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ABSTRACT

Objective: To evaluate the pattern of civilian vascular injuries, demonstrate any change in pattern and document management challenges in a resource challenged environment.

Design: A retrospective study.

Setting: The division of Thoracic and Cardiovascular Surgery of University College Hospital a major referral centre, not only for south-west Nigeria but for the whole country.

Subjects: All patients presenting with vascular injury through the division during the study period were recruited. There were no exclusion criteria.

Results: Males accounted for 85% of the study group. Mean age was 31.98 years (± 14.94 S.D.) with peak in 20–29 years group (28.3%). Stab and gunshot injury were responsible in 36.7% and 30% respectively. Upper limb vessels were involved in 58.3%. Delayed presentation (>4 hrs post injury) occurred in 58.3% and presentation-operation interval was four to six hours in 55% of cases. Specific diagnostic investigation was required in only 20%. Morbidity, amputation and mortality rates were 10.1, 3 and 6.7% respectively.

Conclusion: Penetrating vascular injuries are on the increase amongst civilian population. Poor transportation and lack of organised referral system contribute to delay in surgical intervention. Prompt evaluation for hard signs of vascular injury is of immense value in deciding for surgery in our environment where patients have financial challenges and resources are limited.

INTRODUCTION

Vascular injury is a common indication for emergency thoracic and cardiovascular surgery care. Road traffic, occupational and industrial accidents account for a large proportion of cases while stab wounds and gunshot injuries are emerging as common causes in civilian practice (1). The incidence of vascular injuries is increasing in the developing countries due to rising frequency of high speed travel and socio-political crises with attendant violence. Vascular injuries have a potential to cause significant morbidity and mortality if they are not recognised

and treated promptly. Strict criteria need to be followed to help make timely diagnosis and prevent complications of limb amputation, contractures and even death. Management of vascular injuries remains challenging in developing countries where there is paucity of material and human resources and poor transportation and communication networks. The picture is worsened by poorly coordinated emergency response system with attendant loss of valuable time in transit.

This study is aimed at reviewing the pattern and operative management of vascular injuries in Ibadan between June 2003 and June 2011.

MATERIALS AND METHODS

A retrospective study of all vascular injuries managed between June 2003 and June 2011 at the Division of Thoracic and Cardiovascular surgery, University College Hospital Ibadan, Nigeria was conducted. Data were obtained from case notes, unit and theatre operation records along with discharge summaries of the patients. All data on age, sex, mechanism of injury, anatomic location of arterial injury, associated vein, nerve, and/or tendon injury, bone fracture and its location, arterial repair techniques, fasciotomy procedure, presence of soft tissue disruption, compartment syndrome development, clinical signs and symptoms on admission, methods of repair as well as injury-presentation and presentation-surgery intervals were gathered.

Diagnosis was made mostly by physical examination alone in patients with hard signs of vascular injury. Hard signs include active or pulsatile haemorrhage, expanding or pulsatile haematoma,

distal circulatory deficit (ischaemia, diminished or absent pulse) and bruit or thrill suggesting arteriovenous (AV) fistula. Doppler ultrasonography or angiography were done in suspicious cases with soft signs such as palpable but diminished distal arterial pulses, fracture or missile in proximity of major artery, asymmetric extremity blood pressures, shock (unexplained by other injuries), and/or non-expanding and non-pulsatile haematoma. Statistical analysis was performed using SPSS version 14 statistics software programme (SPSS Inc., Chicago, Illinois, USA).

RESULTS

Demographics: The study group consisted of 51 males (85%) and 9(15%) females with age range from 17 days to 72 years with a mean (SD) age of 31.98 years (± 14.94) years. The peak age incidence was in 20-29 years age group accounting for 28.3% (Table 1).

