

Management of Acute Upper Extremity Ischemia Attributed to Cardiac Abnormalities: 3 Cases

O. Lamliki^{1*}, O. Zahdi^{2*}, H. EL Bhali², M. Chemlal¹, Y. Bahij², M. Cherti¹, Y. Sefiani², B. Lekehal², A. EL Mesnaoui², Y. Bensaid²

¹Cardiology B department; Souissi Maternity Hospital, 10080 Agdal, Rabat, Morocco

²Vascular surgery department; Ibn Sina University Hospital Centre, 10104 Souissi, Rabat, Morocco

*Corresponding author

O. Zahdi

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Abstract: Ischemia of the upper extremity is a relatively infrequent problem facing the vascular surgeon. Patients usually present with a cool, pallid hand or evidence of distal gangrene. Claudication is unusual because of the abundant collateral arteries around the shoulder. When it occurs, arm ischemia may seriously jeopardize the livelihood and independence of the patient involved. Herein, we report three cases of upper extremity ischemia that all resulted of a cardiac aetiology, and we will consequently present a literature revue of the global management of acute upper limb ischemia attributed to a cardiac abnormality. Conclusion: Upper extremity ischemia related to cardiac abnormalities is frequently due to thromboembolism, most commonly from atrial fibrillation, which accounts for approximately 80% of upper extremity thromboembolism. Other less frequent causes include valvular abnormalities, cardiomyopathy, and atrial septal defects. In addition to treating the cardiac abnormality responsible for the embolism, these patients require systemic anticoagulation and often embolectomy. After embolectomy, patients must be monitored closely for development of compartment syndrome caused by reperfusion and treated accordingly.

Keywords: ischemia-upper-limb-cardiac-amputation.

INTRODUCTION

Ischemia of the upper extremity is a relatively infrequent problem facing the vascular surgeon. Patients usually present with a cool, pallid hand or evidence of distal gangrene. Claudication is unusual because of the abundant collateral arteries around the shoulder. When it occurs, arm ischemia may seriously jeopardize the livelihood and independence of the patient involved [1]. Non traumatic causes of upper limb ischemia present diagnostic challenges, carry systemic implications, and require a multidisciplinary approach. Understanding the causes of upper limb dysvascularity will allow the vascular surgeon to approach these patients in a systematic manner. An estimated 58% to 93% of acute upper extremity ischemia is attributable to cardiac embolism [2]. We review three cases of upper limb acute ischemia due to a cardiac disease, and at the light of it reviewing published results of the literature.

CASES PRESENTATION

Case 1

A 45 year old woman, with no cardiovascular risk factors or history of any disease, presented with an acute upper left limb ischemia with a blue and cold arm. In the electrocardiogram (ECG) we note an atrial fibrillation with an elevated heart rate at 140 beats per minute (bpm). The trans-thoracic echocardiography (TTE) showed no left ventricle dysfunction, no valvular disease, but a dilated left atrium at 25cm². A biological analysis found a hyperthyroidism with a TSHus at 0.005 mU/L and elevated thyroid hormones. The patient underwent embolectomy using a Fogarty catheter, but no pulse was re-established and the arm remained ischemic, for that an unfortunate amputation was performed. A long term anticoagulation was started with Acenocoumarol (Sintrom*).



Fig-1(a,b): Image of an ischemic arm of a 45 year old patient, due to atrial fibrillation

Case 2

A 100 year old woman, with a history of hypertension and chronic chest pain neglected by the patient, presented with a critical ischemia of the upper left arm. The ECG showed a sinus rhythm with Q waves

at the anterior territory and a microvoltage in the peripheral leads. TTE revealed an apical aneurysm with a large thrombus m. An emergent arm amputation was performed in front of an ischemic, and a curative anticoagulation started.

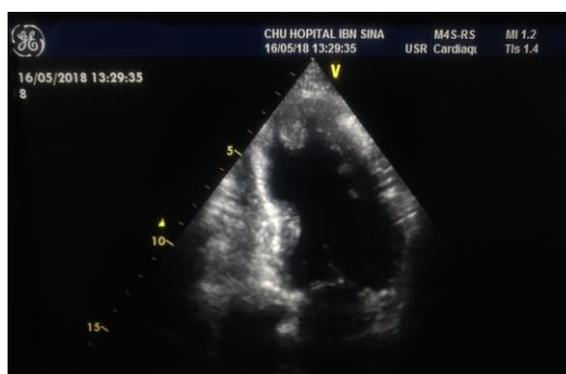


Fig-2: Image of a left ventricle apical thrombus, of a patient presenting with an arm ischemia

Case 3

A 75 year old man, presenting with a left arm acute ischemia and a history of diabetes, hypertension and renal failure with 3 times a week hemodialysis sessions. The ECG we found a sinus rhythm with no abnormalities. However, the TTE revealed signs of

endocarditis with a large vegetation in the atrial side of the tricuspid valve measuring 11 millimetres. Microbiologically, 3 blood-cultures identified a *Staphylococcus aureus*. The patient underwent embolectomy using a Fogarty catheter, associated with antibiotherapy.



