



Case Report

Rapid heparinization as a decisive strategy for acute upper limb ischemia: a case report

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ABSTRACT

Background: Acute upper limb ischemia is a rare clinical presentation of thromboembolism, mostly known in patients with atrial fibrillation. Both conservative and surgical procedures are available as alternatives to therapy. In this case report, a patient who had been diagnosed with acute upper limb ischemia received immediate heparin administration in order to protect the upper limb and restore its functional capabilities.

Case Illustration: A 60-year-old male presented with acute pain and numbness, along with bluishness and a cold sensation in the right hand. He has unrestricted arm mobility. The patient has a medical background of atrial fibrillation for over 11 years. The right hand exhibited reduced peripheral saturation, pulselessness, pain, pallor, and poikilothermy, but neither paresthesia nor paralysis. Duplex ultrasonography showed no detectable blood flow from the right brachial artery up to the distal arteries. However, the vein remained audible. The patient received heparinization immediately.

Conclusion: Immediate identification and administration of heparin in instances of acute upper limb ischemia (AULI) are crucial for achieving favorable outcomes and a good prognosis. Continued treatment with anticoagulants is necessary for the therapeutic intervention in order to enhance limb preservation, minimize complications, and ensure patients have an excellent quality of life subsequent to conservative treatment.

1. Introduction

Acute upper limb ischemia (AULI) is a rare vascular emergency that can have serious consequences or even be life-threatening if treated improperly. Abrupt arterial blockage, a result of thrombosis, embolism, arterial dissection, or iatrogenic trauma, frequently causes it. Compared to acute lower limb ischemia, acute upper limb ischemia is less common. The clinical manifestations are similar to those in the lower limb: pallor (white limb with mottled, cyanotic pattern), pain, cold extremities, lack of pulse, and, when immediately at risk, paralysis, paresthesia, and sensation of soreness in the forearm.¹ The annual incidence rate of AULI is estimated to be 1.5 cases per 10,000 individuals.

The association between atrial fibrillation (AF) and thromboembolism has been well acknowledged. It was observed that patients with embolism often had elevated levels of atrial fibrillation.² Atrial fibrillation is the most common cardiac arrhythmia, and it increases the likelihood of blood clot formation and subsequent systemic thromboembolism, which can result in acute upper limb ischemia and contribute to higher rates of morbidity and mortality.³ Accurate artery obstruction location and rapid identification are critical for successful limb salvage and revascularization. For the condition with AULI, some approaches are being used, like pharmacological, endovascular interventional, and surgical revascularization. However, the effects of those modalities are comparable in terms of limb amputation, 12-month mortality, and

recurrent ischemia.⁴ Due to its rarity and potential severity, early recognition and timely intervention are crucial in preventing irreversible limb damage and systemic complications. Understanding the underlying etiology and selecting the most appropriate treatment strategy remain key challenges in optimizing patient outcomes.⁵ Here, we illustrated a successful resolution of AULI through prompt heparinization.

2. Case Illustration

A 60-year-old man was admitted to the hospital due to the sudden onset of pain and numbness in his right hand. An abrupt onset of numbness, accompanied by bluishness and a cold sensation, was experienced in the patient's right hand, extending from the forearm to the tip of the fingers. He has unrestricted arm mobility. The patient has been diagnosed with hyperthyroidism and atrial fibrillation for over 11 years. The patient was receiving medical therapy and was prescribed thiamazole (1 × 5 mg), propranolol (3 × 20 mg), and warfarin (1 × 2 mg); nevertheless, the patient did not take his prescription as directed. The patient has a history of uncontrolled hypertension.

During the initial physical examination, the patient's general appearance indicates moderate illness, with full consciousness and normal vital signs. The right hand exhibited reduced peripheral saturation (digits 1–5: 56%, 50%, 43%, 42%, 32%) with normal saturation at other extremities, upper right brachial arterial pulse was weak. However, the right radial arterial pulse and the right ulnar arterial pulse were not palpable, pain, pallor, and poikilothermy, but neither paresthesia nor paralysis. The electrocardiogram showed atrial fibrillation, with a

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ventricular rate of 95–105 bpm irregularly irregular, an inferior old myocardial infarct, and an incomplete right bundle branch block (RBBB)

The echocardiography test findings revealed the presence of regional wall motion abnormalities, a low left ventricular ejection fraction (LVEF 27.1% by teich), and no thrombus at the LV or LAA. Duplex ultrasonography was performed to him, the result was no detected blood flow from the right brachial artery up to the distal arteries, but the vein was still audible (Figure 3A).

