

ORIGINAL ARTICLE

Urgent Vascular Surgery for Trauma Early Experience of Dedicated Vascular Surgery in a Teaching Hospital

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Abstract :

From Jan 2000 to Dec 2002, 58 patients had vascular surgery consultation for trauma. 2 patients were offered primary amputation the remaining 56 patients and 60 vessels were dealt with by this dedicated vascular surgery unit. 28 of the 56 patients did not need direct intervention of the blood vessels. In the remaining 28 patients the procedures performed were ligations 2, repairs 5 and 25 vascular reconstructions (arterial 24, venous 1). The region wise distribution of the vessels were as follows:- Brachial 39/60, Ileo-femoral 4/60, Popliteal 3/60, Radial 5/60, Ulnar 2/60, Axillary 3/60, IVC 1/60 and Digital 2/60 and Cephalic 1/60. 42 cases had an associated bony injury. 37-supracondylar fractures of the humerus with ischaemic forearm. 3 were near total amputations (wrist, forearm and thumb). 2 were dislocations (Knee 1, Hip 1). 36 were open injuries (Compound fractures 19 and 17 penetrating injuries.). 30/60 vessels needed other procedures than direct arterial repair. 2 stiff limbs were seen both in supracondylar fracture of humerus with fore arm ischaemia one due to VIC and one due to myositis ossificans. 2 patients needed amputation after vascular reconstruction.

Introduction :

Dedicated vascular surgery services became feasible in Pokhara from Jan 2002. Western Regional Hospital Pokhara and Manipal Teaching Hospital drain 16 districts of the western region of Nepal. Major vascular trauma is a taxing problem for the operator. There is no area of surgery less forgiving for imperfect technique. Vascular injuries of the extremity require urgent treatment. Urgency could range from a crash surgery in a clinically dead patient to previously misdiagnosed or conservatively treated vascular lesion. Death could result from excessive bleeding if not promptly controlled. Delay in repair will lead to high amputation rate. Ligation of a major artery is the last resort with a considerable penalty. A policy of primary ligation of arterial injuries in

World War II lead to 50% amputation rate¹, the amputation rate was reduced to 13% with a policy of arterial repair in the Vietnam war². Arteriography for diagnosis is currently recommended only in doubt³. Unless the limb is totally unviable some form of vascular repair is universally recommended⁴. Repair inside 6-8 hours achieves the maximum limb salvage rate.

Material and Methods :

The Western Regional Hospital and the Manipal Teaching Hospital are the 2 major tertiary care-providing hospitals of the Western Region. This is the only dedicated vascular surgery unit outside the capital Kathmandu. Prospective records were kept in a computerized database. The vascular surgery database is maintained with MS Access software. This is a retrospective study and statistical analysis is done by MS Excel software. Only those cases of limb trauma for which a vascular consult was made are included. If the patient was offered primary amputation without a vascular surgical

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consult, then it was not included. The authors have included all cases from Jan 2000 to Dec 2002.

Results :

In the period included there were a total of 58 patients with trauma who were offered vascular consultation. 2 were offered primary amputation. The first case was a 26 year female with compound fracture neck of humerus (L) sided and laceration of the axillary artery and rupture of all the cords of the brachial plexus following a road traffic accident. The second case was an amputated hand for which reimplantation was not attempted. 56 patients had injuries to 60 vessels. The patient profile consisted of (39/56) 69.64% males and (17/56) 30.35% females. The overall age ranged from 3 years to 84 years with a mean of 15.46 years. Injury to Hospital time (defined as the time taken by the patient to attend the Accident and Emergency department of the hospital) had a mean of 5.07 hours and ranged from 0 hours to 98 hours. Once the patient reached the hospital, to treatment time (defined as the time taken to have the patient in the operating room) was ranged from 0.5 to 5.5 hours and had a mean of 2.16 hours. The injury to treatment time had a mean of 8.26 hours (when revascularization was completed). (28/56) 50% did not need direct intervention of their vasculature, and their ischaemia was relieved by reduction of their fracture/dislocation. Such cases included 26 supracondylar fracture of the humerus with ischaemic forearm, one knee dislocation and one hip dislocation. 28 of the remaining patients needed 32 direct vascular procedures. The procedures consisted of 2 ligations, 5 repairs (direct or with vein patch), and 25 reconstructions (where we needed to use a conduit).

Ligations (2):- 1 brachial artery in 4 days delayed presentation of a compound supracondylar fracture of humerus with avulsed brachial artery, and 1 radial artery ligation for multiple lacerations of the radial artery in a suicide attempt.

Repair	Artery (Number)	Vein (Number)
Vein Patch	Axillary (1)	0
	Ilofemoral (1)	0
Direct	Radial (1)	IVC (1)
		Cephalic (1)

Table 1: Description of the vascular repairs without conduit in this series.

