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THE OUTCOME OF VASCULAR INJURY IN NAJAF CITY WITH A REPORT OF AN UNUSUAL PRESENTATION OF CASES AND SURGICAL TECHNIQUES IN MANAGEMENT

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Abstract
To provide a comprehensive description of the epidemiology, management, and outcome of vascular trauma, with a report of unusual case presentation and surgical technique in management. A retrospective observational study of patients presented with vascular trauma between 1st January 2017 and 1st August 2020. Most of the cases operated on in the Al-Sadder Medical City. Patients' mean age was 31.2 ± 12.6 (range, 10-60). There were 55 males (91.6%) and five female (8.3%). About 14 (23.3%)cases of blunt trauma and 46(76.6%) cases of penetrating trauma. The femoral A was the most commonly affected vessel in 19(31.6%) patients. The most common type of vascular injury was complete cut in 40%, and the most common surgical intervention was reverse interposition venous graft 46.6%. The amputation rate was 6.6%, and the mortality rate was 6.6%. Vascular injury is an increasing problem in Najaf city because of community expansion, increased violence, and advancement in medical interventions that led to more iatrogenic vascular injury. Early diagnosis and management is of paramount importance to achieve a satisfactory outcome.

Keywords: Vascular injury; Spontaneous vascular injury; Aortic bifurcation injury; Aortic bifurcation reconstruction

Introduction

Iraq is a hot zone for around four decades and is still boiling. Mortality from conflict, terror, domestic violence, road traffic accident (RTA), and other forms of trauma had surpassed the mortality from ischemic heart disease for many occasions Vascular injury can be devastating. Dr. Hallowell did the first urgent repair of an arterial injury on 15th June 1759 [3]. Important information had been gained in the management of vascular injuries during the first and second world wars, but only in the Korean and Vietnamese wars were vascular reconstructive methods were introduced [4].

Vascular trauma constitutes 4.4% of all civilian trauma admission but responsible for up to 20% of trauma death [5, 6].

We aimed to provide a comprehensive description of the epidemiology, management, and outcome of vascular trauma in Najaf, Iraq with a report of unusual case presentation and surgical technique in management.

Methods

A retrospective observational study of patients with vascular trauma between 1st January 2017 to 1st August 2020. Most of the cases operated on in the Al-Sadder Medical City, the tertiary center in the city, receive patients from the whole middle Iraq region. The diagnosis was established by clinical assessment, Duplex scan, and computerized tomographic angiography (CTA). Vascular injury complicating hemodialysis access in patients with renal failure were excluded from the study. Small vessel injury (below the knee and below elbow), and we excluded patients with primary amputation from the series. Means and standard deviations were used to express the numerical variable, while frequency and percentage were used to express categorical data.

Results

Sixty cases of vascular trauma were encountered. At the time of presentation, patients' mean age was 31.2±12.6 (range, 10-60). There were 55 males (91.6%), five females (8.3%). All 41 (68.3%) patients with hard signs were operated immediately. The rest 19(31%) patients with the soft signs were assessed using a Duplex scan. Conventional angiography was used to diagnose occlusion to celiac, superior mesenteric, and right renal arteries by the aortic stent in one patient.

There were 14(23.3%) cases of blunt trauma and 46(76.6%) cases of penetrating trauma. The most common injury mechanism is bullet injury, followed by a road traffic accident and a stab wound (Table 1). Torso injury comprised only one-third of the cases. The most common anatomical site of arterial injury was the femoral A (19, 31.6%),

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followed by the brachial A (14, 23.3%) (Table 1). There were 21(35%) cases associated with venous injury, managed by lateral repair (Table 1). The most common arterial injury type was complete cut (24, 40%), followed by partial laceration (18, 30%). The remaining are contusion with thrombosis, arteriovenous fistula, and pseudoaneurysm (Table 1) (Figure 1).removed the retroperitoneal mass (Figure 2A), this is leading to a free wall rupture. An unusual aortic bifurcation reconstruction technique successfully managed it without using prosthetic material (Figure 2B) (Table 2).

In case scenario (3), a 47-years-old male with acute extensive aortic dissection treated by the stent and complicated by flap occlusion of celiac, superior mesenteric, and right renal arteries. A retrograde graft from the right common iliac A to the superior mesenteric then right renal arteries was done. Unfortunately, the patient died in the ICU two months later (Figure 3) (Table 2).

