Early and Long-term Outcomes of Obturator Bypass in Patients with Femoral Pseudoaneurysm and Critical Limb Ischemia

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Background: *Vascular groin conditions are not uncommon and challenging in some surgical practices. The obturator bypass is one option for the treatment of some of these conditions.*
Material and Method: *From 2002 to 2013, Retrospective study was done on eleven patients who underwent obturator bypass. The indications for bypass were femoral pseudoaneurysm and critical limb ischemia with extensive atherosclerosis.*
Result: *Early outcomes revealed that postoperative mortality was 9% (1/11). Both 30-day graft patency and amputation-free survival were 72.7%; whereas, the 5-year outcomes in primary patency, amputation-free survival and overall survival rates were 22.7%, 45.5% and 70.7%, respectively. There was no statistical significance in graft patency, amputation-free survival and overall survival between obturator bypass in atherosclerosis artery and in femoral pseudoaneurysm patients.*
Conclusion: *The obturator bypass may be an alternative procedure for patients with conditions requiring groin revascularization. There was no statistical significance in graft patency, amputation-free survival and overall survival between obturator bypasses done in atherosclerosis artery and in femoral pseudoaneurysm patients.*

Keywords: *Obturator bypass, Critical limb ischemia, Femoral pseudoaneurysm*

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The management for lower extremity salvage in groin vascular conditions is difficult. These include acute or chronic infections of femoral pseudoaneurysm at proximal anastomosis of arterial bypass, access site of endovascular intervention, or needle puncture in drug addiction within this area. Moreover, there are other instances which may cause difficulty in performing groin route bypass such as ulceration as a result of carcinoma, radiation necrosis, ischemia of skin flap, excessive scaring and trauma compounded by the lack of suitable soft tissue for covering the femoral vessel[1-3].

The groin incision carries a risk for surgical site infection[4]. This may lead to wound infection of 4 to 14%[5]. In addition, the incidence of femoral artery pseudoaneurysm complication varies between 2 to 8%[6,7] after endovascular interventions. Although minimal invasive therapy is an effective alternative in management of femoral pseudoaneurysm, conventional surgery is still necessary for complicated femoral artery pseudoaneurysm. The principle treatments of an infected groin wound and complicated femoral artery pseudoaneurysm is eradication of infected tissue and extra-anatomical bypass to restore blood flow to the lower extremities.

The extra-anatomical bypass is a method used to maintain adequate blood supply to lower extremities and avoid manipulation of the complicated groin problem. There are 4 types of extra-anatomical bypass techniques performed in the groin area[8-10].

1) Lateral femoral bypass.
2) Obturator bypass.
3) Femoro femoral bypass.
4) Axillo femoral bypass or axillo popliteal bypass.

The obturator bypass, first described by Shaw and Baue in 1963[11], is an option of an extra-anatomical route for arterial bypass surgery. The inflow of the bypass is iliac artery or aorta, whereas the outflow is anastomosed at the popliteal artery, deep femoral

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artery or tibial arteries[12,13]. The route of the bypass graft passes through the obturator foramen and the anterior portion of the hamstring muscle and ultimately to the popliteal fossa, without involvement of the groin area. Nevertheless, obturator bypass remains a procedure infrequently performed due to the difficulty in surgical technique. The purpose of this study is to evaluate early and long-term outcomes of an obturator bypass procedure in a descriptive observational study.

Material and Method

Between January 2002 and December 2013, eleven patients diagnosed with either femoral arterial pseudoaneurysm or critical limb ischemia from aortoiliac and iliofemoral arterial occlusive disease underwent obturator bypass (Fig. 1).

All operations were performed under general anesthesia. Patients received therapeutic antibiotics in cases of infected pseudoaneurysm and prophylactic antibiotics in cases of peripheral vascular disease.

The inflow vessels were abdominal aorta in 5 and iliac arteries in 6 cases. The exposure of abdominal aorta was achieved through an intraperitoneal or extraperitoneal approach. The iliac artery was exposed only by an extraperitoneal approach. The outflow vessel was the below-knee popliteal artery. The technique of obturator bypass was performed in the same manner as the previous study[14] (Fig. 2).

The distal anastomosis was performed in end-to-side anastomosis or with a Miller cuff (Fig. 2). Finally, any false aneurysm and infected tissue at the groin were removed in the same operation. Healthy arterial ends were over sewn with polypropylene suture. Postoperative antiplatelet or anticoagulant were administered if deemed necessary.

