**Pseudo-aneurysm and associated case study**

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Course:

Due Date:

**Abstract**

Pseudo-aneurysm is usually vascular malformations that generally constitute the disruption in the arterial wall continuity. Most complications related to Pseudo-aneurysm usually develop without noticing and can carry relatively high mortality rates (Lneo et al.,2015). A pseudo-aneurysm, or pseudo-aneurysm of the blood vessels, occurs in the damaged or weakened areas of arteries; it usually occurs when the wall of the blood vessel is damaged and the emanating blood flow and accumulate in the surrounding tissues (Sinoh et al.,2020). Pseudo-aneurysm is a false aneurysm because the three layers of the blood vessels are not involved in any bulging or weakening out. The invention of new, improved radiology techniques with relatively higher sensitivity of the asymptomatic diseases has resulted in a diagnosis of Pseudoaneurysm more frequently.

Keywords: pseudo-aneurysms, aorta, visceral artery, rupture, and ultra-guided thrombin

**Pseudo-aneurysm**

The incidences of Pseudoaneurysm have rapidly increased in hospital-based activities and practices. It occurs as a result of the invasive procedures or the steps performed. The commonly implicated methods are central venous line insertions, percutaneous catheter angiographies, and surgical procedures close to the main blood vessels. In addition to that, the mortality rate after surgically repairing the left ventricular Pseudo-aneurysm stands between 13% and 29%. Nevertheless, cardiologists contemplate this high mortality rate possible and acceptable due to the risks of fatal rapture (Lneo et al.,2015).

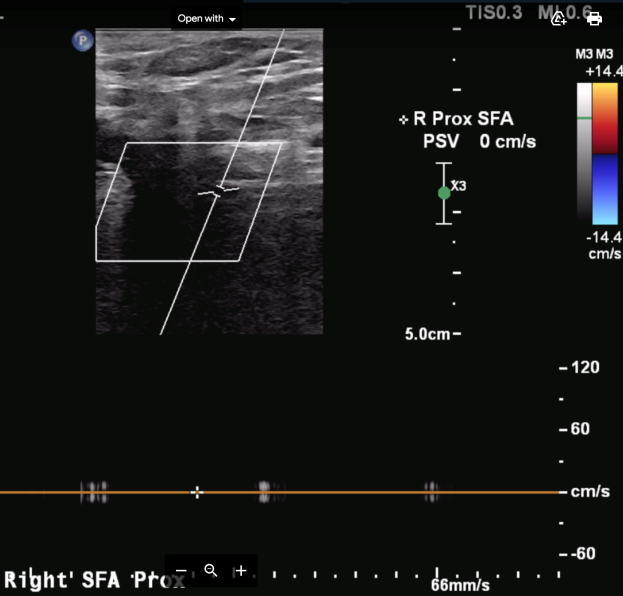
It is crucial to educate and guide the general public on Pseudoaneurysm and the dangers that accompany Pseudoaneurysm. If they feel or meet the criteria, the crowd gets aware and may take relevant action to Pseudoaneurysm screening. This research paper will include pathogenesis, effects, pathological progression, diagnostic procedures, and treatments for Pseudoaneurysm Batagini et al., 2016). Moreover, a clinical case study is also included in this paper. The patient provided informed consent to use her medical information as necessary. Correlations will be made between the case study and the research obtained for this paper.

**Patient Review**

The significance of choosing this specific case study is that the author, student name, was able to scan and find the patient’s Pseudo-aneurysm as an incidental finding during an aorto-iliac duplex examination. The case is about an 81-year-old female who presented to the hospital with pain and swelling of her right leg. Balloon angioplasty procedure was conducted since the patient had history of balloon angioplasty in the left femoral artery. The surgeon asked the patient to lie on the x-ray table, generally flat on her back. He then put a needle into the vein in her arm in which he injected the painkillers into the patient’s body. The surgeon cleaned the skin near the point of insertion, probably the groin by the antiseptic and covered most of her body with sterile drapes. Skin and the deeper tissues were cleaned with a local antiseptic. The surgeon then placed the guide wire through the needle into the blood vessel. The needle was then withdrawn allowing the fine plastic tube over the wire and into the groin. The procedure was done several times to allow the narrowed area to open up sufficiently to allow the blood flow. The surgeon assessed it from the other leg because the patient was experiencing pain and swelling in her right leg.

