Descending thoracic aortobifemoral bypass in the management of aortic occlusive disease in surgically fit patients: 'the forgotten operation'

Mahmoud Nasser, Hossam Zaghlol

Department of Vascular Surgery, Cairo University, Cairo, Egypt

Correspondence to Mahmoud Nasser, MD, Department of Vascular Surgery, Cairo University, Cairo, 11213, Egypt.
Tel: +20 100 171 8859;
e-mail: mahmoud.nasser@kasralainy.edu.eg

Received 18 January 2019
Accepted 20 February 2019

The Egyptian Journal of Surgery 2019, 38:424–428

Aim of the work
To study the efficacy of using the descending thoracic aorta as the inflow artery for patients with aortoiliac occlusions regarding its morbidity, mortality, and patency rate.
Patients and methods
This is a prospective study done in Cairo University Hospitals from May 2014 till November 2018 using the descending thoracic aortobifemoral bypass. Inclusion criteria included surgically fit patients with juxtrarenal aortic occlusion or hostile abdomen. Exclusion criteria included unfit surgical patients and/or no adequate runoff vessel and/or contraindications for thoracotomy.
Results
This study included 15 patients, who underwent descending thoracic aortobifemoral bypass, with 12 male and three female patients, with a patient mean age of 61 years. Patient presentations were disabling claudication pain in eight (53.3%) patients, rest pain in four (26.7%) patients, and tissue loss in three (20%) patients. Indications of intervention were juxtarenal aortic block in nine (60%) patients and hostile abdomen in six (40%) patients. Estimated blood loss ranged from 500 to 900 ml. The duration of the ICU stay ranged from 1 to 4 days (mean, 1.8 days) and the total hospital stay ranged from 5 to 10 days (mean, 8.2 days). Clinical improvement was evident in all 15 (100%) patients. No mortality was reported in our study. Procedure-related complications occurred in four (26.7%) cases; one case developed dehiscence of the abdominal wall, two cases of pneumonia, and one patient suffered from groin wound gapping. Primary patency rate at 12 months was 100% with no major amputations.
Conclusion
Thoracobifemoral bypass offers a good alternative to aortofemoral bypass due to less embolization and good patency rate. We recommend its use as an alternative procedure in fit patients with juxtarenal aortic occlusive disease or failed previous aortic bypass surgery.

Keywords:
aortoiliac occlusive disease, descending thoracic aortabifemoral artery bypass, juxtarenal aortoiliac occlusion

Egyptian J Surgery 38:424–428

1110-1121

Introduction

Bypass surgery from the descending thoracic aorta (DTA) as inflow artery to the ilio-femoral arterial segment has been used as a good alternative approach for aortic reconstruction when the conventional transabdominal approach is contraindicated or not feasible [1].

However, routine use of descending thoracobifemoral bypass surgery as the primary choice for treatment of juxtarenal aortic occlusive disease is controversial. There are several advantages for that approach; the DTA is less commonly affected by atherosclerotic burden than the infrarenal aortic segment. Moreover, the use of a thoracic aorta partial clamping during proximal anastomosis reconstruction maintains visceral and spinal cord perfusion [2].

Patients and methods

This is a prospective study conducted in Cairo University Hospital over a period of 4 years about the efficacy of use of DTA as the inflow artery for patients with aortoiliac occlusion regarding its morbidity, mortality, and patency rate. Study was approved with our institutional ethics committee.

All patients were subjected to detailed history talking and proper general and local physical examination. Risk factors and associated comorbidities were carefully

assessed including smoking, hypertension, diabetes, hyperlipidemia, ischemic heart disease, carotid artery disease, respiratory disease, and renal disease.

Inclusion criteria included surgically fit (ASA I and II) patients with juxtrarenal aortic occlusion or hostile abdomen due to failed previous aortic surgery, abdominal sepsis, multiple abdominal operations, abdominal stoma, and fistula with adequate femoral vessel and distal arterial tree.

Exclusion criteria included unfit surgical patients and/or no adequate runoff vessel on both lower limb arteries or contraindications for thoracotomy such as thoracic aorta aneurysm or occlusive disease, severe chronic obstructive pulmonary disease, and previous left thoracotomy.

