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False Aneurysms: Varied Presentations in General Surgery

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An aneurysm by definition is a permanent localized arterial dilation with 50 percent or greater increase in size over the normal diameter of the affected artery. Aneurysms have been classified as true or false (pseudo) aneurysms. True aneurysms involve all three layers of the arterial wall (intima, media, & adventitia). A false or pseudo-aneurysm is a collection of blood or hematoma which had leaked from a defect in the wall of an artery to be later variably confined by the surrounding interstitial tissues. The varied presentations of six patients with false aneurysms admitted and treated on General Surgical wards are presented with the pertinent literature on the subject reviewed along with a review of the records of patients that presented at Gondar University Hospital (GUH) with the diagnosis of false aneurysm over a six years period.

Introduction

Historically, false aneurysms have been rarely encountered on General Surgery wards. More recently, though still infrequent, they are more commonly encountered due to an increase in arterial wall injury from many causes. A false aneurysm can easily masquerade as an abscess. It behooves one then to have a high suspicion for a false aneurysm whenever a mass pulsatile or not, presents proximate to a named artery, as simple incision and drainage may result in untoward consequence. The aim of this paper is to increase awareness of this disease, the investigations to be employed and the treatment options that may be employed.

Methods

The information presented in this paper on the 6 illustrative cases was obtained by a retrospective review of patient charts and operating room log books at GUH and the attending notes of patients personally treated in Washington D.C. . Additionally, a statistical analysis **of** cases presenting to and treated at GUH over a six years period (2006-2012) with the diagnosis of false aneurysm was undertaken by retrospective review of patient charts and the operating room log books. In this time period, there were a total of 21,672 surgical patients admitted to GUH with false aneurysms accounting for 0.037%. Over the same period, 17,970 surgical procedures were done with that of false aneurysm accounting for 0.0445%.The results are presented along with a review of the English literature.

Case 1.

This was a four years and six months old female child that presented to Gondar University Hospital with a left anterior neck mass of 3 weeks duration which increased in size rapidly in the week immediately prior to presentation. This was associated with shortness of breath, difficulty of swallowing, a change in voice and fever. On the admission physical examination: the vital signs were a pulse rate of 140 /minute, a respiratory rate of 29/minute & a temperature of 38.1 degrees centigrade. There was a 7 x 6 cm diameter firm mass over the left anterior lateral neck which was pulsatile, tender & hot (Figure 1). She was investigated with an ultrasound with the finding of a thick walled 6 cm x 4.5 cm size cystic mass with continuous floating echo debris having close proximity to the left common carotid artery anteriorly but with no clear communication demonstrated (Figure 2). `

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Figure 1. Showing a left sided neck mass (big arrow) and a tracheostomy tube(small arrow) in place for airway patency.

Figure 2. Ultrasound image of the patient neck shown in figure 1 with the arrow pointing to the false aneurysm

Following admission as an emergency a tracheostomy was done to secure the air way. Seven days later she was operated under antibiotic coverage with initial proximal control of the left common carotid artery at the base of the neck. An Incision was then done over the mass parallel to the anterior border of the left sternocleidomastoid muscle. The findings were a minimal amount of pus & a large organized hematoma. This was evacuated from its pseudo capsule and an approximately one centimeter long laceration of the internal carotid artery extending from the bifurcation of the common carotid artery was identified (Figure 3).

Following irrigation and debridement, lateral repair of the arterial defect using 3-0 PDS was done (no preferable alternative suture was available). The adjacent viable soft tissues were approximated over the repair & the skin was left open after putting a glove drain in the deep part of the wound (Figure 4). The wound and tracheostomy sites were dressed with gauze. On the ward she had to be fed with an NG tube for one month postoperatively because of aspiration encountered on swallowing. She also had transient left facial nerve palsy. She went on to full recovery after three months of outpatient follow up (Figure 5).

