

CASE REPORT

When Time is Limb: A Rare Case of Acute Upper Limb Ischaemia

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ABSTRAK

Iskemia tangan akut (ALI) merupakan kes perubatan kecemasan yang memerlukan intervensi yang segera dan menyeluruh. Kes iskemia tangan (AULI) lebih jarang berlaku berbanding dengan iskemia tungkai bawah. Ia boleh menyebabkan kecacatan kekal dan kegagalan fungsi yang ketara. Rawatan segera dalam tempoh masa enam jam dari permulaan gejala akan memberikan hasil yang lebih baik. Walau bagaimanapun, ianya menjadi cabaran disebabkan oleh tanda klinikal yang tidak jelas dan proses penyiasatan yang mengambil masa yang lama untuk membuat diagnosis. Penilaian klinikal yang baik dibantu dengan penyiasatan Doppler adalah penting terutamanya kes berlaku di hospital yang tidak mempunyai peralatan yang canggih kerana iskemia tangan boleh disalahkenal sebagai penyakit lain. Kami menghuraikan kes AULI dengan tanda klinikal yang tidak klasikal dan berjaya dipulihkan dengan intervensi segera.

Kata Kunci: Embolektomi; iskemia tangan atas akut; Jabatan Kecemasan

ABSTRACT

Acute limb ischemia (ALI) is a medical emergency with a time-sensitive outcome. Acute upper limb ischemia (AULI) is less common than lower limb ischemia,

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and relatively few cases have been reported. It may cause significant disabilities and severe functional impairment even in the absence of overt tissue loss. Six hours window of presentation yielded a better outcome. However, diagnosing and treating within the time frame has always been a challenge. A high index of suspicion assisted with Doppler study in a limited-resources health centre is of sound importance as limb ischemia might be mimicked by other diseases. We illustrated a case of AULI with atypical presentation and successful revascularisation intervention.

Keywords: Acute upper limb ischemia; embolectomy; Emergency Department

INTRODUCTION

Acute upper limb ischaemia (AULI) is less common than acute lower limb ischaemia, and the annual incidence of AULI is 1.3 cases per 100,000 patients (Wong et al. 2016). Delays in diagnosis may result in severe disability and loss of function. As AULI is rare, there must be more evidence-based guidelines for the management and post-intervention follow-up. The success of the intervention in AULI depends on the timely diagnosis and rapid localisation of the arterial occlusion. AULI has myriads of aetiologies, with thromboembolic events as the most common causative agent (Quraishy et al. 1992). This report illustrated a patient with low-risk factors and atypical presentation of AULI detected only with a Doppler study in a limited-resources health centre. He underwent mechanical embolectomy thrombolysis therapy, successfully salvaging his limb and its function.

CASE REPORT

A 47-year-old man presented to the

Emergency Department (ED) of the district hospital with a sudden onset of numbness in the left upper limb for two days. He had not known medical illness, was an active smoker, has no history of trauma to the left upper limb and had no family history of arterial or venous thrombosis. The numbness of the left upper limb was worsened by active movements and alleviated when resting. The numbness progressively worsened and affected his daily activities, such as combing his hair, lifting heavy objects and driving. He denied any similar episode before, any infective symptoms, and the numbness was not associated with debilitating pain deterioration in the function. The patient denied having any contact or symptoms related to COVID-19 and had no recent vaccination history. Additionally, the patient did not have any previous episodes of claudication, peripheral arterial disease, coronary arterial disease, congestive heart failure, or cardiac dysrhythmia.

Examination revealed a cold and clammy left hand with local cyanosis of the left hand compared to the right hand. The capillary refill time

at the left upper hand was three seconds, with poor brachial, radial and ulnar pulse volumes with bruits on auscultation. The right radial pulse was strong and regular. When tested with an oxygen probe for saturation detection, the probe failed to get any reading at the left hand. On cardiovascular examination, S1 and S2 were heard with no heart murmurs. Upon neurological examination, his sensations at dermatomes C5 till T2 were impaired at the left upper limb. However, his power, reflexes, and range of movements were intact in his bilateral upper limbs. Vitals signs were within normal range, and other examinations were unremarkable. Blood investigation showed high blood glucose (random blood sugar of 13 mmol/L) and hypercholesterolemia (total cholesterol of 10 mmol/L, LDL of 9 mmol/L, HDL of 3 mmol/L and TG of 15 mmol/L).

