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● Case Report ●

Bloodless Surgery for Rupture of Isolated Internal Iliac Artery Aneurysm

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Abstract: Blood-sparing surgical techniques and perioperative medical management allow for complex cardiovascular surgery for patients who refuse blood transfusion. We describe here successful surgical treatment of a ruptured isolated internal iliac artery aneurysm in a Jehovah's Witness patient who was suffering from renal dysfunction, shock, and chronic heart failure and was not a candidate for endovascular therapy. The surgical procedure included ligation, endoaneurysmorrhaphy, and a prosthetic bypass and required meticulous hemostasis, so that blood transfusion was not required. (J Jpn Coll Angiol, 2010, **50**: 203–207)

Key words: internal iliac artery aneurysm, rupture, bloodless surgery

Introduction

An isolated internal iliac artery aneurysm (IIIAA) is rare, accounting for about 1% of all arterial aneurysms and less than 7% of all intra-abdominal aneurysms.[1] Most IIIAAs are asymptomatic until they rupture, and even asymptomatic IIIAAs have a high risk of rupture (40%–80%) and a high postoperative mortality rate (48%).[2] Preventive endovascular repair is appropriate for IIIAA, but specific treatment selection depends on several factors, including patient preference. Jehovah's Witnesses (JWs) refuse blood transfusions, but surgical treatment of JW patients cardiovascular disease is well documented. Ruptured aortic aneurysm and acute aortic dissection, however, were found to present a considerable treatment challenge for such patients.[3] We describe here successful bloodless surgery for a JW patient with a ruptured IIIAA complicated by renal insufficiency, shock, and chronic heart failure.

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Case report

A 75-year-old, obese JW man (body mass index: 32.6) had sudden-onset hypogastric pain for 24 hours, following similar episodes during the preceding 2 months. The patient had undergone aortic and mitral valve replacement 10 years earlier. He was not fully conscious (GCS; $E_3M_4V_3$) and had extreme abdominal tenderness and pale lower legs. An irregular, slightly pulsatile, retroperitoneal mass extended for a width of approximately two fingers above the inguinal ligament. Clinical and laboratory assessments yielded the following results: blood pressure, 76/30 mmHg; pulse, 98 beats/minute; normal electrocardiographic findings; severe anemia; delayed prothrombin time (because of warfarin therapy); severe renal dysfunction; and elevated C-reactive protein level (**Table 1**). Abdominal computed tomography (CT) scanning showed massive retroperitoneal bleeding and a capsulation hematoma due to a 7-cm ruptured left IIA (**Fig. 1**). Compression of the left ureter by the aneurysm had apparently produced hydronephrosis. This emergency situation was first evaluated by our staff and then discussed with the patient's family and members of a medical care organization committee associated with JWs.

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Table 1 Preoperative laboratory data

Urinalysis:	
Glucose	1+
Protein	2
Occult	1+
Peripheral blood:	
White blood cell	11,700/mm^3
Red blood cell	177×10^4/mm^3
Hemoglobin	4.6 g/dl
Hematocrit	14.3%
Platelet	10.9×10^4/mm^3
Chemistry:	
Total protein	3.5 g/dl
Albumin	2.0 g/dl
AST	22 IU/l
ALT	12 IU/l
LDH	314 IU/l
ALP	163 IU/l
CPK	536 IU/l
Total bilirubin	0.4 mg/dl
BUN	106.2 mg/dl
Creatinine	4.26 mg/dl
Na	128 mEq/l
K	6.0 mEq/l
Cl	101 mEq/l
CRP	6.4 mg/dl
Coagulation test:	
PT-INR	5.2
FDP	550 mg/dl
D-dimmer	2.34 mg/ml
Fibrinogen	303
TAT	4.5 mg/ml

We engaged in extensive discussions about the natural disease course standard and modified surgical strategies (options of further observation versus embolization, endovascular or open repair), the possible risks of surgery, the need for blood and blood products during surgery and postoperatively, and postoperative course. The committee members agreed to surgical therapy, but they refused transfusion of allogenic blood and blood products. However, they agreed to cell salvage blood replacement as long as the blood was kept in a circuit in continuity with his body's circulation. We then decided to operate on the patient and evaluated various data such as CT and laboratory data to plan our surgical strategy, which we dis-

Figure 1
Preoperative abdominal computed tomography scans.
A: Coronal view shows a large isolated internal iliac artery aneurysm compressing the bladder.
B: A capsulation hematoma and hemorrhage in the pelvis appear as a mixture of low and high density, indicating rupture and gradual enlargement of the aneurysm. Hydronephrosis of the left kidney is presumably the result of compression of the left ureter by the hematoma and aneurysm.
C: Sagittal view shows normal diameter of the infrarenal aorta.

cussed with the committee members. Finally, written informed consent and an agreement regarding refusal of blood transfusion and release from liability were obtained (**Table 2, 3**).

