

Case Series

Extra – anatomic bypass for abdominal aortic disease in the era of endovascular: A Case Series

Tan Shong Sheng¹, Rosnelifaizur Ramely^{1,2*}, Syaiful Azzam Sopandi³, Mohd Nizam Md Hashim^{1,2}, Wan Zainira Wan Zain^{1,2}, Andee Dzulkarnaen Zakaria^{1,2}

¹Department of Surgery, School of Medical Sciences, Universiti Sains Malaysia Health Campus, Kubang Kerian, Kelantan, Malaysia

²Hospital Universiti Sains Malaysia, Kubang Kerian, Kelantan, Malaysia

³Department of Surgery, Hospital Raja Perempuan Zainab II, Kota Bharu, Kelantan, Malaysia

Corresponding author*: faizur@usm.my

Abstract

The term “extra – anatomic bypass” refers to deliberate avoidance of the natural anatomic route for vascular pathway. Common types of extra – anatomic bypass include axillofemoral and femorofemoro bypasses and their combination, being known as axillobifemoral bypass. There are 2 main purposes for doing so which are: to avoid “hostile” intra-abdominal pathology and to avoid higher risk of transabdominal reconstruction in patients with serious visceral or systemic diseases. We report our case series of extra – anatomic bypass for management of complicated abdominal aortic diseases, namely aortoiliac occlusive disease, chronic contained ruptured aneurysm, mycotic aneurysm, and lastly infected penetrating aortic ulcers. Our case series demonstrated extra – anatomic bypass as suitable operative modality for the abovementioned diseases.

Keywords: aortoiliac disease, abdominal aortic aneurysm (AAA), chronic contained rupture (CCR), extra – anatomic bypass, mycotic aneurysm

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Introduction

The term extra – anatomic bypass refers to deliberate avoidance of the natural anatomical vascular pathway and utilization of vascular substitutes, whose course is different from that of the arteries they are replacing (1). Axillofemoral and femorofemoral bypasses and their combination, also known as axillobifemoral bypass, are among the most usual examples of extra – anatomic bypass. Prevention of abdominal entrance in this situation was due to either to avoid “aggressive” intra – abdominal pathological conditions or to evade the increased risk of transabdominal reconstruction in those with serious visceral or systemic disease (1). There is scarce literature on usage of open extra – anatomic bypass in management of complicated abdominal aortic pathologies in the era of endovascular. We present our case series of extra – anatomic bypasses in managing such conditions.

Case Series

Case 1

A 75-year-old gentleman, with underlying ischemic heart disease, presented with intermittent claudication over left lower limb for past 3 months, worsened over past 1 month. Clinical examination revealed shiny

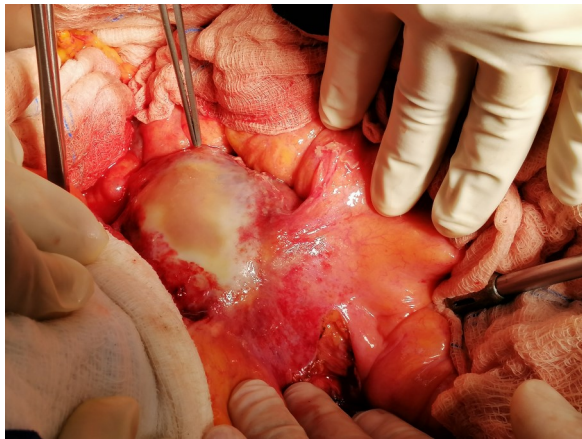
and hairless left lower limb with dry gangrene over left 3rd and 5th toes. CT Angiography bilateral lower limb revealed bilateral peripheral vascular disease with trifurcation diseases (non-opacification of left external iliac, common femoral and left posterior tibial artery). Clinical diagnosis of left chronic limb threatening ischemia (CLTI) with left iliac artery total occlusion was made. He had undergone left axillo – unifemoral bypass, where atheromatous plaque felt over left common femoral up to superficial femoral artery.

Case 2

A 69-year-old gentleman presented with left lumbar pain for past 3 months associated with constipation, worsening for past 2 days. On examination, he had a pulsatile expansile abdominal mass which is mild tender on palpation. CT Aortogram revealed saccular aneurysm of infrarenal abdominal aorta with concealed hematoma and multiple penetrating atherosclerotic ulcers, no CT evidence of active leak. Overall features suggest impending rupture. A transperitoneal approach laparotomy revealed adhesion of infrarenal aortic aneurysm to small bowel and its mesentery was encountered

