

Percutaneous Transluminal Angioplasty of Popliteal Artery Steno-occlusive Atherosclerotic Disease at the King Hussein Medical Center: Two Year Primary Patency

Jan Al Shishani, ^{1*}Sizeph Haddad, ²Kristi Janho ³

Abstract

Purpose: To evaluate the two year primary patency following the percutaneous transluminal angioplasty (PTA) used to treat popliteal artery steno-occlusive atherosclerotic disease in the King Hussein Medical Center (KHMC).

Methods: A retrospective single-center study, analyzing the patency of 92 PTA procedures of the popliteal artery performed in 86 patients. Follow up patency was assessed by clinical examination, the ankle-brachial pressure index, and color duplex scanning over two years.

Results: Two year primary patency following popliteal artery PTA was 76% for stenotic lesions versus 37% for occlusive lesions. There was no procedure related periprocedural mortality.

Conclusion: Popliteal artery PTA is performed effectively in the KHMC for patients with disabling intermittent claudication and critical lower limb ischemia with better results in stenotic lesions in comparison to occlusive lesions.

Keywords: Popliteal artery, Atherosclerosis, percutaneous transluminal angioplasty, critical lower limb ischemia, disabling intermittent claudication.

(*J Med J 2012; Vol. 46 (4):341- 346*)

Received

December 12, 2011

Accepted

March 25, 2012

Introduction

Atherosclerotic peripheral arterial disease affects different segments of the arterial tree. Different modalities are present for treatment according to the involved segment and complexity of the disease including medical, endovascular and surgical treatments according to Trans-Atlantic Inter-Society Consensus (TASC) recommendations.¹⁻³

Popliteal artery is not an exclusion, and atherosclerosis is the main steno-occlusive disease affecting it with endovascular intervention being one of its treatment options characterized by low morbidity and mortality and the possibility of performing it as an outpatient procedure or during short hospital stays.⁴⁻⁷

1. Vascular Surgeon, Vascular Surgery Unit, King Hussein Medical Center, Amman, Jordan.

2. Interventional Radiologist, Interventional Radiology Department, King Hussein Medical Center, Amman, Jordan.

3. Vascular Surgeon, Vascular Surgery Unit, King Hussein Medical Center, Amman, Jordan.

* Correspondence should be addressed to:

Jan Al Shishani

P. O. Box: 10081, Postal code 13181, Zarqa, Jordan.

E-mail: Jan_shishani@yahoo.com; christiejanho2001@yahoo.com

Although there is no consensus on the optimal form of endovascular intervention used in this arterial segment, PTA is a primary endovascular option for such lesions. Still there is some confusion in the literature about it being the first treatment choice in this arterial segment.^{8,9}

Furthermore, attractive new technologies for popliteal artery steno-occlusive lesions ranging from transcatheter plaque excision to laser ablation, rotational atherectomy, cryoplasty, brachytherapy, and placement of drug-eluting stents are now becoming available with encouraging results.⁹⁻¹²

This is a retrospective study that was performed to evaluate the two year primary patency of popliteal artery PTA in our institution the KHMC in Amman.

Methods

All the patients who underwent lower limbs PTA at the KHMC between November 2006 and April 2009 were reviewed. Of those, 92 PTA procedures were performed for the popliteal arteries in 86 patients. Forty seven limbs (51.1%) had popliteal artery stenosis (1st group) and forty five limbs (48.9%) had popliteal artery occlusion (2nd group). All procedures were performed either for disabling intermittent claudication (Rutherford class 3) or critical lower limb ischemia (Rutherford class 4-6).¹³ Aorto-iliac and femoral arterial segments in all patients were free from significant flow limiting lesions identified by angiogram or duplex scanning (peak systolic velocity (PSV) at stenosis / PSV upstream < 2.0, PSV < 200 cm/sec).^{14,15} There was at least one patent distal run-off artery down to the ankle. Patients with coexistent aorto-iliac or femoral significant disease and patients with absent patent distal run-off artery were excluded from this study. Characteristics of the patients are shown in table (1).

