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Traumatic false aneurysms in Port Moresby

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SUMMARY

***Background*: Trauma is responsible for about 30% of surgical admissions in Port Moresby. Vascular injuries are frequently missed due to inadequate assessment by primary health care workers and often present late with large aneurysms which are difficult to manage. The aim of this study was to identify the patterns of morbidity associated with traumatic false aneurysms complicating vascular injuries in Port Moresby General Hospital from January 1995 to July 1999. *Methods*: A surgical database with 11,004 records was used to identify patients with a diagnosis of false aneurysm. Charts of patients with gunshot wounds, knife wounds and compound fractures were also reviewed to identify further cases with vascular injury. *Results*: 51 patients were found to have had documented evidence of vascular injury requiring surgical repair within the study period. 21 patients with traumatic false aneurysm presented to Port Moresby General Hospital. 17 of the 21 patients were aged 11 to 40 years. There was only one female patient. Stab wounds (50%) were the commonest mode of injury followed by lacerations (23%) and fish bites (14%). The calf (42%), forearm (13%) and the head (13%) were the commonest sites involved. The time from insult to admission varied from 4 days to 11 years with the modal time being 14 days. Most patients presented with hard signs of false aneurysms (94%) and 81% of the patients were treated within five days. Ligation (67%) was the commonest operation, followed by excision (43%) and vascular repair (19%). There were no deaths or amputations in any of the patients with false aneurysms. *Conclusion*: False aneurysms are a not infrequent complication of vascular injuries. Greater awareness of the possibility of vascular injury is needed. Patients in Port Moresby often present after considerable delay. However, the diagnosis can be made clinically and the results of surgical exploration are good. Although colour Doppler ultrasound is a useful investigation it sometimes fails to identify the aneurysm because it requires blood flow to be present in the aneurysm.**

Introduction

Trauma is a leading cause of admission to the Port Moresby General Hospital (PMGH) (1) and accounts for about 30% of surgical admissions. However, there is a lack of awareness of the possibility of vascular injuries in those who provide the primary management of wounds in Papua New Guinea (PNG). Two recent articles referred to vascular trauma within PNG, outlining case histories and successful management of these wounds in the context of provincial and base hospital care in PNG (2,3).

A false aneurysm is formed when a full thickness arterial wall puncture results in the formation of a haematoma outside the blood vessel. The thrombus plug that forms within the arterial wall is gradually pushed out so that there is a direct continuity of the intima of the blood vessel and the wall of the aneurysm. Endothelialization of the structure completes the formation of long-standing false aneurysms.

The morbidity and mortality associated with the development of a false aneurysm ranges from being totally asymptomatic, as in the case

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of some profunda femoris false aneurysms, to the more drastic picture of acute haemorrhage, shock and death from an aneurysm rupture. Many patients present with a swelling (Figure 1a) which may or may not be painful. In PNG it is important that those investigating a potential aneurysm do not attempt to incise and drain it or biopsy it.

In tertiary centres in developed countries patients with vascular injuries are promptly investigated by Doppler ultrasound and angiography. In PNG, as in other third world centres, access to such radiological investigation is limited so that clinical assessment must be used to detect the majority of aneurysms.

The aim of this study was to review the presentation, management and outcome of patients with traumatic false aneurysms in Port Moresby.

Method

A surgical database comprising 11,004 records was used to identify patients admitted to PMGH with a diagnosis of false aneurysm between January 1995 and July 1999. Furthermore, all patients with gunshot wounds, knife wounds and compound fractures within this time period also had their charts reviewed for signs of vascular injury and possible signs of a false aneurysm. All cases of vascular injury requiring surgical intervention were selected and their charts retrieved from medical records. The relevant data were then entered into an Epi-Info 6 database for record and analysis.

