Endovascular Embolisation for Rectus Sheath Haematoma

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ABSTRACT

Objective: To review outcomes of patients who underwent endovascular embolisation for rectus sheath haematoma (RSH).

Methods: We retrospectively reviewed patients who underwent endovascular embolisation for RSH from January 2013 to March 2016 in a regional hospital in Hong Kong.

Results: Six women aged 55 to 93 (mean, 76) years underwent endovascular embolisation after conservative management for RSH had failed. All were prescribed anticoagulants. Clinical presentations included the presence of an abdominal mass, acute abdominal pain, and hypotension, as well as haemoglobin drop of ≥3 g/dl, haemodynamic instability, and persistent active bleeding. Computed tomographic angiography confirmed a large RSH with contrast extravasation in all patients. Digital subtraction angiography (DSA) demonstrated contrast extravasation from the inferior epigastric artery (n = 4) and superior epigastric artery (n = 1) in four patients. The affected arteries were accessed by retrograde placement of a 5-Fr arterial sheath, and cannulated by a Cobra-I catheter (5 Fr or 4 Fr) over a hydrophilic guidewire. The inferior epigastric artery (n = 6) and superior epigastric artery (n = 1) were superselectively cannulated using a microcatheter to enable more precise dispersion of embolic agents. DSA was performed at the external iliac artery and inferior epigastric artery ipsilateral to the side of RSH. The embolic agents used were platinum microcoils (n = 1) and polyvinyl alcohol particles (n = 5). All patients achieved haemostasis with stabilisation of haemodynamic status and haemoglobin level, and absence of contrast extravasation. Two patients had endovascular-related complications: one sustained injury to the left inferior epigastric artery and was treated with coil embolisation; another developed haematoma around the puncture site 9 days later and was treated with surgical ligation of the feeding artery. Both patients were eventually discharged. One patient died from severe pneumonia complicated with myocardial infarction.

Conclusion: Endovascular embolisation is a safe and effective option for severe RSH in which conservative treatment has failed.

Key Words: Embolization, therapeutic; Hematoma; Rectus abdominis

中文摘要

血管內栓塞治療腹直肌鞘膜血腫

鄭希敏、曹君彥、梁錦榮、簡偉權

目的：回顧經血管內栓塞治療腹直肌鞘膜血腫（RSH）的患者。

方法：我們回顧分析2013年1月至2016年3月期間接受血管內栓塞治療RSH患者的治療結果。
INTRODUCTION
Rectus sheath haematoma (RSH) typically has a self-limiting course and responds well to conservative treatment. It can, however, result in life-threatening or fatal haemorrhage. With the increasing use of anticoagulants, RSH has become more prevalent. Prompt diagnosis of severe RSH is important to facilitate endovascular embolisation.

METHODS
The study was conducted in compliance with the Declaration of Helsinki. We retrospectively reviewed six patients who underwent endovascular embolisation for RSH from January 2013 to March 2016 in a regional hospital in Hong Kong. Details of their clinical record, drug history, and laboratory data were extracted from the electronic patient record. Computed tomography (CT) angiography and digital subtraction angiography (DSA) findings were reviewed on the picture archiving and communication system (Figures 1 to 3).

RESULTS
Six women aged 55 to 93 (mean, 76) years who underwent endovascular embolisation after conservative...
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Figure 2. (a) Coronal and (b) axial reformatted maximum intensity projection images of contrast-enhanced computed tomography in the arterial phase showing a type-III rectus sheath haematoma crossing the midline with posterior extension to the pelvic pre-peritoneal space and minimal contrast extravasation from the right inferior epigastric artery (arrow).

Figure 3. (a) Axial and (b) coronal maximum intensity projection images of contrast-enhanced computed tomography showing left rectus sheath haematoma with fluid-fluid levels and contrast extravasation (arrows). Digital subtraction angiography showing (c) extravasation from the left superior epigastric artery (arrows) and (d) embolisation with microcoil (arrow). (e) Follow-up computed tomography showing the microcoil and resolved left rectus sheath haematoma (arrow).
management for RSH had failed were retrospectively reviewed (Table 1). All were prescribed anticoagulants; two were also prescribed antiplatelet drugs. Clinical presentations included the presence of abdominal mass, acute abdominal pain, and hypotension, as well as haemoglobin drop of ≥3 g/dL, haemodynamic instability, and persistent active bleeding. CT angiography confirmed a large RSH with active contrast extravasation in all patients; three of which extended beyond the rectus abdominis sheath to the pelvic preperitoneal space.

