VASCULAR SURGERY

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Role of rural general surgeons in managing vascular surgical emergencies

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Abstract

Background: A rural general surgeon has historically been required to perform a wide variety of subspecialist procedures. Increasingly sub-specialized training programs have restricted younger surgeons' experience in the general surgery-associated subspecialties. Time critical vascular surgical emergencies are frequently encountered by rural general surgeons. This study aims to audit the prevalence of vascular surgical emergencies at a geographically remote regional centre and define the role of the general surgeon in managing these patients.

Methods: A single-centre, retrospective study was performed to analyse the outcomes of the patients who presented to Dubbo Base Hospital with an emergency vascular pathology or developed such a condition during admission, between October 2010 and June 2019. Patients were identified by relevant International classification of diseases (ICD) (10th revision) diagnostic codes for vascular emergencies. Acute complications following surgery for haemodialysis access were excluded.

Results: A total of 134 patients were identified during the study period and the majority were transferred to a tertiary centre for surgical intervention. Sixteen patients underwent emergency vascular surgery locally due to concerns about potential loss of life or limb if intervention was delayed by transfer; 69% of patients who underwent surgery locally survived with limb salvation.

Conclusion: While most patients can safely be transferred to a tertiary centre, some require surgery locally in order to maximize chance of life or limb preservation. There is a strong argument for exposure of general surgical trainees with an interest in rural surgery to vascular surgery and other subspecialties.

Introduction

Approximately 33% of the Australian population reside in rural, regional or remote locations. This population is serviced by less than 15% of practicing surgeons, of which almost half are general surgeons.[1,2] While most rural centres have visiting subspecialist surgeons on fly-in, fly-out contracts, mostly to meet the need for elective procedures, many units do not have full time subspecialist surgeons on call. Rural general surgeons have historically been required to perform a wide variety of subspecialty procedures, particularly in the emergency setting. This includes neurosurgical, thoracic, vascular and urological procedures, which would typically be performed by subspecialists at metropolitan centres. General surgical training traditionally involved rudimentary training in a variety of these subspecialty areas. In recent decades, increasingly sub-specialized training programs and a perceived reduction in breadth of subspecialty surgery exposure have raised concerns about younger surgeons' experience in these general surgery-associated specialties.

Vascular surgical emergencies present time-critical threats to life or limb and are frequently encountered by rural general surgeons. While most cases permit urgent transfer to centres with vascular surgical services, others require more immediate life or limb-preserving intervention, particularly in a geographically vast country like Australia. For this reason, general surgeons at rural and regional surgical units without specialist vascular surgeons, must be prepared and equipped to manage vascular emergencies. This study aims to audit the prevalence of vascular surgical emergencies at a geographically remote regional centre and define the role of the general

surgeon in managing these patients in contemporary rural surgical practice.

Methods

A retrospective review of medical records was performed for all patients who presented to Dubbo Base Hospital (DBH), New South Wales (NSW), Australia, with a vascular surgical emergency, or developed such a condition during an admission, between October 2010 and June 2019. Patients were included based on relevant International Classification of Diseases (10th revision) diagnostic codes relating to acute thrombosis, dissection, embolism, aneurysm, pseudoaneurysm and major vascular injury/trauma (Table 1). Patient demographics, presenting symptoms, imaging findings, details of vascular intervention, postoperative complications, and rates of vessel patency and limb salvage were collected from patient medical records. Acute complications relating to arterio-venous fistulas for haemodialysis access were excluded.

DBH services approximately 160 000 people in western NSW and is situated 390 km from central Sydney (approximately 5–5.5 h driving time and 65 min by aeroplane), the nearest capital city. In the authors' experience, time taken for urgent patient transfer to Sydney via air retrieval is at least 5 h. DBH has no residential vascular surgeon. Seven general surgeons share the on-call roster to provide 24-h emergency surgical service, including vascular emergencies. The surgeon on-call decides, usually after consultation with a vascular surgeon at the referral centre, whether the patient can be managed locally with non-operative management while awaiting transfer or whether the patient needs urgent surgery locally. Angiography facilities are not available at DBH.

