Successful hybrid treatment for huge visceral artery aneurysms with contained rupture complicating segmental arterial mediolysis

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Abstract
Segmental arterial mediolysis (SAM) is a rare arteriopathy that can cause acute abdomen. This report describes the case of a 31-year old male suffering from huge visceral aneurysms with contained rupture. We established a treatment strategy using a hybrid procedure that consisted of endovascular and surgical techniques for these splenic, common hepatic artery and coeliac axis aneurysms related to SAM. The patient was successfully treated with aorto-superior mesenteric artery bypass followed by endovascular aortic stent grafting to interrupt inflow to coeliac aneurysms, and distal splenopancreatectomy with en bloc resection of those aneurysms. We conclude that this hybrid procedure consisting of endovascular and surgical techniques is useful and is a safe treatment option for SAM-related visceral aneurysms.

Keywords: Hybrid operation • Endovascular aortic stent grafting • Aorto-superior mesenteric artery bypass • Segmental arterial mediolysis • Visceral aneurysms

INTRODUCTION
Segmental arterial mediolysis (SAM) is a rare arteriopathy characterized by the development of a dissecting haematoma, aneurysm, occlusion or haemorrhage after lysis of the arterial media [1]. Typical presentation of SAM includes acute onset of abdominal pain from haemorrhage after rupture. Recent advances in vascular surgery and interventional radiology hybridized aortic branch vessel revascularization with endovascular aortic repair allow less invasive, safer and more effective treatment of surgically ill patients affected by thoraco-abdominal aortic aneurysms [2]. The present report describes a patient with contained rupture of coeliac, common hepatic and splenic artery aneurysms complicating SAM. This patient was successfully treated with a hybrid procedure consisting of an endovascular and surgical technique. This patient provided consent for the use of his clinical data, including images, to be published in a medical journal.

CASE REPORT
A 31-year old male patient presented to the Emergency Department of a referral hospital, complaining of sudden onset of abdominal pain. The patient was moderately hypertensive and required continuous infusion of nicardipine hydrochloride to control blood pressure. The patient’s abdomen was diffusely tender with mild firmness. The patient was referred to our hospital with a diagnosis of contained rupture of huge abdominal visceral aneurysms. Computed tomography (CT) and 3D CT angiography revealed huge aneurysms with a cyst-like or beaded appearance along the coeliac axis to the proper hepatic and splenic artery (Fig. 1A–C). This finding was accompanied by extravasation of contrast media, suggesting contained rupture (Fig. 1B). Arterial inflow to the upper abdominal viscera was from the inferior pancreaticoduodenal artery (Fig. 1C). Visceral aneurysms were too enormous to be treated with endovascular coil embolization, and surgical approaches with a low risk of intraoperative sudden rupture were chosen. This strategy was a hybrid operation with the following steps: aorto-superior mesenteric artery (SMA) bypass grafting followed by aortic endografting, distal splenopancreatectomy and en bloc resection of the visceral aneurysms.

Aorto-superior mesenteric artery bypass grafting and endovascular procedure
Under general anaesthesia with a midline incision, end-to-side anastomosis from the saphenous vein graft (SVG) to the SMA and side-to-end anastomosis from the aorta to the SVG were fashioned with 6-0 monofilament non-absorbable continuous sutures, allowing for a sufficient distal landing zone for subsequent endograft deployment. Special attention was paid to the SVG alignment with a lazy C configuration, so as to run along the distal portion of the duodenum.
The introducer for the endovascular stent was delivered from the right femoral artery. A Talent Thoracic Stent Graft System (TF2424C116XJ, Medtronic Cardiovascular™, MN, USA) was introduced with a proximal landing zone at the thoracic descending aorta and with a distal landing zone just above the orifices of the renal arteries. Technical success, as defined by the exclusion of visceral aneurysms and the proximal SMA without intraprocedural evidence of endoleaks, was confirmed by on-table angiographic analysis. The blood flow of the distal SMA was sufficient (>150 ml/min) on flowmetry. Endograft placement can decrease pressure in the aneurysms and allow for easier dissection with a lower risk of rupture.

