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ORIGINAL ARTICLE

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。

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結果：6名年齡在55至93歲（平均76歲）的女性在保守治療RSH失敗後接受血管內栓塞治療。他們全服用抗凝血藥。臨床表現包括腹部腫塊、急腹痛、低血壓、血紅蛋白下降≥3g / dl、血流不穩定和持續活躍出血。CT血管造影證實有大量RSH，併有造影劑外滲。數字減影血管造影（DSA）顯示下腹壁動脈（n = 4）和上腹壁動脈（n = 1）有造影劑外滲。通過逆行放置5-Fr動脈鞘進入受累的動脈，並通過親水性導絲在Cobra-I導管（5 Fr 或 4 Fr）上插管。將下腹壁動脈（n = 6）和上腹壁動脈（n = 1）用微導管超選擇性插管，以使栓塞劑更精確地注入。DSA在髂外動脈和下腹壁動脈的同側進行。所使用的栓塞劑是鉑微線圈（n = 1）和聚乙烯醇顆粒（n = 5）。所有患者成功止血，血流狀態和血紅蛋白水平穩定，沒有造影劑外滲。兩名患者有血管內相關併發症：一位患者左下腹壁動脈損傷並接受線圈栓塞治療；另一位患者9天後在穿刺部位出現血腫並接受手術結紮供血動脈。兩名病人最終出院。另一位患者因重症肺炎合併心肌梗死死亡。

結論：對於保守治療失敗的嚴重RSH，血管內栓塞是一種安全且有效的選擇。

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

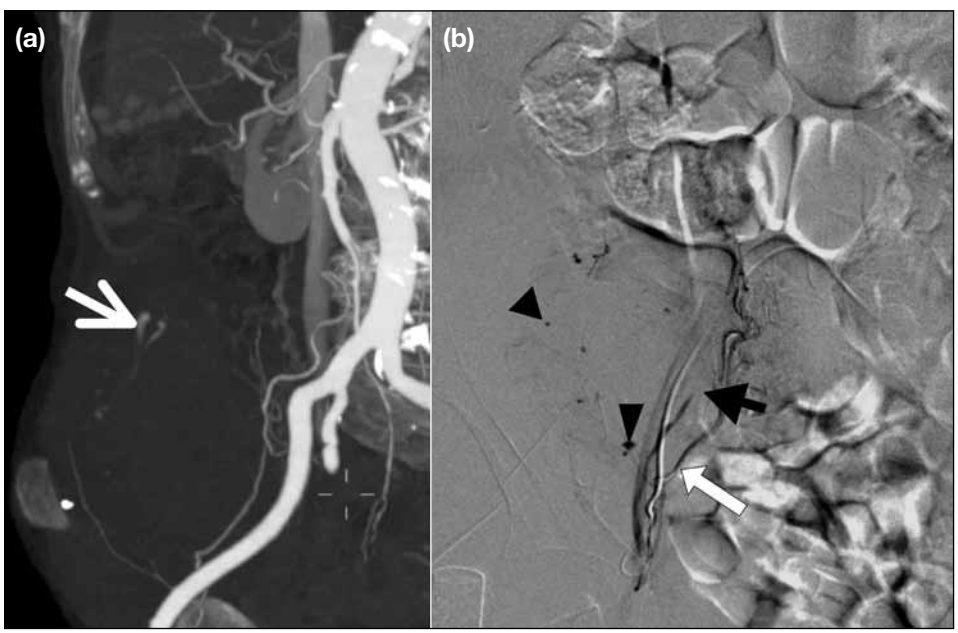

Figure 1. (a) Reformatted maximum intensity projection image of contrast-enhanced computed tomography showing large right rectus sheath haematoma with active contrast extravasation (arrow). (b) Digital subtraction angiography showing cannulation of the right external iliac artery with a 5-Fr catheter (black arrow) and placement of the microcatheter at the right inferior epigastric artery (white arrow), with active contrast extravasation (arrowheads).