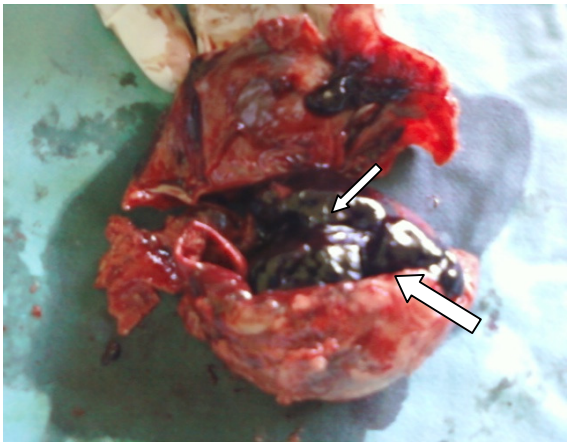

Figure 3. Showing an organized hematoma which was associated with a defect in the internal carotid artery. The big arrow shows the false capsule. The small arrow shows the blood clot.

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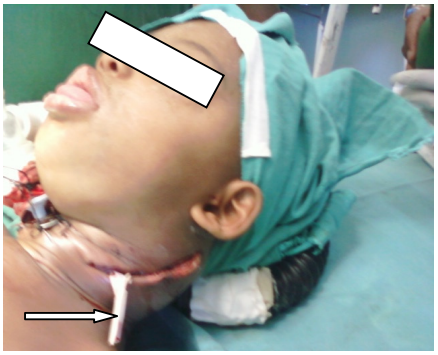

Figure 4. Showing the patient after surgery with glove drain placed in the deep wound and the skin left open

Figure 5. Showing the patient fully recovered at about 3 months post operation

***Case2*.**

This was a 40 years old man who presented to GUH with a swelling over the left thigh (Figure 6) of six months duration. He had no other causative or pertinent past history. On physical examination he had an 8cm by 7cm pulsatile swelling over left upper anterior thigh with the proximal extent just distal to the left inguinal ligament. The pulses in the distal arteries of the left extremity were not palpable but the leg was warm and non-tender. He was investigated with ultrasound and CT scan (Figure 7). With the diagnosis of false aneurysm of the left common femoral artery radiologically confirmed, he underwent operation with first proximal control of the external iliac artery via an oblique left lower quadrant extra-peritoneal abdominal incision. This was extended across the inguinal ligament and the mass.

The clot was evacuated (Figure 8) and a one centimeter clean obleak defect in the common femoral artery was identified (Figure 9) and closed by lateral arterioraphy with 5-O monofilament prolene suture. The wound was thoroughly irrigated and debrided of non-vital tissues. Adjacent viable soft tissues were sewn to cover the vascular repair and a tube drain was left in the wound. The incision was then closed in layers. He was transfused one unit of blood intra-operatively and one unit post-operatively. He had a smooth post-operative course and was discharged about one week after his surgery.

