Hospital Practice

Vascular injury after arterial catheterization

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Summary: Twenty-three cases of arterial injury after 8,208 arterial catheterizations for diagnostic or therapeutic indications at Glasgow Royal Infirmary are reviewed. Clinical presentation included haematoma formation, development of an acutely ischaemic limb or a false aneurysm. Patients with valvular heart disease are identified as a high risk group. Nine cases were managed by simple suture of the puncture site whereas thrombectomy and vein patch closure was required in 12 patients. The incidence of late complications requiring vascular reconstruction was 9%. The early recognition of complications after arterial catheterization and prompt referral to a specialized vascular unit is essential if morbidity is to be avoided.

Introduction

Iatrogenic injury is an important cause of vascular trauma in civilian practice.¹ The majority of these injuries requiring surgical intervention are secondary to arterial catheterization as a diagnostic or therapeutic procedure. We have reviewed our experience of the management of these injuries. Aspects of treatment which could influence the eventual outcome are discussed.

Patients and methods

Over a 7-year period, 1980–1986 inclusive, 8,208 diagnostic and therapeutic arterial catheter procedures, including 5,338 cardiac catheterizations were performed at Glasgow Royal Infirmary. Twenty-three patients (aged 14–84 years; 9 males) developed vascular complications which required arterial repair. Arterial cannulation had been carried out as a therapeutic measure in 4 patients (Table I). Details of the indication for arterial cannulation, the mode and timing of presentation, the site of injury, type of repair carried out and outcome, were collected from a review of the case records of patients who required arterial repair. The incidence of vascular injury after catheterization requiring arterial repair was 0.28%. Injury to the femoral artery occurred in 21 patients and to the brachial artery in 2 patients. (Most arterial catheterizations were done by the femoral route.) Fifteen patients undergoing cardiac catheterization developed vascular complications at site of arterial

puncture. Of these, 2 patients had undergone coronary angioplasty and 2 patients had insertion of a balloon pump catheter. Patients with valvular heart disease undergoing cardiac catheterization had a significantly higher incidence ($P < 0.01$ χ^2 test) of arterial injury (6 patients out of 1,510 catheterizations) than patients with ischaemic heart disease (6 patients out of 3,828 catheterizations). Six of the 9 patients with valvular heart disease who developed arterial injury requiring repair were receiving anticoagulants prior to cardiac catheterization.

The clinical details of these patients are shown in Table I. One patient required exploration of the groin to retrieve the catheter from the femoral artery. Two of the patients with groin haematomas had neurological symptoms from pressure on the femoral nerve. Five out of twelve patients presenting with acute limb ischaemia also had significant haematomas.

Fourteen of the 23 surgical procedures were performed under general anaesthesia. Seventeen patients were found to have an injury to the common femoral artery whereas 4 had superficial femoral artery involvement. Nine patients required simple suture of the puncture site in the artery while 3 patients needed formal arteriotomy and thrombectomy. The arterial injury was repaired with a vein patch in 8 patients.

There was no mortality and 20 patients made an uneventful recovery. Two patients developed intermittent claudication after the arterial injury; one required a femoro-distal popliteal vein graft at 8 months and the other an aortic bifurcation graft at 12 months. The patient who had required fasciotomy continues to complain of short distance claudication and has wasting of the calf muscles. There was no limb loss.

