Volume : 2 | Issue : 11 | Nov 2013 • ISSN No 2277 - 8160

Research Paper | Medical Science

Management of Vascular Injuries in Trauma: A Literature Review

Dr.Mathe Zsombor Institute for Cardiovascular Disease and Transplantation, University of Medicine and Pharmacy, Targu Mures, Romania

ABSTRACT *Management of vascular injuries in trauma is a challenge because we must deal with a critical ill patient with unclear history, injuries and physiologic status. Trauma remain the main cause of death at young patients. The orthopedic surgeon plays a key role, but is also important to cooperate with different type of surgeons to obtain the best result. The time remain essential in trauma. Also important is to recognize the compartment syndrome and to perform at time fasciotomy. There are some studies that recommend revascularization also in that cases with limb ischaemia after 24h.*

KEYWORDS : vascular injury, trauma, orthopaedics.

Introduction:
Nowadays trauma is very often in our country. For example in U.S.A. about 2,6 millions were hospitalized as a fact of a traffic incident. Most of them are very young, between 25 and 44 years, and probably about 20 % are between 15 and 24 years. This young age of these pacients is one of the most important reason for whom I started to begin this study. Trauma remain the main cause of death at patients aged between 1 and 44 years old and is followed by cancer and atherosclerothic disease. The orthopedic surgery plays a key role in the treatment of the traumatized patient.

Pathology
Basically, injury to an artery can result in rupture, occlusion or both. Rupture leads to bleeding, either internal or external, depending on the circumstances, or in cases of contained bleeding the more chronic condition of a traumatic or false aneurysm. The other less common consequence of rupture occurs when artery and parallel vein are each breached with a resulting arterio-venous fistula, whose classical sign is the machine bruit. This condition, if sufficiently large, can result in high output heart failure(1). Partial rupture may or may not be associated with distal ischemia. Occlusion, whether intrinsic, as in a contusion with intimal flap and dissection or after complete transection, or extrinsic as a result of fracture and compression, results in ischemia of the tissues reliant on the vascular supply. The degree of ischemia is dependant on the associated collateral vessels and can be expressed in the amputation rate when the specific vascular injury is treated by ligation:axillary and brachial artery 45-60%, common femoral artery 80%, superficial femoral 45%, popliteal 85%(2). Clearly successful revascularization in these cases will reduce morbidity significantly. Thrombosis and embolism are additional associated occlusive mechanisms. In trauma there are hard signs and also soft signs of arterial injury as seen in Table 1.

Table 1.
Management of peripheral Vascular Trauma
Hard signs of arterial injury(immediate surgery)
- External arterial bleeding
- Rapidly expanding hematoma
- Palpable thrill, audible bruit
- Obvious arterial occlusion (pulseless, pallor, paresthesia, pain, paralysis, poikilothermia, especially after reduction of dislocation or realignment of fracture) Soft signs of arterial injury(consider arteriogram, serial examination, duplex)
- History of arterial bleeding at the scene
- Proximity of penetrating wound or blunt trauma to major artery
- Diminished unilateral distal pulse
- Small nonpulsatile hematoma
- Neurologic deficit
- Abnormal ankle-brachial pressure index(<0,9)
- Abnormal flow-velocity waveform on Doppler ultrasound

The compartment syndrome
Acute compartment syndrome occurs when the tissue pressure within a closed muscle compartment exceeds the perfusion pressure and results in muscle and nerve ischemia. We found this syndrome typically in a traumatic event, most commonly in a fracture. Late manifestations of compartment syndrome include the absence of a distal pulse, hypoesthesia, and extremity paresis, because the tissue pressure compromises arterial blood flow. If left untreated or if inadequately treated, the muscles and nerve within the compartment undergo ischemic necrosis, and a limb contracture, called a Volkmann contracture, results. Severe cases may lead to renal failure and death. The incidence of compartment syndrome depends on the patient population studied and the etiology of the syndrome. In a study by Qvarfordt and colleagues, 14% of patients with leg pain were noted to have anterior compartment syndrome[3]; compartment syndrome was seen in 1-9% of leg fractures. The definitive surgical therapy for compartment syndrome is emergent fasciotomy (compartment release), with subsequent fracture reduction or stabilization and vascular repair, if needed. The goal of decompression is restoration of muscle perfusion within 6 hours. Compartment syndrome outcome depends on both the diagnosis and the time from injury to intervention. Rorabeck and Macnab reported almost complete recovery of limb function if fasciotomy was performed within 6 hours.[4] Matsen found necrosis after 6 hours of ischemia, which currently is the accepted upper limit of viability.[5]. When fasciotomy was performed within 12 hours after the onset of acute compartment syndrome, Sheridan and Matsen reported that normal limb function was regained in 68% of patients.[6]. However, when fasciotomy was delayed 12 hours or longer, only 8% of patients had normal function. Thus, little or no return of function can be expected when the diagnosis and treatment are delayed. Tendon transfers and stabilization may be indicated as late treatment for CS. In the lower leg, the results of fasciotomies for posterior compartment syndrome are not as good as those for the anterior compartment, probably because the incomplete decompression of the deeper posterior compartment. However, early diagnosis, with institution of the appropriate treatment, results in a good outcome. Although a serious complication of compartment syndrome is the infection. In a retrospective review by Matsen et al, 11 of 24 extremities that had late surgical decompression developed infections, and 5 of these infections led to an amputation.[7] Infection after fasciotomy may become chronic. Patients, especially those with multiple traumatic injuries, may die because of infections or metabolic complications (renal failure or multiple organ failure may occur preoperatively or postoperatively).