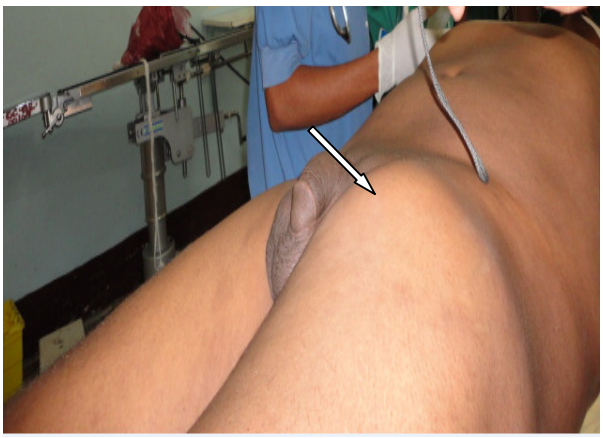

Figure 6. Showing the mass on the left proximal anterior thigh

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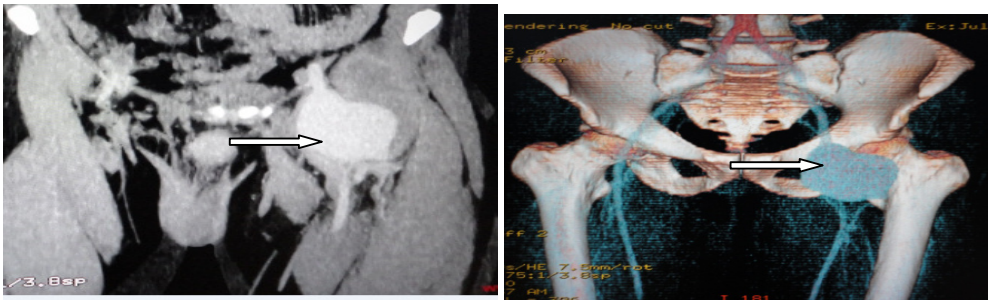

Figure 7. Showing the CT scan of the mass in Figure 6.

Figure 8. Showing the clot and debrided wall from the false aneurysm

Figure 9. Showing site of false aneurysm intra-operatively.

Case 3.

This was a case of a 23yr old male that presented to GUH with a bullet injury to his right posterior chest that exited in the anterior chest above right costal margin three hours prior to arrival to the emergency room. On admission physical examination, the pulse rate was 112/minute, blood pressure was120/70 mm HG and the respiratory rate was 33 breaths/minute. He had pale conjunctiva and buccal mucosa. There was a1x1 cm entry wound over the right posterior chest and a 3 x4 cm sucking exit wound on the anterior chest at the 9th inter costal space along the anterior axillary line. Air entry was decreased on auscultation over the right posterior lung field. On abdominal examination he had generalized tenderness.

With the assessment of a penetrating thoraco abdominal injury, he was resuscitated and a chest tube was inserted under local anesthesia during which 800 ml of dark blood and air was immediately evacuated. Laparotomy was then done with the intra operative finding of 300 ml of hemoperitoneum and a 4 cm laceration over the dome of the right liver without notice of active bleeding. There was minimal hematoma around the area of the porta hepatis. After suctioning and peritoneal lavage and repair of the diaphragmatic perforation, the abdomen was closed with a sub hepatic drain. He was transfused with 5 units of blood. Two units were given intra operatively and three units post operatively. On the 8th post operative day, he developed abdominal pain, distension, tachycardia and generalized abdominal tenderness with signs of fluid collection in the abdomen.

Re-laparotomy was done with the intra operative finding of a huge hematoma in the sub hepatic space, the right sub diaphragmatic space and the right paracolic gutter. After evacuating the haematoma and blood and lavage of the abdomen, no bleeding vessel was identified. The liver

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and the sub diaphragmatic space was drained with glove drains. He was transfused additionally with 2 units of blood intra operatively and 2 units of blood post operatively. Despite this his haematocrit remained low. The drainage became excessive on the 3rd day after the second laparotomy and was associated with rapid hemodynamic deterioration. He then underwent a third exploratory laparotomy via a right anterior thoraco-abdominal incision. There was again a huge clot in the right sub diaphragmatic and sub hepatic space and the right paracolic gutter. Upon removal of the clot, active bleeding was seen coming from deep inside the injured right dome of the liver from a big artery that was partially severed. The artery was easily controlled and ligated. The abdomen was closed with drains and the patient was awakened. The patient was hemodynamically stable post operatively and even in a humorous and grateful mood on rounding the morning after surgery. Unfortunately, he suddenly developed cardiopulmonary arrest secondary to a presumed massive pulmonary embolism and was declared dead after a failed attempt at cardiopulmonary resuscitation.

Case 4.