The constellations of signs and symptoms suggested acute limb ischemia, including the acute onset, neurological deficits and poor perfusion of the left upper limb. As the patient did not present with any known risk factor other than smoking, the initial electrocardiogram (ECG) did not show any arrhythmias. Bedside echocardiography (ECHO) by the Emergency Physician showed normal heart chamber dimensions, systolic function and diastolic function for both ventricles and no intracardiac clots were seen. We still maintain a broad differential diagnosis such as Berger's Disease. Duplex ultrasound (DUS) was unavailable in this hospital; however, the Doppler study showed

no wave at the left upper limb's brachial, radial, or ulna arteries. The vascular surgeon from the tertiary hospital was consulted, and the patient was referred to the tertiary hospital for further investigation and management.

In tertiary hospitals, urgent echocardiography by radiologists also revealed no significant findings. The dimensions of all heart chambers were normal, the systolic function of the left ventricle (LV) was normal (ejection fraction; EF 68%), the diastolic function of the LV was normal, the systolic function of the right ventricle (RV) was normal, segmental analysis of LV was normokinetic, and no ventricles hypertrophy was observed. A computed tomography (CT) angiogram revealed acute long-segment occlusion of the left axillary, brachial and ulnar arteries. The axillary artery showed complete non-opacification with a filling defect. Meanwhile, the brachial artery showed an opacified proximal part, reconstituted from the anterior circumflex humeral artery. Poor, intermittent opacification mid-part with a central filling defect, reconstituted from radial/ middle collateral arteries. The distal part was non-opacified. Both common internal and external carotid arteries were well opacified. Thoracodorsal and deltoid arteries were opacified. No mural calcification of the left upper limb arteries and was observed with no beaded appearance (Figure 1). As the hospital had no interventional radiologist, a brachial embolectomy was scheduled on the same day post-CT angiogram.

The patient underwent mechanical embolectomy without any

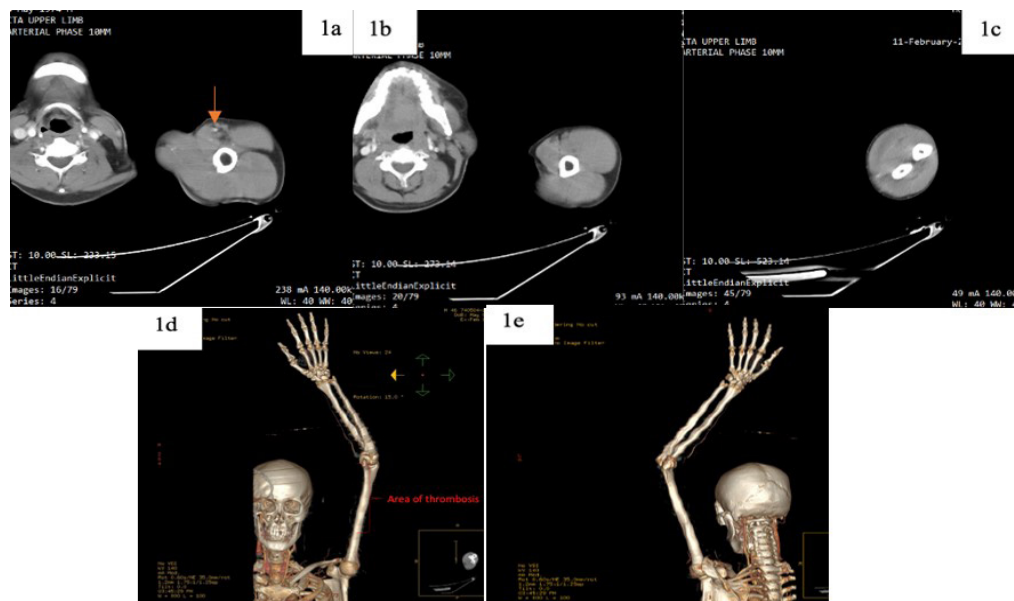


FIGURE 1: A computed CT angiogram pre-embolectomy revealed (a) an opacified proximal part of the left brachial artery (arrow); (b) poor opacification mid part of the left brachial artery; (c) non-opacified left ulnar and radius artery; and (d & e) acute long-segment occlusion of the left axillary, brachial and ulnar arteries

complications. A Fogarty catheter was used to remove the clots. Intraoperatively, 20 cm of thrombus was extracted from the brachial artery. Besides, the team extracted 4 cm of thrombus from the ulnar artery and 2 cm from the radial artery. The patient was then started on heparin infusion and later bridged to warfarin. Post embolectomy, a CT angiogram showed complete revascularisation of the left brachial, radial, and ulnar arteries (Figure 2). Clinically, the numbness of the left upper limb resolved with good capillary refill time and preserved function. Also, the patient was followed up by his surgeon and physician and had remained stable. Tests were ordered to screen for hypercoagulable states, and results indicated unremarkable prothrombin

