

**Case
Report**

Acute Occlusion of the Abdominal Aorta with Concomitant Internal Iliac Artery Occlusion

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Acute aortic occlusion is a rare but catastrophic pathology with high mortality even after revascularization. We describe four patients who underwent thrombectomy or bypass surgery for acute aortic occlusion with concomitant internal iliac artery occlusion. Two patients (82- and 75-year-old men), who had insufficient reperfusion of bilateral internal iliac arteries after treatment (thrombectomy alone and axillobifemoral bypass, respectively), died on postoperative day three of uncontrollable hyperkalemia and multiple organ failure, respectively (mortality: 50%). The third patient (74-year-old man), in whom the left internal iliac artery was reperfused after an axillobifemoral bypass, underwent right lower limb amputation but survived. The fourth patient (63-year-old man) with sufficient internal iliac artery reperfusion bilaterally after aortobifemoral and right internal iliac artery reconstruction, had an uneventful postoperative course. Elevated creatine phosphokinase and myoglobinuria levels were observed in all four patients but were notably higher in the two patients with no reperfusion in either of the internal iliac arteries. Our results suggest that reperfusion of one or more internal iliac arteries may be a crucial factor in reducing mortality in revascularization treatment of acute aortic occlusion with concomitant internal iliac artery occlusion.

Key words: aortic occlusion, Internal iliac artery, pelvic ischemia

Introduction

Acute aortic occlusion is a rare but catastrophic pathology resulting from thrombus formation, saddle embolism, false-lumen expansion in aortic dissection, aortic trauma, and other etiologies related to arteriosclerosis or hypercoagulability. Postoperative mortality is extremely high^{1–5)} even if blood perfusion to the lower extremities is restored

by emergent surgical intervention. The causes of death are not only associated with major organ ischemia such as stroke, myocardial infarction, hepatic infarction, and mesenteric ischemia, but also with severe respiratory failure, fatal arrhythmia, uncontrollable hyperkalemia or renal failure secondary to myonecrosis. The remaining perfusion deficit of the internal iliac artery after surgical intervention may be a crucial factor in determining the therapeutic results. We describe four patients who underwent thrombectomy or surgical treatment for acute abdominal aortic occlusion with concomitant internal iliac artery occlusion.

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Case Report

Case 1

An 82-year-old man presented to a nearby hospital

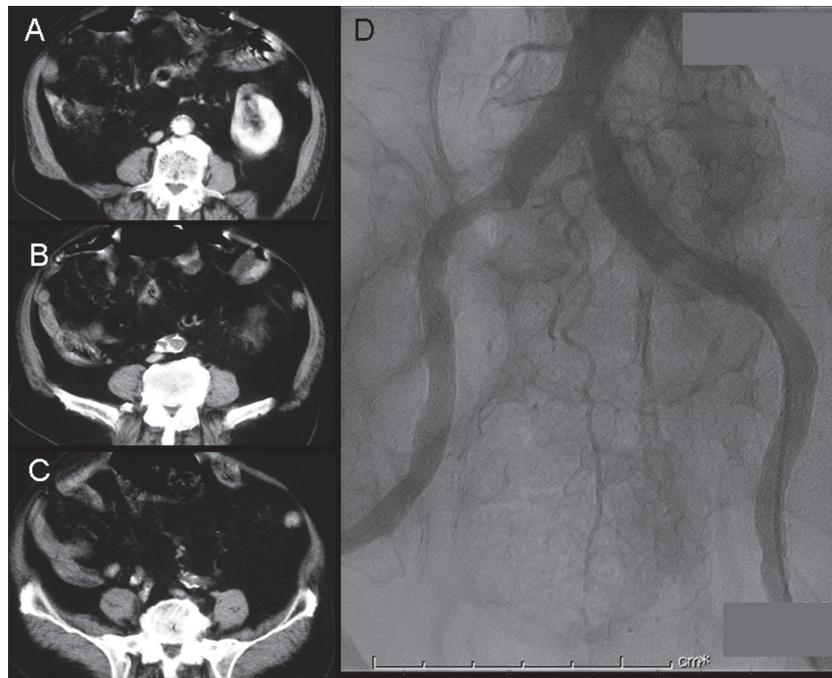


Fig. 1 Cross-sectional computed tomography images before thrombectomy (**A**, **B**, and **C**) and an aortogram after thrombectomy (**D**) in Case 1. **A**: non-aneurysmal aorta at the level proximal to occlusion; **B**: aortic occlusion at the bifurcation level; **C**: bilateral iliac artery occlusion; **D**: total occlusion of bilateral internal iliac arteries.