J.H. was a 38 years old black female that presented in 1986 to the Greater South East Community Hospital in Washington D.C. with jaundice. The only significant history was that she was an IV heroin user. Preoperative work up was positive for a small mass in the porta hepatis associated with dilated intra hepatic bile ducts. She was thought to have a Klatskin`s tumor and was operated and found to have about a 2 cm size tumor in the porta hepatis (Fig.10). The normal sized common bile duct was divided and the gall bladder and common hepatic duct was removed with the tumor.

The right hepatic artery was intimately attached to the mass and it was resected with it as well. The biliary tree was reconstructed with a Roux-en-y limb of jejunum to which the right and left hepatic duct stumps were sewn**.** The tumor was found at pathology to be a mycotic aneurysm of the right hepatic artery. The patient had an uneventful recovery and was discharged from the hospital only to be re-admitted one month later with a stroke secondary to a ruptured false aneurysm of the brain. Unfortunately she did not survive the second event.

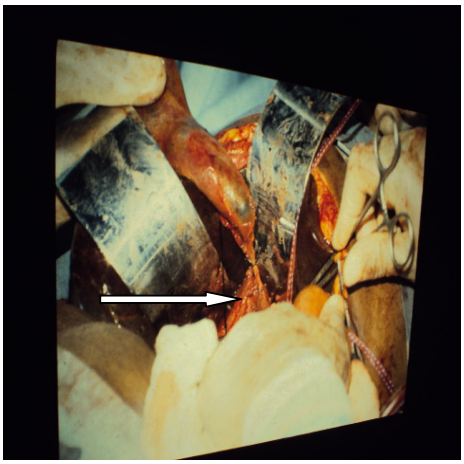

Figure 10. Showing the mass encountered intraoperatively at the porta hepatis (Arrow).

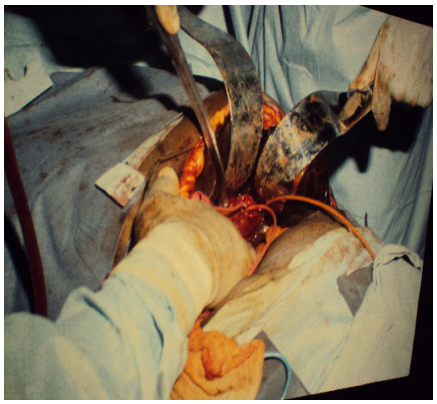

Figure 11. Showing catheters in the right & left hepatic ducts & the transected common bile duct after en block excision of the mass in preparation for anastomosis to the gut.

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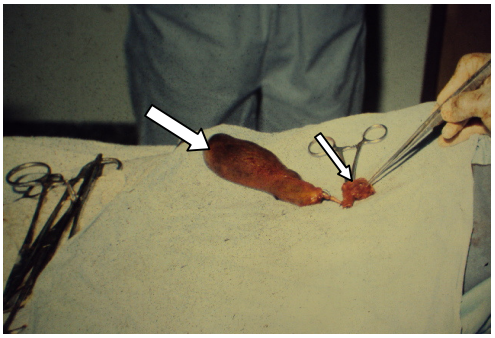

Figure 12. Showing the resected specimen in case number 4. The Big arrow shows the gall - bladder, the small arrow shows the tumor (mycotic aneurysm) with the hemostat in the obstructed common hepatic duct.

Case 5.