time/international normalised ratio (PT/INR), partial thromboplastin time (PTT), D-Dimer, Angiotensin II (ATIII), protein C, protein S, Factor V Leiden, lupus anticoagulant, anti-phospholipid antibodies, and anti-beta-2-glycoprotein antibodies. A repeat CT angiogram from the ascending aorta to the whole upper limb during follow-up showed no residual or new thrombus identified. He is now on a lifelong antiplatelet therapy and has regular follow-ups at the outpatient clinic of surgical and internal medicine.

DISCUSSION

Acute limb injury (ALI) is a limb-threatening condition that carries significant morbidity to the patient. ALI usually presents with the classic 6Ps:

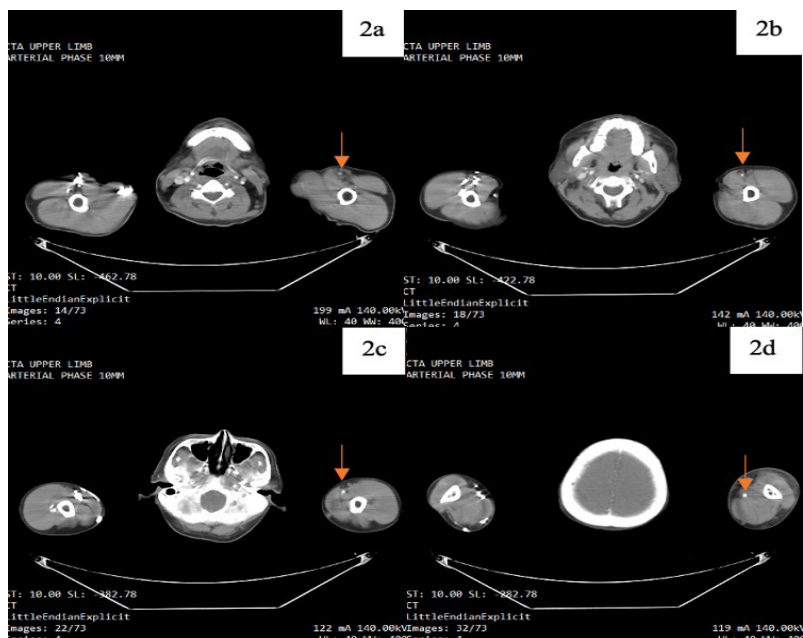


FIGURE 2: CT angiogram post embolectomy showed (2a & 2b) complete revascularization of the left brachial artery; and (2c & 2d) left radial and ulnar artery (arrow)

Paraesthesia (numbness), Pain, Pallor, Pulselessness, Poikilothermia (cold to touch), and Paralysis (Quraishy et al. 1992).

AULI is less common than lower limb ischaemia and usually affects females more than males. It results in a significant limb disability, but limb loss is a rare occurrence. It only accounts for approximately 5% of ALI cases. The causes of non-traumatic ALI can be broadly divided into embolic and thrombotic events (Callum & Bradbury 2000; O'Connell & Quiñones-Baldrich 2009; Santistevan 2017). Various diseases affect the arteries of the upper extremities, but the leading cause of ischemia in the lower extremities is atherosclerosis. Thromboembolism is the most common cause of AULI, accounting for 61% of cases and

usually affecting older patients (Andersen et al. 2013; Skeik et al. 2015). The most common causes include atrial fibrillation (51%), valvular heart disease (6%), and isolated ischemic heart disease with left ventricular hypokinesis (4%) (Licht et al. 2004). The mechanism of chronic ischemia is progressive atherosclerotic narrowing of the subclavian, axillary, or brachial artery, resulting in low flow, stasis, and possible thrombosis. However, clinical manifestations of ischemia due to acute primary arterial thrombosis in upper extremity arterial stenosis are rare, presumably because of the abundant collateral network. It is reported only in case series and is usually caused by aortic arch abnormality (Boas et al. 2002), injury associated with thoracic outlet syndrome (Vemuri et

al. 2017), arterial catheterisation or other vascular injury, or pre-existing stenotic atherosclerotic lesion (Dave et al. 2004).