The primary end-point of this study was to determine the perioperative effects of obturator bypass procedures with its 5-year outcomes in the aspects of the rate of primary graft patency, amputation-free survival and overall survival. This was accessed by clinical examination, non-invasive vascular laboratory studies and computed tomography angiograms (CTA). Statistical analysis and SPSS window 16.0 statistical software were used for analysis of patient medical history, study data and records in general. The continuous data are present for analysis as mean and percentages for discrete variables. The Kaplan-Meier method was used for analyzing the graft patency rate and the amputation-free survival of patients. The ethical consideration of this study was approved by the Siriraj Institutional Review Board (protocol number Si. 436/2014). Ethics Consideration: Si. 436/2014.

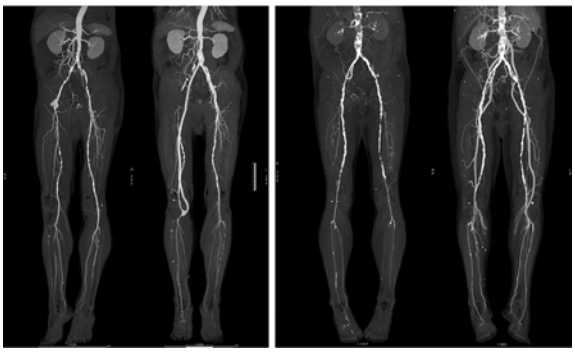


Fig. 1 Preoperative and postoperative computer tomography angiogram of obturator bypass in patient with femoral artery pseudoaneurysm (left panel) and patient with critical limb ischemia (right panel).

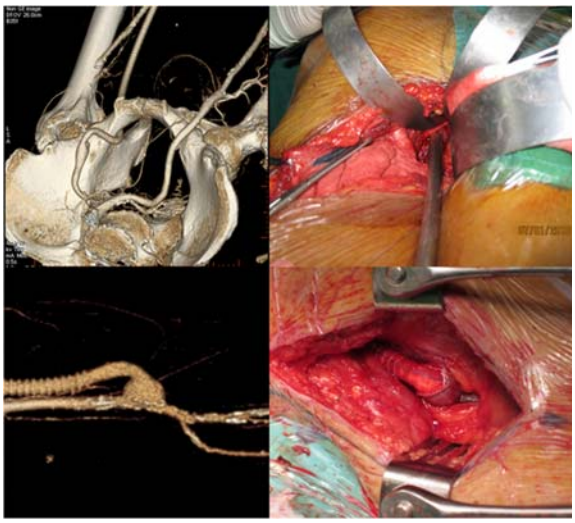


Fig. 2 Surgical technique using in the obturator bypass, tunneling direction through obturator foramen (upper panel) and Miller cuff at distal anastomosis (lower panel).

Results

Of the eleven patients enrolled in this study, 8 (72.7%) were men, with the mean age of 66.8±10.5 years (range, 42 to 80 years). The common comorbidity was hypertension, with approximately 80% of the patients affected (Table 1). All patients had concomitant peripheral arterial occlusive disease.

Perioperative outcome (<30 days)

One patient expired from bowel ischemia within

perioperative period from retroperitoneal hematoma, ischemic heart disease and pneumonia. Two patients underwent below-knee amputation due to rapid and progressive infection of wet gangrene of their feet. The 30-day rate of primary graft patency and amputation-free survival were 72.7%.

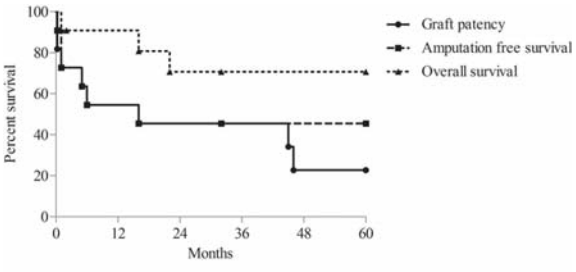
Follow-up outcome (>30 days)

The mean follow-up time of the obturator bypass was 42.7months (range, 1 to 91 months). In this study, the 5-year primary patency of the obturator bypass, amputation- free survival and overall survival rates were 22.7%, 45.5% and 70.7%, respectively (Fig. 3). One patient expired at sixteen months after the procedure. Another had an aneurysmal formation with a Miller cuff reconstruction at 45 months after the procedure. Three patients had graft thrombosis, causing limb ischemia.

