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Vascular Reconstruction for Limb Salvage in the Spinal Cord Injured Patient

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Summary

Severe arterial insufficiency of the lower extremity secondary to atherosclerosis is manifested in the clinical setting by the development of gangrene and ulceration. Clinicians caring for the spinal cord injured (SCI) patient with a threatened ischaemic extremity have previously advocated primary amputation. At our institution, we have adopted an alternative approach to the clinical problem utilising vascular reconstruction for limb salvage. During the period October 1980 to February 1988, 6 spinal cord injured patients were identified who were treated for limb-threatening ischaemia by vascular reconstruction in lieu of primary amputation. A combined approach of local wound care (debridement) and improvement of the arterial inflow by percutaneous transluminal angioplasty and/or operative vascular reconstruction successfully avoided major amputation in 6 of 7 threatened extremities. Follow-up data was complete in all patients and ranged from 4 to 52 months with an average of 20 months. In the review period, there was no operative mortality with a cumulative limb salvage rate of 86%. The clinician caring for the spinal cord injury patient with an ischaemic limb should: (1) proscribe the patient's use of tobacco products; (2) consider vascular reconstruction in lieu of primary amputation whenever feasible. Limb salvage may be of benefit to the SCI population with improvements in body image, sedentary stability and the activities of daily living.
Key words: *Spinal cord injury; Atherosclerosis; Amputation.*

The clinical development of arterial insufficiency secondary to progressive arteriosclerosis obliterans is frequently manifested by ulceration, infection and gangrene of the lower extremity. In the spinal cord injured (SCI) patient, management of the threatened ischaemic limb has frequently involved primary amputation. Clinicians who advocate this therapeutic approach cite the advantages of expeditious control of the problem in the 'anaesthetic and func-

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tionless' extremity. At our institution we have recently adopted an alternative approach to lower extremity ischaemic problems in the SCI patient. Suggestions in the medical literature exist that limb salvage may benefit the SCI patient with respect to body image and improvement in body weight redistribution resulting in less potential for pressure sore formation (Ohry *et al.*, 1983). We elected to review our early observations with regard to the merit of revascularisation for limb salvage with this patient population.

Methods and patient characteristics

The records of all spinal cord injured patients at our institution who were seen by the vascular surgery and spinal cord injury services for limb-threatening ischaemia during the period from October 1980 to March 1988 were reviewed. Six patients with 7 ischaemic extremities were identified in this review and a report of their clinical course constitutes the body of this communication. The average age of the patients in this group was 57 years, ranging from 42 to 69. Risk factors for the development of atherosclerotic vascular disease included cigarette smoking (greater than 50 pack years) in 6 and hypertension in 4. None of the patients had diabetes, obesity, or hyperlipidaemia.

Results

The clinical outcome of 6 patients with 7 threatened lower extremities are represented in the Table. In all, the length of follow-up ranged from 4 to 52 months with an average of 20 months. The cumulative limb salvage rate was 86% with 1 patient requiring below knee amputation for forefoot sepsis 4 years after vascular reconstruction. Percutaneous transluminal angioplasty was used as an adjunct to treatment in 2 patients. One complication developed (wound infection) which responded to local measures. There was no operative mortality.

Discussion

The development of foot ulceration and gangrene in the patient with progressive atherosclerosis signifies an advanced stage of peripheral vascular disease. The clinical problem will likely require a major extremity amputation within the ensuing 12 months if left untreated in approximately 76% of patients. Within 3 years of presentation for limb-threatening ischaemia, nearly 50% of patients will succumb to the sequelae of coronary or cerebrovascular disease emphasising the generalised nature of the disease process (Bloom *et al.*, 1988; High *et al.*, 1984; Keagy *et al.*, 1986).

The management of the ischaemic lower extremity in the spinal cord injured patient has been a matter of controversy. Clinicians have previously favoured primary amputation of the threatened limb; viewing efforts for revascularisation and salvage as overly aggressive and unnecessary. Amputation or disarticulation of the 'useless extremity' was rationalised for weight reduction, improved transfer from bed to chair and avoidance of deforming reflex spasm (Spira *et al.*,