D.B. was a 45 years old black male that presented to Capitol Hill Hospital in Washington D.C. on 2/23/87 with massive lower and upper gastrointestinal tract bleeding. He was known to have alcohol related chronic pancreatitis associated with calcification of the pancreas and the splenic artery. He had no other known co morbidity. Following transfusion and resuscitation in the intensive care unit he underwent emergency laparotomy during which an en block resection of a tumor in the left upper quadrant of the abdomen was done. The tumor resection specimen comprised of the spleen, distal stomach, body and tail of pancreas and the splenic flexure of the colon. The operation was well tolerated. Dissection of the specimen showed a thick walled tumor encompassing an infected hematoma (Figure 13) that had ulcerated through the back wall of stomach (Figure 14). It was presumed that the origin of the false aneurysm was the weakened splenic artery. The patient`s post operative recovery was complicated by gentamycin related nephrotoxicity. On 3/26/87 he develop back pain and 2 days later hemorrhagic shock secondary to intra peritoneal hemorrhage from a rupture of the previously ligated splenic artery stump. Despite emergency thoracotomy with supra diaphragmatic aortic clamping, re exploration of the abdomen with evacuation of the hematoma, identification and control of the bleeding splenic artery, on table transfusion and aggressive resuscitation, the patient arrested and deceased upon release of the aortic clamp.

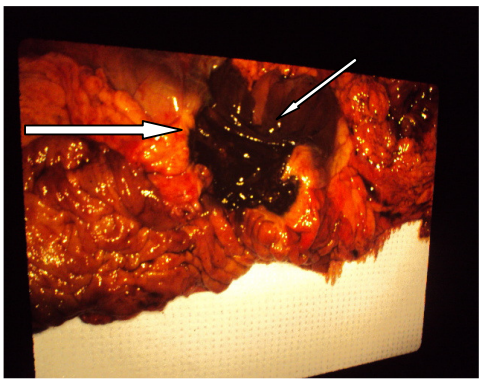

Figure 13. Showing a thick walled tumor (big arrow) encompassing an infected hematoma (small arrow).

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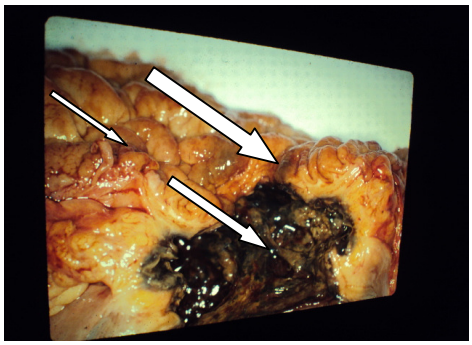

Figure 14. Section through the stomach and the adjacent tumor at the communication site. Big arrow-communication site, Intermediate arrow–hematoma inside false aneurysm and small arrow –gastric mucosa

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Case 6

M.J. was a19 years old black male that was initially evaluated and treated at the Adventist Hospital in Maryland, USA, for a gunshot wound of the abdomen with an injury to the right lobe of the liver. Post laparotomy, he remained hemodynamically stable but developed intermittent jaundice with upper gastrointestinal bleeding and blood and bile drainage from a right sub hepatic Penrose drain site. Abdominal CT scan done at the Adventist Hospital (Figure 15) showed a thick walled intra hepatic hematoma. The patient was referred to the Howard University service at the District of Colombia General Hospital where he was worked up with an HIDA scan (Figure 16) that showed a prominent duct in the right lobe of the liver probably communicating with the hematoma. ERCP showed contrast extravasation into the liver and right sub diaphragmatic space. The findings were taken to represent an intra hepatic false aneurysm with intermittent decompression along the drain site and also decompression into the right hepatic biliary tree. Shortly after admission he was explored through a right sub costal incision during which the clot was evacuated, the cavity washed and ligation was done on all encountered open ducts and bleeding vessels (Figures 17, 18) with 2/0 vicryl suture. The cavity was again drained externally. The patient made an uneventful recovery from surgery and remained fit on long term follow up.

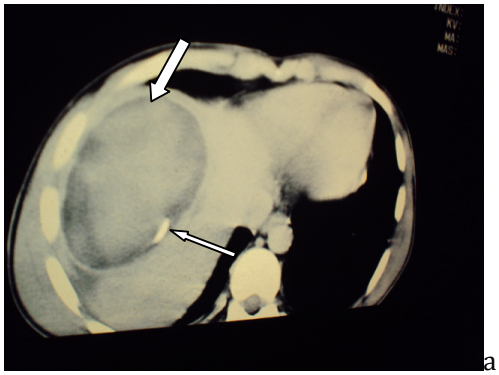

Figure 15. Showing thick walled (big arrow) hematoma of the right lobe of liver & a drain (small arrow) in place.

