TECHNICAL NOTE

The Initial Management of Scapulothoracic Dissociation: A Challenging Task for the Vascular Surgeon

A. N. Katsamouris, A. Kafetzakis, Th. Kostas, D. Tsetis and P. Katonis

Vascular Surgery, Medical Imaging, Department of Orthopaedic Surgery, University of Crete Medical School, University Hospital of Heraklion, Crete, Greece

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Introduction

Scapulothoracic dissociation (STD) is a rare and severe injury of the shoulder girdle and upper extremity resulting from high speed decelerating motor vehicle accidents. To date, there have been only 64 cases of patients with STD reported in the English literature.

Patients

The medical records of nine patients who had sustained a STD secondary to a blunt trauma during the last decade (1990–2000) were reviewed in the University of Crete Vascular Surgery Unit. Patients with penetrating or open trauma, and those with musculoskeletal or vascular or neurologic injury alone, were excluded from the study.

The diagnosis of STD was made initially from the patients' history and the clinical presentation. All patients – males with a median age of 30 years (range from 21 to 54 years) – were victims of decelerating, high speed motorcycle or automobile accidents (Table 1) and presented with a pulseless and severely ischaemic upper limb, absence of motor and sensory function below the shoulder or arm, and a shoulder girdle or chest wall swelling or hematoma and ecchymoses with intact skin. On subsequent plain X-rays or CTs all patients were found to have disruption of the acromioclavicular or sternoclavicular joints and/or clavicular fracture (Table 1).

Surgical exploration in three patients and an urgent arteriogram or CT scan in the remaining patients demonstrated the vascular injury in the thoracic outlet region. Innominate artery or aorta rupture was not found in our patient population. Active bleeding from the damaged subclavian arteries was recognised in five patients and from several perforator arteries and veins of the chest wall in all patients.

Concomitant injuries of the trunks of the brachial plexus were identified in all patients. In all patients, head injury, hypovolaemic shock and upper extremity fractures or ischaemic neuropathy made detailed preoperative assessment of the neurological status of the upper extremity ipsilaterally to the injured shoulder girdle unreliable, if not impossible. The specific injuries of neurovascular structures identified during the operative intervention are outlined in Table 1. Additionally, all patients experienced multiple other moderate or severe local and remote injuries.

After initial stabilisation of the patients’ vital signs and general condition all patients were operated upon urgently. The surgical exploration was performed via a supraclavicular incision in five patients, a combined supraclavicular incision and sternotomy in three patients (Table 1: cases 1, 4 and 8), and a combined supraclavicular incision and left thoracotomy in one patient (Table 1: case 5). After controlling the actively bleeding sites and detailed investigation and identification of the injured trunks of the brachial plexus and other structures, our effort was directed to re-establishing arterial flow to the ischaemic arm. Arterial reconstruction was performed in eight patients, using the autologous great saphenous vein as an interposition arterial graft connecting the proximal...
part of the subclavian artery with the axillary artery. Ligation of the subclavian artery and an above-elbow amputation were performed in the remaining patient, who had open fracture of the humerus and an extensive and massive soft tissue trauma in the shoulder and the arm (Table 1: case 8). Subclavian venous reconstruction was not performed in this series. Fasciotomy of the forearm was performed in five patients. Internal and/or external fixation was applied to initially or permanently stabilise the orthopaedic lesions.

After surgery all patients were transferred, intubated, to the Intensive Care Unit for recovery. Ventilatory support was required for two to twelve days (mean: five days). An average of fourteen units of blood was transfused for each patient during the first 24 hours and the mean hospital stay was nineteen days.

One patient with complete avulsion of the brachial plexus trunks died during the 2nd postoperative day due to severe haemorrhagic shock and intracerebral haemorrhage (Table 1: case 8). The rest of the patients are alive three to ten years after surgery. Their revascularised upper extremities maintain patent arteries and good arterial perfusion. The other two patients with complete avulsion of the brachial plexus trunks (Table 1: cases 4 and 6) have a flail and painless arm. These patients were offered an above-elbow amputation but they refused it. Four patients accepted to have a brachial plexus trunk reconstruction (grafting), which was performed in another centre six to nine months later, after their discharge from our hospital. No patient has complete neurologic recovery of the injured upper limb. However, three have satisfactory and three moderate neurologic function (improved abduction and adduction movements and sensation) accompanied by some degree of occasional hand causalgia without any pain requiring medication.