Two weeks after her procedure, duplex ultrasound diagnostic test was performed. They ordered an arterial scan to rule out Pseudo-aneurysm since the patient was experiencing claudication. We found a pseudo-aneurysm measuring 4.03 x 1.56 cm in the right groin with the to-fro flow in the neck measured with a velocity of 194 cm/s. Neck measured 0.28 cm. The lumen measured 3.31 x 0.85cm. Also, the right superficial artery and the right middle superficial femoral artery was occluded and re-canalized more distally by collateral flow (Regus & Lang 2016).

**Figure 1**

 (Bryn Hospital, [photograph of right’s SFA prox])

Moreover, two-dimensional imaging, pulsed wave, and colour flow Doppler were performed to evaluate the external iliac, common femoral, deep femoral, superficial femoral, popliteal, and tibial arteries. The following findings were obtained. The right external iliac artery, the right profundal femoris artery, the right distal popliteal artery, the right proximal popliteal artery, and the right middle superficial femoral artery demonstrated no significant stenosis, and all had monophasic flow. The right common femoral artery showed mild (30%-49%) stenosis but also had monophasic flow. The right common femoral artery had heterogeneous, and calcific plaque present demonstrated no significant stenosis and monophasic flow. Further, it was found that the right anterior tibial artery, the right posterior tibial artery, and the peroneal artery had monophasic flow.

On the other hand, the left iliac artery, the left common femoral artery, the left proximal superficial artery demonstrated moderate (50%-75%) stenosis. The left middle superficial femoral artery, the left distal superficial femoral artery, and the left distal, proximal popliteal artery demonstrated no significant stenosis, and all had monophasic flow (Regus & Lang 2016).

. Monophasic flow in both the right and left external iliac artery suggests the presence of aorto-iliac disease. The left superficial iliac artery and left common femoral artery had heterogeneous and calcific plaque present. However, the left anterior tibial artery, the left posterior tibial artery, and the left peroneal artery had monophasic flow. The right and left iliac arteries measured normal. We could not calculate the left groin velocity ratios due to elevated velocities nor perform ABI’s Due to severe leg tenderness (Pan et al.,2020). For treatment, they repaired a femoral aneurysm artery. Also, there were a two weeks arterial follow-up scan after the procedure.

**Pathogenesis**

Femoral Pseudo-aneurysm is commonly caused by iatrogenic. The iatrogenic roots include anastomotic failure and less Arterial entry for the endovascular plan (less than 1% incidences). Pancreatic fistula, trauma, and infection are non-iatrogenic causes (Abe et al.,2015). Visceral artery pseudo-aneurysm mostly occurs with interventions based on catheters and are also connected with pseudocysts and pancreatitis (Batagini et al., 2016). Aortic pseudo-aneurysm results from penetrating aortic lesions or trauma. 85% of Patients with aortic injuries secondary to trauma dies before receiving medical care. About 90% of blunt thoracic aortic cuts usually occur just away from the isthmus and results from decreasing injury tethering to the ligamentum arteriosum. Advanced tuberculosis rarely causes thoracic aortic Pseudo-aneurysm. Generally, penetrating trauma, degenerative lesions, infection, and anastomotic sites after vascular repair result in aortic Pseudo-aneurysm.

The communicability of pseudo-aneurysm is not attributable to the disease being contagious. However, it is indicated that there is a generality of developing popliteal artery pseudo-aneurysm related to abdominal aortic Pseudo-aneurysm. Abdominal aortic Pseudo-aneurysm coexist with popliteal Pseudo-aneurysm in about 25% to 40% of cases (Batagini et al., 2016)

Moreover, gender plays a significant role in the enlargement of aortic Pseudo-aneurysm. According to research, males are six times more likely to develop pseudo-aneurysms than females. This is likely because of genetic susceptibility, hormonal factors, and exposure to environmental relevant factors. Also, age plays a key role in the development of pseudo-aneurysms. The elderly are at higher risk for this disease, more specifically males of advanced age. Males ranging from 60-75 years were found to have pseudo-aneurysms in about 5% of cases.