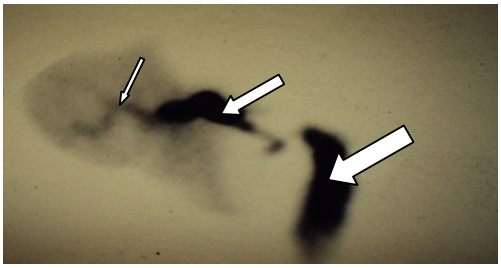

Figure 16. Showing an HIDA scan of the liver showing the radiotracer in the duodenum (big arrow), gall bladder (intermediate arrow) & an abnormally filled duct draining back towards the haematoma in the right lobe of the liver(small arrow).

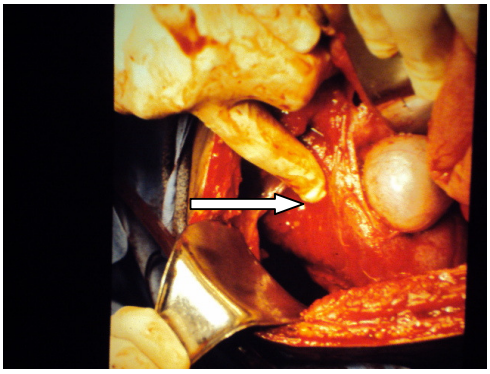

Fig.17. Showing the mass

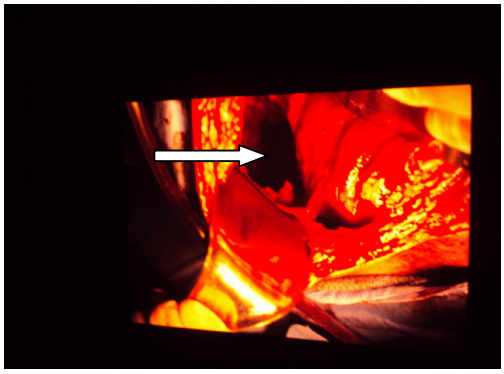

Fig.18. Showing cavity after mass incision, evacuation of hematoma and ligation of identified vessels & open duct

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Table1. Summarizing the presented 6 cases.

Case	Age/sex	Diagnosis	Etiology	Presentation	Type of false aneurysm
1	4 / F	Infected false aneurysm of internal carotid artery	Pyogenic lymphadenitis	Expanding left neck mass with difficulty of breathing & swallowing	Peripheral (internal carotid artery) -mycotic aneurysm
2	40/M	False aneurysm of left common femoral artery	Not identified	Swelling over left thigh	Peripheral-false aneurysm
3	23/ M	False aneurysm(FA) of hepatic artery	Gunshot wound	Repetitive abdominal hemorrhage post operatively	Visceral (liver) -false aneurysm
4	38 /F	FA of right hepatic artery	Intravenous drug abuse	Obstructive Jaundice and porta hepatis mass	Visceral (liver) -mycotic aneurysm
5	45 /M	Infected FA of the splenic artery	Chronic Pancreatitis	lower & upper gastrointestinal bleeding	Visceral(splenic artery) -mycotic aneurysm
6	19 /M	FA of hepatic artery	Gunshot wound	Repetitive drain site bleeding and hemobilia	Visceral(liver) -false aneurysm

