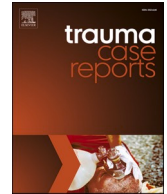




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Case Report

A case of severe hemorrhagic shock caused by traumatic avulsion of uterine fibroid

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ABSTRACT

Case presentation: A 40-year-old woman was injured in a motor vehicle accident. Physician-staffed helicopter emergency medical service (HEMS) was dispatched, and after the HEMS physician performed thoracostomy and tracheal intubation to relieve the tension pneumothorax and hemorrhagic shock, her carotid artery became unpalpable. The physician then decided to perform prehospital resuscitative thoracotomy. Immediately after arriving at the hospital, an emergency laparotomy was performed. Intraoperative findings showed that a huge uterine fibroid had been avulsed from the uterine wall, and we performed temporary hemostasis by extraction of the avulsed tumor and application of packing to the pelvic cavity. She was transferred to a rehabilitation hospital 42 days after the operation.

Conclusion: The injury mechanism in this case was considered a “submarine effect.” This was an extremely rare case in which the acute care surgeon and a gynecologist collaboratively employed a damage control strategy to deal with impending cardiac arrest.

Background

The use of seat belts has become widespread, and although it has reduced serious motor accident injuries, specific injuries such as thoracic and abdominal organ injuries have become apparent. We present a case of impending cardiac arrest after intra-abdominal hemorrhage due to avulsion of a uterine fibroid, which was saved by taking damage control strategies in a prehospital setting.

Case presentation

A 40-year-old woman ran out of the oncoming lane and collided with a one-box car while driving. Her seat belt was fastened, and the airbag got deployed in the accident, but she was thrown out of the car due to the impact of the accident. Six minutes later, physician-staffed helicopter emergency medical service (HEMS) was dispatched at the same time as the ambulance considering the seriousness of the accident. The ambulance crew evaluated the woman's consciousness level to be E1V1M4 on the Glasgow Coma Scale and recorded shock, left thoracic instability, subcutaneous emphysema, abdominal distension, and open fracture in the left lower leg. The base hospital was 48.5 km away from the scene, and so, the HEMS physician contacted the patient 32 min after the injury. A Focused Assessment with Sonography for Trauma (FAST) scan revealed tension pneumothorax and intra-abdominal hemorrhage, for

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which chest tube drainage and tracheal intubation were performed. Subsequently, her carotid artery rapidly became unpalpable; therefore, resuscitative thoracotomy and descending aortic clamping were performed via left anterolateral thoracotomy, and then the victim was transported promptly.

Sixty-nine minutes after injury, she arrived at our hospital with spontaneous circulation and an aortic occlusion time of 25 min. No bleeding in her left thoracic cavity was observed, but a FAST scan showed positive findings around the liver and in the pelvic cavity. Therefore, it was decided to immediately perform laparotomy at the emergency department to achieve hemostasis. The surgery was initiated by a rapidly assembled trauma surgery team. When the abdomen was opened by “trauma incision,” a large volume of arterial and venous blood flowed out. The team noticed a huge uterine fibroid, with a maximum diameter of about 25 cm, protruding outside the uterus in the lower abdomen (Fig. 1). The tumor was extensively avulsed from the uterine wall, with persistent bleeding from the avulsed surface. The avulsed fibroid was quickly removed (Fig. 2), gauze packing to the pelvic cavity was applied, and complete hemostasis was achieved. In addition to surgery, “damage control resuscitation” including unmatched blood transfusion, tranexamic acid administration, and calcium ion replacement were taken.