with sudden pain in the lower back and both lower limbs, which was accompanied by lower limb cyanosis and weakness bilaterally. Computed tomography (CT) scanning revealed occlusion of the infrarenal abdominal aorta and bilateral iliac (including common, external, and internal iliac) arteries (**Fig. 1B** and **1C**). He was referred to our hospital with the diagnosis of acute occlusion of the abdominal aorta. The patient was hemodynamically stable; however, an electrocardiogram showed atrial fibrillation. Physical examination revealed severe cyanosis of bilateral lower limbs with no pulse of the femoral artery or its distal arteries. Laboratory studies disclosed the following values: serum creatine phosphokinase (CPK) 140 IU/l, serum glutamic oxaloacetic transaminase (GOT) 47 IU/l, serum glutamic pyruvic transaminase (GPT) 32 IU/l, serum lactate dehydrogenase (LDH) 429 IU/l, and serum potassium ion concentration ($[K^+]$) 3.6 mEq/l. The patient underwent systemic heparinization and emergent thromboembolectomy with a balloon catheter through bilateral common femoral arteriotomy. Substantial thromboembolic material was retrieved from the femoral artery bilaterally, resulting in successful reperfusion to both lower limbs. Just after revascularization, the patient had no abnormal abdominal findings, and the uri-

nary output was kept constant at over 100 ml/hr with occasional injections of diuretics. However, several hours later he experienced abdominal and buttock pain with slight abdominal distention and myoglobinuria. Metabolic acidosis gradually progressed, requiring correction of acid-base imbalance with a continuous intravenous injection of sodium bicarbonate. Angiography revealed no perfusion of the bilateral internal iliac artery with no occlusion of celiac, mesenteric, renal, or external iliac arteries (**Fig. 1D**). On postoperative day (POD) one, continuous hemodiafiltration (CHDF) was started because of reduced urinary output. Subsequently, the patient required intubation and ventilation because of severe respiratory distress. Postrevascularization laboratory studies revealed the following values: CPK 53081 IU/l, GOT 5621 IU/l, GPT 1159 IU/l, and $[K^+]$ 6.2 mEq/l. The patient died of cardiac arrest due to uncontrollable hyperkalemia on POD 3. Autopsy revealed bilateral thrombosed internal iliac arteries and extensive intestinal ischemia with no occlusion of the celiac or superior mesenteric artery.

Case 2

A 75-year-old man, who had undergone descending

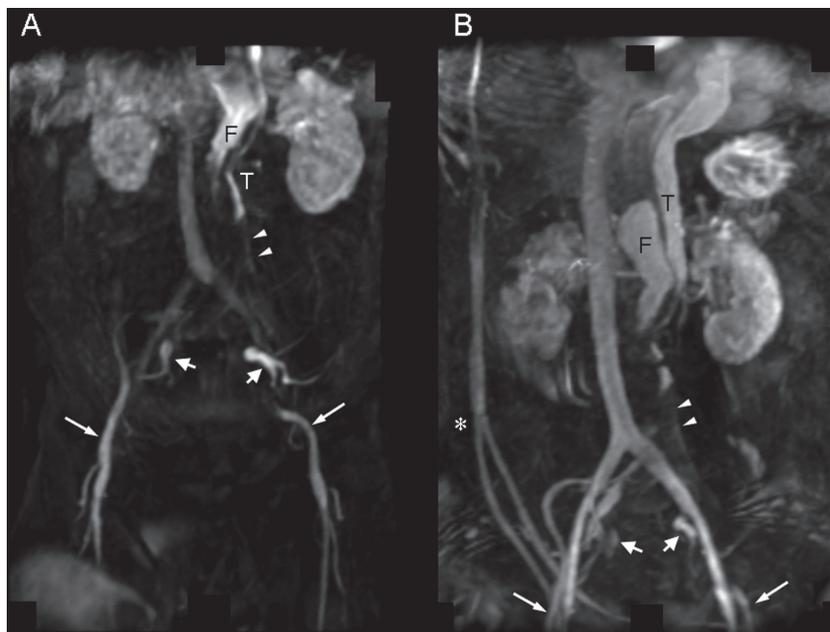


Fig. 2 Magnetic resonance images before and after axillobifemoral bypass surgery (**A** and **B**, respectively) in Case 2. **A**: infrarenal aortic occlusion (arrow heads) distal to the dissecting aorta (T, true lumen; F, false lumen) is seen and bilateral gluteal arteries (short arrows) and femoral arteries (long arrows) are patent; **B**: gluteal arteries are patent bilaterally (short arrows), the right common iliac artery is retrogradely opacified from the right femoral artery, but occluded, and the left iliac artery is not opacified. *: axillobifemoral bypass