All procedures were performed in the interventional radiology suite at the KHMC. Eighty seven procedures were performed by retrograde puncture of the contralateral common

femoral artery (CFA) and the rest by antegrade puncture of the ipsilateral CFA. Those were the patients with unfavorable aortic bifurcation or local contralateral groin surgery. A 6-Fr sheath was used in all cases. A 0.038 hydrophilic wire was used to cross the lesions directed by a vertebral shaped catheter with those cases in which crossing by the wire failed being excluded from the primary patency results. Four and five mm diameter balloons were used for angioplasty. Systemic heparinization was performed in all cases (80 UI/Kg) (figures 1 and 2).

Patients were discharged the second day after the re-measurement of the ankle brachial pressure index and followed up in the vascular surgery clinic at 3, 6, and 12 months and then annually by a clinical examination and a duplex scan. During the follow up period, patients who had a recurrent flow limiting a significant popliteal lesion by duplex scan (peak systolic velocity (PSV) at stenosis / PSV upstream > 2.0, PSV = 200 - 400 cm/sec) which is the Washington university duplex criteria for peripheral vascular disease underwent a repeat PTA procedure and thus were excluded from the primary patency results.^{14,15} Patients with failed PTA procedures that were associated with clinical deterioration, both initially or during the follow up period, underwent surgical bypass procedures and were also excluded from the primary patency results. Patients were followed up for a mean period of two years.

Table (1): Patient characteristics.

<i>Characteristics</i>	<i>Patients, %</i>
<i>Age (years)</i>	66 (range:45-82)
<i>Male: Female</i>	65:21 (76%:24%)
<i>Hypertension</i>	57 (66%)
<i>Diabetes Mellitus</i>	61 (71%)
<i>Dyslipidemia</i>	39 (45%)
<i>Coronary artery disease</i>	31 (36%)
<i>Smoking history</i>	67 (80%)
<i>Disabling intermittent claudication</i>	22 (26%)
<i>Critical limb ischemia</i>	64 (74%)
<i>Popliteal stenosis</i>	47 (51.1%)
<i>Popliteal occlusion</i>	45 (48.9%)

Table (2): Initial technical success and two year primary patency.

<i>Popliteal lesion</i>	<i>Initial technical success</i>	<i>Two year primary patency</i>
<i>Popliteal stenosis (group A)</i>	89%	76%
<i>Popliteal occlusion (group B)</i>	58%	37%



Figure (1): Initial angiogram showing a severe left popliteal artery narrowing, with occlusion of the left tibioperoneal trunk and collateral vessel formations.



Figure (2): Final angiogram showing improvement in the left popliteal artery narrowing and the re-establishment of the flow in the left tibioperoneal trunk and a significant reduction in the collateral vessel formations.

Results

Initial technical success was 89% for stenotic lesions and 58% for occlusive lesions as five limbs having popliteal artery stenosis (1st group) and 19 limbs having popliteal artery occlusion (2nd group) failed the primary PTA procedure and thus underwent surgical bypass procedures (table 2).

Four patients developed minor groin hematoma at the access site that was treated conservatively and didn't require blood transfusion or admission to hospital. There were no major complications.

During the follow up period, eight limbs from the 1st group and 12 limbs from the 2nd group developed a recurrence of significant steno-occlusive lesion. Out of those 20 limbs, 4 limbs underwent a successful second PTA procedure. The remaining 16 limbs failed this second PTA procedure. Out of those last 16 limbs, 12 limbs were associated with clinical deterioration (disabling intermittent claudication or critical limb ischemia) and underwent successful surgical bypass, whereas the remaining 4 limbs were not associated with clinical deterioration and the patients were followed up conservatively in our vascular surgery clinic.

During the follow up period, nine patients (three from the 1st group and six from the 2nd group) died and six patients (four from the 1st group and one from the 2nd group) lost follow up and all were excluded from the final results.

At 2 years, 26 limbs from the 1st group and 7 limbs from the 2nd group remained patent without disabling claudication or critical limb ischemia and without the need for any further intervention. Thus, primary patency results over two years were 76% for stenotic lesions and 37% for occlusive lesions (table 2).