The great saphenous V (SVG) was used in all the cases where V graft is needed except two cases. The first was a 10-year-old child with a bullet injury to the superficial femoral A and V; the SVG was very small, so used the injured superficial femoral V to reconstruct the A. The second case was 20-years-old with blunt trauma to the right shoulder, avulsed brachial plexus, axillary A and V injury. Here, the injured axillary V used to reconstruct the axillary A.

The post-operative complications and mortality is shown in Table 4.

Prophylactic fasciotomy was done in six patients when there was prolong limb ischemia (more than 6 hours), a combined arterial and venous injury, and when there is a massive soft tissue injury. We routinely used small skin incisions for fasciotomy. All cases of fasciotomy closed directly after 3-4 weeks except one patient that needed skin grafting.

Discussion

Vascular injury is a growing problem in Najaf, in parallel with the city's growth and increased violence, and road traffic jams. A more invasive medical procedure is done in the city. This trend is also true in other places in the world [7].In this study the highest male to female ratio compared to other studies, and this can be explained by less role taken by women in our society in high-risk behaviors [8-10]. Torso vascular injury is one-third of our cases, which is less than data from other countries with a more organized trauma system. This fact can be explained by lack of a pre-hospital care system and delayed transfer in Iraq, so that most patients with truncal vascular injury die at the scene [11]. This reason also explain the lower morbidity and mortality rate in Iraqi patients (6.6% mortality rate compared to 18-26% in other studies) because we faced less severe cases who survived the deadly journey to the hospital [11, 12]. Different groups of researchers reported a lower mortality rate (only 2.4%) [13].Amputation is done in four cases in our series, three of which had popliteal A injury, one with delayed revascularization done after 12 hours from injury, the other two with extensive soft tissue injury due to shell (victim of the blast). One case of blunt brachial A injury had delayed presentation ended with amputation. The blunt trauma and popliteal A are associated with a high amputation rate as in other studies [8, 11]. Spontaneous brachial A pseudoaneurysm rupture is reported in a frankly fragile patient with connective tissue disease [14]. Spontaneous popliteal A without preceding aneurysmal dilation is reported in morbidly obese patients [15]. We determined a case of brachial A spontaneous rupture (without preceding aneurysmal dilation) as an initial presentation of connective tissue disease.Retrograde revascularization of the superior mesenteric A from the common iliac A for chronic mesenteric ischemia is reported [16]. We report retrograde revascularization by a prosthetic graft of superior mesenteric A and right renal A from a common iliac A for acute mesenteric ischemia. Aortic injury during induction of pneumoperitoneum using the Hasson Trocar had been reported [17] and damage to aortic bifurcation by the Falope Ring application for sterilization was recorded [18]. Both were small punctures repaired by lateral repair. A case of repair of extensive injury to aortic bifurcation sustained by electrocautery presented, and we trying to stop bleeding from the bed of a mass overlying the bifurcation. We used an unusual technique to reconstruct the aortic bifurcation. However, laparoscopic repair of iatrogenic aortic injury is reported previously in the literature [19], which was inapplicable in our unstable patient.Sachinder et al., documented an iatrogenic vascular injury to the thoracic aorta by screw. In thoracolumbar spine fusion and repair using atrio-femoral bypass [20]. We figured a brachial A coiling by the drill that required a saphenous V graft.

Limitations

The small number cases, retrospective design, missing some critical data, and the lack of use of the endovascular technique to manage vascular injury are the limitations of the study.

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Conclusion

Vascular injury is an increasing problem in Najaf because of expansion, increased violence, and advancement in medical interventions that lead to more iatrogenic vascular injury. Early diagnosis and management are of paramount importance to achieve a good outcome.