thoracic aortic replacement for chronic aortic dissection eight years prior and had been receiving follow-up treatment for arteriosclerosis obliterans, presented to our hospital with sudden weakness in both lower limbs. Several hours later he was unable to walk but had no pain in the lower extremities. Physical examination revealed loss of bilateral femoral pulse but no paleness or cyanosis. He was admitted to our hospital with the diagnosis of a neurological disorder and progression of arteriosclerosis obliterans and received heparinization and an intravenous injection of prostaglandin E_1 . After admission, he had persistent diarrhea with occult blood in his stool, but endoscopic examination revealed no evidence of intestinal ischemia. During the following two days, he developed severe buttock pain and lower limb sensory loss with cyanosis. Magnetic resonance imaging (MRI) revealed a residual false lumen of the dissecting aorta, infrarenal aortic occlusion, and bilateral common and external iliac artery occlusion with bilateral gluteal arteries being patent via collateral arteries (**Fig. 2A**). Laboratory studies revealed the following values: CPK 122 IU/l, GOT 72 IU/l, GPT 61 IU/l, and LDH 777 IU/l. We attempted to perform emergent thrombectomy through

bilateral femoral arteries, but a balloon catheter could not be inserted proximally into either external iliac artery because of arteriosclerosis obliterans. Therefore, a right axillobifemoral bypass was performed with a Dacron graft, resulting in successful distal reperfusion in both sides. After revascularization, however, the patient developed bilateral buttock ischemia with myoglobinuria and severe abdominal distention, and concomitant metabolic acidosis progressed even under a continuous intravenous injection of sodium bicarbonate. MRI at POD 1 revealed insufficient pelvic artery reperfusion and abdominal aortic occlusion (**Fig. 2B**), which was accompanied by extensive intestinal ischemia with renal and hepatic infarction. Abdominal ultrasonography revealed patent celiac and superior mesenteric arteries. Laboratory studies at POD 2 showed the following values: CPK 5636 IU/l, GOT 5000 IU/l, and GPT 4500 IU/l. The patient died of multiple organ failure on POD 3.

Case 3

A 74-year-old man, who had right hemothorax and a spinous process fracture of the cervical vertebra resulting from a traffic accident, was referred to our hospital with

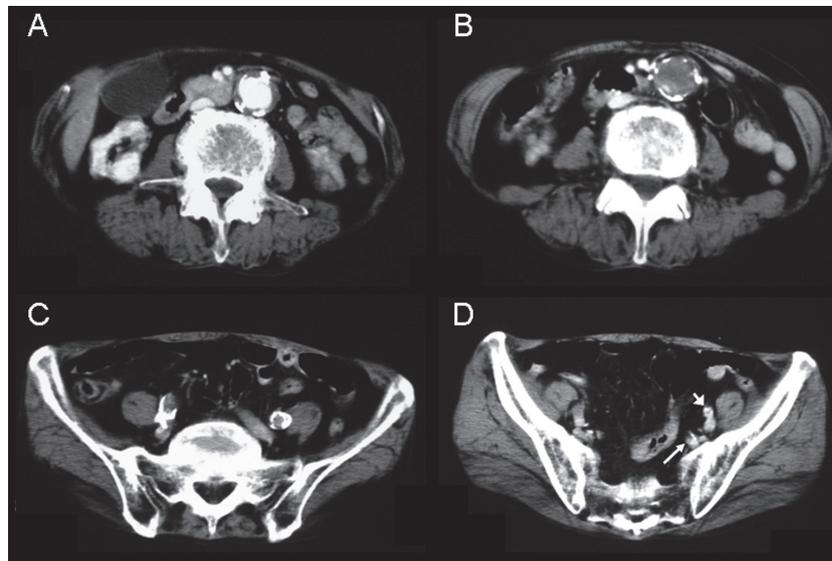


Fig. 3 Preoperative cross-sectional computed tomography images (A, B, C, and D) in Case 3. A: non-aneurysmal aorta at the level proximal to occlusion; B: aortic occlusion; C: common iliac artery occlusion in both sides; D: occluded left external iliac artery (short arrow) and patent left internal iliac artery (long arrow).