Ethics approval was granted by the Western NSW Local Health District Human Research Ethics Committee prior to the commencement of this study.

Results

A total of 134 patients with acute vascular surgical emergencies were assessed at DBH during the study period. Table 2 demonstrates the number of presentations by year. Thromboembolic disease-causing acute limb ischaemia was the most common pathology (57%), followed by complicated (leak or rupture) aneurysmal disease (19%; Table 3). In total, 105 patients (79%) were transferred to a tertiary centre for vascular intervention, 16 (12%) required surgery locally. The remaining 13 patients were managed conservatively or palliated. Figure 1 summarizes the disposition of all patients within the study period.

Table 2 Number of acute vascular presentations to Dubbo Base Hospital by year

Year	Number of patients
2010 (3 months)	6
2011	13
2012	19
2013	14
2014	18
2015	20
2016	13
2017	11
2018	12
2019 (6 months)	8

Table 3 Type of acute vascular presentations to Dubbo Base Hospital between October 2010 and June 2019

Pathology	Number of patients	%
Thomboemobolic	76	57
Aneurysmal	26	19
Pseudoaneurysmal	15	11
Dissection	11	8
Others	6	5
Total	134	

Locally performed surgeries were carried out by four resident general surgeons, with previous vascular training, who were at least 10 years post-fellowship at the time of surgery. Of the 16 patients who underwent surgery, eight required embolectomy and two required grafting for acute ischaemic limb (Table 4). Six of the eight patients had their limb salvaged. One patient required below knee amputation despite successful revascularisation. Of the remaining six patients who had surgery at DBH, one underwent open graft repair of a ruptured abdominal aortic aneurysm and another required graft repair of a ruptured left common iliac aneurysm.

Three patients required intervention for major iatrogenic vascular injury; including one patient who underwent synthetic patch repair for an inferior vena cava injury, one patient required primary repair of a right external iliac artery puncture site (following angiography)

Table 1 International classification of diseases (ICD) codes for acute vascular emergencies

	ICD codes
Haemopericardium	123.0
Intermittent claudication	170.21
Rest pain	170.22
Gangrene of the extremities	170.24
Aortic dissection/aortic aneurysm rupture	171.00; 172.01; 171.02; 171.03; 171.1; 171.3; 171.5; 171.8
Aneurysm or dissection of other vessels	172.0; 172.1; 172.2; 172.3; 172.4; 172.8; 172.9
Thromboembolism of aorta or extremities or iliac vessels	174.0; 174.1; 174.2; 174.3; 174.4; 174.5; 174.8; 174.9
Rupture of artery	177.2
Accidental injury to vessel during procedure	197.31; 197.33; 197.34; 197.35