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References

1. "Iraq: Governorates, Cities, Towns, Municipal Districts - Population Statistics in Maps and Charts." www.citypopulation.de.
2. http://www.healthdata.org/iraq.
3. Feliciano DV, Moore FA, Moore EE et al. Evaluation and management of peripheral vascular injury. Part 1. Western Trauma Association/critical decisions in trauma. J Trauma. 2011 Jun; 70(6):1551-6.
4. Feliciano DV, Rasmussen TE. Evaluation and treatment of vascular injuries. In: Browner BD, Jupiter JB, Kretteck C, eds. Skeletal Trauma. Basic Science, Management, and Reconstruction. Philadelphia: Elsevier Saunders, 2015: 423-35
5. Mattox KL, Hirshberg A. Vascular trauma. In: Haimovici H, Ascer E, Hollier LH, Strandness DE, Towne JB, editors. Haimovici′s Vascular Surgery. 4 th ed. USA: Blackwell Science; 1996. p. 480-96.
6. Sugrue M, Caldwell EM, Damours SK et al. Vascular injury in Australia. Surg Clin North Am 2002 Feb; 82(1):211e9.
7. M T Caps. The epidemiology of vascular trauma. Semin Vasc Surg 1998 Dec; 11(4):227-31.
8. Zhui Li, Liang Zhao, Kaizhen Wang. Characteristics and treatment of vascular injuries: a review of 387 cases at a Chinese center. Int J Clin Exp Med. 2014; 7(12): 4710–4719.
9. Rashid Usman, Muhammad Jamil, Muhammad Faheem. Evaluation, Surgical Management, and Outcome of Traumatic Extremity Vascular Injuries: A 5-year Level-1 Trauma Centres Experience Ann Vasc Dis Vol. 11, No. 3; 2018; pp 312–317.
10. Dheeraj Sharma, Anula Sisodia, Sanjeev Devgarha. Management of vascular trauma: A single-center ten years' experience. Journal-Cardiovascular Surgery 2014:2(3):33-38.
11. Z B Perkins 1, H D De'Ath, C Aylwin. Epidemiology and outcome of vascular trauma at a British Major Trauma Centre. Eur J Vasc Endovasc Surg 2012 Aug; 44(2):203-9.
12. Michael Sugrue 1, Erica M Caldwell, Scott K Damours. Vascular injury in Australia. Surg Clin North Am 2002 Feb; 82(1):211-9.
13. Charles H.Moore, Fred J.Wolma, Richard W.Brown. Vascular trauma: A review of 250 cases. The American Journal of SurgeryVolume 122, Issue 5, November 1971, Pages 576-578.
14. E.Gok, O.S.Goksel, U.Alpagut. Spontaneous Brachial Pseudo-aneurysm in a 12-year-old with Kyphoscoliosis-type Ehlers–Danlos Syndrome. European Journal of Vascular and Endovascular Surgery Volume 44, Issue 5, November 2012, Pages 482-484.
15. Ryan T. Hagino, Jeffrey D. DeCaprio, R.James.Valentine. Spontaneous popliteal vascular injury in the morbidly obese. J Vasc Surg, Volume 28, ISSUE 3, P458-463, 01st September 1998
16. Hee Jae Jun, Isolated Bypass to the Superior Mesenteric A for Chronic Mesenteric Ischemia. Korean J Thorac Cardiovasc Surg. 2013 Apr; 46(2): 146–149.
17. S C Lynn Jr, A R Katz, P J Ross. Aortic perforation sustained at laparoscopy. J Reprod Med 1982 Apr; 27(4):217-9.
18. CM Pring. Aortic Injury Using the Hasson Trocar: A Case Report and Review of the Literature. Ann R Coll Surg Engl. 2007 Mar; 89(2): W3–W5.
19. George P Abraham, Krishanu Das, Krishnamohan R et al. Laparoscopic repair of aortic injury. BJUI. DOI: 10.1002/BJUIw-2010-087-web.
20. Sachinder Singh Hans, Alexander D. Shepard, Pritham Reddy. Iatrogenic arterial injuries of spine and orthopedic operations. Journal of vascular surgery. https://doi.org/10.1016/j.jvs.2010.08.084.

Figure Legend

Figure (1) 22-years-old male with an axillary A pseudoaneurysm caused by a shell.

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Figure 2 (A) Aortic bifurcation burned by cautery during laparoscopic surgery; (B) Technique of aortic bifurcation reconstruction

Figure (3) After occlusion of the superior mesenteric A, right renal, and celiac arteries by a stent. A prosthetic graft from the right common iliac to the superior mesenteric to right renal arteries was grafted. The bowl and right kidney immediately restored their pinkish color

Table 1. Mechanism, types, anatomical sites, and surgical intervention of arterial injuries