Under ultrasound guidance and local anaesthesia, DSA was performed through the common femoral artery contralateral to the side of RSH using a micropuncture set. Active contrast extravasation from the inferior epigastric artery (n = 4) and superior epigastric artery (n = 1) was shown in four patients. The affected arteries were accessed by retrograde placement of a 5-Fr arterial sheath, and cannulated with a Cobra-I catheter (5 Fr or 4 Fr) [Cook Medical, Bloomington [IN], USA] over a hydrophilic guidewire, crossing the aortic bifurcation to cannulate the external iliac artery and the origin of the inferior epigastric artery ipsilateral to the side of RSH. The inferior epigastric artery (n = 6) and superior epigastric artery (n = 1) was superselectively cannulated using a microcatheter (2.8-Fr Renegade HI-FLO [Boston Scientific, Natick, USA] or 2.7-Fr Progreat [Terumo, Tokyo, Japan]) to enable more precise dispersion of embolic agents. DSA was performed at the external iliac artery and inferior epigastric artery ipsilateral to the side of RSH. The embolic agents used were platinum microcoils (Cook Medical, Bloomington [IN], USA) [n = 1] and polyvinyl alcohol particles (355-500 μm; Boston Scientific, Natick [MA], USA) [n = 5]. Microcoils were used when the targeted vessels were proximal or larger. Polyvinyl alcohol particles were used when targeted vessels were smaller or when initial DSA did not demonstrate active extravasation. All patients achieved haemostasis, with stabilisation of haemodynamic status and haemoglobin level, and absence of contrast extravasation.

Two patients had endovascular-related complications: one sustained injury to the left inferior epigastric artery related to micro-guidewire manipulation and was treated with coil embolisation; another developed haematoma around the puncture site at the common femoral artery 9 days later (probably owing to delayed removal of the arterial sheath due to coagulopathy) and was treated with surgical ligation of the feeding artery. A vascular closure device may be used in future. Both patients were eventually discharged. One patient died from severe pneumonia complicated with myocardial infarction.

**DISCUSSION**

RSH occurs more commonly in elderly females, with a female-to-male ratio of 1.8:1, and particularly in those prescribed anticoagulants. Other predisposing conditions include atherosclerosis, hypertension, renal insufficiency, thin body habitus, recent abdominal surgery, repeated subcutaneous injections, and chronic increased intra-abdominal pressure from coughing and straining. Increasing use of anticoagulants and wider use of CT has resulted in increased detection of RSH. RSH occurs more frequently in the inferior and posterior portions of the two rectus abdominis muscles, owing to the anatomy of the ventral abdominal wall. The paired vertically aligned muscles are horizontally divided by an arcuate line located about 5 cm below the umbilicus. Above the arcuate line, the rectus muscles are enclosed within a strong aponeurosis that comprises the external and internal oblique and transverse muscles. Below the arcuate line, only the transversalis fascia and peritoneum separate the muscles from the abdominal compartment. The lower portions of the rectus muscles are also the longest and hence the most shortened portions during muscle contractions.

Arterial supply to the rectus muscles derives from the superior epigastric arteries (the terminal branches of the internal thoracic arteries) and the inferior epigastric arteries (that originate from the external iliac arteries). They course between the posterior aspects of the muscles and the rectus sheath, and form an anastomosis within the muscles. The inferior epigastric arteries pierce the transversalis fascia and ascend anterior to the arcuate line. Due to the weaker fascial support, greater muscle shortening during contractions and the insertion of inferior epigastric arteries, RSH occurs more commonly at the lower portions, with rupture into the pelvic pre-peritoneal space when they enlarge. Females usually have a reduced muscle bulk and hence less protection against muscle and vascular injuries.

Diagnosis of RSH requires a high degree of clinical suspicion due to its rarity and non-specific symptoms. In patients with haemodynamic instability, CT with intravenous contrast agent is the preferred imaging technique with high accuracy, efficiency, and operator
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**Table 1. Clinical details, treatment, and outcome of patients.**