Table Clinical course of SCI patients treated for limb-threatening ischaemia

Patient	Age	ABI	Cord level	Risk factors	Problem	Procedure	Outcome
R.E.	70	0.20	C6 central cord syndrome	Tobacco, hypertension	Necrosis 2nd toe	Axillo-femoral bypass, toe amputation	Patent bypass foot healed (33 months)
H.R.	64	0.50	C5	Tobacco, hypertension	5th metatarsal ulcer	Percutaneous iliac artery angioplasty, 5th ray amputation	Patent iliac artery, healed (13 months)
C.J.	58	0.40	T12	Tobacco	Heel ulcer	Femoral-popliteal bypass	Patent bypass, ulcer healed (13 months)
C.C.	42	0.20	T12	Tobacco	Gangrene 1st toe	Percutaneous iliac artery angioplasty, Ilial-femoral endarterectomy	Patent iliac artery, healed foot (4 months)
R.P.	62	0.37	T10	Tobacco, hypertension	Lateral malleolus ulcer	Iliac artery endarterectomy, femoral-tibial bypass	Patent bypass, healed ulcer (6 months)
P.Y.	55	0.41	T12	Tobacco, hypertension	Gangrene right forefoot	Femoral-femoral bypass, profundaplasty	Below-knee amputation, 52 months post bypass
P.Y.		0.37			Gangrene left forefoot	Aorto-femoral bypass	Patent bypass, healed foot (17 months)

1963; Georgiades *et al.*, 1956). Amputation offered the advantage of expeditious control of poor healing ulcers and life-threatening wound sepsis. The need for soft tissue coverage of ischial ulcers encouraged plastic and reconstructive surgeons to perform primary amputation and use the accessible posterior thigh musculature for creation of a myocutaneous flap.

During the previous 8 years at our institution we have adopted an alternative approach to limb threatening ischaemia in the SCI population. Psychological investigations have suggested that amputation in the SCI patient is a serious detriment to a previously impaired body image (Lundberg *et al.*, 1986). Body image is impaired in almost all SCI patients and the addition of a limb amputation has not only physically compromised rehabilitative efforts but has required more intensive psychotherapy (Friedland, 1968). The post-operative complications which may develop in the SCI amputee are numerous and include the development of phantom pain, pressure sore formation, low back pain and difficulties in the activities of daily living (Bors, 1963; Lundberg *et al.*, 1986; Michaelis, 1964; Guttman, 1976). The sedentary stability of the SCI patient is impaired following amputation and requires modification or replacement of the patient's wheelchair and cushion. Rear-tipping accidents in wheelchairs are increased in likelihood; a consequence of the occupant's altered body morphology following lower limb amputation (Loane *et al.*, 1986). Our studies suggest a tendency toward maldistribution of body weight in the amputee with a predisposition toward ischial pressure sores and low back pain (Perkash *et al.*, 1984).

The clinical course of 6 SCI patients who presented with signs of limb-threatening ischaemia due to advanced atherosclerosis have been presented. In review, all of the vascular problems were treated with a combined approach of local wound care (debridement) and improvement of the arterial inflow by percutaneous transluminal angioplasty and/or operative endarterectomy/bypass to the femoral or tibioperoneal circulation. Restoration of arterial inflow during the critical period of hospitalisation allowed for subsequent healing of refractory ulcers. Percutaneous transluminal angioplasty has proven to be a valuable adjunct to operative arterial reconstruction in this patient population. The vascular surgeon treating the patient with advanced atherosclerotic peripheral vascular disease frequently must choose between the relative merits of primary amputation versus attempts at revascularisation to salvage the limb. The utility of revascularisation procedures of the femoral and tibioperoneal circulation for limb salvage has been well established. The presence of life-threatening sepsis may limit the available treatment options to amputation to gain control of the infectious process. Any discussion of the relative benefits of limb revascularisation requires an ongoing dialogue between patient and physician to: (1) fully address the treatment options, potential for perioperative morbidity; (2) clarify the patient's wishes with regard to limb salvage; (3) admonish against future tobacco usage.

We feel that the clinician treating the SCI patient should consider revascularisation of the ischaemic extremity as he/she would in the general population. Amputation in the SCI population is not without subsequent risk for physical and psychological morbidity. Although the length of follow-up in the patients presented above has been relatively short, the potential benefit of limb salvage to the patient's psychological and physical health is substantial and warrants serious consideration.

Conclusion

A retrospective review of vascular reconstruction for limb-threatening ischaemia in the spinal cord injured patient has been presented. Arterial reconstruction performed by a combination of percutaneous transluminal angioplasty and/or operative endarterectomy to restore arterial inflow was successful in preventing major amputation in 6 of 7 extremities. The clinician caring for the spinal cord injured patient with advanced peripheral vascular disease should consider vascular reconstruction in lieu of primary amputation for limb threat as he/she would in the general population.

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