Case 3

A 66-year-old gentleman presented with fever and lower abdominal pain for a week, associated with loose stool. Clinically tender over left iliac fossa with pulsatile expansile mass. Ultrasound and CT Aortogram revealed suspicions of left common iliac artery mycotic aneurysm. He had undergone left axillo – bifemoral bypass, laparotomy, aneurysmectomy and distal aortic ligation where infected hematoma and contained leak was noted. His blood and intra operative cultures were positive for *Salmonella sp.* (Figure 1). Decision was made for left axillo – bifem-

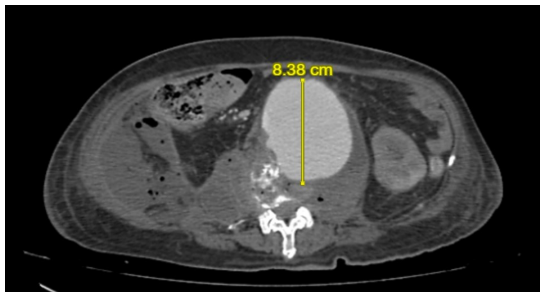


oral bypass followed by infrarenal aortic ligation. Intra operative cultures were negative for bacteria.

Figure 1: Proximal clamping prior to opening sac of chronic contained rupture (CCR) aneurysm, after axillo – bifemoral bypass

Case 4

A 56-year-old gentleman presented with right loin pain for 1 month, radiating to back, associated with lethargy and poor oral intake. Clinical examination revealed tender over right lumbar region with pulsatile mass. CT Aortogram revealed infrarenal abdominal aortic aneurysm with infrarenal paraaortic hematoma (could be chronic leaking) (Figure 2). Intra operative noted sealed ruptured mycotic aneurysm. He had undergone left axillo – bifemoral bypass followed by abdominal aortic aneurysm ligation and



debridement of mycotic aneurysm (Figure 3). His blood culture is positive for *Salmonella sp.*, intra operative culture however was negative.

Figure 2: CT Aortogram showed infrarenal abdominal aortic aneurysm size 8.4cm (AP diameter) with surrounding paraaortic hematoma

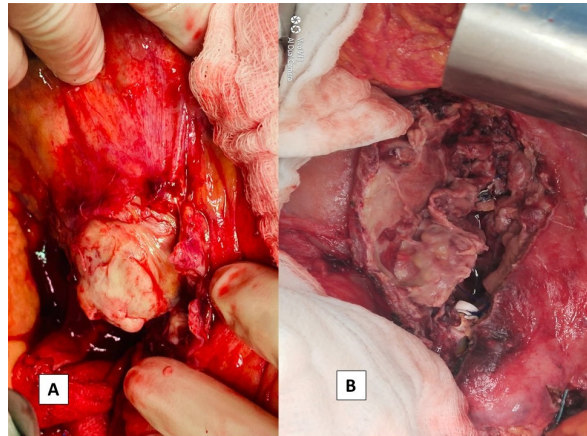


Figure 3: (A) Mycotic aneurysm with bullae seen. (B) Cut open aneurysm

Case 5

A 60-year-old gentleman presented with low back pain for 2 months radiating to suprapubic region associated with fever for 2 weeks. Clinical examination revealed tender over left iliac fossa with pulsatile mass. CT Aortogram revealed fusiform infrarenal abdominal aortic aneurysm with large penetrating atherosclerotic ulcer (Figure 4). He had undergone exploratory laparotomy + left axillo – bifemoral bypass (Figure 5) + lay open aneurysmal sac + infrarenal and inferior mesenteric artery ligation + omental plasty + bilateral common iliac artery ligation. His blood and intra operative specimens revealed positive for *Salmonella sp.*



Figure 4: CT Aortogram showed infrarenal aortic

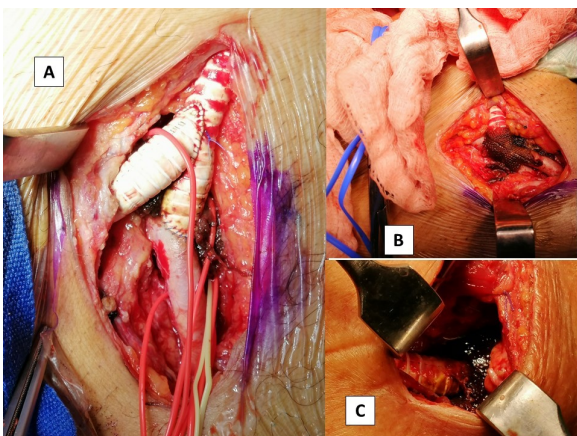


Figure 5: Construction of left axillobifemoral bypass (all using 8mm ePTFE graft with external support ring)

- A) Graft to graft anastomosis external support ring (ETS) to left femoral artery
- B) Right femoral artery and graft anastomosis
- C) Left axillary artery and graft anastomosis

All 5 cases had extra – anatomic bypass done using ePTFE graft. There was no 30 – days postoperative mortality as well as early vascular – related complications. All 5 cases remained alive and continue to follow up in our surgical clinics (mean follow up: 14 months). There was good patency of graft for our patients with no sign of graft thrombosis till present.

