

Research Article

Open Access, Volume 1

Revascularisation of Marginally Viable Limbs; A Long-Term Follow-Up Study

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Abstract

Introduction: Reperfusion of the limb is usually not attempted if more than 2 of 4 compartments are non-viable due to Acute Limb Ischemia (ALI) because of the risk of reperfusion effects. This study reports long term follow up of such patients who underwent revascularisation at the Teaching Hospital Anuradhapura (THA).

Methods: This is a cross-sectional descriptive study of patients admitted with marginally viable limbs to THA. Limb viability was confirmed in all by fasciotomy. Patients lost to follow up were excluded. Patients' demography, cause and duration of ALI, viability of limb at presentation, present activity status and satisfaction were assessed.

Results: Three were included with two males. Two had arterial injury and one had arterial thrombo-embolism. Two had 3 compartments and one had 4 compartments non-viable on fasciotomy. Mean age was 44.3 years (25 - 69). Two underwent graft repair and one embolectomy. Mean ischemic time was 14 hours (12 -18). Embolectomy patient developed acute kidney injury needing dialysis and recovered. At mean follow up of 33.8 months (11.2 -47.2) all were able to walk and was happy to have a viable limb, but had reduced muscle power (grade 4) and atrophy of leg and numbness in foot.

Discussion and Conclusions: ALI results in high amputation rate. Earlier series [1] showed that reperfusion of marginally viable limbs in young, fit patients with close post-operative monitoring can be done. This series shows that the long-term outcome of such legs is acceptable.

Keywords: Acute Limb Ischemia; marginally viable limbs; amputation

Manuscript Information: Received: February 27, 2020; Accepted: March 25, 2020; Published: March 27, 2020

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Citation: Arudchelvam J, De Soya M. Revascularisation of Marginally Viable Limbs; A Long-Term Follow-Up Study. *J Surgery*. 2020; 1(1): 1002.

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Introduction

Traditionally following acute ischemia of the lower limb (ALI) if 2 out of the four compartments are not viable the limb was not reperfused due to increased risk of reperfusion effects. The author reported revascularization of four such limbs in 2017 done at the Teaching Hospital Anuradhapura (THA) [1]. All of the four patients had surviving limbs at the time of discharge from the hospital. In Sri Lanka patients after vascular injury often present late due to delays in diagnosis and delays in transfers. This results in significant numbers of limb non-viable at the time of presentation to the hospital [1]. This study reports the long-term outcome of two of the patients from the previous reported series in 2017 [1] and another patient who underwent delayed embolectomy following lower limb thrombo-embolism.

Methods

This is a retrospective long-term follow-up study of patients who underwent revascularization of lower limb arteries at the Teaching Hospital Anuradhapura. Patient demography, comorbidities, cause and duration (ischemic time) of ALI, viability of limb at presentation, surgical procedure, post perfusion effects, the present functional status, and the patient satisfaction were assessed. Patients who were lost to follow-up were excluded. In all patient's limb viability was assessed clinically and confirmed by fasciotomy (If the muscles are not contracting with electrical stimulation i.e. stimulation with a diathermy, it was considered non-viable). In patients who had doubtful viability (Rutherford IIb and III) on clinical assessment and who were young and otherwise fit, hemo-dynamically stable with no evidence of sepsis and the limb is not mangled (Mangled Extremity Severity Score - MESS less than 7), preoperative consent was obtained for revascularization of such limbs, explaining the risks of reperfusion effects. All such patients agreed with the idea of reperfusing rather the non-revascularisation and undergoing amputation in future. Two patients who underwent traumatic arterial repair underwent skeletal stabilization with an external fixator. All patients were admitted to Intensive Care Unit for postoperative monitoring.

Results

Three patients were included (Table 1). Two were males. Two had arterial injury following Road Traffic Accident (RTA) and

one had arterial thrombo-embolism from cardiac origin (ventricular aneurysm). Two had 3 compartments non-viable and one had 4 compartments non-viable at the time of fasciotomy. Mean age was 44.3 years (25 - 69). Two underwent Reversed Saphenous Vein Graft (RSVG) repair. And the other patient who had thrombo-embolism (Case 3) who presented after 12 hours of ischemia was found to have 3 compartments non-viable at the time of fasciotomy but he did not give consent for amputation and insisted on revascularisation. This patient underwent embolectomy. He had ischaemic heart disease and chronic kidney disease. This patient developed acute kidney injury needing dialysis following reperfusion but recovered. Patient number 1, who had traumatic fracture of the femur underwent internal fixation after 2 months. Patient number 2 underwent anterior cruciate ligament repair after 3 months period.

At mean follow up of 33.8 months (11.2 -47.2) all were able to walk and was happy to have a viable limb. All had reduced muscle power (grade 4) and atrophy of the leg. All patients reported numbness of the foot. Patient number 1 complained about Raynaud's phenomenon on exposure to cold water. Patient number 2 had Complex Regional Pain Syndrome (CRPS) with burning sensation and shiny warm skin. Mean ischaemic time was 14 hours (12 -18).

Conclusion

Acute limb ischaemia either due to trauma or thrombo-embolism results in high amputation rate if not revascularized early. It is well known that longer the ischemic time there is progressive skeletal muscle loss and the risks of reperfusion effects are higher. The death of a skeletal muscle is not a uniform process (i.e., occurring in all muscle fibres at the same time). It is focal, occurring through a series of reversible changes progressing to irreversible changes. These changes first start in some muscle fibres and then progress to the rest of the muscle fibres and eventually resulting in complete death of the whole muscle [2]. Therefore, even if there is a part of the muscle which is not contractile on stimulation with a diathermy, there may be other parts which are still contractile and viable. In addition, the skeletal muscle contraction is shown to recover after a period of reperfusion, depending on the severity and the duration of ischemia [3]. In our setting skeletal muscle viability is confirmed at the time of fasciotomy with diathermy stimulation. In this scenario as mentioned above

Table 1: Patient details

No	Age	Sex	Vessel involved / Intervention	IT	Cause of ALI	Outcome
1	25	M	SFA RSVG + SFV Direct repair	18	RTA	Femur Plating Done, Able to Walk, Power Reduced 4/5 Atrophy Present, RP Present
2	39	F	PA RSVG repair	12	RTA	Underwent ACL repair, Able to Walk, Power Reduced 4/5, Atrophy Present, CRPS
3	69	M	Femoral Embolectomy	12	TE	Able to Walk, Power Reduced 4/5, Numbness Present

Table showing patient details. M – Male, F – Female, SFA – Superficial Femoral Artery, RSVG – Reversed Saphenous Vein Graft, SFV - Superficial Femoral Vein, RTA – Road Traffic Accidents, IT – Ischemic Time in hours, ACL - Anterior Cruciate Ligament, CRPS - Complex Regional Pain Syndrome, RP - Raynauds Phenomenon, TE - Thrombo-Embolism, ALI – Acute Limb Ischemia

the ischemic muscle which was stimulated with diathermy may not contract but it would recover after reperfusion. And also, there may be other parts which can contract but not stimulated by the diathermy.

In addition, skeletal muscle is known to show regeneration [4] which may also explain the recovery of the function of the muscles which was seen in this series. Therefore, earlier series [1] showed that reperfusion of limbs with doubtful viability in young, fit patients with close post-operative monitoring can be done. This especially needs to be considered in the local setting where there are often long delays in transfer and intervention. This series shows that the long-term outcome of such legs is acceptable.

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