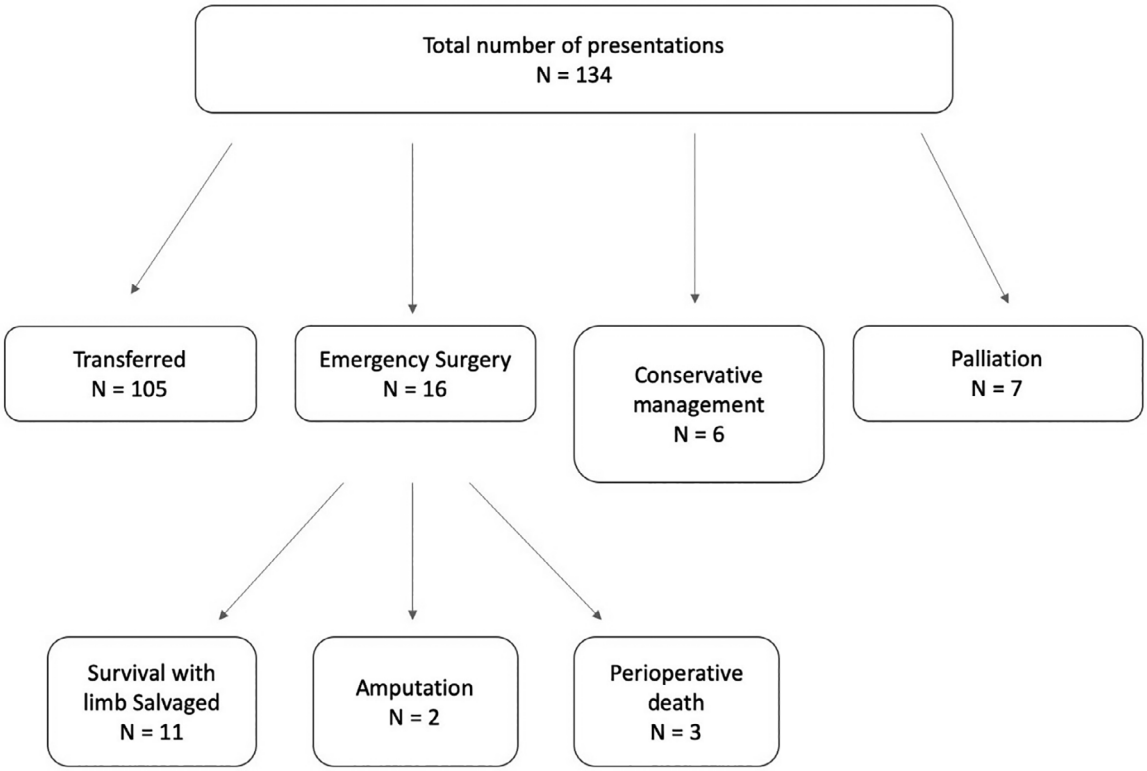

Fig 1. Disposition of 134 patients who presented to Dubbo Base Hospital with vascular surgical emergencies.

and another patient who required primary repair of a right common femoral artery pseudoaneurysm. Two of these patients survived. One patient had a thoracotomy for a stab injury to the left ventricle and aortic arch but unfortunately did not survive surgery. These results show that locally performed vascular emergencies can achieve a 69% survival with limb salvation.

Discussion

Vascular surgical procedures account for approximately 5% of overall rural surgical workload, and 16–38% of subspecialist procedures performed in a rural setting.[2–4] Historically, rural general surgeons have been trained in vascular surgery and routinely performed both elective and emergency vascular procedures.[4] While increasing subspecialist availability for elective procedures at regional centres should be encouraged, the rural general surgeon must still be prepared to manage critical acute vascular emergencies. The data presented in this report indicates that general surgeons on-call at regional centres can expect to be involved in the management of 10–20 emergency vascular surgery presentations per year. Occasionally, the time-critical nature of the disease necessitates surgery be performed locally. The decision to transfer a patient is generally made in discussion with a vascular surgeon at the tertiary centre and after consideration of any foreseeable delay in transfer which may be significant (such as retrieval aircraft availability and weather conditions).

During the study period, 16 patients (12%) were assessed as being too unstable for transfer or having the best chance of limb preservation if surgery was performed locally. This is a highly selected group of patients with ruptured aneurysms, advanced limb ischaemia or major vascular injury already at high risk of mortality or limb loss. In patients with acute limb ischaemia, reported rates of amputation are as high as 25% with in-hospital mortality in the range of 9–15%.[5] Delay in treatment to re-perfuse the limb increases the risk of amputation.[5,6] Similarly, in patients with a ruptured AAA, delay to surgery due to transfer is well-established as a predictor of mortality.[7] It is therefore important for rural general surgeons, particularly at geographically remote centres, to be able to offer this selected group of patients the best chance of limb salvage and survival.

