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CASE REPORT

Large Hematoma Following Ultrasound-Guided Rectus Sheath Block

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Purpose: Rectus sheath block is a commonly used nerve block to reduce pain from abdominal surgery. Although hematoma complications due to vascular injury during nerve block is rare, it remains an important consideration, particularly in cases requiring the use of antithrombogenic agents. In rectus sheath block, anesthesiologists are aware that major vessels subject to needle puncture injury during the procedure include the inferior epigastric artery (IEA) and inferior epigastric vein (IEV). However, increasing use of ultrasound-guided block has resulted in a decrease in significant bleeding risk, including in patients taking antithrombogenic agents. We recently experienced a large subcutaneous hematoma (430 mL) after rectus sheath block. In this case report, we describe the clinical course of the hematoma and discuss its cause and the possible vessels involved, including the IEA and IEV, and branches such as the superior epigastric arteries and veins.

Case Presentation: A 40-year-old female underwent bilateral ultrasound-guided rectus sheath block and transversus abdominis block following laparoscopic cholecystectomy. After the operation, a large, painful hematoma was identified with a volume estimated at 430 mL. Investigation of the bleeding site by CT scan showed that the hematoma was subcutaneous and in an area with multiple venous and arterial branches. Identification of the responsible vessel appeared difficult; however, on discussion with the radiologist, bleeding from a cutaneous (or deeper) vessel from the block or surgical (trocar or needle) injury was included in the different diagnosis. The superficial epigastric artery was considered the most probable source because it was the closest to the hematoma.

Conclusion: Although the IEA and IEV are the major candidates for vascular injury in rectus sheath block, clinicians should recognize that the SEA can also be injured during rectus sheath block procedures.

Keywords: nerve block, vascular injury, superficial epigastric artery, subcutaneous hematoma

Introduction

Nerve blocks of all types carry a shared risk of inadvertent damage or puncture of particular vessels during advancement of the needle and the consequent production of a hematoma. Rectus sheath block – commonly used to reduce pain from abdominal surgery – rarely results in vascular injury and hematoma formation. In this block, the anesthesiologists generally recognize the inferior epigastric artery (IEA) and inferior epigastric vein (IEV) as vessels requiring particular care to avoid injury.

We recently experienced a very large hematoma with an estimated volume of 430 mL after ultrasound-guided rectus sheath block. We had not experienced such a large bleed following nerve block and decided that further investigation of the source and cause should be considered. Suspicion initially fell on the IEA or IEV, but the CT scan showed that the hematoma was located outside the rectus sheath. Attention then focused on the superficial epigastric artery (SEA), which is less familiar to anesthesiologists as a cause of hematoma and might be overlooked.

Here, we describe the development of this large hematoma following rectus sheath block, and factors related to the potentially causative vessels.

Case Report

A 40-year-old female, gravida 8 para 8, with a history of gallstones and right upper quadrant pain underwent an elective laparoscopic cholecystectomy. Her past medical history was otherwise unremarkable, and she was not receiving

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antithrombogenic therapy. Physical examination revealed no abnormalities. Laboratory values were normal (WBC 3.6 × 10^9/L, RBC 3.2 × 10^{12}/L, platelets 2.24 × 10^9/L, PT 11.3 sec, APTT 28.8 sec, total bilirubin 6.8 μmol/L, SGOT 38 U/L, SGPT 15 U/L, BUN 2.2 mmol/L, creatinine 49.5 μmol/L). Height and weight were 161 cm and 53 kg (BMI = 20.5), respectively. Chest x-ray and ECG were normal. The laparoscopic cholecystectomy was performed smoothly using 4 trocars, including the umbilicus. Post-operatively, but while still under general anesthesia, bilateral rectus sheath blocks (RSBs) and transversus abdominis blocks (TAPs) were performed under ultrasound guidance. The needles for the RSBs and TAPs were inserted with an in-plane approach and positioned just lateral to the umbilicus, with needle directions from medial to lateral in each site. In RSB, the vessels were checked using color Doppler before insertion of the needle, but no pulsatile vessels were visualized on the image. Approximately, 15 mL of 0.2% ropivacaine was infused into each site (60 mL in total) using a 22 G nerve blockade needle (CCR-needle: Echogenic Needle Type CCR, Hakko, Nagano, Japan). Sixty milliliters of 0.2% ropivacaine infusion was considered an appropriate dose and concentration in terms of local anesthetic toxicity.[1] The patient emerged from anesthesia smoothly. Just before she left the operating room, an approx. 5 mm subcutaneous periumbilical hematoma on the puncture site of the right RSB was noted by the nurse in charge. This was covered with a dressing by the nurse, and the patient was returned to the ward. Approximately, one hour later, the patient complained of severe abdominal pain (numerical rating scale 10/10). The surgeon and anesthesiologist were called to her room and examined her abdomen. The peri-umbilicus was found to be bulging where the patient complained of pain. Ultrasound examination showed an subcutaneous hypoechoic area with an approximate size of 5 cm which was considered a hematoma. However, the actively bleeding vessel could not be observed on the color Doppler image around that area. We decided the patient did not require surgical intervention and instead applied a compressed ice pack and placed the patient under observation. Four hours later, the hematoma had approximately doubled in size. An abdominal CT scan confirmed the presence of a right-sided subcutaneous hematoma which had spread into the subcutaneous fat over the rectus sheath with an estimated volume of 430 mL (Figures 1 and 2).