Detailed explanation of the procedure and its possible complications discussed with all included patients with informed consent signed by all of the patients prior to intervention. Preoperative routine laboratory investigation, multislice CT angiography figure a, pulmonary function tests, ECG, and echocardiography were performed for all included patients.

Surgical technique

After combined general anesthesia with full hemodynamic monitoring and epidural anesthesia for good postoperative pain control, endotracheal intubation was done with a double-lumen tube if possible for collapse of left lung to facilitate descending thoracic aortic exposure.

The patient is positioned in the right lateral position with the left hemithorax elevated to an angle of 60° and the pelvis positioned as flat as possible to allow both groin access. The chest, the abdomen, and the groins were prepared with betadine and draped. Dissection of the femoral vessels is done as the first procedural step to minimize unnecessary prolonged exposure of the pleural cavity. Exposure of the femoral vessels was done and a longitudinal pararectal incision was made in the left lumbar region midway between the left last rib and left iliac crest going into the retroperitoneal space to guide the tunneling under vision.

Left posterolateral thoracotomy through the eighth or ninth intercostal space was done; The intercostal muscles are then incised along the superior border of the ninth rib. A retractor was inserted, with selective deflation and medial retraction of the left lung. The lower segment of the DTA was dissected while preserving the intercostal arteries. A separate opening was done in the posterior aspect of the left copula of the diaphragm, a retro-renal tunnel is created from the diaphragm down to lateral to the iliac vessels, under left ureter and a 36 Fr catheter was passed to maintain the tunnel figure b.

At this point systemic heparin was given, and proximal DTA control was obtained with partial vascular clamps to maintain the antegrade flow to the visceral branches and the spinal cord while performing the proximal anastomosis. Longitudinal arteriotomy was done in the DTA, proximal anastomosis was done using continuous Prolene 3/0 suture to a bifurcated Dacron graft 16×8 mm and then the graft is clamped followed by removal of the aortic clamp figure c.

The graft is then pulled in the tunnel with proper orientation of the two limbs and the left limb is anastomosed to the left femoral or the left external iliac artery, then the right limb is tunneled under the viscera with the covering peritoneum and under the ureter to the right groin to be anastomosed with the right femoral artery by continuous Prolene 5/0 suture figure D.

One or two 36 Fr chest tubes were inserted apically and basally. All wounds were closed in layers.

Epidural analgesia in the postoperative period reduces the risk of atelectasis, with the use of early chest physiotherapy to avoid thoracotomy complications. The patient ambulates and resumes oral intake on the second postoperative day. The chest tubes were removed on the third or fourth postoperative day after all air leaks have resolved and lungs become fully expanded. Acetylsalicylic acid 75 mg was orally administered to patients postoperatively.

All operative and postoperative details were documented for all patients including: operative time, blood loss, complications, mortality, and duration of ICU and total duration of hospital stay.

Follow-up was done for all patients clinically for claudication distance, rest pain, wound healing for tissue loss cases, ABIs, and using arterial duplex scanning 3, 6, and 12 months after the procedure.

Results

This study included 15 patients, who underwent descending thoracic aortobifemoral bypass, presented to the Kasr El Aini Hospital with chronic lower limbs ischemia, in the period between May 2014 and

November 2018, with 12 male and three female patients, their age ranged between 53 and 67 years with a mean of 61 years.

Patient presentations were disabling claudication pain in eight (53.3%) patients, rest pain in four (26.7%) patients, and minor tissue loss in three (20%) patients. The associated risk factors were smoking in 11 (73.3%) patients, hypertension in six (40%) patients, diabetes in five (33.3%) patients, hyperlipidemia in three (20%) patients, and cardiac disease in only two (13.3%) patients, with no associated renal or respiratory diseases.

All patients were fit for surgery, and there was no contraindication for thoracotomy. Indications of intervention were juxtarenal aortic block in nine (60%) patients, hostile abdomen due to failed previous aortic bypass surgery in five (33.3%) patients, and previous colon resection and hernia repair in one (6.7%) patient.

Regarding the technique, proximal descending thoracic aortic control was obtained with partial vascular clamps in all cases maintaining antegrade flow to the visceral branches and the spinal cord while performing the proximal anastomosis which usually took about 20–30 min in most of the cases with a mean time of 24.3 min.