Results

Of 11,004 patients entered into the surgical database, 51 patients were found to have had documented evidence of vascular injury

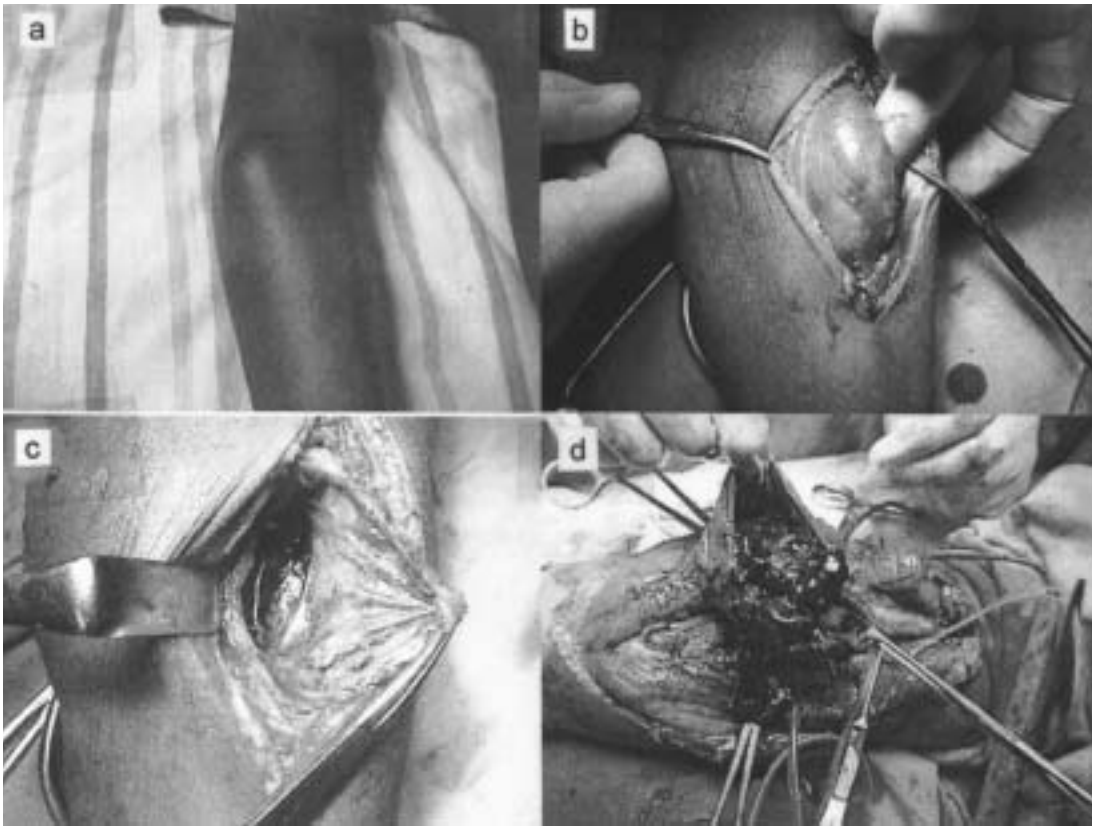

Figure 1. a. False aneurysm in a 10-year-old boy's leg following a stab wound six weeks earlier. b. Exploring the aneurysm with proximal control including a tourniquet. c. Opening the aneurysm and suturing the feeding vessel from within the sac. d. A different case of false aneurysm in the leg showing the blood clot being cleared from the sac prior to releasing the proximal control to identify the feeding vessel. Control has been achieved with both bulldog clamps and a sling.

