Arterial Embolism of Extremities in Patients with Cardiac Disease

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To define the pattern of aetiological factors and problems in management 29 cardiac patients with 40 acutely ischaemic limbs due to arterial embolism were studied. The mean age was 53 years (range 25-100). The male to female ratio was 1.2:1; and 13 patients were Saudi nationals (44.8%). There was a delay in management in 18 patients (62%), as they presented after more than 8 h of onset of the ischaemia. Lower limbs were affected in 26 patients (89.7%). While rheumatic valvular heart disease was found to be the commonest aetiological disease in the non-Saudi patients, atherosclerotic coronary heart disease was encountered more frequently in Saudi patients. Emboli occluded a large artery in 22 patients (75.9%); four of them were saddle aortic emboli. Embolectomy was considered the treatment of choice and performed on 33 limbs (82.5%) out of the 40 limbs treated, while heparin therapy only was used in treating four limbs (10%). Seven limbs were amputated, three primary and four after embolectomy. Five of our patients (17.2%) expired and death was associated with a delayed, large peripheral embolism and myocardial ischaemia. In order to increase the chances of saving limbs, early referral of cases is highly recommended, followed by aggressive cardiac and surgical management. Whenever possible, the latter should be performed in vascular units.

Limb ischaemia due to peripheral distal arterial embolism is uncommon.1 However, when it occurs, it represents a major challenge to every vascular surgeon as it is associated with a high incidence of morbidity and mortality. Early diagnosis followed by aggressive medical and surgical management may help in reducing the tragedy of amputation and/or death, a task which is even harder in a developing country such as Saudi Arabia.

Peripheral arterial embolism has been strongly related to concurrent cardiac disease. In the industrialized world, rheumatic heart disease has been largely replaced by atherosclerotic coronary vascular disease in the past few decades. In our
part of the world, little is known about the pattern of arterial embolism in patients with cardiac disease. In this article, the author's local experience in a regional vascular referral centre in Jeddah, Saudi Arabia, will be discussed. Particular attention is focused on the difficulties in managing this high risk group of patients.

Patients and Methods
Between May 1988 and August 1990 (27 months) 29 consecutive patients with 40 acutely ischaemic limbs due to arterial embolism, were admitted to the vascular surgery service of King Fahad Hospital in Jeddah, Saudi Arabia. The unit is the only one of its kind in the western region of Saudi Arabia and serves a population of approximately one million, living widely dispersed over a large area. Only those peripheral arterial emboli arising from the heart and extremities were included. On admission, the diagnosis of arterial embolism was based on the patients' history and clinical examination. Sudden pain, coldness, paraesthesiae and loss of distal pulses were found in most of our patients; pallor is difficult to assess in dark-skinned people. Paralysis was found in four patients (13.8%). The clinical suspicion was sufficient for diagnosis in 24 patients. Full blood count, chemistry and coagulation profile were performed, followed by angiography in selected cases (n = 6, 20.7%). All patients were assessed by a senior cardiologist, and had ECG and echocardiography performed, in the search for a cardiac source. Only those patients who had a confirmed cardiac origin for their emboli were included in this study.

The patients were classified into two groups; Type I, in which large emboli occluded proximal large arteries; and Type II, in which small emboli lodged in distal arteries, e.g. popliteal, or brachial and smaller arteries distal to them. Embololysis was considered the first line of treatment, and it was actually performed under local anaesthesia whenever possible. Conservative treatment with full anticoagulation (heparin 1000–2000 units/h) was adopted in cases of small emboli with reasonable collateral circulation and/or in cases where the duration of ischaemia was longer than 3 days. A secondary re-constructive arterial procedure was required in one case (axillo-bifemoral bypass). All patients undergoing surgery received heparin 5000 units at presentation, and were given anticoagulants postoperatively. Except for four patients, the group was followed up for periods ranging from 3 to 24 months. Two patients had recurrence of the embolism from a cardiac source during the follow-up period and were treated surgically. All patients were referred to the cardiology department for follow-up and further management of their underlying cardiac problem.

Results
We studied 29 patients with 40 acutely ischaemic limbs. The male to female ratio was 1.2:1. The mean age of the group was 53.0 years (range 25–100). Thirteen patients were Saudi nationals. There was a delay in management, as 18 of our patients (62%) presented after 8 h of onset, the classical ischaemia time (Table 1). Lower limb ischaemia was commonly involved and occurred in 26 patients (89.7%). In contrast, upper limb ischaemia was encountered in only three patients (10.3%). In the group with lower limb ischaemia, unilateral limb involvement was more common as it occurred in 16 patients (61.5%), and was equally divided between the right and left side. Bilateral lower limb ischaemia occurred in ten patients (38.5%), nine of which had saddle aortic emboli. In this series, emboli secondary to rheumatic valvular disease, which were associated primarily with mitral stenosis and atrial fibrillation, were found to be the commonest, as they occurred in ten patients (34.5%). Interestingly, eight of them were non-Saudi and came from poor developing countries. On the other hand, Saudi patients were affected more by atherosclerotic coronary artery disease and myocardial infarction. The other aetiological factors are illustrated in Table 2.