		N (%)
Mechanism	Bullet injury	20 (33.3)
	Road traffic accident	10 (16.6)
	Stab wound	10 (16.6)
	Iatrogenic	9 (15)
	Shell injury	7 (11.6)
	Fall from height	3 (5)
	Spontaneous	1 (1.6)
Anatomical site	Femoral A	19 (31.6)
	Brachial A	14 (23.3)
	Popliteal A	7 (11.6)
	Subclavian A	4 (6.6)
	Axillary A	4 (6.6)
	Aorta	3 (5)
	Superior Mesenteric A	2 (3.3)
	Carotid A	2 (3.3)
	External Iliac A	1 (1.6)
	Common Iliac A	1 (1.6)
	Renal A	1 (1.6)
	Vertebral A	1 (1.6)
	Hepatic A	1 (1.6)
Types	Complete transection	24 (40)
	Partial laceration	18 (30)
	Contusion and thrombosis	9 (15)
	Arteriovenous fistula	5 (8.3)
	Pseudo-aneurysm	4 (6.6)
Surgical intervention	Reverse interposition venous graft	28 (46.6)
	End to end anastomosis	15 (25)
	Lateral repair	12 (20)
	Ligation (hepatic, femoral and brachial arteries)	3 (5)
	Prosthetic graft	1 (1.6)
	Bone wax to stop bleeding from vertebral A	1 (1.6)

Table 2. Mechanism, anatomical sites, and surgical intervention of venous injuries

Anatomical site	**N (%)**	**Surgical intervention**
Femoral V	9 (42.8)	Five lateral repairs, two ligated and two grafted by GSV
Popliteal V	5 (23.8)	Two lateral repairs, two grafted by GSV and one ligated

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Internal jugular V	2 (9.5)	One lateral repair and one ligated
Axillary V	2 (9.5)	One lateral repair and one ligated
Common iliac V	2 (9.5)	One lateral repair and one ligated
Portal V	1 (4.7)	Lateral repair

Table 3. Iatrogenic vascular injury.

Vessels involved	**Mechanism of injury**	**Surgical intervention**	**Fate**
Aortic bifurcation	Cauterization during laparoscopic removal of retroperitoneal mass (Figure 2A)	Aortic bifurcation reconstruction (LCIA anastomosed end to end to distal aorta and RCIA anastomosed end to end to LIIA after distal ligation of LIIA (Figure 2B)	The patient survived with no complication
SMA and RRA	Stent for aortic dissection caused flap occlusion of the two vessels	A retrograde prosthetic graft from the RCIA (only great vessel in the abdomen not involved by the dissection) to SMA then to RRA (Figure 3)	The patient developed ARSD and died in ICU after two month due to MODS
Femoral A	Inadvertent ligation to control bleeding during femur internal fixation	GSV grafting	Pulse restored without complication
Hepatic A and portal V	Laceration during dissection for Porta hepatis mass removal	Hepatic A ligated and portal V repaired	The patient survived with no complication
External iliac A	Laceration during sixth redo-surgery for colonic tumor causing intestinal obstruction	End to end anastomosis	Pulse restored without complication
Brachial A	Coiled by drill during external fixation of humorous	GSV grafting	Pulse restored without complication
Carotid A	Partial laceration during neck dissection	Lateral repair	The patient survived with no complication
Femoral A	Arteriovenous fistula as an Access site complication of PCI	Division and lateral repair	The patient died MI on 2^{nd}-day post-op
Femoral A	Pseudoaneurysm as an Access site complication of PCI	Resection and GSV grafting	Pulse restored without complication

SMA=Superior Mesenteric A, RRA=Right Renal A, LCIA= Left Common Iliac A, RCIA=Right Common Iliac A, LIIA=Left Internal Iliac A, ARDS= Adult Respiratory Distress Syndrome, MODS=Multi-organ dysfunction syndrome, GSV=Great Saphenous V, AVF=Arterio-venous Fistula, PCI=Percutaneous Coronary Intervention, MI=Myocardial infarction.

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Table 4. Post-operative complications and mortality.

Complication	**N (%)**
Graft thrombosis	2 (3.3)
ICU admission	2 (3.3)
Compartment syndrome	2 (3.3)
DIC	2 (3.3)
Renal Failure	3 (5)
Wound infection	8 (13.3)
ARDS	1 (1.6)
Major amputation	4 (6.6)
DVT	3 (5)
Pulmonary embolism	1 (1.6)
Death	4 (6.6)

ICU=Intensive Care Unit, DIC=Disseminated Intravascular Coagulation, ARDS=Adult Respiratory Distress Syndrome, DVT= Deep V Thrombosis.