**Discussion**

The first reports of scapulothoracic dissociation (STD) in the literature are associated with the development of the resuscitation systems and vascular surgery. The diagnosis in these rare cases is based on a high index of suspicion and on accurate interpretation of clinical findings. Resuscitation and stabilisation of vital signs are the major first priorities for the physician and special attention must be paid to hypovolaemic shock. The massive bleeding into the soft tissues of the shoulder and chest wall which is characteristic of STD is generally ascribed to disruption of the subclavian arteries and veins and the perforator arteries and veins of the chest wall. In most series, active bleeding appeared to issue not from the damaged subclavian vessels, but rather from the perforating ones, presumably avulsed or sheared off by rotation and separation of the shoulder girdle from the chest wall. The latter was the case in this series, but five patients were also bleeding from a torn or crushed subclavian artery. Similarly, active bleeding from a damaged subclavian artery was reported by several authors. So, while rapidly deteriorating hypovolaemia or declining haematocrit requires immediate operative management, as happened in three of our patients, more clinically stable patients should undergo emergency thoracic aortography and selective subclavian/axillary/brachial arteriography. This

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**Table 1. Summary of type of scapulothoracic dissociation, mechanism of injury and neurovascular status of the patients.**

<table>
<thead>
<tr>
<th>Case</th>
<th>Type of STD</th>
<th>Mechanism of injury</th>
<th>Vascular damage</th>
<th>Neurologic damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Acromioclavicular disruption</td>
<td>Motorcycle crash</td>
<td>Stretched and crushed 1st and 2nd portion of S.A.</td>
<td>Stretch and crush of brachial plexus</td>
</tr>
<tr>
<td>2</td>
<td>Clavicular fracture and acromioclavicular disruption</td>
<td>Motorcycle crash</td>
<td>Avulsed, crushed and torn 3rd portion of S.A. and crushed A.A.</td>
<td>Partial avulsion and crush of brachial plexus</td>
</tr>
<tr>
<td>3</td>
<td>Acromioclavicular disruption</td>
<td>Motorcycle crash</td>
<td>Crushed and torn 3rd portion of S.A.</td>
<td>Stretch and crush of brachial plexus</td>
</tr>
<tr>
<td>4</td>
<td>Clavicular fracture</td>
<td>Motorcycle crash</td>
<td>Avulsed, crushed and torn 1st and 2nd portion of S.A.</td>
<td>Complete avulsion of brachial plexus</td>
</tr>
<tr>
<td>5</td>
<td>Clavicular fracture and acromioclavicular disruption</td>
<td>Motorcycle crash</td>
<td>Avulsed and crushed 2nd and 3rd portion of S.A.</td>
<td>Partial avulsion and crush of brachial plexus</td>
</tr>
<tr>
<td>6</td>
<td>Clavicular fracture and sternoclavicular disruption</td>
<td>Automobile crash</td>
<td>Avulsed, crushed and torn 2nd and 3rd portion of S.A.</td>
<td>Complete avulsion of brachial plexus</td>
</tr>
<tr>
<td>7</td>
<td>Clavicular fracture</td>
<td>Motorcycle crash</td>
<td>Avulsed and crushed 2nd and 3rd portion of S.A.</td>
<td>Partial avulsion and crush of brachial plexus</td>
</tr>
<tr>
<td>8</td>
<td>Clavicular fracture</td>
<td>Automobile crash</td>
<td>Avulsed, crushed and torn proximal S.A.</td>
<td>Complete avulsion of brachial plexus</td>
</tr>
<tr>
<td>9</td>
<td>Clavicular fracture</td>
<td>Motorcycle crash</td>
<td>Torn and crushed 3rd portion of S.A. and crush of A.A.</td>
<td>Partial avulsion and stretch of brachial plexus</td>
</tr>
</tbody>
</table>

*The subclavian vein was found avulsed, torn or crushed in six patients. M = Male, Yrs = Years, S.A. = Subclavian artery, and A.A. = Axillary artery.*
investigation can be performed rapidly in the operating room by using the C-arm facilities, while continuing life-support treatment. This is an important diagnostic tool in identifying the possible source of an active bleeding artery and the exact level or levels of the arterial lesion(s). Based on those findings, the vascular surgeon can select the most rapid and appropriate route for vascular exploration to control the haemorrhage and decide about the appropriate sites of revascularisation of the ischaemic upper extremity.

The decision whether or not to perform an above-elbow amputation or to revascularise the upper extremity ipsilaterally to the injured shoulder of patients with STD is difficult. The ultimate goal is to offer it the best possible functional outcome. Several reports, and our own experience, show that satisfactory or moderate results can be achieved in those patients with partial disrupted, stretched or crushed injuries of the brachial plexus.1,4 Urgent surgical exploration is mandatory in patients with active haemorrhage and severe hand ischaemia. Poor long-term functional outcome in the injured upper extremities is a result of a devastating injury of the trunks of the brachial plexus. If a complete disruption of these trunks is found, primary amputation should be considered. Partial brachial plexus injury has a satisfactory prognosis. In such cases, urgent revascularisation of the ischaemic upper extremity is highly recommended.

References

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