Distal splenopancreatectomy and en bloc resection of the visceral aneurysms

The distal pancreas and spleen were fully mobilized. The coeliac axis was carefully encircled and then dissected with suture closure. Dense adhesions between the aneurysms and the superior mesenteric–portal vein were carefully dissected, and the pancreatic neck was resected with electrosurgery. Finally, the specimen, including the distal pancreas, spleen and visceral aneurysms, was resected (Fig. 2A). The operative time was 734 min and the estimated blood loss was 1760 ml. Blood transfusion was not necessary.
Postoperative course

The patient developed a minor pancreatic fistula at the pancreatic stump and acute acalculous cholecystitis by postoperative day 7. Acute acalculous cholecystitis might have been caused by transient insufficiency of hepatic artery flow. These complications required conservative treatment with drain exchange and percutaneous transhepatic gallbladder drainage. The patient was discharged on postoperative day 34 without any liver dysfunction. Pathological examination reported the affected vascular lesions to be compatible with SAM (Fig. 2A). Forty-eight months later, the patient is well, with no additional episodes of abdominal pain. Repeat CT angiography has revealed no progression in the small, segmented, cyst-like arteries that were located on the proximal portion of the inferior pancreaticoduodenal artery (Fig. 2B).

DISCUSSION

In SAM cases, arterial mediolysis results in wall defects that can lead to focal dissection, aneurysm formation, stenosis or haemorrhage caused by rupture of the artery [1]. The fact that the mortality rate of patients who underwent definitive therapy versus those who did not undergo such therapy clearly differed at 18 versus 82% [3] suggests that prompt definitive treatment (e.g. surgery or interventional treatment) is required.

Open repair and endovascular treatment have been used to treat this condition. Obara et al. reported the case of a patient with large splenic and coeliac artery aneurysms who was treated with aortic stent graft implantation and coil embolization of these aneurysms [4]. As an alternative to endovascular treatment, surgical treatment generally consists of surgical ligation or resection of the aneurysm; therefore, neither ligation nor suture closure of the coeliac artery seemed to be appropriate. Direct clamping of the coeliac artery was considered, but we were concerned that intra-aortic balloon occlusion would work insufficiently and result in partial interruption of arterial flow to the aneurysms. Collateral arteries derived from the proximal portion of the SMA also supplied the aneurysms; therefore, neither ligation nor suture closure of the coeliac artery seemed to be appropriate. Direct clamping of the supraceliac abdominal aorta was also considered to require the least manipulations that were associated with unignorable risk of sudden rupture; then vascular surgeons recommended endovascular stenting. To remove visceral aneurysms completely, distal splenopancreatectomy was required, evidently, because those aneurysms were firmly connected to the body and tail of the pancreas.

Ultimately, we chose a hybrid procedure that consisted of endovascular and surgical treatment; this strategy consisted of SMA bypass grafting, endovascular aortic stent grafting and distal splenopancreatectomy with en bloc resection of the visceral aneurysms. Recent advances in endovascular stenting have allowed the development of branched endovascular devices, one of which is designed with chimney endografting to the SMA. Such a device might be able to obviate the need for SMA bypass grafting and endovascular aortic stent grafting, but clinical application of that device has only recently been approved in Japan and was not available at the time of this patient's management. The aneurysm on the inferior pancreaticoduodenal artery was not treated in our patient because of its small size. SAM is associated with periodic development of multiple lesions of the visceral arteries that frequently diminish, partially resolve or remain unchanged during close long-term monitoring [5]. The clinical course of this disease remains controversial, and careful observation is required to monitor disease progression.

To the best of our knowledge, this is the first report of a patient suffering from SAM-related visceral aneurysms who was successfully treated with a hybrid procedure consisting of endovascular and surgical techniques. This approach is a useful and safe treatment option for this condition.

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