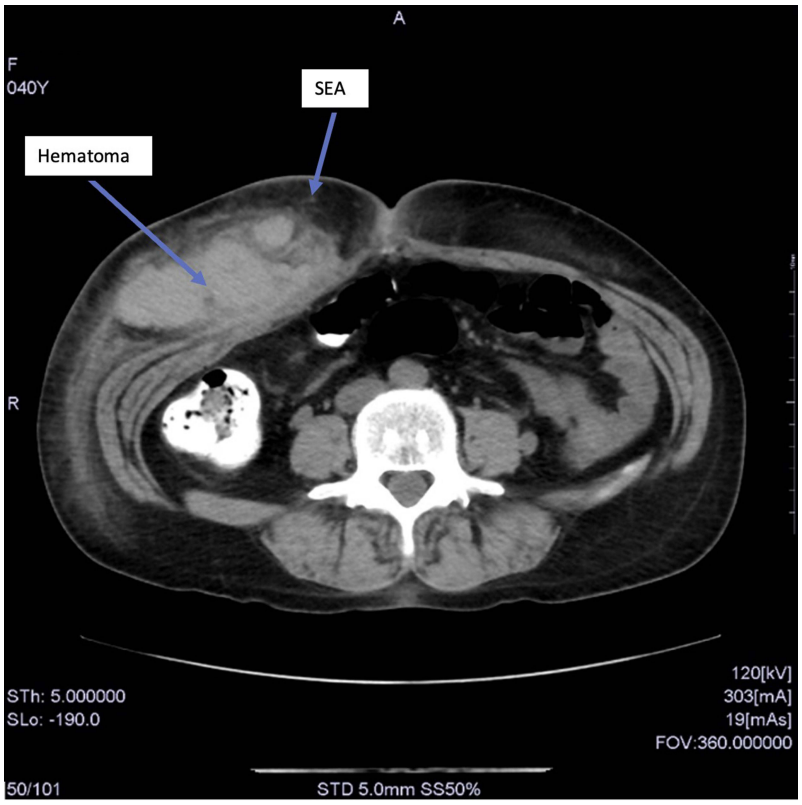

Figure 1 CT scan of the subcutaneous hematoma 4 hours after onset. The hematoma is superficial to the right rectus abdominis muscle (RAM). Both RAMs show marked thinning. A small vessel is visualized anteromedial to the hematoma, and suspected to be the right superficial epigastric artery (SEA).

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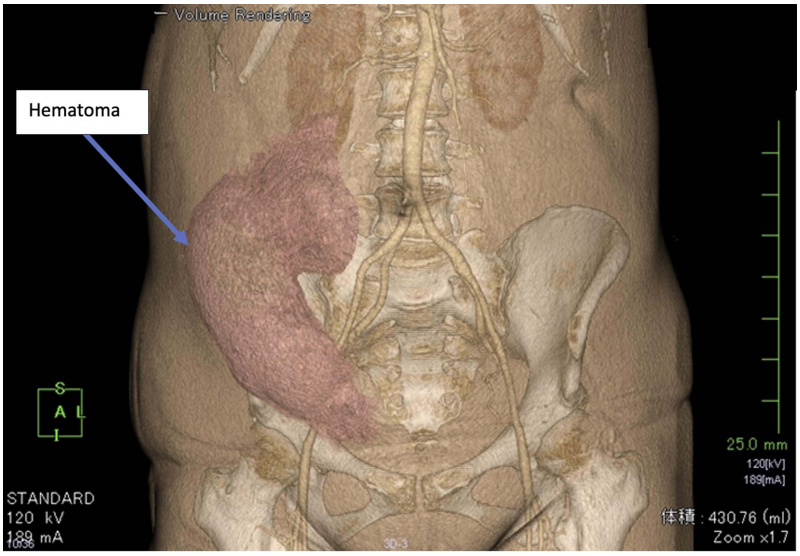