In 22 patients, the emboli arrested in a large artery (75.9%), i.e. Type I, while Type II occurred in seven patients (24.1%). Among the 40 limbs treated, embolectomy was performed on 33 limbs (82.5%), while heparin therapy was used in treating four limbs (10%). In view of the advanced irreversible ischaemia, primary amputation was deemed necessary in three limbs (7.5%). Secondary arterial reconstructive surgery was performed in one case. The immediate postoperative mortality rate (within 1 month after surgery) was 17.2% (n = 5), and was associated mainly with large emboli lodged in a proximal artery in elderly patients with severe ischaemic heart disease. Indeed, four of those patients had a saddle aortic embolus. There was a delay of more than 24 h in the presentation of all patients who died postoperatively.

We managed to save 24 limbs (60%) in the whole group. If the expired patients are excluded, the limb salvage rate was 77.4% in the survivors. In addition to the three limbs

<table>
<thead>
<tr>
<th>Condition</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rheumatic valvular disease and atrial fibrillation</td>
<td>10</td>
<td>34.50</td>
</tr>
<tr>
<td>Atherosclerotic heart disease and atrial fibrillation</td>
<td>5</td>
<td>17.25</td>
</tr>
<tr>
<td>Atherosclerotic heart disease and myocardial infarction</td>
<td>5</td>
<td>17.25</td>
</tr>
<tr>
<td>Arrhythmias only</td>
<td>4</td>
<td>13.80</td>
</tr>
<tr>
<td>Cardiomyopathy</td>
<td>3</td>
<td>10.30</td>
</tr>
<tr>
<td>Prosthetic cardiac valves</td>
<td>2</td>
<td>6.90</td>
</tr>
<tr>
<td>TOTAL</td>
<td>29</td>
<td>100.00</td>
</tr>
</tbody>
</table>
Table 3
Outcome of 29 patients treated for arterial embolism in Type I and Type II Occlusion

<table>
<thead>
<tr>
<th>Result</th>
<th>Type I (n = 22)</th>
<th>Type II (n = 7)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Death</td>
<td>5</td>
<td>22.7</td>
</tr>
<tr>
<td>Asymptomatic</td>
<td>13</td>
<td>59.0</td>
</tr>
<tr>
<td>Amputation</td>
<td>3</td>
<td>13.6</td>
</tr>
<tr>
<td>Claudication</td>
<td>1</td>
<td>4.5</td>
</tr>
</tbody>
</table>

lost primarily, another four were amputated postoperatively.

The sequelae of Type I and Type II arterial embolism are compared in Table 3. The most striking feature is that no patient died of Type II embolism, otherwise, the morbidity is more or less comparable. Nevertheless, a larger series of patients is required for confirmation of this observation.

Discussion

Acute limb ischaemia due to peripheral distal arterial embolism is not common, and retrospective studies have included cases for as long a period as 20 years.\textsuperscript{1,2} For instance, in the Oxford region (UK), the incidence was estimated as approximately one case per 15,000 population per annum.

Recently, the author reported his experience in the western province of Saudi Arabia (Jeddah area) and suggested an incidence of approximately one case per 60,000 population per annum.\textsuperscript{3}

Due to the recent development of the health services in our country, it may be expected that the size of the elderly population will increase in the next few decades. This may explain the relatively old age group in this series (mean of 53 years). There is no difference in the sex distribution between our series and previously published series.\textsuperscript{1-3}

The occurrence of peripheral arterial embolism has been closely related to cardiac disease. Indeed, a cardiac source is found in the overwhelming majority of patients with arterial embolism.\textsuperscript{1-5} Atrial fibrillation is the commonest cardiac condition which may produce arterial embolism on its own, or secondary to an underlying aetiological factor, such as rheumatic valvular disease, atherosclerotic coronary heart disease, etc. In this series, rheumatic valvular disease associated with atrial fibrillation was responsible for 34.5% of cardiac emboli. Certainly, this percentage is still high when compared with that in the USA, for example.\textsuperscript{4,6} However, 80% of our patients affected by rheumatic valvular disease were non-Saudi nationals and came from poor developing countries. Therefore, it may not reflect the true incidence in Saudi nationals which is much less. Saudi patients were found to be more affected by atherosclerotic coronary artery disease (34.5%). This was divided equally between arrhythmic and infarcted patients (Table 2). The high percentage of atherosclerotic coronary vascular disease may be attributed to the increase in the size of the elderly population and, perhaps, the change of life pattern to a more Western oriented one. In patients suffering a myocardial infarction, only 1–5% may develop peripheral embolism as a result of ventricular thrombus or aneurysm formation.\textsuperscript{7} In this study, only two patients (6.9%) had thromboembolism originating from a prosthetic mechanical cardiac valve. However, apart from the use of the bioprosthetic valve, anticoagulation is necessary in the majority of cases.\textsuperscript{8}