Then, the hemodynamics improved, and aortic occlusion was released 11 min after arrival during damage control surgery (complete occlusion time was 36 min, and the total occlusion time including partial occlusion time was 42 min). Both the thoracic wound and the abdominal wound were temporarily closed, and the damage control surgery was completed. The operation time was 40 min, and the intraoperative blood transfusion volume was 14 units (1960 ml) of red blood cells and 10 units (1200 ml) of fresh frozen plasma. By the next day, sufficient resuscitation of hemodynamics and coagulation had been obtained; therefore, the planned reoperation was performed jointly with a gynecologist. Sufficient hemostasis was obtained by removing the packing in the pelvic cavity, but there was bleeding from a part of the uterine wall from which the fibroid was removed. This part was sutured and covered with the visceral peritoneum. Both the chest wall and the abdominal wall were routinely closed to complete the operation. After the operation, the respiratory and circulatory status remained stable, but cerebral infarction, which seemed to have occurred in the acute phase, was revealed. The patient was transferred to a rehabilitation hospital 42 days after admission without major problems. She was subsequently discharged home with residual brain dysfunction but was able to live independently while performing her daily activities.

Discussion

Intra-abdominal hemorrhage requiring a gynecological surgery due to a traffic accident is rare, and in previously reported cases, such hemorrhage has been roughly classified to be caused by a pregnant [1,2] or non-pregnant uterus [3]. Since there is a high risk of seatbelt injury in a pregnant woman's traffic accident, a seatbelt wearing position that avoids injury to the pregnant uterus is recommended due to the recent spread and obligatory use of seatbelts. Giant uterine fibroids simulate a pregnant uterus and pose a similar injury risk, even in non-pregnant women. Even slight external force in women with large-sized uterine fibroids can cause spontaneous intra-abdominal hemorrhage due to the rupture of superficial veins, and fibroids larger than 10 cm pose a high risk [4]. In the present case, the “submarine effect” was suspected to cause injury. The “submarine effect” refers to the sinking of the patient's body in the forward direction due to the impact of collision even if the seatbelt is properly attached to the ilium, causing the seatbelt to deviate upward and directly compress the abdominal organs (Fig. 3) [5,6]. The abdominal wall and gastrointestinal tract have been reported to be injured because of the submarine effect owing to their position with respect to the seat belt, but in women, the risk of injury to the uterus must also be considered. In addition, if women with a pregnant uterus or uterine tumor are accident victims, injury to the uterus should be suspected.

Even if the cause of bleeding is injury to a gynecological organ, clinical guidelines for blunt abdominal trauma in a physiologically critical situation are similar [3]: rapid resuscitation of physiological instability is a top priority in clinical practice. In the present case, the woman's carotid artery became unpalpable after the HEMS physician performed thoracostomy and tracheal intubation in the prehospital setting. Therefore, prehospital resuscitative thoracotomy (pRT) was performed, and the patient was transported under

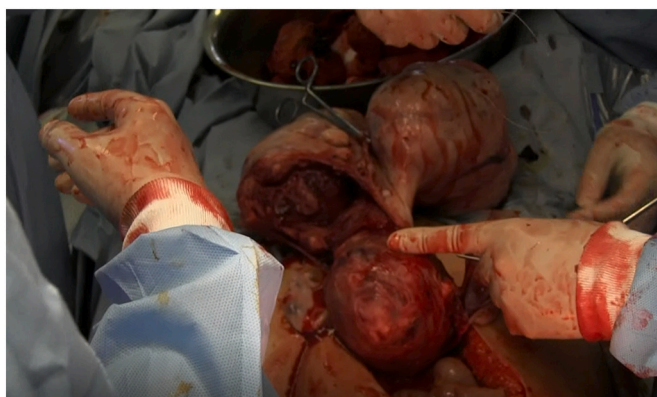


Fig. 1. Intraoperative findings; huge fibroids avulsed from uterine wall.

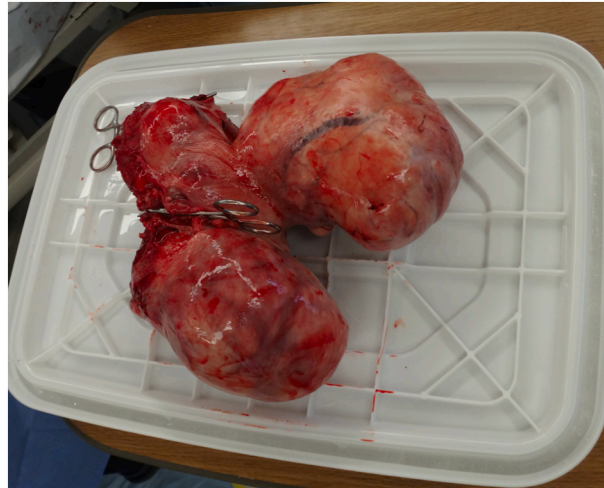


Fig. 2. Removed fibroids; maximum diameter 25 cm, 2830 g.