Figure 2 3D-CT 4 of the hematoma 4 hours after onset. The subcutaneous hematoma is clearly visualized.

The CT scan also revealed two intact arteries which were considered to be the superficial epigastric artery (SEA) and IEA near the hematoma (Figures 1–3). The proximal SEA appeared to be truncated, and the IEA was also fully visible. On discussion with the radiologist, a small vessel was identified beside the hematoma (Figure 3), which suggested that the right SEA was a more probable source than the IEA.

The patient's hematoma on post-operative day (POD) 2 is shown in Figure 4. Her Hb had decreased from 12.0 g/L preoperatively to 8.8 g/L on POD 1 and 7.3 g/L on POD 2. She was discharged from the hospital on POD 4 and told to watch and wait regarding her hematoma. The hematoma gradually became smaller, but the intense pain continued for approximately 1 month. The hematoma and pain disappeared completely within about 3 months (Figure 5).

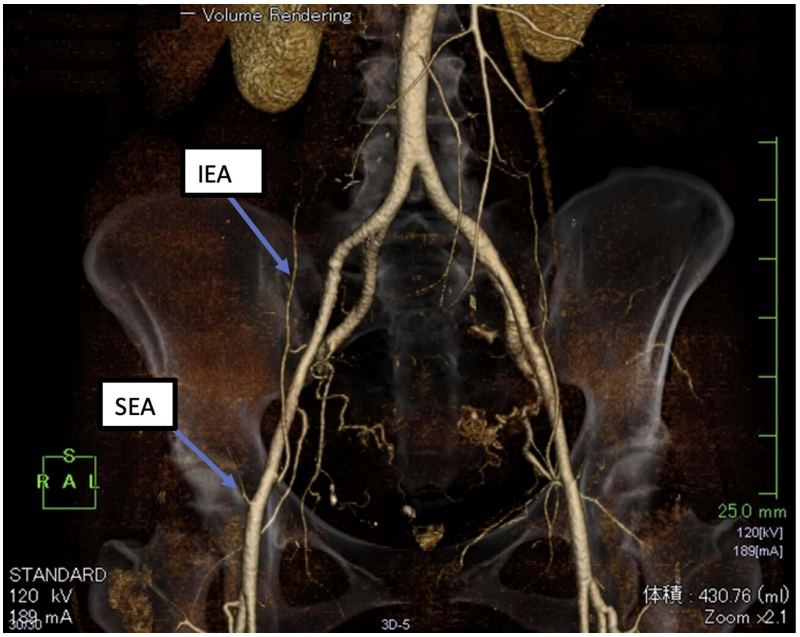

Figure 3 3D CT of the vascular anatomy of the abdomen. The right inferior epigastric artery (IEA) is easily identified but the right superficial epigastric artery (SEA) is not visible where it arises from the femoral artery.

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Figure 4 Surface appearance of the subcutaneous hematoma on postoperative day 2. The hematoma is large and was associated with severe pain.

Figure 5 Surface appearance of the hematoma at 3 months after onset. The hematoma appears completely resolved.

The patient was fully informed prior to giving their consent for the publication of the study, as well as for the accompanying images. The Ethic committee of Yotsuya Medical Cube, Tokyo, Japan, gave the ethical approval for the study.

Discussion

Vascular injury and subsequent hematoma formation are an uncommon but important complication in RSB. In this case, imaging which included the ruptured vessel responsible for the hematoma was discussed with the radiologist (Figures 1–3). On postoperative ultrasound of the rectus abdominis muscle (RAM) and rectus sheath, no active bleeding from the IEA or IEV was identified. The SEAs were not assessed by postoperative ultrasound because the bleed was superficial and could not be visualized clearly. The radiologist suspected that the right SEA was the culprit vessel because the hematoma was outside the RAM, and because the SEA was located near it. Given the marked thinning of the patient's RAM following 8 births, however, the IEA cannot be completely ruled out.