A total intravenous technique was used for continuous high FiO_2 and hypotensive anesthesia. The patient was placed in the Trendelenburg position and a left radial artery catheter and a pulmonary artery catheter were used for hemodynamic monitoring.[4] An incision made in the left groin was extended along the common femoral artery (CFA). Occlusion for hypotension was attained with a Fogarty 8/14 F occlusion catheter (Edwards Lifesciences, Irvine, CA) inflated in the left common iliac artery. Through a medial xiphopubic laparotomy, intraoperative salvaging autologous blood transfusion with washing (Cell Saver; Haemonetics Corporation, Braintree, NA) was used for suction in case of intraperitoneal/retoperitoneal hemorrhage or hematoma before and after optimal irrigation with saline. The Cell Saver's disposal volume was 3367 ml, and the volume of autotransfusion was 780 ml. The Cell Saver was thus used to eliminate the need for red blood cell transfusion and also to maintain circulating volume and tissue oxygen transfer.[5]

The distal abdominal aorta was mobilized, and the left common and external iliac arteries were exposed. After heparinization,[6] these vessels were clamped close to the origin of the hypogastric artery. The anterior aneurysm wall was excised, and backbleeding was controlled by suture ligation of the ostia of the branch vessels with the obliterative aneurysmorrhaphy technique (endoaneurysmorrhaphy). The distal end of the aneurysm was oversewn. One end of an expanded polytetrafluoroethylene graft was sutured to the right CFA. Thrombi were flushed, and the other end of the graft was sutured to the left CFA (crossover femoro-femoral bypass), because signs of massive atherosclerosis were seen macroscopically and CT imaging findings and condition of the intraoperative field were rather poor. No anatomopathological study was performed. The operation and cross-clamp times were 215 and 21 minutes, respectively; blood loss was 140 ml.

The patient's pain was resolved and no major complications occurred, but his postoperative hemoglobin level was initially 4.8 g/dl. Oral iron supplementation was begun, and erythropoietin was administered until discharge, when his hemoglobin level had reached 8.6 g/dl. Postoperative CT scanning showed

Table 2 Philosophy of Jehovah's Witnesses regarding transfusional therapies

Jehovah's Witnesses are deeply committed to the tenets of their faith, which include the refusal of blood transfusion. Whole blood and its components are clearly prohibited, whereas the acceptance of albumin, immune globulin, hemophilia preparations, vaccines, sera, and organ transplants is an individual decision. Autotransfusion of banked blood or blood products is prohibited because they believe that blood that has left the body is best discarded. Blood remaining in a circuit in continuity with the body's circulation, however, such as during cardiopulmonary bypass, plasmapheresis, or dialysis, is acceptable to many Witnesses. Nonblood plasma expanders, erythropoietin, and the new fluorinated blood substitutes are also generally accepted. Because this philosophy leaves so much to personal discretion, the importance of open and continuous communication between physician and patient cannot be overstated.

- Generally accepted
  - Crystalloids
    - Ringer's lactate
    - Normal saline
    - Hypertonic saline
  - Colloids
    - Dextran
    - Gelatin
    - Hetastarch
  - Perfluorochemicals
  - Erythropoietin
  - Intraoperative salvaging autologous blood transfusion with washing (cell saver)
  - Continuous hemodilution autologous blood transfusion
- Generally not accepted
  - Whole blood and its components
    - Packed red cells
    - Leukocytes
    - Platelets
    - Plasma
  - Autotransfusion of blood or blood components
- Individual decision
  - Cardiopulmonary bypass
  - Dialysis
  - Plasmapheresis
  - Vaccines
  - Sera
  - Immune globulin
  - Albumin
  - Hemophilia preparations
  - Transplants

Table 3

A. Nonblood management principles observed at our hospital
- (1) Examination: Formulate a detailed and individual clinical management plan to minimize blood loss and treat anemia without transfusion.
- (2) Consultation/Explanation/Agreement:
  - a. Discuss our management plan with other physicians regarding their nonblood management procedures.
  - b. Obtain informed consent for anticipated or potential procedures. Discuss the risks and benefits of proposed interventions with the patient/family.
  - c. Obtain written agreement from the patient/family.
- (3) Communication: Depending on the risk of transfusion, treatment and available blood management options, refer patient to another institute if better resources are available.
- (4) Transfer: If necessary, transfer a stabilized patient to a major medical center before the patient's condition deteriorates.

B. Therapeutic principles observed at our hospital
- (1) Adopt a proactive approach including anticipation, preparation, and management steps to prevent uncontrolled blood loss and utilize a combination of interventions.
- (2) Perform a thorough preoperative workup.
- (3) Identify appropriate management strategies to optimize the patient's condition before surgery.
- (4) Minimize diagnostic phlebotomy.
- (5) Combine surgical and anesthetic blood conservation techniques.
- (6) For preoperative patients with acute bleeding and shock, perform immediate concomitant investigation and diagnosis and early intervention aimed at rapid control of hemorrhage.

resolution of the IIIAA, filling of the left external iliac artery by backflow from the bypass, adequate lower-limb vascularization, and graft patency (**Fig. 2**). One year after surgery, the patient was asymptomatic except for anemia.