Two of the five patients suffering from infected femoral artery pseudoaneurysm had Salmonella gr. D and Burkholderia Pseudomalii. Three other patients had false aneurysm at their anastomotic sites from previous femoropopliteal bypass procedures. They had no sign of fever, inflammation at aneurysm, leukocytosis nor discharge from the aneurysm during the operation. The pathological report revealed an atherosclerotic aneurysm with thrombus and gram stain of tissue and tissue culture for pathological bacteria tested were negative.

Table 1. Preoperative co-morbidities risk factors of the 11 patients

Comorbidities	Patients (%)
Hypertension	9 (81.8)
Diabetic mellitus	8 (72.7)
Smoking	4 (36.4)
Coronary artery disease	3 (27.3)
Dyslipidemia	2 (18.2)
Cerebrovascular disease	1 (9.1)
Concomitant peripheral arterial disease	
Aortoiliac occlusion	3 (27.3)
Ileofemoral occlusion	3 (27.3)
Femoropopliteal occlusion	4 (36.4)
Tibioperoneal occlusion	1 (9.1)



Year	0	1	2	3	4	5
Patient at risk graft patency	11	7	6	5	3	3
SD graft patency		0.15	0.15	0.14	0.13	0.13
Patient at risk amputation free survival	11	7	6	5	5	5
SD amputation free survival		0.15	0.15	0.15	0.15	0.15
Patient at risk overall survival	11	10	8	7	7	7
SD overall survival		0.08	0.12	0.12	0.12	0.12

Fig. 3 Graft patency rate, amputation free survival rate and overall survival rate within the study.

Discussion

The present study showed that the obturator bypass had a two-year graft patency rate of 45.5% and a 5-year graft patency rate of 22.7%. This bypass procedure provided a completely separated route from the bypass graft from a pathological perspective in the groin area. Moreover, the alignment was short, straight and pass along the medial part of the thigh; it delivered an excellent laminar flow. This allowed for easy access in which to perform a distal anastomosis to the popliteal artery facilitating a successful bypass graft without kink by hip flexion.

In 30-day postoperative outcome, the postoperative mortality rate was 9% and the primary patency of the obturator bypass and amputation free survival rate was 72.7%. From the literature review, the 30-day mortality rate varies from 0 to 17%[3,15-18]. For the 30-day primary patency rate of the bypass, Patel et al[3] had a 100%, Nevelsteen et al[15] 91%. Sautner et al[16] 88.2% and Pearce et al[10] at the lowest 66.7%.

Regarding the 5-year primary graft patency of the obturator bypass, the graft patency rate was 22.7% and amputation-free survival rate at 45.5%. However, contrary to other studies, Nevelsteen et al[15] had 5-year primary graft patency rate at 37%. In addition, Sautner et al[16] had 5-year secondary graft patency rate at 59.7%. The reason may be from the concomitant atherosclerosis with all patients in the study and the distal anastomosis of obturator bypass was an infrapopliteal artery, which may have led to the poor results of the graft patency. Comparable with Albers et al, the meta-analysis of polytetrafluoroethylene bypass graft of the femoral artery to infrapopliteal artery which had 5-year primary patency rates of 30.5% and 5-year amputation-free survival rate of 55.7%[19].

The major cause of graft failure during the perioperative period in this study was rapid progressive infection of wet gangrene of the lower extremities

(66.6%). And during the late follow-up was graft occlusion (37.5%). The occurrence of graft occlusion ranged between 4 to 46 months after the procedure. One patient with graft occlusion underwent major amputation due to acute irreversible limb ischemia. Others had clinical leg rest pain requiring a new bypass for limb salvage; one had thrombosis within the new bypass graft and major limb loss.

Within the subgroup analysis in this study, there is no statistical significance to the graft patency (p = 0.334), amputation-free survival (p = 0.209) and overall survival (p = 0.988) between obturator bypass in patients with atherosclerosis artery group and patients with femoral pseudoaneurysm group (Fig. 4). This may be due to patients in the femoral pseudoaneurysm group also having concomitant peripheral arterial occlusive disease, which affect the distal runoff of the bypass graft.

The limitation of this study is the small number of cases for statistic assessment.

Conclusion

The obturator bypass has a 5-year primary patency rate of 21.8% and amputation- free survival rate of 43.6%. There is no statistical significance of graft patency, amputation-free survival and overall survival for obturator bypass between patients with atherosclerotic arteries and those with femoral pseudoaneurysm patients. It is an optional procedure for complicated groin condition situations.