Treatment
The first important thing in a situation with a trauma victim represent the initial assessment and resuscitation according to the ABC Principles. The management of vascular lesion begin with a good exposure of the arteries. The basic principle of vascular repair is to gain proximal and distal control of the relevant vessel before investigating the site of injury. Specific surgical techniques must be performed if successful vascular repair is to be achieved. These techniques includes: proximal and distal exposure for control haemorhage with vascular clamps and loops, dissection and isolation of all injured vessels including also veins, heparinization, local or systemic, use of vascular sutures, use in cases of shunting, anatomic repairs with vein patch(is very important the proper handling of the autogenous vein graft), end/end anastomosis without tension, for larger defects the use of reversed autologous vein graft, distal trombectomy, completed with arteriography, fasciotomy and soft tissue coverage in some cases.

Management of fracture

The timing of the vascular repair in relation to fracture management has long been a source of controversy.The standard recommendation is for vascular repair to precede orthopaedic management, to prevent the prolonged tissue ischemia. McHenry in a retrospective study suggested an increased need for fasciotomy when fracture are stabilized before revascularization.(8). Most fractures can be adequately stabilized with traction or posterior plaster splinting but external fixation may be necessary in some cases.

Discussion

Limb loss following lower extremity arterial injury has been variously ascribed to extent of tissue damage, duration of ischaemia before revascularization, associated venous injuries, popliteal artery involvement and development of compartment syndrome. The question is that the revascularization later than 24 h after trauma is it worthwhile? There are some studies which have demonstrated that revascularization can be successful for patients who retain only one foot movement. Moini and the authors recommend revascularization also for cases presenting late and with compete motor deficit below the knee, but without mottling.(9).

Conclusion

The management of multiple trauma patients is very complex, requiring a good collaboration with trauma surgeon and other members of trauma team. Appling the damage control resuscitation principles in case of severely injured patients it is life-saving in many patients with multisistemic trauma. Imaging in particular contrast arteriography, has played an important role in the investigation of these patients. Time is essential in managing the vascular lessions in trauma.

REFERENCES

1.Durakoglugil ME, Kaya MG, Boyaci B, Cengel A.High output heart failure 8 months after an acquired arteriovenous fistula, Japanese Heart Journal 2003;44(5):805-809.2.Chapter 10:Wounds of Limbs In: Dufour D, Kromann Jensen S, Owen-Smith M, Salmela J, Stening GF, Zetterstrom B, editors, Surgery for victims of war. Geneva: International Committee of the Red Cross, 1998: 83-87.3.Qvarfordt P, Christenson JT, Eklof B, et al. Intramuscular pressure, muscle blood flow, and skeletal muscle metabolism in chronic anterior tibial compartment syndrome. Clin Orthop. Oct 1983;(179):284-90. [Medline]4. Rorabeck CH, Macnab I. The pathophysiology of the anterior tibial compartmental syndrome. Clin Orthop Relat Res. Nov-Dec 1975;52-7. [Medline].5.Matsen FA 3rd, Winquist RA, Krugmire RB Jr. Diagnosis and management of compartmental syndromes. J Bone Joint Surg Am. Mar 1980;62(2):286-91. [Medline].6.Sheridan GW, Matsen FA 3rd. Fasciotomy in the treatment of the acute compartment syndrome. J Bone Joint Surg Am. Jan 1976;58(1):112-5.[Medline].7.Matsen FA 3rd, Winquist RA, Krugmire RB Jr. Diagnosis and management of compartmental syndromes. J Bone Joint Surg Am. Mar 1980;62(2):286-91. [Medline].8.McHenry TP, Holcomb JB, Aoki N, Linsey RW. Fractures with major vascular injuries from gunshot wounds:implication of surgical sequence.Journal of Trauma-Injury Infection&Critical Care 2002;53(4):717-721.9.Majid Moini, Mir Alireza Takyar, Mohammad R.Rasouli. Revascularization later than 24 h after popliteal artery trauma:is it worthwhile? Injury, Int.J.Care Injured(2007) 38, 1098-1101.