-label use of rFVIIa (activated recombinant FVII) and 4F-PCC (4-factor prothrombin complex concentrate) are considered.[6]

Management of pregnant trauma patient

Approach to pregnant trauma patients is managed by primary and secondary surveys, including perimortem caesarian section (CS) decision indications[2] (figures 1A and B). If the mother is unstable physiological first steps of the primary survey are listed below[4]:

- Assure airway patency – immobilize the cervical spine where appropriate
- Administer oxygen to the patient
- Prevent maternal hypoxemia to avoid a poor fetal outcome
- Intubate patients with airway compromise/respiratory distress or impaired level of consciousness (to optimize oxygenation and prevent aspiration)
- Consider awake fiberoptic intubation in known/suspected difficult intubation, morbid obesity and facial/cervical injury
- Provide preoxygenation and cricoid pressure for intubation – then confirm endotracheal intubation
- PEEP improves maternal-fetal oxygenation but does not use in head trauma/raised ICP.

Indications for perimortem CS are viable pregnancies (>24 weeks) or near term, maternal death, trauma patients with cardiac arrest, no later than 4 minutes of properly performed cardiopulmonary resuscitation (CPR) that has failed, loss of fetal being in the viable fetus, irreparable uterine rupture, massive haemorrhage/shock, a threat to life from exsanguination, a mechanical limitation for repair and unstable thoracolumbar spine injury. Perimortem CS should be performed as mentioned below within 5 min to optimize fetal outcome since infants born within 5 min have a chance of minimal neurological injury [2,3];

- the abdomen should not be prepared/draped, and time should not be wasted
- midline skin incision and vertical midline uterine incision should be performed consecutively
- maternal CPR should be continued, as delivery of the fetus may improve venous return and the success of CPR subsequently

- after cord clamping, focus on newborn

Transfusion management strategies

Based on the recent evolution of transfusion management in the trauma population, either empiric strategy (early transfusion of a fixed ratio blood components), goal-directed strategy (administration of blood components guided by viscoelastic tests), or hybrid (combination of two; first start with empiric then continue with goal-directed strategy) have been outlined.[5,6] Empiric and goal-directed transfusion strategies have been demonstrated in benchmark trials of PROPPR and ITACTIC, respectively though a hybrid strategy has not been tested yet.

Since administering any blood component, hemostatic agent or factor concentrate is too late, the importance of the prehospital bundle has been discussed. [6,7] Conceptually early use of plasma by emergency personnel, empiric fixed dose of blood components with high dose fibrinogen, 4F-PCC incorporated to either empiric or hybrid approach or whole blood at the initial stage has been reviewed by Gauss et al.[6] Improved survival/mortality rates after early/prehospital use of RBC in military casualties within 30 min of injury (COMBAT trial), and plasma and/or RBC during helicopter transport in civilian trauma patients (PAMPER trial) have been stated.[7] Maybe the change has come to consider using these approaches for all.

PT/INR is used to assess the severity of traumatic coagulopathy and needs for MT because PT values on admission correlate well with the degree of shock[4]. However, predicting who will need an MT is still very difficult. Recently Revised Assessment of Bleeding and Transfusion (RABT) score includes; + FAST, penetrating mechanism, shock index>1 and pelvic fracture; and FiBAT score including 8 variables (each variable corresponds to 1 point in both scorings) may be helpful tools if used in pregnant women as well. If RABT score ≧2 points, there is a high probability of MT (≥ 10 units of RBC within 24 h), while the FiBAT score of≧5 points indicates a fibrinogen level <1.5 g/dL, which requires correction.[8,9] Noteworthy that every unit/centre has an adapted Massive Transfusion Protocol, which should be activated in a timely and performed by a multidisciplinary approach. Protocol modified from postpartum haemorrhage was shared[10] (Figure 2).

In conclusion, follow algorithms accordingly, strict to DCR and consider using one of the transfusion strategies (empiric, goal-directed or hybrid) and early use of blood products (fixed ratio 1:1:1/RBC:FFP:PLT), administration of TXA within 3 hours, correction of

hypofibrinogenemia with fibrinogen concentrate or cryoprecipitate. No matter which management strategy/algorithm/protocol is adapted, intervening should not be too late. Further work is required to refine the role of all these approaches in the pregnant trauma setting.