the diagnosis of acute aortic occlusion and bilateral lower limb ischemia. CT scanning revealed infrarenal aortic occlusion and bilateral common and external iliac artery occlusion with a patent left internal iliac artery (**Fig. 3**). Laboratory studies yielded the following values: CPK 5406 IU/l, GOT 96 IU/l, GPT 43 IU/l, and LDH 570 IU/l. Emergent thrombectomy through bilateral femoral arteries did not establish adequate blood flow; therefore an axillobifemoral bypass with a Dacron graft was performed, and CHDF was started just after revascularization intraoperatively. However, the patient had to undergo right lower limb amputation at the thigh level because severe ischemia remained in the right lower limb even just after revascularization. Postoperatively, the CPK increased up to 36200 IU/l, but gradually normalized on POD 9 to a level within the normal limits and myoglobinuria gradually disappeared. The patient suffered repeated pneumonia and long-lasting malnutrition as a result of nothing per os for treating ischemic colitis, but he gradually recovered by intravenous alimentation with occasional tube feeding and was discharged four months later.

Case 4

A 63-year-old man presented to a nearby hospital with sudden pain in the right lower limb and was referred to our hospital with the diagnosis of acute aortic occlusion

with acute bilateral lower limb ischemia. CT scanning revealed occlusion of the infrarenal abdominal aorta and the right iliac arteries (ie, common, external and internal) with patent left common and right internal iliac arteries (**Fig. 4A–4C**). Laboratory studies showed the following values: CPK 10825 IU/l, GOT 164 IU/l, GPT 50 IU/l, and LDH 306 IU/l. The patient underwent emergent in situ placement of an aortobifemoral bypass with concomitant reconstruction of the right internal iliac artery using Dacron grafts and inferior mesenteric artery reattachment. CHDF was started just after revascularization intraoperatively. This procedure established successful perfusion of the pelvic area and lower limbs. The CPK was normalized to within normal limits on POD 6. Myoglobinuria disappeared a few days after revascularization. Postoperative CT scanning revealed a patent aortobifemoral graft with adequate internal iliac perfusion (**Fig. 4D**). Besides requiring walking rehabilitation, the patient's postoperative course was uneventful, and he was discharged from the hospital on POD 54.

Discussion

Prognosis of acute aortic occlusion is considerably poor. Postoperative mortality has been reported to be between 14% and 60% in the studies analyzing 10 or more patients with acute aortic occlusion.^{1, 2, 6–11} These

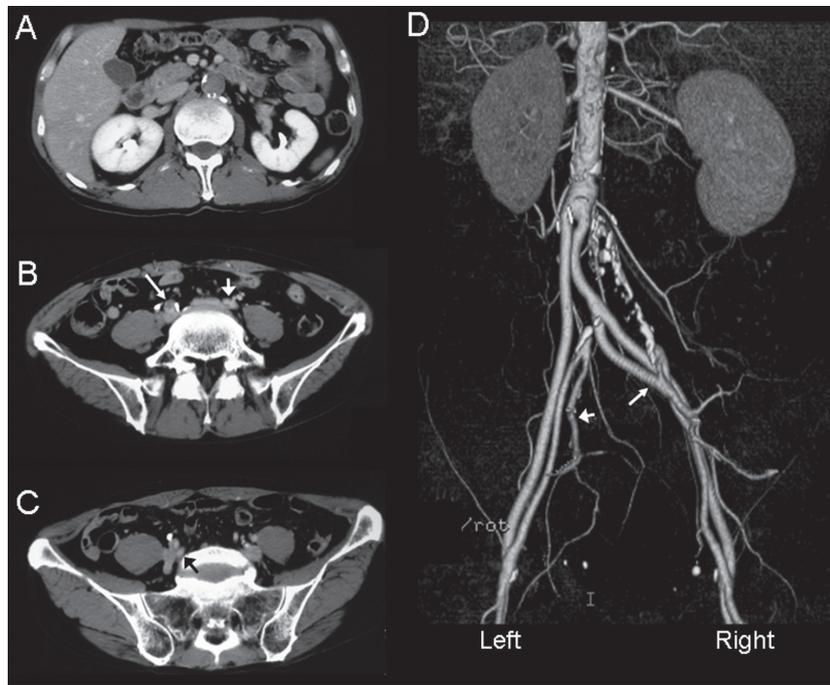


Fig. 4 Preoperative cross-sectional computed tomography images (**A**, **B**, and **C**) and postoperative 3-dimensional computed tomography image (**D**) in Case 4. **A**: non-aneurysmal aorta at the level of occlusion; **B**: occluded right common iliac artery (long arrow) and patent left common iliac artery at the level of iliac bifurcation (short arrow); **C**: patent right internal iliac artery (black arrow); **D**: posterior view after aortobifemoral bypass with right internal iliac artery reconstruction using Dacron grafts (long arrow). The left internal iliac artery (short arrow) is clearly visualized by retrograde flow from the right femoral artery.

