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Original Research Article

Management of Vascular Injury in Rural Setup

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ABSTRACT

Background: Trauma to the extremities results in combination of injuries ranging from injury to the soft tissue, vasculature, muscle, tendon, neurovascular bundle. Due to the proximity for access to the national highway, high-velocity trauma is very common in our area. Also the population density in our zone leads to more number of paediatric patients with upper limb trauma on the play grounds and household trauma.
Settings: This is retrospective, descriptive and observational study conducted at Krishna institute of medical sciences Karad. Total 46 patients of vascular injury were treated from January 2006 to December 2010.
Material & methods: The vascularity of all patients admitted with vascular injury in the extremity was assessed with pulse-ox meter and Colour Doppler study. The management involved fluid resuscitation, correction of hypotension and immediate operative intervention. Oxygen saturation and pulse volume of both traumatized and healthy upper extremities were studied with pulse-ox meter.
Results: Out of total 46 patients of vascular injury 24 were in the upper extremity, 21 in the lower extremity and one involving the inferior vena cava. 20 patients had transection of vessel, 5 had contusion, 21 contusions with partial tear of the vessel. Great saphenous vein graft was used in two upper & two lower limbs each and the remaining 42 were sutured end to end. Primary skeletal stabilization was done in those with bone involvement.
Conclusions: To conclude, careful evaluation of the neurovascular bundle in the injured extremity and subsequently early exploration and repair of arterial injury can help in saving the limb with restoration of function with less morbidity.
Key Words: vascular injury; pulse ox- meter; inferior vena cava

INTRODUCTION

The upper and lower extremities are injured quite often in motor vehicle accidents, farm accidents, group fighting and falls on the ground. Trauma to the extremities results in combination of injuries ranging from injury to the soft tissue (Skin, Muscle, tendon etc.), neurovascular bundle and skeletal injuries. Fractures involving the groin region and the elbow region frequently place the distal vascular supply at risk due to the close approximation of the vasculature with the bone in these areas.

Irreversible tissue ischemia occurs within six hours after trauma. The principles of any neurovascular trauma reside on stabilizing the extremity in the anatomical position, controlling haemorrhage with direct pressure and use of tourniquet if direct pressure is inadequate in controlling haemorrhage. The initial treatment of any patient with vascular trauma involves correction of hypotension, fluid resuscitation and reduction & stabilisation of associated fractures or dislocations. The arterial injury is suspected if there is persistent ischemia of limb even after correction of shock and comparison with the contralateral normal limb. The arterial injury may be associated with nerve and venous injury. The site and nature of arterial injury can be confirmed with angiography and Doppler flow study.

The pulse-ox meter is good tool to assess the oxygen saturation and pulse volume distal to the injury.

MATERIAL AND METHODS

Total 46 patients of vascular injury were treated from January 2006 to December 2010 at Krishna Institute of Medical Sciences University Karad involving 24 in the upper extremity, 21 in the lower extremity and 1 involving the inferior vena cava.

All patients admitted with vascular injury in the extremity were assessed with pulse-ox meter and Colour Doppler study. Both the tools were used to assess the oxygen saturation, pulse volume and site and status of injured vessel before and after operation. All patients were given preoperative antibiotics (Third generation Cephalosporins), Tetanus Toxoid prophylaxis and Human Tetanus IgM (in severe contaminated compound injuries). The average interval between the trauma event and operative intervention was around 5.4 hours and in one patient it was 7 hours since the patient reached the hospital 5 hrs after the incidence. All the patients underwent haematological, biochemical investigations, ABG and radiographic evaluation as per requirement.

The management involved fluid resuscitation, blood transfusions and correction of shock, operative intervention after haemodynamic resuscitation of the patient. On operative intervention, the vessel was explored after rigid fixation of the skeletal injuries; followed by embolectomy and vessel repair. Operations were done under supraclavicular brachial plexus block, combined spinal-epidural and general anaesthesia within 2 to 3 hours after hospital admission. Tourniquet was not used in any of the patients.

Arterial cut ends were inspected for thrombus proximally and distally. Preoperative colour Doppler was used to verify the patency of the vessel and any associated injury. Dilute solution of heparin was instilled in proximal and distal run of vessel. There were no major associated venous injuries. The site of repair was covered with viable (muscle or skin) tissue.
Skeletal stabilisation was done in those with bone involvement. The associated soft tissue injury (muscles, tendons etc) repair was also undertaken simultaneously. Fasciotomy of the distal limb was done wherever needed. Skin grafting or local flaps for cover was done as and when required. Postoperatively, smooth muscle relaxant duvadilan, dextran and antiplatelets were administered. Bone graft with artificial bone substitutes was used in one patient to recover the bone loss at the site of injury.

Oxygen saturation and pulse volume of both traumatized and healthy upper extremities were studied with pulse-ox meter. The pulse-ox meter did not show any reading of oxygen saturation and pulse volume when brachial artery or both radial and ulnar arteries were injured. However, in isolated radial and ulnar artery injury there was no significant difference in pulse-ox meter readings of the injured and normal extremity.