Discussion

Our case series demonstrate various spectrum of complicated abdominal aortic disease, from aortoiliac occlusive disease, chronic contained ruptured aneurysm, mycotic aneurysm, and lastly infected penetrating aortic ulcer. All cases had been managed by extra anatomic bypass with certain adjunctive procedures. We would like to discuss the role of extra – anatomic bypass in management of complicated abdominal aortic diseases.

Our first patient had suffered from left CLTI secondary to left iliac artery occlusion, which is among the common sites of chronic atherosclerosis in those with symptomatic occlusive diseases of the lower extremities, besides infrarenal abdominal aorta (2). Occlusive disease in the aortoiliac segment frequently coexists with pathology below the inguinal ligament due to generalized process of arteriosclerosis (3). Management of aortoiliac disease can be classified as anatomic approach, extra anatomic bypass, or various non operative catheter – based endoluminal therapy. Aortoiliac endarterectomy, being anatomic approach has advantage of avoiding usage of prosthetic graft, had been rarely used in current vascular practice (4 – 6).

Endarterectomy is useful for localized aortoiliac disease in 5 – 10% of patients (3), where vast majority of patients with extensive disease benefited from bypass graft with better patency rate (7 – 9).

Rutherford et al. found that treatment of nonocclusive disease with axillobifemoral bypass was beneficial, with 5 years primary and secondary patency rates of 91% and 100% respectively (1). Cautious avoidance of the natural anatomical route of arteries is coined with the term “extra – anatomic bypass” (1,10). Axillobifemoral and femorofemoral bypass and their combination, known as axillobifemoral bypass are among common examples (1). Reasons for extra anatomic bypass include to avoid “aggressive” intra – abdominal pathologic features and to exclude patients with serious comorbidities to the high risk of trans-abdominal reconstruction (1).

A chronic contained abdominal aortic aneurysmal rupture is a well – documented subtype of abdominal aortic aneurysm (AAA) rupture in which characterized by sealed retroperitoneal hematoma (11). Absence of characteristic features of hemorrhagic shock in patients with sealed AAA rupture often possess management dilemma. (11) This group of patients often remained well for variable time frame and may only present with abdominal or back pain, like those uncomplicated AAA (11,12). Despite diagnostic modalities of choice in sealed AAA like contrasted enhanced computed tomography (CT) and magnetic resonance imaging (MRI) (11,13), we have recently dealt with unexpected chronic contained rupture of abdominal aortic aneurysm (CCR – AAA) in our second patient which results in change of operative approach. This gentleman, who had radiologically proven abdominal aortic aneurysm with concealed hematoma and focal intimal calcification discontinuity was presumed to be impending rupture in nature. These radiological findings however found to be due to contained AAA rupture with adhesion to small bowel intra – operatively (11).

Szilagyi et al. first described this phenomenon of chronic contained rupture of abdominal aortic aneurysm (14). CCR – AAA comprises of only 4% of all ruptured cases of AAA (15). To diagnose CCR – AAA, few conditions need to be fulfilled: (i) known case of AAA; (ii) previous pain symptoms that may have resolved; (iii) stable patient with normal hematocrit; (iv) a CT scan demonstrates a retroperitoneal hematoma; and (v) pathological proven organized hematoma (16).

Infected aortic aneurysm can be caused by various types of bacteria, gram – positive and gram negative. *Salmonella sp.* however remained the most common agent, accounting for up to 75% (17 – 21), which correlates with our last three patients, which yield same organism growth in either blood, intra operative specimen cultures or both.

Preliminary axillobifemoral bypass followed by aortic aneurysm resection can be useful to treat infrarenal aortic infections, which can minimize infectious graft complications, further justified by uncertainties of the magnitude of retroperitoneal infection and nature of the causative agent (22).

We had applied such principle for best interest of post operative outcome to our last three patients with diagnosis of mycotic aneurysm and infected penetrating aortic ulcers.

Conclusion

In the era of endovascular therapy, we believe that extra – anatomic bypass followed by adjunctive procedures for intra – abdominal pathologic condition especially

mycotic aneurysm and chronic contained rupture aneurysm which prohibit direct entry to aneurysm sac can be considered as suitable operative modalities.

Extra – anatomic bypass often found to be more effective in managing extensive aortoiliac occlusive disease as well. Our case series had demonstrated good postoperative outcomes for abovementioned patients using extra – anatomic bypass.

Competing interests

There was no funding for the study and no conflicts of interest to disclose.

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