<table>
<thead>
<tr>
<th>Sex / age (years)</th>
<th>Anticoagulation / antiplatelet used</th>
<th>Indication for anticoagulation</th>
<th>Abnormal coagulation profile</th>
<th>Haemoglobin drop of ≥3 g/dl</th>
<th>Clinical presentations</th>
<th>Transfusion</th>
<th>Fresh frozen plasma</th>
<th>Medication</th>
</tr>
</thead>
<tbody>
<tr>
<td>F / 81</td>
<td>Warfarin</td>
<td>AF</td>
<td>INR &gt;8</td>
<td>Yes</td>
<td>Hypotension, abdominal mass</td>
<td>Yes</td>
<td>Yes</td>
<td>Factor IX complex</td>
</tr>
<tr>
<td>F / 93</td>
<td>LMWH, aspirin, clopidogrel</td>
<td>STEMI</td>
<td>No</td>
<td>No</td>
<td>Abdominal pain</td>
<td>No</td>
<td>No</td>
<td>-</td>
</tr>
<tr>
<td>F / 82</td>
<td>LMWH, warfarin</td>
<td>DVT</td>
<td>INR = 3.3</td>
<td>Yes</td>
<td>Abdominal mass, pain</td>
<td>Yes</td>
<td>Yes</td>
<td>Vitamin K1</td>
</tr>
<tr>
<td>F / 73</td>
<td>LMWH, aspirin</td>
<td>NSTEMI</td>
<td>No</td>
<td>Yes</td>
<td>Abdominal mass</td>
<td>Yes</td>
<td>No</td>
<td>-</td>
</tr>
<tr>
<td>F / 72</td>
<td>Warfarin</td>
<td>Mitral valve replacement, AF</td>
<td>INR = 3.99</td>
<td>Yes</td>
<td>Abdominal mass, pain</td>
<td>Yes</td>
<td>Yes</td>
<td>Factor IX complex, vitamin K1</td>
</tr>
<tr>
<td>F /55</td>
<td>Heparin</td>
<td>Severe pneumonia on ECMO</td>
<td>APTT = 42 sec</td>
<td>Yes</td>
<td>Hypotension, abdominal mass</td>
<td>Yes</td>
<td>No</td>
<td>-</td>
</tr>
</tbody>
</table>

**Table 2. Classification of rectus sheath hematoma based on clinical and computed tomographic (CT) findings.**

<table>
<thead>
<tr>
<th>Type</th>
<th>Clinical findings</th>
<th>CT findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>No haemodynamic compromise</td>
<td>Unilateral, intramuscular haematoma</td>
</tr>
<tr>
<td>II</td>
<td>Drop in haematocrit level, moderate deterioration in clinical condition</td>
<td>Uni- or bi-lateral, haematoma extending to between rectus muscle and transversalis fascia</td>
</tr>
<tr>
<td>III</td>
<td>Haemodynamic instability, requiring transfusion, fluid resuscitation</td>
<td>Extension of haematoma to peritoneum and prevesical space of Retzius</td>
</tr>
</tbody>
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Abbreviations: AF = atrial fibrillation; APTT = activated partial thromboplastin time; DVT = deep vein thrombosis; ECMO = extracorporeal membrane oxygenation; EIA = external iliac artery; IEA = inferior epigastric artery; INR = international normalised ratio; LMWH = low-molecular-weight heparin; NSTEMI = non-ST elevation myocardial infarction; PVA = polyvinyl alcohol; RSH = rectus sheath haematoma; SEA = superior epigastric artery; STEMI = ST-segment elevation myocardial infarction.

In a classification of RSH based on clinical and CT findings, types of RSH are associated with prognostic implications and therefore help guide management (Table 2). Small RSH (types I and II) can often be managed conservatively because they are usually self-limiting and can be tamponaded by the rectus sheath. Supportive treatment with close monitoring, analgesia, and fluid resuscitation with or without blood transfusion is recommended. For those with a deranged clotting profile, correction of underlying coagulopathy should be performed including withdrawal of anticoagulation and / or antiplatelet medications, administration of vitamin K, factor IX complex (prothrombinex-VF), and fresh frozen plasma. All of our patients had type-III RSH with or without intra-abdominal extension, associated with haemodynamic instability and required surgical or percutaneous endovascular intervention. Surgical procedures include haematoma evacuation, ligation of bleeding vessel, and repair of the rectus sheath. With the advancement of endovascular procedures, endovascular embolisation is the treatment of choice. Selective or superselective catheterisation of the diseased artery through DSA achieves a high success rate. Complications of

independence. CT has a high level of sensitivity (100%) and specificity (100%) in detecting RSH. It can detect the site of active bleeding and delineate the vascular anatomy. In all our patients, the arterial and portovenous or delayed phases of contrast-enhanced CT depicted large haematomas with active contrast extravasation.
endovascular embolisation of RSH include vascular injury (e.g. femoral artery pseudoaneurysm, arterial dissection, and arteriovenous fistula), inadvertent distal embolisation, migration or dislodgement of coil, contrast nephropathy, and ischaemia of the rectus abdominis muscles.12

The major limitation of our study was the small number of patients and lack of comparison with surgical management.

CONCLUSION
Endovascular embolisation is a safe and effective option for severe RSH in which conservative treatment has failed.

CORRECTION
This article was amended on 28 March 2018 to correct the ‘Complications’ column in Table 1. Please see: Hong Kong J Radiol. 2018;21:73 | http://doi.org/10.12809/hkjr1716846-c

REFERENCES