Table 2 . Analysis of cases operated at GUH from 2006-2012

Case	Age/sex	Diagnosis	Etiology	Presentation	Type of FA
1	40/M	FA of right femoral artery	Trauma	Swelling over the right thigh	Peripheral
2	20/ M	FA of right femoral artery	Trauma	Swelling and bleeding over the right thigh	Peripheral
3	65/ M	FA of left popliteal artery	Atherosclerosis	Bleeding(ruptured) and infected	Peripheral -mycotic
4	65 /M	FA of left brachial artery	Trauma	Swelling over the left elbow joint	Peripheral
5	38/M	FA of left radial artery	Trauma	Bleeding	Peripheral
6	4/F	Infected FA of internal carotid artery.	Pyogenic cervical lymphadenitis	Expanding left neck mass with difficulty breathing & swallowing	Peripheral -mycotic
7	40/M	FA of left common femoral artery	Not identified	Swelling over the left thigh	Peripheral
8	23/M	FA of hepatic artery	Trauma	Repetitive hemorrhage	Visceral

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Discussion

An Aneurysm is defined as a permanent and irreversible localized dilation of a blood vessel, having at least a 50% greater diameter than the expected normal diameter of the vessel in question[1,2]. Aneurysms are further classified as true or false aneurysms. True aneurysms are dilations that involve all three layers of the arterial wall (intima, media, and adventitia). The Commonest cause of true aneurysms is atherosclerosis. The commonest site of true aneurysm is the aorta, followed by the iliac, popliteal, and femoral arteries in decreasing order of frequency[2].

A false or pseudo aneurysm is a collection of blood or hematoma which has resulted from a defect in the arterial wall to be variably confined by the surrounding tissues. False aneurysms are usually caused by trauma as was in 54.5 %of the cases presented in this paper. Aneurysms (true or false) are further said to be mycotic when there is associated infection of the arterial wall by either a primary or secondary process. Initially the term mycotic was applied to aneurysms caused by septic emboli in patients with bacterial endocarditis[3].

The Causes for false aneurysms, mycotic or not, include:

1. Direct trauma to an artery as in cases following arterial puncture or following injury to the artery from penetrating or blunt trauma (6 out of 11 of our cases were from this cause),
2. Bacterial seeding of the blood stream from a distant site (as in case number 4),
3. Secondary involvement of the artery from a contiguous infection[4] (as in case number 1).
4. Another cause for false aneurysms can be damage to an adjacent vessel from processes such as pancreatitis[5] (as in case number five of our series).
5. HIV infections[6].

The most common organisms indentified in mycotic aneurysms were staphylococcus auerus and the salmonella species. Streptococcus pneumoniae was a frequent etiology of infected aneurysms in the pre-antibiotic era, but became rare with the advent of penicillin. Other gram-negative organisms are also associated with bacteremic seeding. Less common causative organisms include Treponema pallidum, the bacillus causingTuberculosis and fungal organisms[4].

The clinical features of false aneurysms vary depending on whether the artery involved is superficial or deep, whether the aneurysm is proximate to vital structures or not and whether or not there is associated infection. Superficially located false aneurysm may present with a mass that may or may not be painful, pulsatile, tender, enlarging, associated with a bruit, thrill, erythema, or decreased distal pulses. They may also have evidence of ischemia, or may show systemic features of infection, such as fever[3, 4]. In some cases, the signs of infection may be prominent while the signs of an associated arterial pathology may be absent or minimal. Thus, the presence of a mass even with obvious signs of infection over a named blood vessel should raise suspicion of a false aneurysm [3]. Infected aneurysms have been misdiagnosed as cellulitis, abscess, and thrombophlebitis[4]. Deeply sited false aneurysms may not present with classic features like those of superficially located aneurysms. They may present with nonspecific symptoms such as fever or with symptoms that result from compression (as in case number 4) or invasion (as in case number 5) of an adjacent structure.

Visceral arterial aneurysms may be asymptomatic or may give rise to vague abdominal discomfort. Unusual presentations occur when a false aneurysm erodes into an adjacent structure which can lead to rupture and bleeding (as in case number 5). Splenic artery

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aneurysms account for 2/3 of visceral aneurysms and affect women more than men. They mostly present with rupture, hemorrhagic shock and left upper quadrant pain[2, 5]. Initially the rupture may be partially contained either by the adjacent connective tissues or the lesser sac which may later rupture into adjacent gut presenting with gastrointestinal bleeding (as in case number 5)[2,5].