References

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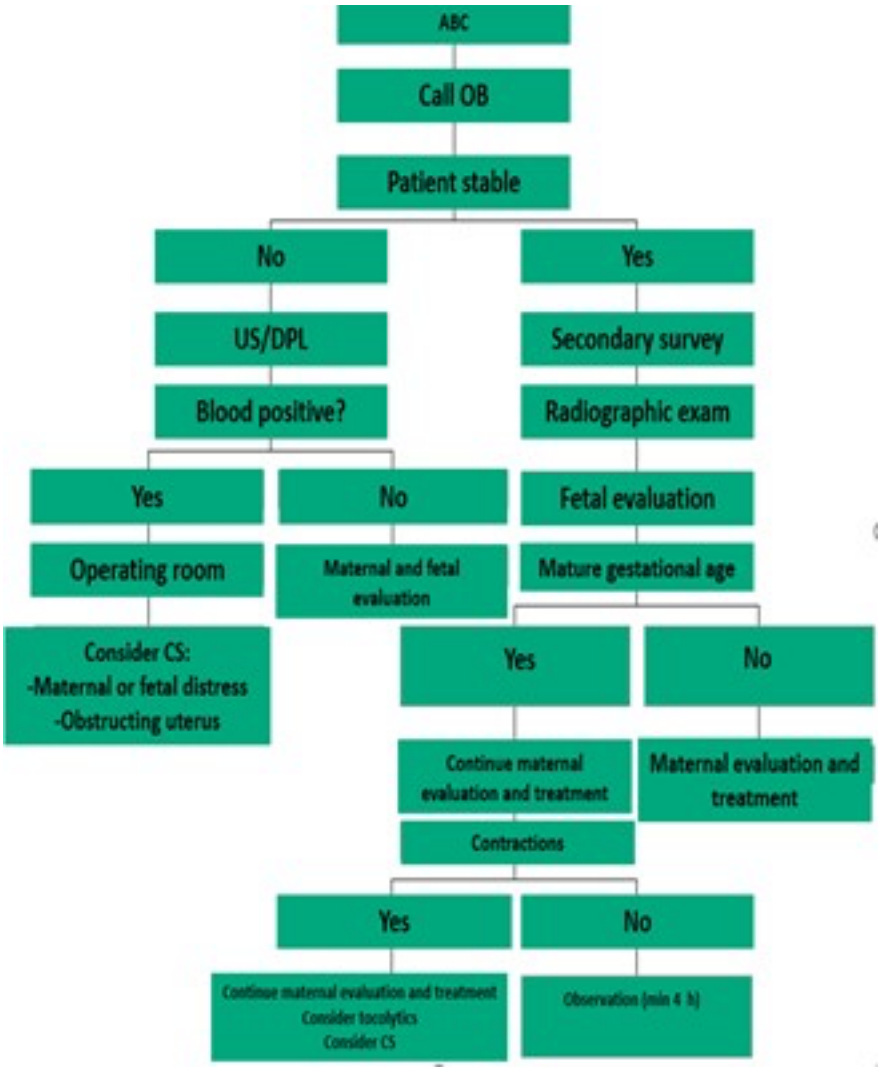
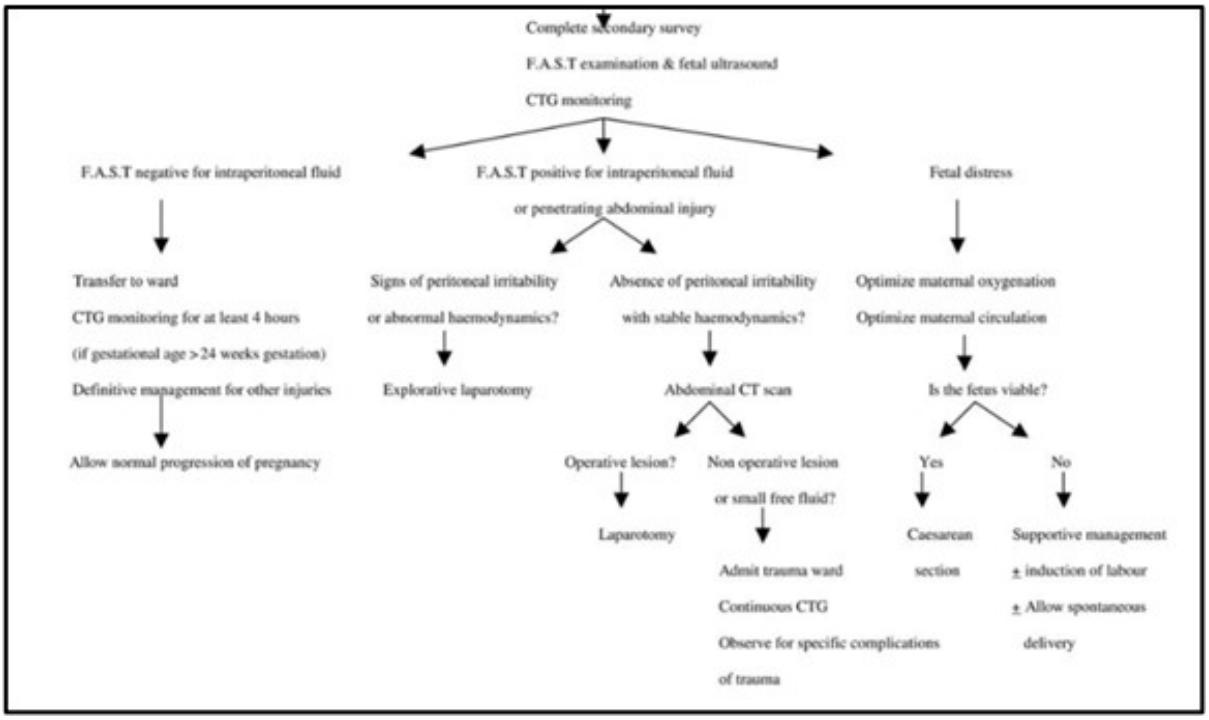
Figure 1A. Algorithm for initial maternal and fetal assessment in pregnant trauma



US: Ultrasound **DPL:** Diagnostic peritoneal lavage. **CS:** Caesarean section

Figure 1B. Secondary survey



FAST: Focussed abdominal ultrasound trauma

Figure 2. Modified Massive Transfusion Protocol