Discussion

Ruptured IIIAA has a high mortality rate (29%–80%).[1, 2] Causes of death include hemorrhage-induced shock, myocardial infarction, and arrhythmia due to insufficient circulating blood volume. Causes of death may also be considered to include such effects of anemia as myocardial infarction and organopathy due to decreased coronary perfusion pressure resulting from decreased diastolic pressure occurring because of decreased oxygen-carrying capacity or blood viscosity.[7, 8]

Treatments include endovascular intervention, surgical exclusion, aneurysmorrhaphy, resection, and bypass.[9] Endovascular therapy is often selected for patients with a severe, complex disease who are poor candidates for surgery.[10] We could not use a stent-graft in our case because there was insufficient time to prepare a homemade endoprosthesis and manufactured devices had not yet been approved for use in Japan. Moreover,

Figure 2 Multi-slice follow-up computed tomography scan shows resolution of the internal iliac artery aneurysm, filling of the external iliac artery by backflow from the femoro-femoral bypass, and adequate flow in the lower extremities.

any pressure-effect symptoms caused by the aneurysm would not have been relieved by stent-grafting because retrograde flow could have refilled the aneurysm, with the accompanying risk of late rupture and massive hemorrhage, which may also occur after most types of surgery.[11] We therefore ligated the aneurysm, removed the thrombi, excised most of the aneurysmal wall, and performed an endoaneurysmorrhaphy. We chose these procedures in order to avoid buttock necrosis, colitis, paralysis, and technical difficulties associated with hemorrhage from the collateral circulation.[12] In addition, treatment of the renal insufficiency required alleviation of compression of the ureter by the aneurysm.

Although JWs refuse blood component transfusion as part of their religion, surgical treatment of cardiovascular disease of JWs is well documented on a global scale. The following cases are presented to illustrate the various strategies used to enable complex vascular surgery for JWs. However, clinical experience in treating JWs with cardiovascular disease is still limited.[3, 4] In hemodynamic management of JWs with acute bleeding, if hemodynamics can be maintained through such means as crystalloids and colloids, it has been confirmed that oxygen-carrying capacity and organic function can be adequately maintained, even if Hb concentration is temporarily severely reduced.[4, 13] Crises of viability are more closely related to duration than to degree of anemia. Since organic function cannot be maintained in the case of accumulated oxygen debt,[8] we carried out treatment based on this facility's surgical treatment protocol for JWs (**Table 2, 3**) to avoid anemia as early as possible.

Our surgical strategy included endoluminal occlusion of the common iliac artery with a balloon, cell-saver suction of intraperitoneal blood, minimization of cross-clamp and total operating times, insertion of a tube to prevent paralytic ileus, and perioperative normovolemic hemodilution. Our case shows that even the combination of ruptured IIIAA, delayed prothrombin time, chronic heart failure, severe anemia, and the need for an emergency non-endovascular procedure does not preclude successful treatment of JW patients.

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References

1) McCready RA, Pairolero PC, Gilmore JC et al: Isolated iliac artery aneurysms. Surgery, 1983, **93**: 688–693.
2) Lowry SF, Kraft RO: Isolated aneurysms of the iliac artery. Arch Surg, 1978, **113**: 1289–1293.
3) Holt RL, Martin TD, Hess PJ et al: Jehovah's Witnesses requiring complex urgent cardiothoracic surgery. Ann Thorac Surg, 2004, **78**: 695–697.
4) Mann MC, Votto J, Kambe J et al: Management of the severely anemic patient who refuses transfusion: lessons learned during the care of a Jehovah's Witness. Ann Intern Med, 1992, **117**: 1042–1048.
5) Hamasaki N, Yamamoto M: Red blood cell function and blood storage. Vox Sang, 2000, **79**: 191–197.
6) Chinien G, Waltham M, Abisi S et al: Systemic administration of heparin intraoperatively in patients undergoing open repair of leaking abdominal aortic aneurysm may be beneficial and does not cause problems. Vascular, 2008, **16**: 189–193.
7) Crystal GJ, Salem MR: Myocardial oxygen consumption and segmental shortening during selective coronary hemodilution in dogs. Anesth Analg, 1988, **67**: 500–508.
8) Viele MK, Weiskopf RB: What can we learn about the need for transfusion from patients who refuse blood? The experience with Jehovah's Witnesses. Transfusion, 1994, **34**: 396–401.
9) Dix FP, Titi M, Al-Khaffaf H: The isolated internal iliac artery aneurysm—a review. Eur J Vasc Endovasc Surg, 2005, **30**: 119–129.
10) Hachiro Y, Kurimoto Y, Morishita K et al: Endovascular stent grafting for thoracic aneurysms in Jehovah's Witnesses: report of three cases. Surg Today, 2005, **35**: 317–319.
11) Soury P, Brisset D, Gigou F et al: Aneurysms of the internal iliac artery: management strategy. Ann Vasc Surg, 2001, **15**: 321–325.
12) Bao ZM: Ligation of the internal iliac arteries in 110 cases as a hemostatic procedure during suprapubic prostatectomy. J Urol, 1980, **124**: 578.
13) Takaori M, Safar P. Treatment of massive hemorrhage with colloid and crystalloid solutions. Studies in dogs, Jama, 1967, **199**: 297–302.

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