Discussion

Over the last decade, the number of endovascular procedures performed on the popliteal artery has significantly increased but still there is no

consensus on the optimal form of endovascular intervention used in this arterial segment. Different endovascular modalities were used for those lesions with different results.^{10-12,16-22}

In our study, results of PTA for popliteal artery stenosis were encouraging and comparable to international studies such as the study of Ilias Dalainas and Giovanni Nano in which the primary patency after two years for popliteal artery stenotic lesions was 86% for intermittent claudication (IC) patients and 54% for critical limb ischemia patients.⁴ Furthermore, Popliteal artery PTA didn't compromise further bypass surgery.^{9,23}

Although results in the case of popliteal artery occlusion were less durable, still it may be reasonable to dilate such lesions for limb salvage indications in patients with prohibitive surgical risks, and it can be an option for patients without available saphenous veins for a venous graft.⁹

Recurrence of a significant steno-occlusive lesion was treated in our study as well as in some other studies by a repeat angioplasty with some further success suggesting the possible benefit for a second PTA attempt in those patients before proceeding to a surgical bypass procedure.^{5,23}

Our experience shows better results of PTA in the management of popliteal artery stenosis compared to popliteal artery occlusion reflecting the need for further advances in the means of endovascular recanalization of a totally occluded popliteal artery to improve its outcome.

Conclusion

Popliteal artery PTA is performed effectively as a treatment option at the KHMC for patients suffering from disabling intermittent claudication or critical lower limb ischemia due to popliteal artery stenosis. Nevertheless, the results are not as promising in the case of popliteal artery occlusion.

References

1. Perera GB, Lyden SP. Current trends in lower extremity revascularization. *Surg Clin North Am* 2007; 87:1135-47.
2. Norgren L, Hiatt WR, Dormandy JA, et al. Inter-society consensus for the management of peripheral arterial disease. *Int Angiol* 2007; 26: 81-157.
3. Norgren L, Hiatt WR, Dormandy JA, et al. Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II). *J Vasc Surg* 2007; 45: S5-67.
4. Ilias Dalainas, Giovanni Nano. Percutaneous transluminal angioplasty of the popliteal artery without the use of stents: A review of 116 consecutive procedures. *Int J Angiol*. 2007 Summer; 16(2): 47-49.
5. Matsi PJ, Manninen HI, Vanninen RL, et al. Femoropopliteal angioplasty in patients with claudication: Primary and secondary patency in 140 limbs with 1-3-year follow-up. *Radiology*. 1994; 191: 727-33.
6. Abdul Raouf A, Rouleau Y, Clement A, Le Roux P, Genay P, Ricco JB. Endoluminal angioplasty of the popliteal artery. Review of 54 consecutive patients. *Eur J Vasc Endovasc Surg*. 2005; 30: 610-3.
7. Zdanowski Z, Albrechtsson U, Lundin A, et al. Percutaneous transluminal angioplasty with or without stenting for femoropopliteal occlusions? A randomized controlled study. *Int Angiol*. 1999; 18: 251-5.
8. Dalainas I, Nano G. Balloon angioplasty or nitinol stents for peripheral-artery disease. *New Engl J Med*. 2006; 355: 521.
9. Gray BH. Endovascular treatment of Lower Extremity Arterial Occlusive Disease: Femoropopliteal and Tibial Interventions. In : Hallet JW, Mills JL, Earnshaw JJ, et al. *Comprehensive vascular and endovascular surgery*. Mosby, 2009; 151-75.
10. Ramaiah V, Gammon R, Kiesz S, et al. Midterm outcomes from the TALON Registry: treating peripherals with SilverHawk: outcomes collection. *J Endovasc Ther* 2006; 13: 592-602.
11. Zeller T, Rastan A, Schwarzwald U, et al. Percutaneous peripheral atherectomy of femoropopliteal stenoses using a new-generation device: six-month results from a single-center experience. *J Endovasc Ther* 2004; 11: 676-85.