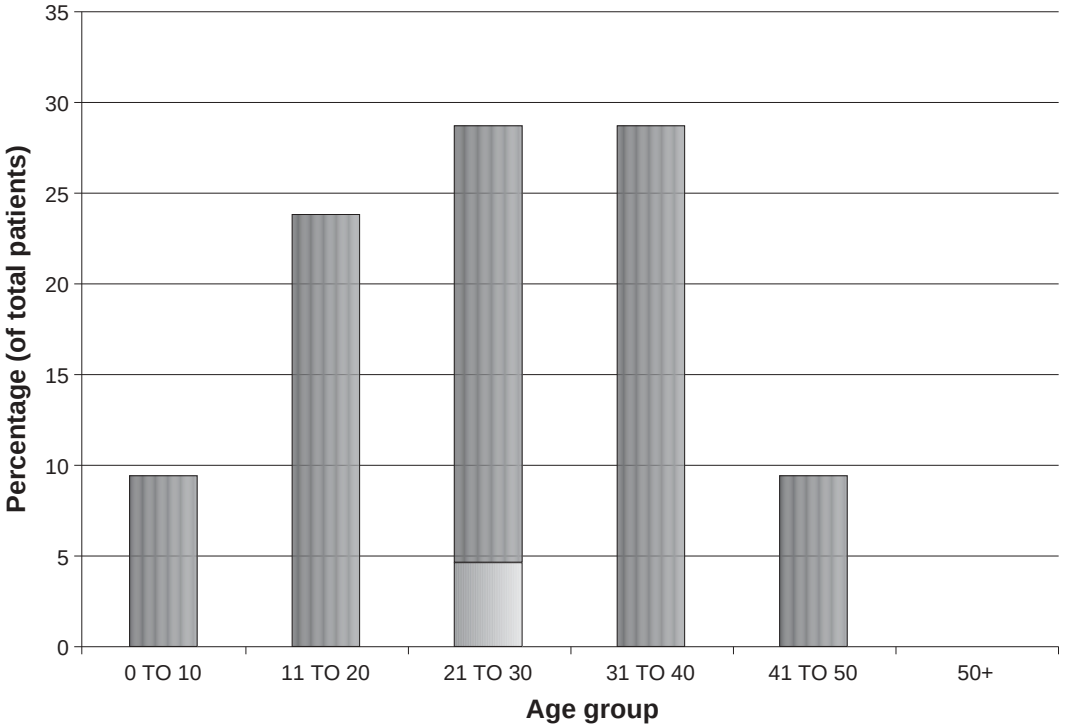

Figure 2. Ages of patients with false aneurysms in Port Moresby; the one female patient is indicated by lighter shading.

requiring surgical repair within the study period. These 51 patients suffered from a total of 57 vascular injuries. 21 patients had their initial vascular injuries complicated by a false aneurysm and required definitive treatment at the PMGH. These 21 patients accounted for the 22 false aneurysms documented in this series.

Characteristics of the patients

The mean age was 27.3±11.5 years (range 7-48 years). 20 of the 21 patients (95%) were males. The age distribution of the patients is shown in Figure 2. 17 of the patients were aged between 11 and 40 years.

Clinical presentation

The median time from initial insult to hospital admission was 21 days (range 4 days-11 years); the modal time was 14 days.

The comorbidities recorded were 3 with an AV-fistula, 2 with fractures and 1 each with nerve compression and eyeball rupture.

Figure 3 shows the mode of injury and location. It should be noted that there were 22 false aneurysms in 21 patients and of these half (50%) were due to stab wounds; other causes were lacerations (23%), fish bites (14%), pellets/shrapnel (9%) and high velocity bullets (4%). Those injured by the high velocity bullets and shrapnel had the greatest collateral damage in comparison with other modes of injury. The left side (58%) was slightly more often injured than the right (42%). There were also two arteriovenous fistulae associated with concomitant tibial vein injuries in this group of patients.

In 17 patients the presence or absence of specific signs could be assessed and in 16 of them (94%) at least one hard sign was present (Table 1). An expanding or pulsatile haematoma was found in 65% of cases. Active haemorrhage was almost as common (59%) and these two were the main features upon which the diagnosis of a false aneurysm was made when the history was also taken into account. Pulse deficits and bruits were only present in about one in five patients (18%) while signs of distal ischaemia were not as common (12%). Soft signs were present in only 4 patients (24%) with 18% having a past history of haemorrhage, 12% a stable

Location of injury	Mechanism of injury					Total (Vascular injury)
	Stab	Fish Bite	Lacera-tion	Bullet	Pellet / Shrapnel	
Upper Extremity						
Brachial	1	-	-	-	-	1
Radial	1	1	1	-	-	3
Ulna	-	1	-	-	-	1
Palmar arches	1	-	-	-	-	1
Lower Extremities						
Femoral	1	-	-	-	-	1
Popliteal	2	-	-	-	-	2
Anterior tibial	2	-	-	-	1	3
Anterior tibial vein	-	-	1	-	1	2
Posterior tibial	2	1	-	1	-	4
Dorsalis pedis	1	-	-	-	-	1
Head						
Temporal	-	-	3	-	-	3
Total	11	3	5	1	2	22