Repairs (5):

There was only one patient with solely venous injury that was the iatrogenic IVC laceration. This leaves us with 25 patients with 29 procedures (25 reconstructions + 4 repairs). There were 3 patients who needed more than one vessel intervention. These 3 patients had 7 vessel interventions. Case (a) Radial and Ulnar artery reconstruction and Cephalic vein repair for near total amputation of forearm following thresher accident (See plate 2). Case(b) Radial and Ulnar artery reconstruction for major laceration at the flexor aspect of wrist. Case (c): Digital artery and vein reconstruction for near total thumb amputation. Of the remaining 22 cases 3 needed arterial repairs. 19 patients needed single arterial reconstruction for salvage. There were total of 25 reconstructions using conduits. (Table 2).

	Vein	Artery
Digital	1	1
Ulnar	0	2
Radial	0	3
Brachial	0	12
Axillary	0	2
Ileofemoral	0	2
Popliteal	0	2
Total	1	24

Table 2: 25 Vessel reconstructions with conduit in this series.

There were only 3 repairs of the venous vessels. One was direct repair of IVC, the second one was a reconstruction of the digital vein (in the revascularization of the thumb) and the third case was a repair of the cephalic vein (in the revascularization process for a near total amputation of the forearm). There were 2 instances when the injury was iatrogenic. One was when the femoral artery got punctured over an atheromatous plaque and dissected, the other one was avulsion of part of the wall of the IVC during radical nephrectomy for renal cell carcinoma. Total of 28 patients did not need exploration of the blood vessel itself as the ischaemia was reduced with reversal of the fracture/dislocation. Fasciotomy was needed in 27 patients. The most suitable vein was used in all the bypasses. We had to amputate 2 limbs post revascularization. We also had a documented VIC in one patient and one myositis ossificans, both these complications were in supracondylar fractures of the humerus with ischaemic forearm.

Discussion :

Injuries are inherent to times of disaster and violence. It is from these unfortunate circumstances that major advances have been made in the fields of trauma management. In war the commonest form of vascular injuries is of the limb and account for 91%² to 96%¹ of vessel injuries. They will also comprise about 85% of the civilian vascular trauma cases⁵. In this series 58/59 vessels were of the limbs and only one exception (the IVC laceration). In the third world, vascular injuries will continue

to present late in one series only 28% presented within 12 hours⁶. The relative early presentation in this series simply represents the fact that if the patient were presenting late then vascular consult was just not made, and only the patients who reported in time to the A and E department were called for vascular consultation. Liberal use of fasciotomy will also improve limb salvage rate⁷. This series also has a high fasciotomy rate. Vascular injuries are still being missed⁸ leading to what could be avoidable amputation. This is further proved by the fact that many of the injuries are being offered amputation without a vascular consult. Duplex scanning is perhaps the best even then it is an operator dependent modality⁹ for screening purpose. Report of 90% sensitivity and 100% specificity¹⁰ has already been published. The most important prognostic factor for limb salvage is the ischaemia time and the golden period has been traditionally set at less than 8 hours. Associated orthopedic injuries increase the chance of amputation^{6,12,13} 42/56 patients in our series had associated bony injury. Blunt trauma will have a higher amputation rate of about 52% as compared to penetrating trauma, which is at about 10%¹³. Mangled extremity score has been used to predict limb salvage in complex injuries¹⁴. Failed arterial repair is a very strong predictor of eventual amputation⁵. Both the 2 patients who had failed vascular repair needed amputation of their limbs. One was a close range gunshot injury to the elbow and was offered radical debridement, followed by bone fixing, artery and nerve repairs. He continued to develop progressive myonecrosis and we amputated him 3 days post operatively. The second case was a near total amputation of the forearm following a thresher injury. We did compression plating for the radius and nailed the ulna after shortening both bones. Then we reconstructed his radial, ulnar and median nerves. We reconstructed the radial artery and cephalic vein. He developed gangrene on 2nd post operative and we amputated his forearm. We have one documented VIC, this was a patient with compound supracondylar fracture of the humerus with avulsed brachial artery, who presented 4 days post injury. We ligated the

artery and did debridement, fasciotomy, k wire fixation, and later arthrodesis and flap surgeries to cover the defect. One patient again of supracondylar fracture of humerus with avulsed brachial artery did get arterial reconstruction inside 7 hours but had a stiff limb with deficient flexion due to myositis ossificans.

Conclusion

Potential for salvage of a limb in major trauma is an extremely difficult decision to be taken by the senior most surgeon available. Usually it would be possible to give the patient the benefit of doubt and proceed with revascularization. Only a combined multidisciplinary approach, rapid resuscitation and urgent definitive therapy will save life and limb. We totally agree with John V Robbs¹⁵ that in almost all cases vascular repair should precede orthopedic or plastic surgery procedures. It is very rare for orthopedic manipulations to disrupt vascular repairs, thus all efforts must be made to avoid temporary shunts which considerably prolong surgery in a sick patient. Vascular surgery has been assumed as a status of a separate specialty and whenever possible, emergencies should be referred to the appropriate unit. It is not a field to enter occasionally, unless absolutely necessary. General surgeons must visit vascular units and must have at least a nodding acquaintance with spectacular problems of this specialty. Isolated vascular trauma is rare, they are always accompanied by other bony or soft tissue injuries. Vascular consultation and reconstruction bring about a major decrease in amputation rate.

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