Symptomatic hepatic artery aneurysms may present with right upper quadrant pain. Occasionally they may present with gastrointestinal bleeding following erosions into the gastrointestinal tract. They may also present with biliary colic, jaundice and hemobilia (as in case number 6) after rupture into the biliary tract. They may also compress a major bile duct and cause jaundice or masquerade as tumor of the bile duct (as in case number 4)[2,5].

The diagnosis of a false aneurysm infected or not, depends on a high level of suspicion and a through history and physical looking for known risk factors. For deeply sited visceral aneurysms, imaging modalities may help. Arteriography is said to be the gold standard imaging modality. However less invasive modalities such as ultrasound, computed tomography (CT), magnetic resonance imaging (MRI) are helpful. CT and MRI angiography are diagnostic modalities that are considered to be gold standards as well. An elevated WBC and ESR and positive blood culture may support the diagnosis of a mycotic aneurysm[4]. The management of false aneurysms is affected by different factors such as whether they present with rupture, whether they are symptomatic or asymptomatic, as well as the capabilities of the treating facility. Patients with infected aneurysms should get appropriate intravenous antibiotics based on culture results or started on antibiotics based on the known common infecting organisms until culture results become available.

The basic principles that should be followed in the surgical management of patients with false aneurysms include the following:

1) Appropriate resuscitation
2) prophylactic or therapeutic intravenous preoperative antibiotics
3) Proximal and if practical, distal control of the involved artery
4) Aggressive debridement of all unhealthy tissue on the involved vessel as well as the adjacent hematoma and infected tissues.
5) The definitive surgical option to be exercised depends on several factors that include the age and co morbid status of the patient, the location of the aneurysm, whether or not there is alternative or adequate collateral blood supply to the organ or tissue perfused by the artery involved and whether or not infection is present in the surgical bed.

Debridement to viable tissues and arterial reconstruction is the best option in general. Reconstruction techniques include lateral arterioraphy, vein patch, interposition grafting and in the case of the internal carotid artery, the vascular switch procedure. When simple lateral arterioraphy is not an option autogenous vein is preferable to synthetic material in the presence of an infected environment[1,3,4]. The preferred suture is fine monofilament non absorbable suture such as prolene on a non cutting needle, although some surgeons have advocated braided silk and teflon coated dacron[1]. In a compromised patient or an infected setting ligation may be the most appropriate option. When undertaken close follow up and continued optimization of the patient is necessary in the event that re intervention for observed ischemia is indicated. In the setting of infection or when it is clear that gangrene would result from ligation or when ischemia follows ligation, extra anatomic bypass grafting or amputation may be appropriate options.

6) Vascularized tissues should be recruited to cover any anastomosis.

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7) The skin and subcutaneous tissues should be left open and the deep wound should be drained in case of infection.
8) Close followup, watching for complications that include thrombosis, ischemia, infection & rupture of the ligation or anastomotic site is necessary.
9) At times viscera may need to be resected (as in case number 4 and 5) and amputation may be the only practical resort in some situations.

Conclusion

In summary, a false aneurysm, infected or not, may occur at any site in the body. Though infrequently encountered on General Surgery wards they have become a more frequent occurrence for many reasons such as the increasing incidence of civilian trauma, invasive diagnostic and therapeutic procedures that require arterial access and the rise of intravenous drug abuse in urban settings. Finally a high level of suspicion for a false aneurysm should be had for any mass over a named artery and for symptomatic patients with tumors who also have known risk factors for false aneurysms. The specific treatment depends on the unique presentation of each case, the co morbid factors and the experience of the treating facility.

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