studies have shown that the causes of death were attributed to a wide range of pathologies including respiratory failure (eg, respiratory distress syndrome), mesenteric ischemia, fatal arrhythmia, myocardial infarction, stroke, hyperkalemia, or renal failure, and most of the patients who died after revascularization appear to have had fatal organ failure even without obvious arterial occlusion in major organs. This suggests that the cause of death may be related to systemic dissemination of the toxic and inflammatory substances released from the damaged cells of inadequately reperfused tissues (eg, myonecrosis) or organs.

To our knowledge, no study has suggested internal iliac artery occlusion to be a substantial, contributing factor affecting the postoperative mortality of acute aortic occlusion. Danto et al. treated nine patients with acute aortic occlusion and reported that one of them, who also had bilateral internal iliac artery occlusion, died of hyperkalemia five days after only retrograde thrombectomy through bilateral femoral arteriotomy.¹²⁾ In the pres-

ent study, the results of Cases 1 and 2 indicate that thrombectomy only or axillobifemoral bypass without resolving internal iliac artery occlusion would have a minimal effect on postoperative survival, suggesting that remaining buttock or pelvic ischemia with inadequate reperfusion may lead to a lethal outcome even without severe vital-organ ischemia. Gluteal compartment syndrome due to gluteal ischemia in treating abdominal aortic aneurysm has been reported in a patient undergoing unilateral internal iliac artery ligation during open surgery¹³⁾ or unilateral internal iliac artery coil embolization before endovascular repair.¹⁴⁾ Both patients developed a significant elevation of CPK and creatinine levels, a few days after treatment. Karch et al. investigated the influence of internal iliac artery occlusion (20 unilateral and 2 bilateral occlusions) in endovascular repair of 22 patients with abdominal aortic aneurysms and reported that three patients developed colon ischemia (5.0% and 100% in unilateral and bilateral occlusions, respectively).¹⁵⁾ These reports suggest that inadequate internal iliac artery

perfusion could result in gluteal or colon ischemia inducing lethal complications secondary to myonecrosis or mesenteric ischemia.

As a technical consideration in treating acute aortic occlusion, inadequate reperfusion of the internal iliac artery may be a detrimental factor for postoperative survival. If the patient has thrombi in both internal iliac arteries concomitantly with acute aortic occlusion, then retrograde thromboembolectomy with a balloon catheter through bilateral femoral arteriotomy is not effective in restoring adequate blood flow to the internal iliac artery because the thrombus located in the internal iliac artery cannot be removed. If blood flow from the proximal artery is insufficient, an axillobifemoral bypass can be an alternative procedure in order to establish lower limb perfusion. This procedure, however, is not effective in preventing buttock ischemia unless the ipsilateral external and internal iliac arteries are patent. In Case 3 of the present report, preoperative CT scanning showed a patent left internal iliac artery, which may have enabled blood perfusion to the internal iliac artery from a retrograde flow after an axillobifemoral bypass, thus preventing lethal buttock or pelvic ischemia. As shown in Case 4, aortoiliac arterial reconstruction to ensure resumption of blood flow to the internal iliac artery may be an optimal alternative if the patient is able to tolerate laparotomy under general anesthesia.

Detecting insufficient blood flow to the internal iliac artery is difficult, because no monitoring method exists to assess buttock or pelvic perfusion. Continuous elevation of the CPK value, myoglobinuria, and progressive acidosis after only retrograde transfemoral thrombectomy indicates residual ischemia. If the residual ischemia is due to only critical lower limb ischemia, it can be resolved by amputation or distal bypass surgery, whereas if not, sustained unfavorable elevation of biochemical markers with myoglobinuria or progressive acidosis may reflect residual ischemia in the buttock, colon, or pelvic organs. Basically, emergent treatment is essential. Compared with intentional internal iliac artery occlusion, acute aortic occlusion may result in more severe buttock or pelvic ischemia because collateral circulation is obstructed by extensive clot formation in the abdominal aorta and its branches. Further strategic consideration will be required to improve the results of such a catastrophic pathology.

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