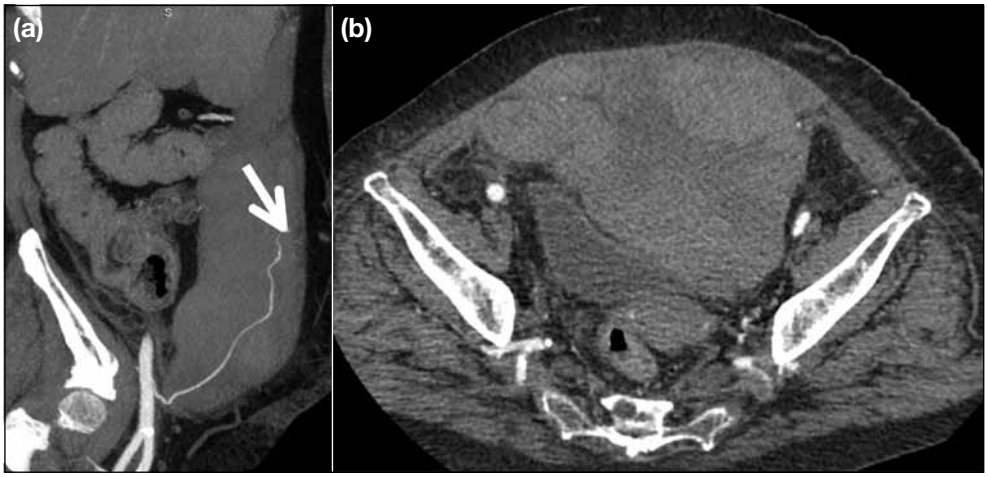

Figure 2. (a) Coronal and (b) axial reformatted maximum intensity projection images of contrast-enhanced computed tomography in the arterial phase showing a type-III rectus sheath haematoma crossing the midline with posterior extension to the pelvic pre-peritoneal space and minimal contrast extravasation from the right inferior epigastric artery (arrow).