Clinical examination and pulse oxymetry was performed during the postoperative period to know about the re-establishment of circulation in the ischemic limb. The average follow-up period was 8 months.

RESULTS

Total 24 patients had injuries in upper limb, 21 patients had in lower limb and one patient had Inferior vena cava injury below the origin of renal artery with multiple jejunal perforations. The lower limb injuries were common in Road traffic accidents and upper limb injuries were common in falls on grounds.

In total 46 patients of vascular injury were treated as:

20 had transection of vessel, 5 had contusion, 21 contusions with partial tear of the vessel. Great saphenous venous graft was used in 2 upper and 2 lower limbs each and the remaining 42 were sutured end to end without tension with prolene no.6-0 and 7-0 depending on the vessel calibre after refashioning of the cut ends.

Upper extremity	Total	Lower extremity	Total
Brachial: 20	20	Femoral artery and vein below inguinal region	5
Radial and ulnar arteries at the forearm	2	Femoral artery only near the adductor canal	8
Isolated radial artery	2	Posterior tibial artery mid-calf	3
Inferior vena cava below the origin of renal artery with multiple jejunal perforations	1	Popliteal artery	5

All patients were followed up for at least 6 months, 3 patient's limbs were lost after the arterial repair.

Wound infection: One (2.5%) patient developed postoperative wound infection on 5th postoperative day due to severe crush injury and severe contamination of wound at the accident site.

Amputation: One (2.5%) patient required amputation due to graft failure.

In another patient, amputation of the right great toe was required as there was gangrene of that toe with fasciotomy and debridement of the involved gangrenous muscles in the posterior compartment of right leg.

Most of the patients required additional arterial surgery. There was no persistent oedema of the limb suggesting venous blockade. The nerve injuries recovered in all patients.

Postoperative deformities: Shortening of tendoachilles occurred in one (2.5%) patient requiring successive surgery for lengthening of the same.

DISCUSSION

The injured extremities must be examined for associated neurovascular injuries. This hospital being a referral centre for trauma for around 100 sq. km area, road traffic accident was the commonest cause of injury in this series.

The skeletal injuries were compound in nature suggestive of the severity of injury. Rigid skeletal stabilisation is needed before vascular repair when the skeleton is unstable, dislocation of joints or subsequent bone manipulation may disrupt the arterial reconstruction. The skeletal stabilisation can be done using internal or external fixation. Howard and Makin (1990) recommended external fixation as a method of choice of stabilisation of skeletal injury after studying 35 lower limb fractures with vascular injury. In our study, plate was used for fracture stabilisation. [1] Arterial transection was the common type of vascular injury. The reversed saphenous graft was used in four patients without any postoperative complications.

Dhal et. al. found that thorough clinical examination was sufficient to diagnose vascular injury. [2] In our series, in addition to thorough clinical examination, pulse oxymetry and Doppler was used to know the oxygen saturation and thrombus distal to the site of injury which suggest ischemia following vascular injury. Arteriography has limited usefulness in the assessment of arterial damage except to provide proof of patency in a doubtful or suspected injury. Under no circumstances, should it delay exploration, and if this procedure is considered necessary, facilities should be made available for its performance in the operation theatre. [3] Medical therapy alone is rarely an option in penetrating or blunt trauma to the extremity vasculature with hard signs. [4] Surgical exploration and repair is performed as soon as possible for patients with “hard signs” of vascular injury, refractory hypotension, and obvious limb ischaemia. [5] Restoration of arterial continuity by end-to-end anastomosis is the recommended technique for all arterial injuries. [6, 7] The basic tents for successful arterial repair include- minimal delay in recognition and treatment, generous use of preoperative and intraoperative arteriography, proximal and distal thrombectomy with a ballon tipped catheter, judicious use of heparin, and use of autogenous vein rather than cloth grafts. [8] Sympathetic blockade of the vessels resulted in increased blood flow to the injured extremity, which increases the rate of success of surgery. Moreover, postoperative pain management can be performed with continuous blockade of the nerves. [9] Also, there are early postoperative benefits from peripheral nerve blocks, including a reduced incidence and severity of postoperative nausea and vomiting, sore throat and concentration difficulties, and a shorter time to both oral intakes and discharge from the hospital readiness by one hour. [10] In the unusual circumstance of isolated vascular injury, 5,000-10,000 units of intravenous heparin can be given to prevent thrombus formation. Otherwise, a small amount of dilute heparin solution (100 units/mL) may be gently injected into the proximal and distal lumen of the injured vessel before clamps are applied. Proximal and distal thrombi are removed with a Fogarty embolectomy catheter. Back-bleeding from the distal artery is not a sure indication that thrombus is absent. [11] A shunting catheter has been used to obtain rapid arterial inflow from the brachial artery to the ampulated part in major upper limb reimplantation. (Urbaniak 1998) . Al-Quattan et. al (1994) suggested shunting catheter to bridge the arterial defect until definitive arterial repair is performed. We have not used the procedure.

CONCLUSIONS

To conclude, a high index of suspicion with careful evaluation of the neurovascular bundle in the injured upper extremity and subsequently early exploration and repair of arterial injury can help in saving the limb with restoration of function.

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