Kwon et al reported that vascular injury after RSB is rare, with an occurrence rate of 0.2% in 4077 studies.[2] Among eight vascular injuries in their study, seven cases were related to the IEA and one to the inferior mesenteric artery. We are unaware of any previous reports of bleeding from the SEA after a rectus sheath block. The inferior mesenteric artery is

intra-abdominal and might be involved in intestinal injury as an additional complication of RSB. The SEA and IEA or their branches form numerous anastomoses between the RAM and posterior layer of the rectus sheath.[2] Additionally, the contour of the abdomen is dependent on several factors, including age, muscle mass, muscle tone, and parity.[3] Our present patient was gravida 8 para 8, and although the vascular architecture appeared normal on US, we cannot rule out the possibility of change associated with her eight pregnancies, including progressive weakening of the abdominal wall. Indeed, her RAM appeared markedly thin on US and CT scan, and we surmised that her fertility might have lead to anatomical changes in some vessels.

Interestingly, the hematoma was first noted as an approx. 5 mm subcutaneous periumbilical hematoma just before the patient left the operating room. This was around 20 minutes after the RSB and TAP. The blood supply to the RAM originates from the SEA and IEA. The SEA arises from the internal thoracic artery and travels caudally within the rectus sheath to anastomose with the IEA. In contrast, the IEA arises from the external iliac artery and travels cephalad along the posterior surface of the rectus muscle, where it lacks the protection of the posterior rectus sheath until it reaches the arcuate line. The arcuate line is located one-third of the distance between the umbilicus and pubic symphysis. Thus, the relatively rapid appearance of blood in this case may suggest that the IEA was causative. Given that the IEA is the main supply for the RAM, the rapid appearance may be consistent with the emergency approach reported by Mantelas et al in a case of rectus sheath hematoma in which conservative therapy failed and instead required emergency ligation of the IEA to ensure immediate hemodynamic stabilization.[4] Generally, hematoma occurring around the rectus sheath is treated conservatively if the patient's hemodynamics are stable, and surgery is considered only if the bleeding cannot be controlled.[5]

The IEA is subject to anatomical variation. Commonly it runs under the RAM but can also run within the muscle.[6] Therefore, regarding needle insertion direction, it is controversial whether medial to lateral insertion avoids the risk of intraperitoneal puncture, but instead increases injury to the IEA because it often runs near the midpoint of the RAM. In contrast, lateral to medial insertion faces the contrary risk.[7] In this case, the medial to lateral approach was selected but still resulted in a hematoma. However, as different cases of nerve block may involve different approaches, this may not be true for all cases of hematoma formation.

In usual anesthesiology practice for RSB, the IEA is considered the most important artery to avoid injuring when the needle is advanced.[8] The SEA is an small artery which runs superficially and is not commonly assessed by anesthesiologists, as surgeons are more familiar with its anatomy owing to the protection it requires during trocar insertion.[9] To raise awareness of this possibility, Wong and Merkur outlined a danger zone for damage to the IEA and SEA.[8] First, surgeons and anesthesiologists should recognize this danger. Second, as it is difficult to avoid injury completely because the SEA is a thin artery, the possibility of injury should be kept in mind, together with careful observation for the occurrence of hematoma. The SEA is a very superficial vessel and if a small hematoma occurs, it would appear easy to compress the site before enlargement occurs.

Conclusion

This case illustrates the need for caution in RSB not only for the IEA and IEV but also for the SEA to avoid punctures that can lead to giant hematomas. Further consideration should be given to multiple births and the possible effect of the resulting anatomical characteristics on the risk of vessel injury. The use of color Doppler and the direction of needle insertion may be relevant to avoiding the vessel puncture which causes this kind of rare complication. In RSB, the SEA may be the pitfall as the cause of the injury. However, it is a small artery, and might be difficult to assess before the procedure, and thereby completely avoid puncture. Recognition of the risk of hematoma in RSB and observation for its occurrence are required.

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Disclosure

The author reports no conflicts of interest in this work.

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