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Table I Clinical details

Sex	Age	Indication for catheterization	Presentation	Interval to surgery	Artery involved	Surgical procedure	Outcome
F	66	Claudication	Haematoma	24 hours	CFA	Suture	Uneventful
F	48	Myocardial ischaemia	Haematoma	24 hours	CFA	Suture	Uneventful
M	50	Myocardial ischaemia	Haematoma	24 hours	CFA	Suture	Uneventful
F	57	Mitral stenosis	Haematoma	24 hours	CFA	Vein patch	Uneventful
F	46	Mitral stenosis	Haematoma	24 hours	CFA	Suture	Uneventful
F	69	Aortic valve disease	Haematoma	3 days	CFA	Suture	Uneventful
M	50	Aortic stenosis	False aneurysm	4 days	CFA	Suture	Uneventful
F	43	Mitral stenosis	False aneurysm	1 week	CFA	Suture	Claudication Fem pop graft
F	64	Mitral stenosis	False aneurysm	1 week	SFA	Suture	Uneventful
F	56	Mitral stenosis	False aneurysm	8 weeks	SFA	Suture	Saphenous neuralgia
M	57	Transient ischaemic attack	Ischaemia	24 hours	CFA	Thrombectomy	Uneventful
M	70	Subclavian embolus	Ischaemia	24 hours	CFA	Thrombectomy Vein patch	Uneventful
F	14	Hepatic tumour	Ischaemia	24 hours	CFA	Thrombectomy	Uneventful
F	44	Takayasu's arteritis	Ischaemia	24 hours	CFA	Thrombectomy	Uneventful
F	46	Aortic mitral valve disease	Ischaemia	24 hours	CFA	Thrombectomy Vein patch	Uneventful
M	55	Transient ischaemic attack	Ischaemia	24 hours	BA	Thrombectomy Vein patch	Uneventful
M	57	Transient ischaemic attack	Ischaemia	24 hours	BA	Thrombectomy	Uneventful
M	55	Myocardial ischaemia	Ischaemia	24 hours	CFA	Thrombectomy Vein patch	Claudication Aortofem graft
F	84	*Angioplasty Aortic valve disease	Ischaemia	24 hours	SFA	Thrombectomy	Uneventful
F	50	*Angioplasty *Balloon pump catheter	Ischaemia	2 days	CFA	Thrombectomy Goretex patch	Uneventful
M	55	*Balloon pump catheter	Ischaemia	2 days	CFA	Fasciotomy	Claudication
F	36	Subclavian steal	Ischaemia	10 days	SFA	Thrombectomy Vein patch	Uneventful
M	55	Myocardial ischaemia	Catheter twisted	24 hours	CFA	Removal of catheter	Uneventful

SFA = superficial femoral artery; CFA = common femoral artery; BA = brachial artery.

*Arterial cannulation as a therapeutic procedure.

Discussion

Since the introduction of the Seldinger technique in 1952² there has been an increasing use of arterial catheterization for both diagnostic and therapeutic

purposes. The incidence of arterial injuries requiring repair in this experience (0.28%) is in keeping with previous reports.³⁻⁵ It has been suggested that can-

nulation of the superficial femoral artery rather than the common femoral artery is associated with a higher incidence of lower limb ischaemia.⁶ This has not been our experience. Other authors have reported an increased incidence of ischaemic complications in patients with valvular heart disease.^{7,8} In this study the development of haematoma or false aneurysm was more common in these patients particularly when receiving concomitant anticoagulation therapy. Thus the patients with valvular heart disease should be

regarded as a high risk group and should be monitored carefully in the post-catheterization period.

The reported number of arterial catheterizations performed each year has been increasing,^{9,10} in particular in patients with ischaemic heart disease. Such procedures carry a recognized risk of arterial injury. These injuries should be managed by a vascular surgeon and careful follow-up for those patients who require arterial repair is required to recognize any late complications.

References

1. Thomas, W.E.G. & Baird, R.N. Arterial injuries in two Bristol hospitals from 1974–1980. *Injury* 1983, **15**: 30–34.
2. Seldinger, S.I. Catheter replacement of needle in percutaneous arteriography. *Acta Radiol* 1953, **39**: 368–376.
3. Chiverton, S.G. & Murie, J.A. Incidence and management of arterial injuries from left heart catheterization. *J R Coll Physicians Lond* 1986, **20**: 126–128.
4. Hessel, S.J., Adams, D.F., Abrams, H.L. Complications of angiography. *Radiology* 1981, **138**: 273–281.
5. Davis, K., Kennedy, J., Kemp, H.G. *et al.* Complications of coronary arteriography. *Circulation* 1979, **59**: 1105–1112.
6. McMillan, I. & Murie, J.A. Vascular injury following cardiac catheterisation. *Br J Surg* 1984, **71**: 832–835.
7. Mortensen, J.D. Clinical sequelae from arterial needle puncture, cannulation and incision. *Circulation* 1967, **33**: 1118–1123.
8. Kloster, F.E., Bristow, J.D. & Griswold, H.E. Femoral artery occlusion following percutaneous catheterisation. *Am Heart J* 1970, **79**: 175–186.
9. Dorros, G., Cowley, M.J., Simpson, J. *et al.* Percutaneous transluminal angioplasty: report of complications from the National Heart, Lung and Blood Institute PTCA registry. *Circulation* 1983, **67**: 723–738.
10. Anderson, J.B., Wolinski, A.P., Wells, I.P., Wilkins, D.C. & Bliss, B.P. The impact of percutaneous transluminal angioplasty on the management of peripheral vascular disease. *Br J Surg* 1986, **73**: 17–19.