Acknowledgements

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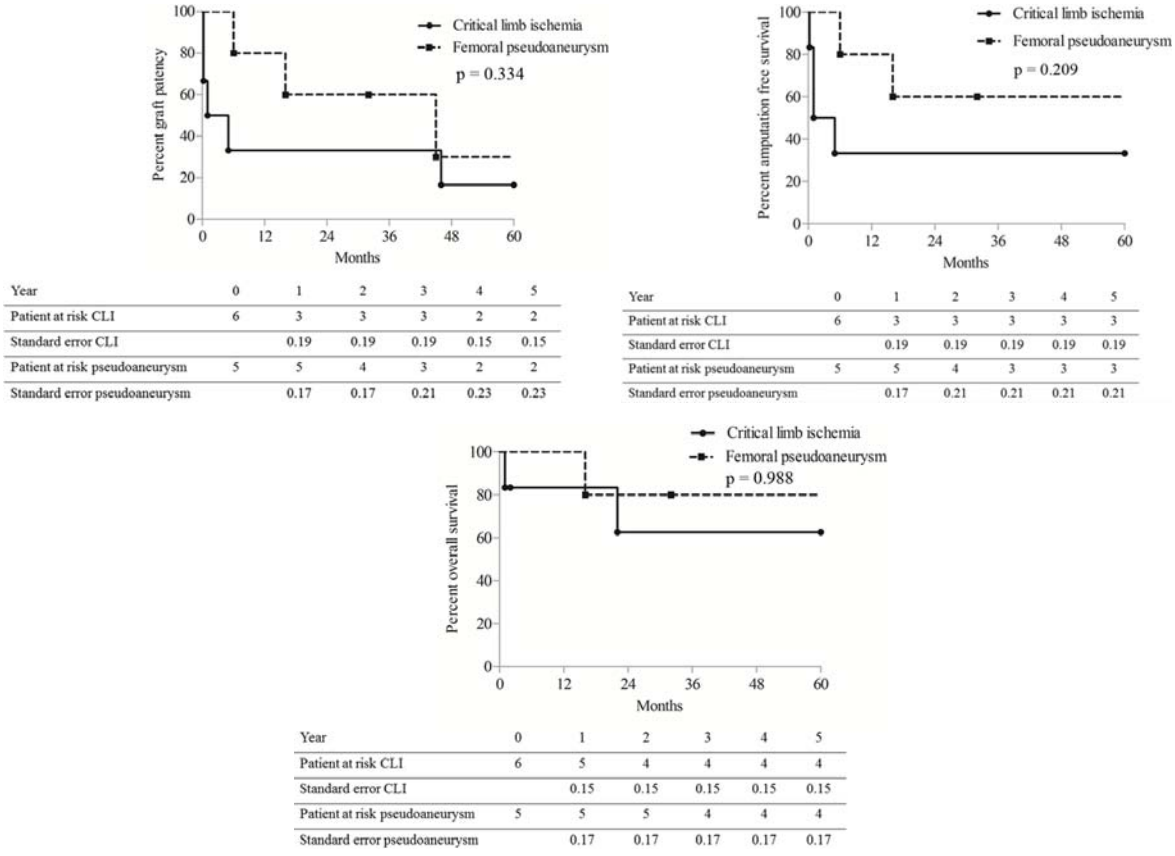
What is already known on this topic?

The obturator bypass was known as an option of treatment for patients who have complicated vascular problem in the groin area. It was the only route



Year	0	1	2	3	4	5
Patient at risk CLI	6	3	3	3	2	2
Standard error CLI		0.19	0.19	0.19	0.15	0.15
Patient at risk pseudoaneurysm	5	5	4	3	2	2
Standard error pseudoaneurysm		0.17	0.17	0.21	0.23	0.23

Year	0	1	2	3	4	5
Patient at risk CLI	6	3	3	3	3	3
Standard error CLI		0.19	0.19	0.19	0.19	0.19
Patient at risk pseudoaneurysm	5	5	4	3	3	3
Standard error pseudoaneurysm		0.17	0.21	0.21	0.21	0.21

Year	0	1	2	3	4	5
Patient at risk CLI	6	5	4	4	4	4
Standard error CLI		0.15	0.15	0.15	0.15	0.15
Patient at risk pseudoaneurysm	5	5	5	4	4	4
Standard error pseudoaneurysm		0.17	0.17	0.17	0.17	0.17

Fig. 4 Comparison-graft patency, amputation free survival and overall survival between patient presented with critical limb ischemia and patient presented with groin aneurysm.

of the bypass graft to separate completely from the groin area. However, short- and long-term results in previous publications have proven to be effective and durable.

What this study adds?