Table 1
Characteristics of the study population

Variables	All patients (N = 60)
Age distribution	
0-9	3 (5.0%)
10-19	8 (13.3%)
20-29	17 (28.3%)
30-39	14 (23.3%)
40-49	8 (13.3%)
50-59	6 (10.0%)
60-69	3 (5.0%)
70-79	1 (1.7%)
Total	60 (100.0%)
Occupation	
Student	18 (30.0%)
Traders	13 (21.7%)
Drivers	9 (15.0%)
Motorcyclists	3 (5.0%)
Farming	1(1.7%)
Manual workers	10(16.7%)
Others	6(10.0%)
Total	60 (100.0%)
Aetiology of injuries	
Stab	22 (36.7%)
Gunshot	18 (30.0%)
RTA	8 (13.3%)

Occupational	4 (6.7%)
Iatrogenic	4 (6.7%)
Others	4 (6.7%)
Total	60 (100.0%)
Body region involved	
Upper extremities	35(58.3%)
Lower extremities	15(25.0%)
Others	10(16.7%)
Total	60(100.0%)

Injuries: Stab injuries and gunshots representing 36.7 and 30.0% respectively were the most common indications for surgery (Figure 1). The brachial and radial arteries were the vessels most commonly injured (23% and 16.7% respectively) (Figure 2). Bone and joint injury was the most commonly associated, seen in 31.6% of cases while nerve injury occurred in 21.7%.

Figure 1
Aetiologic factors of vascular injuries

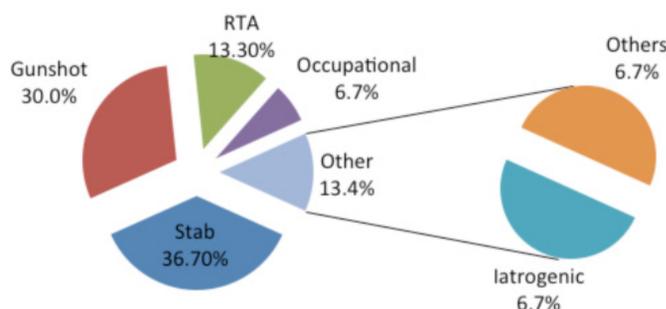
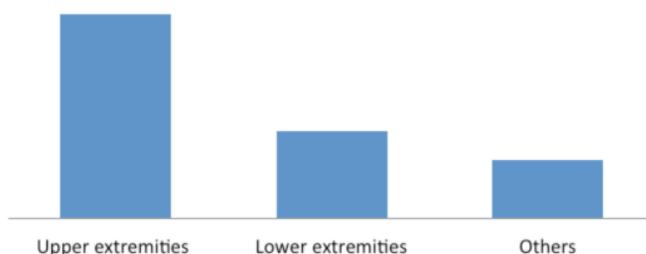


Figure 2
Location of vascular injuries



Treatment: Twenty-seven (45%) of the patients were referred from other health facilities. Forty-one point seven percent of the patients presented within two to four hours of the injury while 55% (33) of the patients had surgery between four to six hours after presentation. Specific diagnostic investigation including Doppler ultrasound and/or CT angiography was done in only 20% of cases (CT angiography alone - 3(5.0%), Doppler ultrasonography alone - 6(10.0%), CT angiography and Doppler ultrasonography - 3(5.0%)). The most

common technique of repair was primary end to end anastomosis (31.6%) followed by lateral repair (25%).

Complications include wound infection in 6.7% of cases while two of the patients (3.4%) had repeat surgeries for failed lateral repair and end to end anastomosis respectively. Subsequent limb amputation was performed in 3% of patients. Hospital stay was less than ten days in 50% of cases. The mean hospital stay was 13.65days ± 11.72S.D. There was 6.7% mortality in this series.

DISCUSSION

Most of the patients in this review were males (85%). The preponderance of males over females in vascular injury which has also been reported by other series (2) may be attributed to the higher activity level of the male gender. The combined age group incidence of 51.6% occurring in the youthful groups of 20-39 years may be due to similar reasons. This observation is in agreement with that of Lakhwani *et al* (2).

Stab wounds and gunshot injuries were the most common causes with combined incidence of 66.7%. Increased civilian violence including armed robbery attacks is responsible for this. Thomas and co-workers reported that twenty three (56.1%) of their forty-one patients suffered gunshot injuries during armed robbery attacks while nine patients (22.0%) had stab injuries from civilian violence (1). This is in contrast to earlier observations of preponderance of blunt trauma aetiology of vascular injuries in earlier reports from Nigeria (3,4). Road traffic accidents were responsible for 13.3% of cases while occupational injury was responsible for another 6.7% in this series. Iatrogenic injury was responsible for 6.7%. This value is lower than 9% reported by Myers *et al* (5). This may be due to the fact that vascular catheterisation procedures are lower in number in our institution.