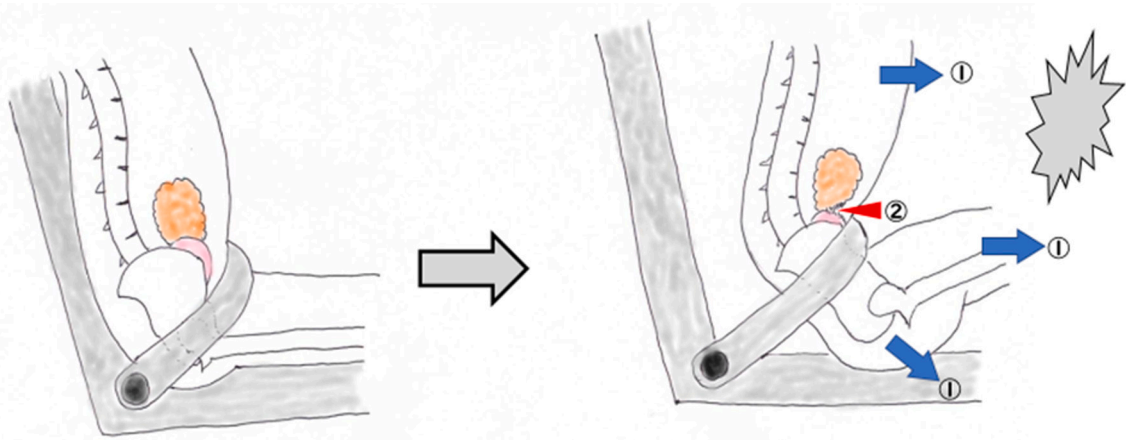


Fig. 3. Injury mechanism.

- ① The impact of the collision causes the occupant's body to sink, and the seat belt fixed to the ilium slips upward, causing an impact on the abdomen (submarine effect).
- ② Strong pressure on the seat belt damaged and exfoliated the neck of the fibroid that had grown outside the uterine wall.

thoracic aortic clamping. When she arrived at the hospital, the aortic occlusion time was 25 min. Therefore, hemostasis was required immediately after arrival. Although no spinal cord infarction was observed due to the prompt release of aortic clamping, cerebral infarction developed after the operation, and brain dysfunction remained. We believe that hypocirculation and hypoxia are likely to have an effect, but we cannot deny that it may be a direct effect of thoracic aortic clamping. However, for massive intra-abdominal hemorrhage, damage control surgery and rapid blood transfusion were performed immediately after arrival, and the aortic clamping could be released 10 min after the visit, which is probably the most important factor in saving the life. To accelerate the hemostatic surgery, we perform emergency department trauma surgery (EDTS) as needed [7]. Since EDTS requires speed, as in our case, it must be assumed that there will not be enough time to convene organ-specific specialists. Thus, it is important to have a system in which trauma surgeons play a central role in initial EDTS and collaborate with specialists to perform a planned re-operation. There is still no clear evidence for resuscitative thoracotomy for blunt trauma [8,9]. As the indications for resuscitative endovascular balloon occlusion of aorta (REBOA) expand, it is technically possible to achieve aortic clamping with REBOA. However, at present, there are no reports of strategic use of REBOA in an emergency scene, and we consider pRT to be the first choice for prehospital impending cardiac arrest in consideration of promptness and equipment [10].

Conclusion

We report a case of intra-abdominal hemorrhage and impending cardiac arrest due to the avulsion of a large uterine fibroid. A

system is needed that allows trauma surgeons and gynecologists to collaboratively employ a damage control strategy.

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