According to the difficulty in surgical technique, some vascular surgeons prefer other revascularization procedures for patients with both groin problem and complicated ischemia situation. This may lead to the limitation in number of the obturator bypass. The present study also showed that the obturator bypass was useful in both femoral pseudoaneurysm patients and those with combine groin problem with extensive atherosclerosis. The result of this study provides encouraging data for the benefits of the obturator bypass and offers an option of revascularization for vascular surgeons to consider for patients with complex vascular groin conditions.

Potential conflicts interest

None.

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การศึกษาประสิทธิผลในช่วงระยะสั้นและระยะยาวของการผ่าตัดทางเบี่ยงหลอดเลือดแดงที่เลี้ยงขาโดยผ่านทางช่อง obturator ในกลุ่มผู้ป่วยที่มีอาการขาขาดเลือดแบบเรื้องรังระยะวิกฤติและกลุ่มผู้ป่วยที่มีอาการหลอดเลือดแดงโป่งพองที่บริเวณขาหนีบ

สุธีคณิต หัถพรสวรรค์, ณัฐวุฒ พ่วงพันธุ์งาม, เกียรติศักดิ์ หงษ์คู, คามิน ชินศักดิ์ชัย, ชุมพล วัองวานิช, เฉนียน เรืองเศรษฐกิจ, ประมุข มุทิรางกูร

ภูมิหลัง: การผ่าตัดทางเบี่ยงหลอดเลือดแดงที่เลี้ยงขาโดยผ่านทางช่อง obturator เป็นวิธีการผ่าตัดที่ใช้รักษาหรือป้องกันภาวะขาขาดเลือดในผู้ป่วยที่มีปัญหาไม่สามารถทำการผ่าตัดบริเวณที่ขาหนีบได้

วัตถุประสงค์: ศึกษาผลการรักษากลุ่มผู้ป่วยที่ได้รับการผ่าตัดทางเบี่ยงหลอดเลือดแดงที่เลี้ยงขาโดยผ่านทางช่อง obturator

วัสดุและวิธีการ: ศึกษาข้อมูลย้อนหลังในผู้ป่วยที่ได้รับการผ่าตัดทางเบี่ยงหลอดเลือดแดงที่เลี้ยงขาโดยผ่านทางช่อง obturator ตั้งแต่ปี พ.ศ. 2545 ถึง 2556 และรวบรวมผลการของผ่าตัดทั้งในระยะสั้นและระยะยาว

ผลการศึกษา: พบว่าอัตราเสียชีวิตในช่วง 30 วันหลังจากการผ่าตัดเท่ากับร้อยละ 9 หลอดเลือดที่เป็นทางเบี่ยงอุดตันร้อยละ 27.3 อัตราการมีชีวิตโดยไม่สูญเสียขาเท่ากับร้อยละ 72.7 ในช่วงระยะยาว 5 ปี พบหลอดเลือดที่เป็นทางเบี่ยงอุดตันร้อยละ 77.3 อัตราการมีชีวิตโดยไม่สูญเสียขาเท่ากับร้อยละ 45.5 ผู้ป่วยยังมีชีวิตอยู่ร้อยละ 79.5 จากการศึกษาในกลุ่มย่อยพบว่าไม่มีความแตกต่างในเรื่องของหลอดเลือดที่เป็นทางเบี่ยงอุดตัน อัตราการมีชีวิตโดยไม่สูญเสียขา และการมีชีวิตอยู่ของผู้ป่วย เมื่อเปรียบเทียบระหว่างกลุ่มผู้ป่วยที่มีอาการหลักในเรื่องของขาขาดเลือดแบบเรื้องรังระยะวิกฤติและกลุ่มผู้ป่วยที่มีอาการหลักในเรื่องของหลอดเลือดแดงโป่งพองที่บริเวณขาหนีบ

สรุป: การผ่าตัดทางเบี่ยงหลอดเลือดที่เลี้ยงขาโดยผ่านทางช่อง obturator เป็นวิธีการผ่าตัดที่ใช้รักษาหรือป้องกันภาวะการขาดเลือดมาเลี้ยงที่ขาในผู้ป่วยที่มีปัญหาไม่สามารถทำการผ่าตัดบริเวณที่ขาหนีบได้และไม่มีความแตกต่าง ในผลการรักษาทั้งในผู้ป่วยกลุ่มที่มีอาการขาขาดเลือดแบบเรื้องรังระยะวิกฤติและกลุ่มผู้ป่วยที่มีอาการหลอดเลือดแดงโป่งพองที่บริเวณขาหนีบ