During this pandemic, acute limb ischaemia was reported as the presentation and complication of COVID-19 and vaccination. A review of three Dutch hospitals reported a 31% incidence of vascular embolism, of which 27% was due to venous thromboembolism and 3.7% to arterial thrombosis (Klok et al. 2020). The upper limb is much less frequently affected than the lower limb. Few cases involving the upper extremities have been reported in the literature. Interestingly, arterial thrombotic events (77%) can occur in patients with few or no respiratory symptoms (Vo et al. 2022).

The Rutherford Classification for ALI is a helpful guide for managing this patient (Rutherford et al. 2017). Since there is no specific classification for AULI, The Rutherford classification is used in this case (Table 1). ALI can be classified into different classes, such as Viable (Class 1), Threatened (Class 2), and Irreversible (Class 3).

One of the most significant prognosis factors in ALI is the presence of muscle weakness. Muscle weakness indicates (although not absolute) that the disease has at least progressed to Class 2B or 3. In ALI class 3, limb amputation will be the preferred option (Quraishy et al. 1992). Besides that, the management is also determined by the timing and the options available at the treatment centre. The golden hour for ALI is 6 hours. In a retrospective analysis of 822 cases of ALI, it was concluded that patients admitted more than 6 hours of symptom onset have a higher rate of amputations than those admitted within the golden hour (Braun & Lin 2015; Dag et al. 2012).

In this case, the diagnosis poses a considerable challenge as the patient only presented with severe numbness in the right upper limb for the last 48 hours. Besides being an active smoker, no significant pre-existing diseases, history of autoimmune diseases or thromboembolism among family members or trauma that may lead to such presentation. Clinical examination showed hypoperfusion signs with significant sensation

TABLE 1: Rutherford classification for acute limb ischemia (Rutherford et al. 1997)

Stage	Prognosis	Findings		Doppler Signal	
		Sensory Loss	Muscle Weakness	Arterial	Venous
I	Limb viable, no immediate threatened	None	None	Audible	Audible
IIa	Limb marginally threatened, salvageable if promptly treated	Minimal (toes)	None	Often inaudible	Audible
IIb	Limb immediately threatened, salvageable with immediate revascularisation	More than toes, pain at rest	Mild or moderate	Inaudible	Audible
III	Limb irreversibly damaged, major tissue lost or permanent nerve damage inevitable	Profound, anaesthetic	Paralysis (rigour)	Inaudible	Inaudible

impairment. The function of the right upper limb is preserved. The patient did not complain of pain or weakness in the affected limb. Therefore, he only fulfilled three out of six classic criteria for ALI. Bedside investigations such as ECG and echocardiography revealed no abnormalities. The patient also did not present with any constitutional symptoms that point towards malignancies. In this case, the possible aetiology for AULI was acute arterial thrombosis due to an atherosclerotic plug, evidenced by hyperglycaemia with hypercholesterolemia. The provisional diagnosis and workups were made based on clinical judgement and a bedside Doppler study in the ED.

DUS is the first imaging choice for evaluating ALI. It is widely available, inexpensive, non-invasive, non-radioactive, and relatively short time to perform. In emergencies where DUS is unavailable, alternative imaging techniques will be required. Continuous Doppler provides information about the presence and nature of arterial blood flow, making it possible to understand the degree of arterial occlusion. Three-phase flow is considered as a normal arterial flow. Occlusion flow decreased peak systolic flow but not diastolic flow. Arterial occlusion usually results in a lack of distal flow. Continued systolic/diastolic blood flow usually indicates an old obstruction already compensated by comorbidities. Continuous Doppler also provides a way to measure distal pressure.

The management of AULI can be challenging due to its rare occurrence, a wide array of symptoms

and aetiologies. Furthermore, there needs to have more evidence-based guidelines for AULI. As technology progressed, the treatment of AULI evolved. A study by Wong et al. (2016) revealed that most AULI cases have a thromboembolic origin, often localise to the proximal arm, and are amenable to the embolectomy technique. The outcomes are excellent, with a high limb salvage rate as high as 97.7%. Anticoagulant is usually concomitantly used with mechanical embolectomy to prevent catheter-associated clot formation.

CONCLUSION

We encountered a rare case of acute upper limb ischaemia. The lack of constitutional and systemic symptoms makes the diagnosis difficult. However, in the limited-resource setting, a high index of suspicion, combined with a positive Doppler study, pointed towards AULI diagnosis. The patient underwent mechanical embolectomy with thrombolysis therapy. We managed to salvage the limb with full function and gradual improvement in sensation. The early diagnosis and appropriate intervention are cornerstones of an excellent clinical outcome for the AULI patient.

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