Upper limbs vessels were more involved than the lower limbs vessels (58.3% as against 25% respectively). Reports in the literature are however variable (1). The brachial artery was the most frequently injured vessel followed by the radial artery; quite similar to the reports from Orcutt and coworker (6). However Myers *et al* (5) reported ulnar artery as the vessel most commonly injured in their series while it was the radial artery in the study by Adeoye *et al* (7).

Forty-five percent of our patients were referred from other centres. Delayed presentation was common in the study population with 58.3% presenting more than four hours following vascular injury. Less than half, (41.7%) of patients presented within two to four hours. A large proportion of those presenting beyond this interval were referred. The lack of facility for vascular repair in majority of health facilities in the country lead to waste of time before vascular repair. Furthermore, poor transport system caused significant delay. Fifty-five percent of the patients had surgery between four to six hours of presentation. The delay is due in most cases to poverty, time lost in transferring patient to operating room and lack of theatre space. A significant proportion of patients who had surgery after six hours of presentation had incomplete vascular injuries needing specific diagnostic tests. One of our patients asked to be discharged against medical advice and represented a month after with wound infection and copious bleeding.

Diagnostic test was not routinely done in this series. Only 20% of patients had diagnostic investigations. In the series by Lakhwani *et al* (1) all patients had ultrasonography. The clinical presentation pattern and financial constraints may be responsible for the low rate of definitive investigations. Bone and joint injuries and nerve injuries were the most common associated injuries. They were present in 31.6% and 21.7% of cases respectively. Myers *et al* also documented a high incidence of associated nerve and bone injuries (5). Our most common technique of repair was end-end anastomosis which is in agreement with most other studies (1-7). Lateral repair and reverse saphenous vein graft were done in 25% and 15% of cases respectively.

The most common complication in the study was wound infection (6.7%). Wounds are mostly contaminated at presentation. Lakhwani *et al* and Adeoye *et al* noted similar findings (2,7). Secondary haemorrhage was seen in 3.3% while failure of lateral repair and end-end anastomosis occurred in 1.7% each. Two (3.3%) of the patient had limb amputation. One of this was due to iatrogenic injury to brachial artery following upper limb venous cut-down in a neonate. Surgery was done three days after the cut down but viability of the limb could not be regained. The amputation rate is lower in this study than reported by other authors (2) although no amputation was required in Orcutt series (6). This variation in amputation rate may be explained by delayed presentation and repair of vascular injuries in developing country settings. Other authors have also noted that duration of ischaemia prior to revascularisation play a significant role in limb loss following vascular injuries. Other factors reported to be contributory to limb loss following lower extremity arterial injury includes severe soft tissue damage, associated venous injuries, associated 2-bone fractures, popliteal artery involvement, below-knee multiple arterial injuries, development of compartment syndrome, injury mechanism, anticoagulation, and failed revascularisation (7-13). Mortality in this review was 6.7%. Most patients died of complications arising from other severe injuries sustained. The patient that initially discharged against medical advice and represented 30 days after died of septic shock. Fifty percent of the patients stayed less than ten days on admission. Overall, 90% of our patients had successful vascular reconstruction and this compares favourably with previous report by Adeoye *et al* (85.7%) (7) and studies from Accra Ghana, a similar setting to ours with a recent report of forty-four of 52 (84.6%) patients having successful vascular reconstruction (14). Most patients that stayed beyond ten days on admission had associated orthopedic injuries and like in other studies chronic morbidity was related to neurologic deficit (13).

CONCLUSION

Vascular injuries to peripheral vessels seen in our environment are increasingly due to penetrating injuries. A vast majority of these injuries occur in young males possibly due to more active nature of this spectrum of patients. There was a high rate of associated nerve and orthopedic injuries with consequent negative effect on the length of post-operative hospital stay and chronic morbidity.

Delay in referring patients with vascular injuries for intervention due to the transportation problems is quite prominent. Despite this, the overall outcome is good with 90% of patients having successful vascular reconstruction. Most of the patients stayed less than ten days on admission. Therefore, successful vascular reconstruction is still possible in the majority of our patients despite our difficult terrain.

We have demonstrated that most of these injuries can be adequately treated without the use of vascular specific investigations like angiograms and duplex ultrasonography which are usually expensive or unavailable. Sound knowledge of vascular anatomy and strict clinical criteria for diagnosis has been of tremendous help.

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