

## Upper Limb Ischaemia – A Single Centre Experience

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### Abstract

**Introduction:** This paper reviews the epidemiology, aetiology and management of upper limb ischaemia in a series of 8 patients presenting to a tertiary referral centre over a 4-year period and the review of the pertinent literature. **Materials and Methods:** Details of patients admitted to Tan Tock Seng Hospital (TTSH) due to critical ischaemia of the upper limbs were obtained from admission summaries through the Computerised Patient Support System (CPSS) and operative notes through LOTUS. **Results:** There were 8 patients who presented with upper limb ischaemia excluding trauma and iatrogenic causes over the last 4 years. All patients underwent embolectomy. One patient had an amputation post-embolectomy. Our short-term results were encouraging with 7 patients who were well enough to be discharged. One patient had a massive brainstem stroke and was discharged home for comfort care at the request of the family. **Conclusion:** Careful physical examination and history taking, prompt recognition of upper limb ischaemia and active approach to management in the form of embolectomy are crucial in obtaining a good outcome and reducing the risk of late disabling effects.

*Ann Acad Med Singapore 2009;38:891-3*

**Key words:** Angiogram, Anticoagulation, Duplex scan, Embolectomy

### Introduction

Upper limb ischaemia is an uncommon entity which presents less commonly as compared to lower limb ischaemia, and has a wide range of aetiology and controversies in preoperative investigations and management. Less than 2% of patients with upper limb ischaemia presents with rest pain, gangrene or ulcer.<sup>1</sup> Although upper limb loss is less as compared to lower limb, it can result in severe functional impairment and disability if there should be any delay in diagnosis and treatment.

The single most common aetiology is thromboembolic events secondary to atherosclerosis followed by trauma. Nevertheless, differential diagnoses such as arteritis, thoracic outlet obstruction and aneurysms need to be considered. This paper aims to review the epidemiology, presentation, management and outcome in patients presenting to a tertiary referral centre with critical upper limb ischaemia between 2003 and 2006.

### Materials and Methods

Patients who presented with upper limb ischaemia and underwent revascularisation procedures by the vascular

team at TTSH between 2003 and 2006 were identified through the Computerised Patient Support System (CPSS) and LOTUS databases.

We excluded patients who developed upper limb ischaemia as a complication secondary to arterio-venous fistula creation for haemodialysis as well as patients who presented with acute ischaemia following trauma. The patient's case notes were subsequently traced and information was analysed retrospectively.

### Patients

Over 4 years from 2006, 8 patients (7 females, 1 male) presented between the ages of 49 and 86 years. All of them have significant medical backgrounds of ischaemic heart disease, hypertension, hyperlipidaemia and diabetes mellitus. Four out of the 8 patients had documented atrial fibrillation which was the cause of their thromboembolic event. Two had myocardial infarction during the same admission and 1 had a transient ischaemic attack a year ago. Three of the patients who presented with acute upper limb ischaemia also had past presentation of acute ischaemia of the lower limbs. One of them presented with both upper and

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lower limb ischaemia in the same admission. One of the patients had metastatic lung carcinoma and 1 had protein S deficiency.

#### *Presenting Signs and Symptoms*

The signs and symptoms of presentation ranged from non-specific slight numbness and weakness to pain, pallor and pulselessness. The most common combination of presenting complaints was cold, pulselessness and painful upper limb. Five out of the 8 patients presented with this. One patient presented with coldness of the limb, weakness and looked pale. One patient presented with coldness, pain and a weak pulse and the last patient presented with pulselessness and pain of the affected limb.

#### *Preoperative Imaging*

Four out of the 8 patients had preoperative duplex ultrasound, 1 of the patients had a duplex ultrasound and another patient had angiogram preoperatively. Three of them were brought into the emergency operating theatre directly after the clinical diagnosis was made.

#### *Operative Procedure*

All of the patients had embolectomy done with Fogarty Balloon and the average time from presentation to surgery ranged from 2 hours to 24 hours. Only 1 patient had surgery done 2 days after presentation to hospital. This patient had symptoms suggestive of ischaemia 2 days prior to admission to hospital.

The brachial artery was the most common site involved. Diagnosis of an embolus causing ischaemia of the upper limb was made intraoperatively in 5 of the patients and thrombus in 3 of them. All of the patients had good backflow and palpable radial pulses postoperatively.

One patient developed recurrent embolic event after the first surgery and had a subsequent revascularisation procedure. Unfortunately, it was unsuccessful and led to amputation.