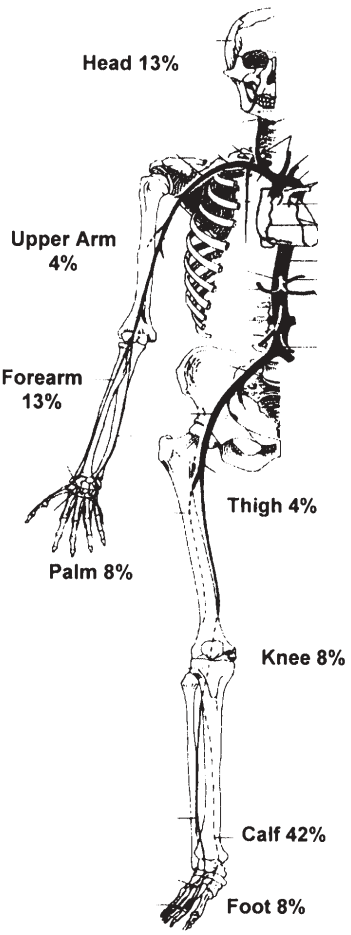

Figure 3: Site and cause of 22 false aneurysms in Port Moresby.

haematoma and 6% nerve compression. Hypotension was not ascertained well because blood pressure readings were not taken on admission.

Management

Six patients were documented to have had their aneurysms confirmed by Doppler ultrasounds. In two cases a radiological diagnosis of an A-V fistula was given and the aneurysm was seen. 17 patients (81%) had their lesions operated on within five days of being admitted to the hospital. Others were delayed because of other injuries. All lesions were ultimately explored surgically. Ligation was performed in 14 (67%), excision in 9 (43%) and only 4 (19%) had arterial repair. In one case a visiting vascular surgeon dissected out a large false aneurysm of the femoral artery after proximal and distal control of the artery was achieved. The false aneurysm was excised and a dacron graft used to effect the repair.

Morbidity and outcome

All patients were treated successfully although there was one wound infection. There were no amputations or deaths due to false aneurysms. During the period of study, amputations only occurred in patients who presented with arterial injury and ischaemia from the time of the injury. In fact, the two senior authors (DAKW and OJJ) cannot remember a false aneurysm ending with amputation at any time in the 1990s. Those amputations that were performed as a result of vascular trauma were for type IIIc Gustillo-Anderson fractures or vascular injuries due to gunshot wounds causing ischaemia and were not due to the development of a false aneurysm.

TABLE 1

PRESENCE OF SIGNS AND PERCENTAGE POSITIVITY PER SIGN AMONG 17* PATIENTS WITH TRAUMATIC FALSE ANEURYSM

	Present	Absent	Positivity
Hard signs			
Expanding or pulsatile haematoma	11	6	65%
Active haemorrhage	10	7	59%
Pulse deficit	3	14	18%
Bruit	3	14	18%
Distal ischaemia	2	15	12%
Soft signs			
Past history of haemorrhage	3	14	18%
Stable haematoma	2	15	12%
Nerve compression	1	16	6%
Hypotension	0	17	-

* In 17 of the 21 patients clinical data were adequate for the assessment of these signs

37% of patients were discharged within the first week of admission and 65% by the third week.

Discussion

As expected young males were the ones most prone to injury. This is in keeping with other studies that have documented that males within the ages of 11 to 40 years form the group with the highest risk of sustaining trauma of any kind in Papua New Guinea (1-3).

Lim and Miller reported that there is a 25 to 30% chance of vascular injury in any penetrating wound to the extremities (4) and this fact should be borne in mind by the surgeon attending to any trauma victim with penetrating wounds. Our data suggest that the incidence of vascular injury in PNG is much less than 25-30% even though the possibility of such injury should always be considered during wound assessment; it must also be remembered that the presence of distal pulsation does not exclude vascular injury.