Fig-3 : image of a tricuspid valve infective endocarditis, showing a vegetation in the atrial side of the valve

DISCUSSION

Incidence

In population surveys, the incidence of all types of limb ischaemia has been reported to vary between 7 and 21 per 100 00 per year 1. This can be

extrapolated to give a total incidence of acute arm ischaemia of 1.2–3.5 per 100 000 per year. Pentti *et al.* [3] reported 97 arm thromboembolectomies over 26 years in an unselected population of 430 000, an incidence of 0.86 per 100 000 per year. As in many

other surgical series, these authors excluded patients with acute arm ischaemia who did not have an operation. Dryjski and Swedenborg [6] reviewed all patients with acute arm ischaemia presenting to hospital during 1 year and found an incidence of 1.13 per 100 000. The accuracy of published data for the incidence of acute arm ischaemia is questionable as most information comes from hospital or surgical reviews.

Patients

There is a slight female preponderance in both observational and operative series. The mean age of patients with acute arm ischaemia is 67 years, slightly higher than the mean of 62 years in studies that included leg ischaemia [2]. Stonebridge *et al.* [4] compared acute ischaemia of the arms and legs, and confirmed that patients with arm ischaemia tended to be older (74 versus 70 years).

Cardiac causes

Several well recognized problems confound investigation of the cause of acute arm ischaemia. Atherosclerosis is rare in the arteries of the upper limb, leading some investigators to label all non-traumatic ischaemia as embolic. While this may seem a reasonable assumption, it fails to distinguish the rarer causes of arterial occlusion such as in situ thrombosis. Furthermore, successful surgical disobliteration by balloon catheter is often taken to confirm the diagnosis of embolism and it is sometimes assumed that a failed procedure implies non-embolic disease. Most studies attribute the cause of embolism to associated cardiac conditions but often this cannot be confirmed pathologically. For example, a history of ischaemic heart disease can be enough for some to label an occlusion as embolic. Thus, assessment of the cause of ischaemia is biased by preconceptions about the aetiology of vascular disease of the upper limb; rare conditions, such as arteritis, can be missed completely.

Embolism is considered the most common cause of acute arm ischaemia, accounting for between 74 and 100 per cent of cases [5-8]. Most investigators use some or all of the following criteria in the diagnosis of embolic ischaemia: sudden clinical presentation, an embolic source, absence of peripheral atherosclerosis and removal of discrete 'clot' at operation. The emboli are attributed to a variety of sources. Cardiac embolism is the most frequently reported cause of acute arm ischaemia, ranging from 58 to 93 per cent [2]. Atrial fibrillation is the usual aetiology. Over the years the incidence of atrial fibrillation has remained fairly constant, although the cause of fibrillation has changed from valvular heart disease as a result of rheumatic fever to ischaemic heart disease and myocardial infarction. The myocardium can be a source of embolism even in the absence of atrial fibrillation or ischaemic heart disease. Rare causes include atrial myxoma [9,10], ventricular aneurysm [11], cardiac failure [11] and paradoxical embolism [12].

Site of occlusion

The commonest sites of upper limb arterial occlusion are the axillary and brachial arteries, consistent with the likely sites for embolic occlusion [13,14]. Comparison between studies is difficult because some record the site of occlusion based on clinical findings whereas others include operative findings and angiography, where available. Acute ischaemia is slightly commoner in the right arm, which may reflect the proximity of the brachiocephalic artery to the heart. In studies of thrombotic occlusion of the upper limb, the subclavian and axillary arteries tend to be favoured, presumably as a result of the associated causes [7, 8, 15-17]. Haemovivvi [18] reported the subclavian artery was the site of occlusion in 11.7%, the axillary in 23%, the brachial in 61%, the radial in 23% and the ulnar artery in 1.6% of patients with acute upper limb ischemia. The subclavian artery once occluded is compensated by its collateral blood supply from the vertebral arteries. The axillary artery, too, has a collateral supply from the more proximal subclavian branches. Combined subclavian and axillary occlusion would normally cause ischemia of the whole arm [19]. Occlusion of the brachial artery has different effects depending on the site of blockage. The brachial can be occluded at the point of the origin of the deep brachial or at its bifurcation [20]. If the occlusion occurs before the deep brachial artery origin, then the arm becomes ischemic because there is no collateral supply. However, the collateral blood supply for an occlusion distal to the deep brachial artery is profuse being supplied by the deep brachial, superior and inferior ulnar collateral arteries, and the cubital vessels; hence the clinical picture is commonly less severe. Occlusion of either the radial or ulnar arteries is usually not markedly injurious because these arteries compensate for each other. However, occlusion of the more distal deep palmar arch results in tissue necrosis in the hand. Conversely, the common digital arteries receive a good collateral blood supply. However, congenital vascular variations that may change the patient's clinical picture occur in 20% to 30% of the population [21].

Treatment

Different studies show that operative management is the most commonly used (86%), followed by conservative management (11%) and interventional radiological approaches (3%) [19]. Reports using embolectomy as the primary management show an overall success rate 85%–90% [3,4, 8, 11, 15, 20-25]. Williams and Bell correctly suggest surgery should be considered in all cases [26].

CONCLUSION

Upper extremity ischemia related to cardiac abnormalities is frequently due to thromboembolism, most commonly from atrial fibrillation, which accounts for approximately 80% of upper extremity thromboembolism. Other less frequent causes include valvular abnormalities, cardiomyopathy, and atrial

septal defects. In addition to treating the cardiac abnormality responsible for the embolism, these patients require systemic anticoagulation and often embolectomy. After embolectomy, patients must be monitored closely for development of compartment syndrome caused by reperfusion and treated accordingly.

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