At DBH, 81% of patients survived after emergency vascular surgery. In acute limb ischaemia, long term limb salvation was achieved in 80% of the patients. Our results demonstrate that survival with limb salvation is achievable in 69% of this group of patients. In view of the highly selected nature of this group of patients (i.e. patients with advanced ischaemia or haemodynamic instability), these outcomes are acceptable and support the need for rural general surgeons with rudimentary vascular surgical skills. A recent reduction in exposure to vascular surgery for general surgical trainees is one of the areas of concern for preparedness of younger fellows for rural surgical practice.[8] Although increasingly subspecialist fellowship training programs will likely result in more subspecialist general surgeons (e.g. upper gastrointestinal or colorectal surgeons) practicing in rural

Table 4 Details and outcomes of patients who required emergency vascular surgical intervention at Dubbo Base Hospital

No.	Pathology	Operative details	Intra/postop mortality	Transferred post-operatively?	Secondary procedure	Last follow up (months)	Survival status at last follow up	Limb status last follow up
1	Ruptured right common iliac artery aneurysm	Attempted open graft repair	Intra-op	NA	NA	—	NA	NA
2	Acute brachial artery thrombosis	Brachial artery embolectomy	No	Yes	Forearm amputation	57	Alive	Limb loss
3	Left ventricular / aortic arch stab injury	Sternotomy, primary repair of ventricular and aortic lacerations	Intra-op	NA	NA	—	NA	NA
4	Ruptured common femoral artery pseudoaneurysm post coronary angiography	Open repair of CFA pseudoaneurysm	Post-op (day 1 myocardial infarction)	NA	NA	—	NA	NA
5	Right brachial artery embolus	Brachial embolectomy	No	Yes. Persistent oozing from the embolectomy site	No	76	Alive	Limb salvaged
6	Right superficial femoral artery (SFA) embolus	SFA embolectomy	No	Yes. For tertiary vascular input	No	Missing	Missing	Limb salvaged
7	Right femoral artery embolus	Femoral embolectomy	No	No	No	41	Alive	Limb salvaged
8	Right femoral artery embolus	Femoral endarterectomy and embolectomy	No	Yes	Below knee amputation	9	Alive	Limb loss
9	Femoral artery embolus	Femoral embolectomy	No	No	No	2	Deceased (myocardial infarction - MI)	NA
10	Femoral artery embolus	Femoral embolectomy	No	No	No	59	Alive	Limb salvage
11	Femoral artery embolus	Femoral embolectomy	No	Yes	No	39	Alive	Limb salvaged
12	Iatrogenic inferior vena cava (IVC) injury during elective left adrenalectomy	Synthetic patch repair	No	Yes	No	21	Alive	NA
13	Right external iliac artery haemorrhage post angiogram	Open primary repair	No	Yes	No	9	Alive	Limb salvaged
14	Traumatic popliteal artery dissection with distal embolus	Great saphenous vein interposition graft, embolectomy	No	Yes	No	41	Alive	Limb salvaged
15	Traumatic brachial artery dissection and distal embolus	Great saphenous vein interposition graft, embolectomy	No	Yes	No	11	Alive	Limb salvaged
16	Ruptured abdominal aortic aneurysm, left femoral embolus	Open graft repair, femoral embolectomy	No	Yes	No	3	Alive	Limb salvaged

centres, some may not be adequately equipped to manage vascular and other subspecialist emergencies under the current training scheme. It has been previously suggested that a rural general surgeon should possess the skillset reflective of the demands of the community and also complement the other specialist surgical services available.[9] Currently, rural rotations provide the best exposure to both elective and emergency non-general surgical procedures for general surgical trainees.[9,10]

Conclusion

The presented data demonstrates that rural general surgeons are frequently required to manage vascular surgical emergencies. While most patients can safely be transferred to a tertiary centre, a small proportion of patients require surgery locally in order to maximize chance of life or limb preservation. Without the knowledge for basic vascular repair as well as approach and technique for open

embolectomy, newer surgeons may not be able to offer these services to the community. We argue that this reduction in exposure to vascular surgery and other subspecialty areas may affect preparedness of newer general surgery fellows for rural surgical practice. There is a strong argument that the option should exist for general surgical trainees to undertake rotations within other subspecialties.

Conflicts of interest

None declared.

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