The graft is then pulled in the tunnel with proper orientation of the two limbs and the left limb is anastomosed to the left femoral in 11 cases or the left external iliac artery in four case. Then the right limb is tunneled under the viscera with the covering peritoneum and under the ureter to the right groin to be anastomosed with the right femoral artery by continuous Prolene 5/0 suture in 10 cases. In five obese patients, we could not do tunneling to the right groin, so we closed the right limb of the bifurcated graft with underrunning Prolene sutures and we performed femerofemoral bypass with subcutaneous tunneling of the graft before systemic heparinization.

All patients were extubated in the operating room without any cardiovascular inotropic support. Estimated blood loss ranged from 300 to 700 ml with a mean of 450 ml with no need for blood transfusion. No surgically related complications were documented during the operation. All patients were allowed to mobilize out of bed and to start oral intake on the second postoperative day. None of the patients suffered from postoperative paralytic ileus. Chest tube was removed 3–4 days postoperatively.

The duration of ICU stay ranged from 1 to 4 days (mean, 1.8 days) and the total duration of hospital stay ranged from 5 to 10 days (mean, 8.2 days).

Clinical improvement was evident in all 15 (100%) patients. Claudication pain and rest pain disappeared with intact distal pulsation apart from a single patient with associated infrapopliteal disease. One case needed femero-upper popliteal bypass at the same session for superficial femoral artery (SFA) block and big toe gangrene with ray amputation of the big toe after successful revascularization. Follow-up was done for all cases at 1, 3, 6, and 12 months postoperatively.

No mortality was reported in our study. Procedure-related complications occurred in four (26.7%) cases; one case developed dehiscence of the abdominal wall 5 days postprocedure due to abdominal wall hematoma with evacuation and secondary closure. We had two cases of pneumonia third and fourth days postoperatively which responded to antibiotics, otherwise there were no other thoracotomy-related complications. One patient suffered from groin seroma and wound gapping after the procedure which was drained and covered using sartorius muscle flaps.

All of the grafts were patent up to 12 months postprocedure with no major amputations. Paraplegia, renal failure, and graft infection were not reported in our study. Primary patency rate at 6 and 12 months was 100% (Fig. 1).

Discussion

The standard surgical treatment for aortoiliac occlusions is aortobifemoral bypass with good 5 years patency rate that exceeds 80% in most of the studies. When abdominal aortic surgery is not feasible because of severe disease at the infrarenal aorta as in juxtarenal aortic block, previous failed aortic surgery, axillobifemoral bypass, or thoracobifemoral bypass are the alternative procedures, with axillofemoral bypass being more commonly used. However, the results of the axillofemoral bypass are generally nonideal in terms of patency rate and for that reason it is suitable for high-risk patients with multiple comorbidities and thoracobifemoral bypass suitable for fit, low-risk patient groups due to its better patency rate [3–5].

Thoracofemoral bypass has major advantages over axillofemoral bypass because it provides better patency rate, deeper tunneling with good coverage, and better

Figure 1

(a) CTA showing juxtarenal aortic block and right SFA block in one patient. (b) Planning for eighth space posterolateral thoracotomy and left vertical pararectal incision for tunneling. (c) Aortic anastomosis and graft passing through separate opening in the diaphragm. (d) Retroperitoneal position of the two limbs with proper orientation.

protection from infection. Thoracofemoral bypass was first described by Blaisdell *et al.* [6] as a possible alternative to standard aortofemoral bypass. Criado *et al.* [7] described 16 cases with a surgical mortality rate of 6.4% and the primary graft patency was 98, 88, and 70.4% at 1, 2, and 5 years, respectively [8].

In our study, renal function tests were normal postoperatively in all cases. The risk of renal artery embolization is a concern with thoracofemoral bypass in patients with juxtarenal aortic occlusion. Using radioisotope renal perfusion scans in a prospective trial done by Cevese and Gallucci [9]; they confirmed normal renal perfusion after thoracofemoral bypass in six cases with juxtarenal aortic occlusive disease.

Most of our patients having normal pulmonary function test, diabetes, and hypertension behaved normally in the postoperative period and were discharged uneventfully.

The graft was tunneled in a separate opening in the diaphragm as in other studies [7,8], but in another study graft was tunneled anteriorly through the anterior aspect of the diaphragm to the short midline incision and then to both femoral arteries with no difference in patency rate [10].