The patient was immediately given heparinization with Bolus Heparin 80 international units per kilogram of body weight each hour

and followed by a maintenance dose 18 international units per kilogram of body weight each hour and additional with cilostazole 100 mg, atorvastatin 40 mg, Atorvastatin 0-0-20 mg, bisoprolol 2.5 mg, Captopril 3x25mg, Vit E 1x1, and pentoxifylline 3x400mg. The next day patient felt better and the pain decreased accompanied by warm right hand. Patient performed DUS evaluation at 2nd day of care and the result showed monophasic flow at level right radial artery and ulnar artery (Figure 3B).

In order to prevent a recurrence of his ischemic event, the patient was maintaining heparin while starting on bridging to warfarin therapy. The patient was discharged without pain complaints anymore.



Figure 1: Initial clinical presentation at the time of admission

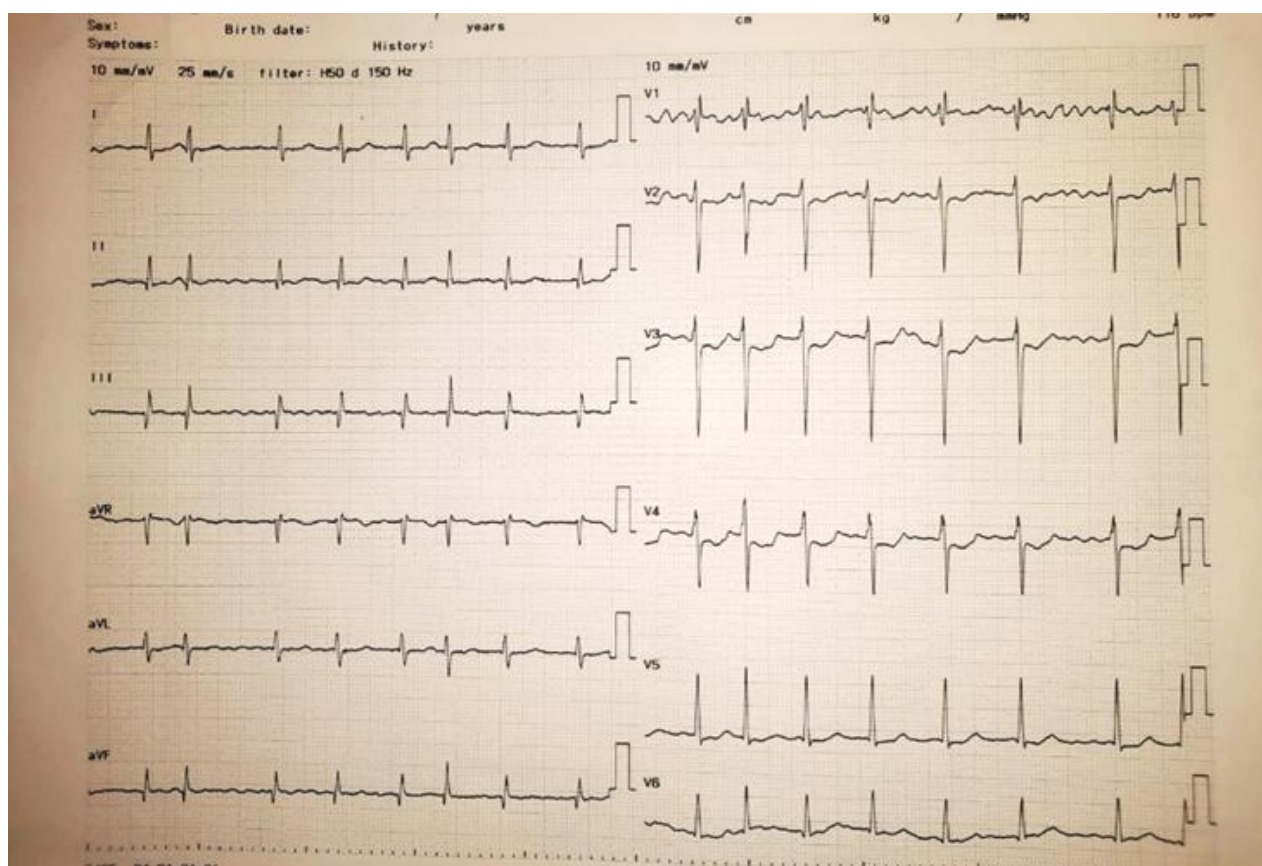


Figure 2: Initial electrocardiography showed atrial fibrillation rhythm

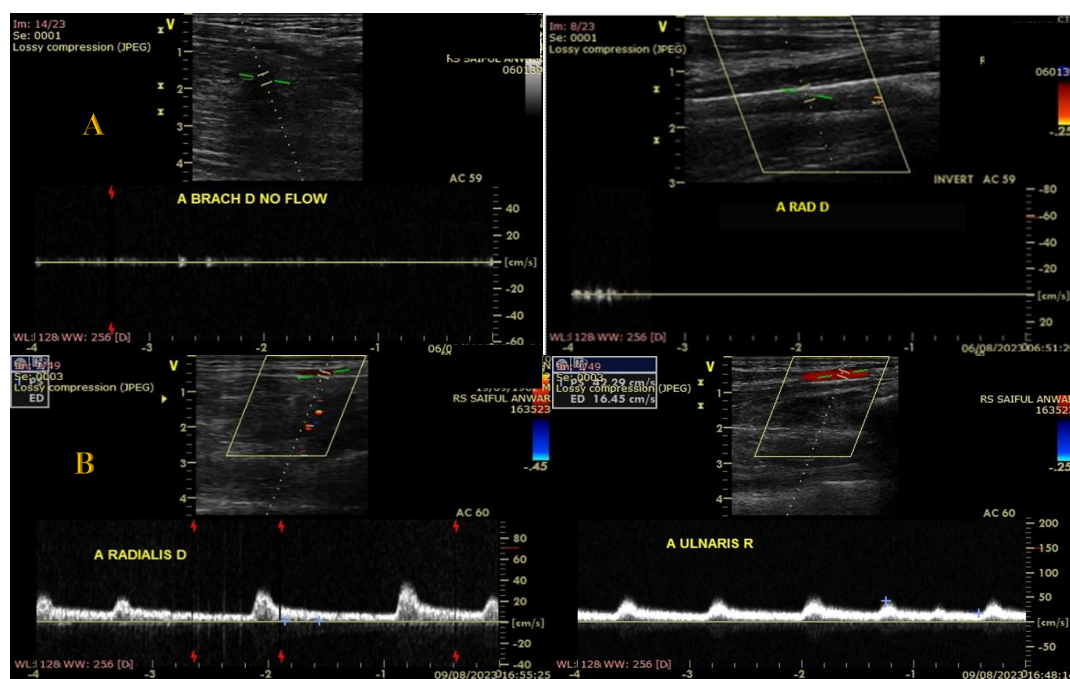


Figure 3: A. Duplex ultrasonography showed no flow at level right brachial artery and right radial artery B. Duplex ultrasonography evaluation showed monophasic flow at level right radial artery and right ulnar artery.

3. Discussion

Cardiac origin is the primary source of upper limb embolism, with the brachial artery being the most frequent location for the embolus to become stuck. Acute upper limb ischemia is a relatively uncommon cases as compared to lower limb ischemia, which represents around 10–15% of all peripheral embolism incidences. Patients diagnosed with atrial fibrillation had a relative risk of thromboembolic events that was 7.5 for men and 9.3 for women when compared to the baseline group.⁶

The probability of thromboembolism is higher in patients with atrial fibrillation who also have hypertension, stroke, myocardial infarction, and heart failure. Other factors to consider include the presence of prominent plaques in the aorta. Plaques that are thicker than 5 mm provide a substantial risk of embolization. The risk of systemic embolism in the elderly is greatly increased by disrupted mobile aortic plaques. Other risk factors include proximal aneurysms of upper limb arteries, external compression from the cervical ribs, intracardiac lesions, arteritis, malignant tumors, fibromuscular dysplasia, and hypercoagulable states.² Genetic predispositions, such as ACE polymorphisms influencing vascular function, may also play a role in the development of these risk factors.⁷ Cardiovascular issues and comorbidities may play a role in the condition.⁸