Cardiogenic embolism involves the extremities in approximately 90% of cases,\textsuperscript{5} and the lower limbs are affected more frequently than the upper limbs.\textsuperscript{1,3,6} In our patients, upper limb arterial embolism occurred in 10.3% which represents a slightly lower incidence than that of 15–23% reported in the English literature.\textsuperscript{1,2,9} In the lower limb, when embolism occurs, it usually involves a major artery at a site of bifurcation. The commonest site is the femoral artery bifurcation. A saddle aortic embolus is very dangerous and associated with a high mortality rate.

The diagnosis of arterial embolism is based on a high index of suspicion in a patient with underlying cardiac disease. Patients usually present with a sudden onset of pain in the affected limb(s) followed by coldness, pallor, numbness and varying degrees of paralysis with absent pulses distal to the site of embolus lodgement. There are some medical conditions which may be confused with arterial embolism, such as acute arterial thrombosis and possibly, severe forms of deep venous thrombosis. Nevertheless, a history and clinical signs of underlying cardiac disease, e.g. atrial fibrillation is strongly suggestive of embolism rather than thrombosis.

Once a clinical diagnosis has been made, the patient should be referred for further management immediately. A significant delay between the onset of ischaemia and presentation occurred in our patients. Indeed, 62% of them had ischaemia for more than 8 h. This is not unexpected in a large country such as Saudi Arabia; however, a significant amount of time was wasted in reaching an early diagnosis and in the transportation of the patient. Fortunately, most of the delayed cases had Type II emboli.

Priority in investigations and treatment should be given to the underlying life-threatening cardiac condition. However, diagnostic studies should be limited to those necessary for management. Preoperative arteriogram should be reserved for selected cases. It was performed in 20.7% of our
patients for the following reasons; questionable diagnosis, to determine the extent of occlusion, and the presence of associated distal occlusive disease. Additional studies to identify the source of the embolus can be delayed until after the initial management. Echocardiography was performed in all our patients. Though a simple and non-invasive procedure, it has its own limitation; for example, its resolution for detection of a ventricular thrombus is approximately 1 mm. Furthermore, it is unreliable in detecting an atrial thrombus, especially a thrombus in the atrial appendage.

The optimal treatment of peripheral arterial embolism is immediate anticoagulation, followed by surgical embolectomy, irrespective of the duration of the symptoms. Surgical embolectomy should be performed under local anaesthesia to avoid the risk of general anaesthesia in this high-risk group. Nevertheless, if the limb is already found to be gangrenous, primary amputation is the treatment of choice; any attempt at revascularization is disastrous. In our series, only three limbs (7.5%) of our patients were amputated primarily, while an attempt of embolectomy was performed in the majority of our patients (82.5%). Blairdell et al. advocated the use of high-dose heparin as the sole initial treatment of acute arterial occlusion. Most vascular surgeons do not recommend this approach, except for small emboli in unfit patients. We opted to use this policy in the treatment of only four limbs (10%). Three out of these four limbs were saved though the distal pulses were not palpable. Recently, fibrinolytic agents, such as streptokinase, urokinase and more recently, tissue plasminogen activator have been employed to treat embolism systemically or via intra-arterial infusion. Again, these agents should be reserved for selected patients who cannot undergo surgical embolectomy.

Since the introduction of Fogarty’s catheter in 1963, the limb salvage rate has improved a little, but not significantly. It varies between 40 and 80%; however, most series fell into the 60–70% range. Our limb salvage rate compares favourably with that. Similarly, the mortality rate is still high, although it has decreased during the Fogarty’s catheter era. It varies between 10 and 11%. In this series, it was 17.2% which is understandable, as all patients had serious underlying ischaemic cardiac disease. Moreover, all of the expired patients were old and had a large embolus occluding a large artery, i.e. Type I, for more than 24 h. Four of the five patients who died had a saddle aortic embolus.

Finally, embolectomy is considered a simple procedure in the sphere of general surgery. However, better results will be achieved if it is performed by vascular surgeons in properly equipped units, particularly if additional complex vascular reconstructive procedures are required.

In conclusion, a high degree of association between cardiac disease and embolism exists. Despite improvements in management, morbidity and mortality rates are still high. Optimal management includes earlier referral of cases, immediate heparin anticoagulation, surgical embolectomy and aggressive management of the serious underlying cause of embolism. Whenever possible, management should be carried out in vascular units.

References