No operative mortality documented in our study; however, operative mortality rate was 0–12% in different series and this may be due to proper selection of young and fit patients with less comorbidities in our study [7–11].

Patency rate was 100% in 1 year; however, graft failure occurred in 4–30% cases on 3–5 years in another series [7–11].

In the largest series of thoracobifemoral bypass (50 patients), Passman *et al.* [4] assessed thoracobifemoral bypass role as a first-line strategy in patients with infrarenal aortic occlusive disease; the primary patency rate at 5 years was 81%, which was comparable to the 83–92% patency rates for the classic aortofemoral bypass procedure.

Thoracobifemoral bypass offers a good alternative to standard aortofemoral bypass procedure because it avoids manipulation of the diseased abdominal aortic segment, avoiding embolization as the descending aorta is less commonly affected by atherosclerotic disease burden compared with the infrarenal aortic segment. However, careful patient selection is of critical value as thoracotomy may carry an increased risk of postoperative lung complications, especially in patients with poor pulmonary functions. Considering its comparable good patency rates to that of conventional aortofemoral approach and superior patency rates to that of extra anatomic axillofemoral bypass, we suggest its use as a good treatment option in patients with juxtarenal aortic occlusive disease or after failed previous aortic bypass surgery.

Conclusion

Our study showed better inflow, better quality of life, and good patency rates with thoracobifemoral bypass. So, we suggest liberal use of that approach in fit patients with aortoiliac occlusions, when other classical abdominal aortic surgeries are not feasible or contraindicated. Small number of patients is one of the limitations of the study, so a large number of patients are needed in the future.

Original article

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1 Criado E, Keagy BA. Use of the descending thoracic aorta as an inflow source in aortoiliac reconstruction: indications and long-term results. Ann Vasc Surg 1994; 8:38–47.

2 Frazier OH, Oalmann MC, Strong JP, Cooley DA. Clinical applications of the supraceliac aorta: anatomical and pathologic observations. J Thorac Cardiovasc Surg 1987; 93:631–633.

3 Passman MA, Taylor LM, Moneta GL, Edwards JM, Yeager RA, McConnell DB, *et al.* Comparison of axillofemoral and aortofemoral bypass for aortoiliac occlusive disease. J Vasc Surg. 1996; 23:263–269.

4 Passman MA, Farber MA, Criado E, Marston WA, Burnham SJ, Keagy BA. Descending thoracic aorta to iliofemoral artery bypass grafting: a role for primary revascularization for aortoiliac occlusive disease? J Vasc Surg 1999; 29:249–258.

5 Mii S, Mori A, Sakata H, Kawazoe N. Fifteen-year experience in axillofemoral bypass with externally supported knitted Dacron prosthesis in a Japanese hospital. J Am Coll Surg 1998; 186:581–588.

6 Blaisdell FW, McMattei GA, Gauder PJ. Extraperitoneal thoracic aorta bifurcation prosthesis: case reports. Am J Surg 1961; 102:583–585.

7 Criado E, Johnson GJr, Burnham SJ, Buehrer J, Keagy BA. Descending thoracic aorta-to-iliofemoral artery bypass as an alternative to aortoiliac reconstruction. J Vasc Surg 1992; 15:550–557.

8 Bowes DE, Youkey JR, Pharr WP, Goldstein AM, Benoit CH. Long term follow-up of descending thoracic aorto-iliac/femoral bypass. J Cardiovasc Surg (Torino) 1990; 31:430–437.

9 Cevese PG, Gallucci V. Thoracic aorta-to-femoral artery by-pass. For the treatment of complete obstruction of the abdominal aorta at the level of the renal arteries. J Cardiovasc Surg (Torino) 1975; 16:432–438.

10 Ihaya A, Chiba Y, Kimura T, Morioka K, Uesaka T. Descending thoracic aortobifemoral bypass for aortoilliac occlusive disease. Asian Cardiovasc Thorac Ann 2001; 9:97–100.

11 McCarthy WJ, Mesh CL, McMillan WD, Flinn WR, Pearce WH, Yao JS. Descending thoracic aorta-to-femoral artery bypass: Ten years' experience with a durable procedure. J Vasc Surg 1993; 17:336–347.