The precise etiology of the thrombus in this case remains uncertain. The echocardiography findings revealed no thrombus at the LV or LAA. Acute upper limb ischemia was classified by anatomical location into small or large arteries and classified the pathogenesis as either occlusive disease or vasospasm.⁹ After conducting a study with a total of 35 patients, Bae M et al. discovered that embolism was the most prevalent cause of upper limb ischemia. Furthermore, they discovered that the distal brachial artery, which is located before the bifurcation of the radial and ulnar arteries, was the most frequently detected site of blockages.¹ According to Spinelli et al. duplex ultrasonography is the most commonly used diagnostic tool.¹⁰ Conversely, Licht et al. found that eighty-eight percent of surgical procedures were carried out solely on the basis of the patient's past medical history and physical assessment.¹¹ Pharmacological therapy (including anticoagulation) and endovascular approaches (which are referred to as catheter-directed thrombolysis and percutaneous catheter embolectomy) are noninvasive alternatives for the management of AULI. Catheter-directed thrombolysis is now widely accepted as the primary treatment for acute lower limb ischemia. Nevertheless, the efficacy of this treatment in revascularization of the upper extremities remains unclear. A recent review emphasizes the

potential usefulness of this for both acute and chronic hand ischemia. Streptokinase, urokinase, and recombinant tissue plasminogen activator are the main thrombolytic agents commonly used.⁵ Thrombolysis has been shown to not only reduce the amount of subsequent tissue damage but also provide an opportunity for the distal ischemia to become obvious. These approaches are more appropriate for distal occlusions that cannot be adequately treated with mechanical thrombectomy.¹²

In the absence of contraindications, including recent or current bleeding, anticoagulation is an essential therapy for ischemia in both the upper and lower extremities and can be promptly initiated. Commonly used alongside thrombolysis, it serves to restrict the development of blood clots surrounding the catheter and potentially reduce the increase of pre-existing blood clots.³ Frequently, it is advised as an alternate choice for patients who are too unstable for surgical procedures or endovascular therapy, or for those with mild symptoms that are either improving or remaining exactly the same. Anticoagulation is crucial in mostly preventing the recurrence of thromboembolic condition.¹³

According to the most recent guidelines, the management of AULI is recommended to be based on grading.¹⁴ In this instance, the patients have been identified as Rutherford I based on a physical examination and duplex ultrasonography. Grade Rutherford I refers to patients who had audible veins and did not suffer any neurological deficits. Therefore, it undergoes revascularization within a few hours. The patient immediately received heparin therapy upon initial symptoms, resulting in restoration of blood flow and significant clinical improvement by the second day of treatment, as confirmed by the DUS evaluation. Continued treatment with anticoagulants is necessary for the therapeutic intervention in order to enhance limb preservation, minimize complications, and ensure patients have an excellent quality of life subsequent to conservative treatment. The effects of those modalities are comparable in terms of limb amputation, 12-month mortality, and recurrent ischemia, making meta-analysis valuable to guide treatment.¹⁵ While the focus of this study is on thromboembolic events, similar community health factors, such as willingness to participate in medical studies, can play a role in the broader understanding and management of vascular health conditions.¹⁶ Environmental and genetic factors, such as those identified in studies of dengue infection, may also influence the incidence of acute ischemic events, suggesting a multifactorial approach to understanding vascular health.¹⁷ Similar to health behaviors in dengue vaccination acceptance, socioeconomic factors and patient attitudes can impact the timely

response and adherence to treatment in cases of acute upper limb ischemia.¹⁸ Genetic factors, including angiotensinogen gene polymorphisms, may contribute to hypertension and vascular conditions, potentially influencing the risk of ischemic events and complications in patients with underlying cardiovascular issues.¹⁹

4. Conclusion

Immediate identification and administration of heparin in instances of acute upper limb ischemia are crucial for achieving favorable outcomes and a good prognosis. Continued treatment with anticoagulants is necessary for the therapeutic intervention in order to enhance limb preservation, minimize complications, and ensure patients have an excellent quality of life subsequent to conservative treatment.

5. Declaration

5.1 Ethics Approval and Consent to participate

Patient has provided written informed consent prior to involvement in the study.

5.2. Consent for publication

Not applicable.

5.3 Availability of data and materials

Data used in our study were presented in the main text.

5.4 Competing interests

Not applicable.

5.5 Funding Source

Not applicable.

5.6 Authors contributions

Idea/concept: ZV, NK. Design: ZV. Control/supervision: NK. Data collection/processing: ZV. Analysis/interpretation: ZV, NK. Literature review: ZV, NK. Writing the article: NN. Critical review: NK. All authors have critically reviewed and approved the final draft and are possible for the content and similarity index of the manuscript.

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