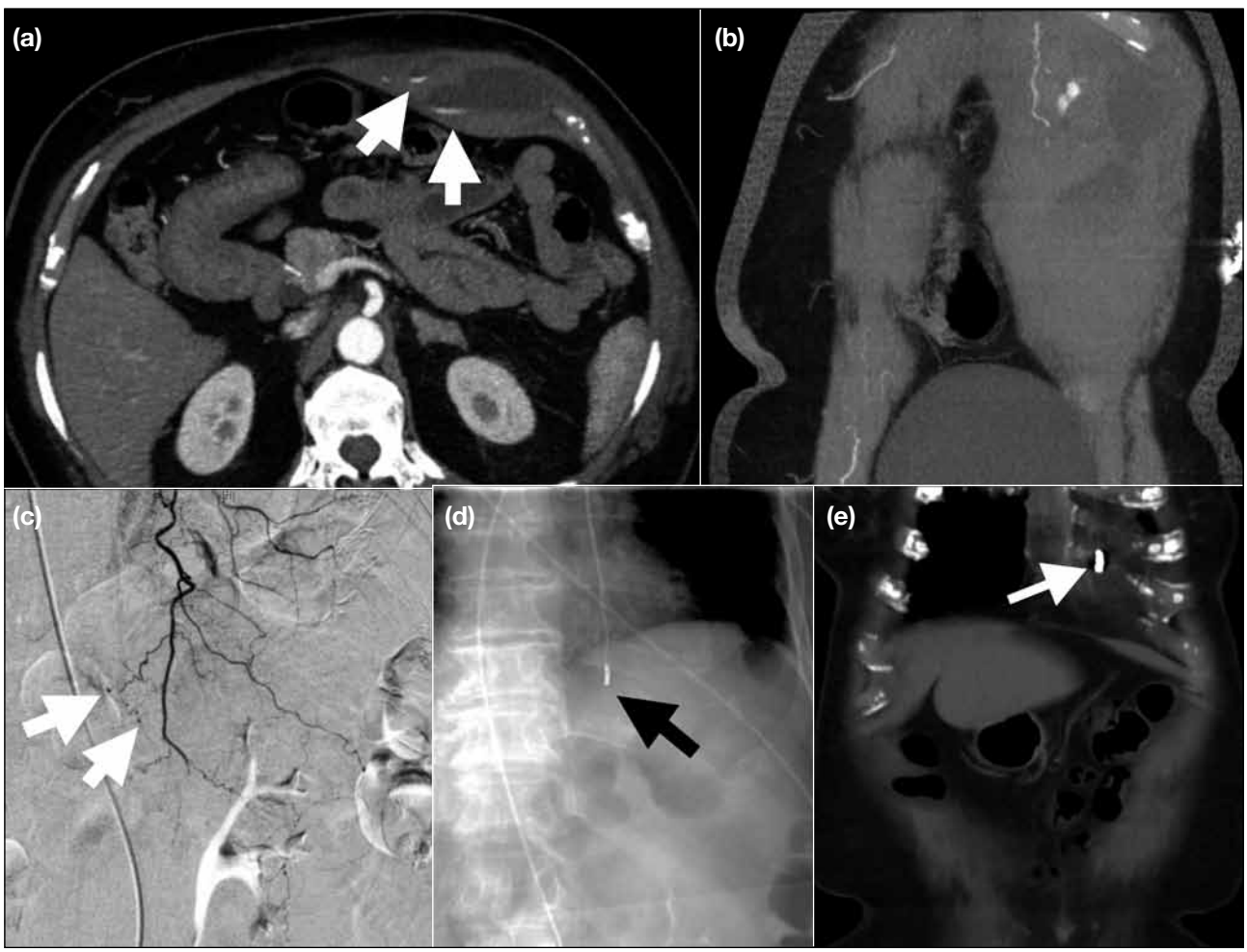

Figure 3. (a) Axial and (b) coronal maximum intensity projection images of contrast-enhanced computed tomography showing left rectus sheath haematoma with fluid-fluid levels and contrast extravasation (arrows). Digital subtraction angiography showing (c) extravasation from the left superior epigastric 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,[1] with a female-to-male ratio of 1.8:1,[2] 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.[2-6] 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.[1,3,6]

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.[1,3,6] 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

Table 1. Clinical details, treatment, and outcome of patients.

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

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.

Table 2. Classification of rectus sheath haematoma based on clinical and computed tomographic (CT) findings.[9]

Type	Clinical findings	CT findings
I	No haemodynamic compromise	Unilateral, intramuscular haematoma
II	Drop in haematocrit level, moderate deterioration in clinical condition	Uni- or bi-lateral, haematoma extending to between rectus muscle and transversalis fascia
III	Haemodynamic instability, requiring transfusion, fluid resuscitation	Extension of haematoma to peritoneum and prevesical space of Retzius

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.[7,8] In all our patients, the arterial and portovenous or delayed phases of contrast-enhanced CT depicted large haematomas with active contrast extravasation.

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).[9] 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

Side of RSH	Size of RSH (cm)	Pelvic extension	Arteries cannulated	Catheters	Embolisation agent	Complications	Length of stay (days)	Outcome
Left	10 x 6 x 23	Yes	EIA, IEA	5-Fr arterial sheath, 5-Fr C1, Dav, 2.8-Fr Renegade HI-FLO microcatheter	PVA particles	-	39	Discharged
Right	5 x 7 x 7	No	EIA, IEA	5-Fr arterial sheath, 5-Fr C1, 2.8-Fr Progreat 2.7-Fr microcatheter	PVA particles	Right groin haematoma at puncture site	39	Death
Left	7 x 11 x 8	Yes	EIA, IEA	5-Fr arterial sheath, 5-Fr C1, 2.8-Fr Renegade HI-FLO microcatheter	Microcoil	-	19	Discharged
Left	2 x 7 x 9	No	EIA, IEA, subclavian artery, SEA	5-Fr arterial sheath, 4-Fr C1, 5-Fr H1, 2.7-Fr Progreat microcatheter	PVA particles	-	65	Discharged
Right	9 x 6 x 14	No	EIA, IEA	5-Fr arterial sheath, 5-Fr C1, 2.8-Fr Progreat 2.7-Fr microcatheter	PVA particles	-	25	Discharged
Right	8 x 12	Yes	EIA, IEA	5-Fr arterial sheath, 5-Fr C1, 2.7-Fr Progreat microcatheter	PVA particles	Injury to left IEA	24	Discharged

catheterisation of the diseased artery through DSA achieves a high success rate.[10,11] Complications of 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.

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