#### *Outcome*

Postoperatively, 6 of them were started on warfarin while 1 was started on a combination of aspirin and plavix. Immediate results and outcomes were good in 7 of them and they were discharged. One of them developed a massive brainstem stroke on postoperative day 12 and was terminally ill when discharged from the hospital following the request of the family.

#### **Discussion**

Compared to lower limb ischaemia, upper limb ischaemia is seen infrequently. However, the consequences of impaired

function or amputation is much more devastating.

There is a slight female preponderance in our patient group as supported by a review done by Eyers et al and they tend to be in the older age group as compared to those in the lower limb ischaemia group.<sup>1,2</sup>

The common causes of acute upper limb ischaemia are thrombosis, embolism and iatrogenic and are frequently associated with post-arteriovenous fistula creation.<sup>3</sup> Embolism is considered the most common cause of acute upper limb ischaemia, accounting for between 74% and 100% of the cases.<sup>2</sup> Atrial fibrillation accounts for the majority of embolic events. In the series by Deguara et al,<sup>4</sup> two-thirds of their patients had co-existing atrial fibrillation. Eighty-four per cent of patients also had associated ischaemic heart disease or recent myocardial infarction.

Thrombosis, on the other hand, forms on an already diseased artery. Patients with embolism will have a recognisable source and symptoms typically present with a sudden onset. On the other hand, patients with thrombosis usually have absent or decreased pulses in the contralateral limb with evidence of peripheral vascular disease.<sup>5</sup> It is important to differentiate these 2 diagnoses because the management of thrombosis usually requires a more aggressive approach as insufficient thrombectomy is associated with higher morbidity and mortality.<sup>2</sup> Arteritis, trauma and thoracic outlet obstructions are among the other causes of acute upper limb ischaemia reported.

Clinical evaluation of acute upper limb ischaemia includes careful history taking and physical examinations. Duplex ultrasound and Ankle Brachial Pressure Index (ABPI) are some of the non-invasive adjuncts to confirm clinical diagnosis. Angiography, however, remains the gold standard<sup>1</sup> not only to determine the extent of obstruction but also to assess anatomical relationships of the arteries such as the presence of collaterals as well as congenital variations that can occur in 20% to 30% of the population.<sup>5</sup> However, Martinet and colleagues<sup>6</sup> proposed that if the clinical diagnosis is clear, no other investigations are necessary before surgical intervention. The common sites of obstruction are the axillary and brachial arteries.<sup>2,4</sup>

Successful treatment depends on early diagnosis and intervention. An active approach to upper limb ischaemia is safe and effective in reducing late complications.<sup>2</sup> Embolectomy with a fogarty catheter is the most frequent and successful surgical procedure performed for acute upper limb ischaemia.<sup>2,7</sup> It remains the best method for removing brachial emboli.<sup>4</sup> In the review by Eyers et al, it was found that favourable outcome can be expected in 65% to 94% of patients treated surgically. Amputation of the arm is seldom necessary.<sup>2</sup>

Good results can be expected in surgery performed in the

first 12 hours<sup>1</sup> and some literature quote satisfactory results in less than 24 hours.<sup>8</sup> Late presentation or diagnosis can result in limb loss.

Thrombolysis, which is established in the management of lower limb ischaemia, is not as useful in upper limb and has complications such as risks of haemorrhage and stroke. Nevertheless, thrombolysis has been described and utilised in selected cases.<sup>3,9</sup>

Long-term anti-coagulation therapy post-surgical intervention should be routine especially if the source of embolus is cardiac.<sup>2,3</sup> Warfarin is recommended for 6 months' duration to counter the risks of recurrence of embolism which may occur in up to two-thirds of patients.<sup>1,3</sup>

### Conclusions

Upper limb ischaemia remains infrequently seen compared to lower limb ischaemia. Nevertheless, the complications and late effects can result in significant impairment in function.

Evaluation of upper limb ischaemia requires careful history taking and clinical examinations. Although angiography remains the gold standard, other non-invasive tools such as duplex USS and ABPI are useful adjuncts. Prompt surgical intervention results in favourable outcomes. Eyers et al<sup>2</sup> recommended anti-coagulation with heparin, unless contraindicated during presentation and referral to a vascular team.

Embolectomy with a Fogarty balloon under local anaesthesia can be performed safely in most patients. Six

months of anti-coagulation with warfarin post-surgical intervention is recommended to reduce the risk of recurrence in thromboembolism.

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