12. Laird J, Jaff MR, Biamino G, et al. Cryoplasty for the treatment of femoropopliteal arterial disease: results of a prospective, multicenter registry. *J Vasc Interv Radiol* 2005; 16: 1067-73.
13. Ad Hoc Committee on Reporting Standards. Suggested standards for reports dealing with lower extremity ischemia. *J Vasc Surg* 1986; 4: 80-94.
14. Moneta GL, Wheeler N, Giswold ME. Vascular laboratory evaluation of lower extremity arterial occlusive disease. In: Hallett JW, Mills JL, Earnshaw JJ, et al. *Comprehensive vascular and endovascular surgery*. Mosby, 2009; 64-72.
15. Leng GC, Whyman MR, Donnan PT, et al. Accuracy and reproducibility of duplex ultrasonography in grading femoropopliteal stenoses. *J Vasc Surg*, 1993; 17: 510-7.
16. Strecker EP, Boos IB, Gottmann D, et al. Popliteal artery stenting using flexible tantalum stents. *Cardiovasc Intervent Radiol*. 2001 May-Jun; 24(3): 168-75.
17. Dearing DD, Patel KR, Compoqinis JM, et al. Primary stenting of the superficial femoral and popliteal artery. *J Vasc Surg*. 2009 Sep; 50(3): 542-7.
18. Steinkamp HJ, Rademaker J, Wissgott C, et al. Percutaneous transluminal laser angioplasty versus balloon dilation for treatment of popliteal artery occlusions. *J Endovasc Ther*. 2002 Dec; 9(6): 882-8.
19. Clark TW, Groffsky JL, Soulen MC. Predictors of long-term patency after femoropopliteal angioplasty: results from the STAR registry. *J Vasc Interv Radiol* 2001; 12: 923-33.
20. Lipsitz EC, Ohki T, Veith FJ, et al. Does subintimal angioplasty have a role in the treatment of severe lower extremity ischemia? *J Vasc Surg* 2003; 37: 386-91.
21. Lipsitz EC, Veith FJ, Ohki T. Subintimal angioplasty in the management of critical lower-extremity ischemia: value in limb salvage. *Perspect Vasc Surg Endovasc Ther* 2005; 17: 11-20.
22. Laird JR, Biamino G, McNamara T, et al. Cryoplasty for the treatment of femoropopliteal arterial disease: extended follow-up results. *J Endovasc Ther* 2006; 13: II52-59.
23. Jansen T, Manninen H, Tulla H, et al. The final outcome of primary infrainguinal percutaneous transluminal angioplasty in 100 consecutive patients with chronic critical limb ischemia. *J Vasc Interv Radiol* 2002; 13: 455-63.

قسطرة الشرايين المأبضية لمرضى تصلب الشرايين في مدينة الحسين الطبية

جان الشيشاني، جوزيف حداد، كريستي جنحو

مدينة الحسين الطبية، عمان، الأردن

الملخص

الهدف: تم تقييم الحالة لمدة عامين بعد القسطرة عبر اللمعة بطريق الجلد (PTA) والتي تستخدم لعلاج التضيق والانسداد في مرض تصلب الشرايين في مدينة الحسين الطبية (KHMC).

الطرق: تحليل سالكية الإجراءات PTA 92 من الشريان المأبضية في 86 مريضا. تم تقييم السالكية عن طريق الفحص السريري، ومؤشر ضغط الكاحل والعضد والمسح الشعاعي لمدة تزيد عن عامين.

النتائج: كانت السالكية الأولية بعد عامين 76% لحالات التضيق مقابل 37% لحالات الانسداد، ولم تكن هناك وفيات.

الاستنتاج: تم تنفيذ المأبضية الشريان PTA بفعالية في KHMC لمرضى العرج المتقطع ونقص تروية الأطراف السفلى الحرج، مع نتائج أفضل في حالات التضيق بالمقارنة مع آفات الانسداد.

الكلمات الدالة: الشريان المأبضية، وتصلب الشرايين، قسطرة عن طريق الجلد PTA، نقص التروية الحرجة في الاطراف السفلى، تعطيل العرج المتقطع.