Bullet wounds are associated with greater soft tissue damage and fractures. Low-velocity projectiles like shrapnel and pellets were also a cause of vascular injury but only accounted for two vascular injuries in this series. The rising use of firearms in PNG will mean that vascular injury becomes all the more likely. Most of the 'bites' (14% of false aneurysms) were due to fishing injuries and included spearing of the hand and stings by sting rays. A previous paper by Barss reported a whole range of different injuries associated with fishing (5).

The calf was the most frequent site of vascular trauma complicated by false aneurysms (42%) followed by the forearm (13%) and the head (13%) (Figure 3). It was expected that the extremities would be frequently involved, but surprising that false aneurysms occurred as often in the head and neck as in the forearm. Perhaps it is the superficial nature of the scalp vessels and the fact that the underlying skull table is firm which makes it easier for penetration to occur through vessels there than in other more compliant sites which may absorb kinetic energy and result in less direct damage. All cases with a false aneurysm in the head were due to a bottle being smashed over the head. There were also two cases of carotid-cavernous fistula treated in Port Moresby, one having being referred from the highlands of PNG (6). Spear wounds and basal skull fractures are usually responsible for this type of injury. In

the forearm, where fractures are most common, the vessels are not as superficial and therefore, despite frequent injuries, the chances of puncturing vessels and false aneurysm formation are much less; this may also account for the similar frequencies of aneurysm formation in the scalp and forearm.

Vascular injuries with distal circulatory compromise will cause rhabdomyolysis after 6 to 8 hours of ischaemia followed by significant nervous dysfunction in 12–24 hours (4). Thus any patient with a possible vascular injury should be urgently explored, especially where arteriography is not available.

In any vascular trauma associated with fractures in which there are signs of distal ischaemia, the limb must be splinted to minimize further neuromuscular damage and urgently taken to theatre for proper reduction and exploration of the wound (4). If transfer from a primary care facility to a hospital is necessary the fracture should be reduced as far as possible prior to splinting. Some form of combined splint and gentle traction device (eg Hare) is ideal but not usually available.

Doppler ultrasound is useful to confirm the presence of a false aneurysm recognized or suspected clinically. However, in two cases an incomplete diagnosis of a false aneurysm only was given and in one case ultrasound did not pick up the false aneurysm. Doppler ultrasound is a useful investigation but it sometimes fails to identify the aneurysm because it requires blood flow to be present in the aneurysm. The ability to investigate vascular problems in Port Moresby is greatly hampered by the reluctance of the radiologists to perform arteriography. Surgical exploration is thus the normal method of confirming the diagnosis.

Most of the false aneurysms were peripherally located so surgical access was easily achieved in most cases. However, the aneurysmal sac cannot always be completely excised when it is large or if access to it may compromise important structures such as nerves. The operative approach involves the following principles:

1 Review the anatomy of the site before operating.

2 Prepare heparinized saline (1000 units in 1 litre). No more than 50-100 ml of this will be used so the dose of heparin reaching the systemic circulation is small.

3 Establish proximal and distal control using bulldog clamps or slings fashioned from infant feeding tubes (sometimes temporarily achieved by the use of a tourniquet). With a sling an assistant can control bleeding by pulling gently and occluding the vessels. This is particularly useful if bulldog clamps are not available.

4 Opening of the aneurysmal sac if it cannot be excised and suturing of the arterial feeder. The proximal control will have to be released to identify the feeding vessel (Figure 1c).

5 Although the surgeon always feels a little inadequate in leaving behind part of the sac, the sac is often adherent to surrounding vessels and nerves and it is safer to leave it alone and do no harm.

6 There is no need to heparinize the patient systemically although flushing the proximal and distal vessels with heparinized saline is valuable if an artery graft or direct repair has been performed.

7 Close with drainage. Always ensure that major vessels have soft tissue cover in addition to the skin. In 43% of cases, an excision and primary anastomosis of the vessel was undertaken. Check for temperature and distal pulsation at the end of the procedure.

The good outcome with no deaths or amputations documented for any of the patients with false aneurysms supports the case reports of Golpak from Rabaul and Mathew from Mendi which showed that general surgeons can manage traumatic false aneurysms competently (2,3).

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