Addressing racial prevalence, Caucasians have a higher probability of developing pseudo-aneurysms. Western population has mean annual reported incidences of pseudo-aneurysms of about 0.4% to 0.67%. Americans have the least risk of developing pseudo-aneurysms.

**Effects**

Pseudoaneurysms and their related effects are yet to be fully understood. However, from research, T-cell, smooth muscle cell apoptosis, collagen turnover, and proliferation have been exposed as the cellular changes concerned with the development of pseudo-aneurysms. These changes usually occur due to gene ALOX5, which contributes to the modulation of cathepsin K. ALOX5 gene is increased as the pseudo-aneurysms continue to develop (Bellmut et al.,2011). It thus results in a rise in leukotriene production. The production of leukotriene causes inflammation of the aortic wall and injury. To find the changes of the cells, gene ALOX5 positioning is noted on the microRNA. The development of pseudo-aneurysms is associated with poorly regulated microRNA-29.

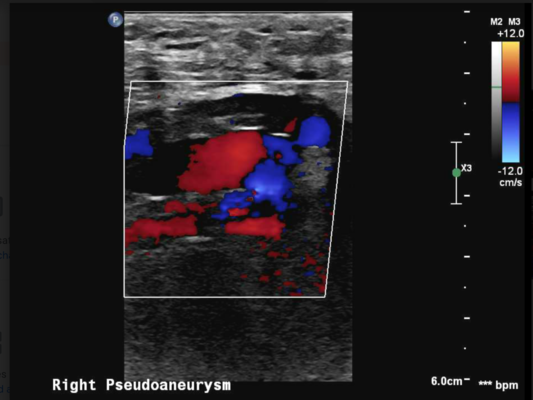
The systematic effect of pseudo-aneurysms takes place when mural thrombus develops in the pseudo-aneurysms. The mural thrombus may cover wider space in the affected vessel, hence generating a residual lumen. As a result, the lower vessels may have decreased blood flow depending on how tiny or small the residual lumen is.

Another noticeable systematic effect of pseudo-aneurysms that can happen is the blue toe syndrome. This syndrome, the "trash foot," occurs when a piece of the mural thrombus pulls off, moves to the arcuate artery, and gets stuck (Bellmut et al.,2011). The arcuate artery penetrates the toes. In extreme cases, the arcuate artery becomes occluded by the emboli, and the toes will not receive oxygenated blood. The affected toe(s) will then become ischemic.

**Pathological progression**

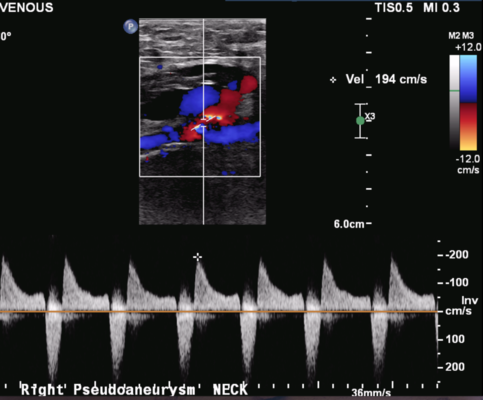
The pseudo-aneurysms enlarge as the individual ages (Sainoh et al., 2020). The femoral artery is said to have pseudo-aneurysms when it reaches about 3centimeters or if the diameter the expected time the expected diameter by on-half times of that location and depends on the gender and body size of the individual. For the case study discussed at the beginning of this paper, pseudo-aneurysms measured 4.03 x 1.56 centimetres. Usually, patients with pseudo-aneurysms in groin are symptomatic. However, conducting a physical examination, a pulsatile mass can be manipulated in the groin. The pathological progression of pseudo-aneurysms may include; intraluminal thrombus, rupture, and dissection. Mural thrombus is generated in the femoral pseudo-aneurysm area because the earliest vessel injury of the vessel institutes coagulation and thrombosis in the location of pseudo-aneurysms. As time goes, the thrombus can enfeeble the walls of the arteries due to the thrombus hindering the proper distribution of the nutrients and oxygenation from the blood flowing freely to the vessel wall (Sainoh et al., 2020). The tiny vessel developing in the mural thrombus and pseudo-aneurysm wall may cause the stability and integrity of the femoral artery pseudo-aneurysm wall to decrease in size. This can lead to more progression of Pseudoaneurysm. It may expedite the risks of rupture.

**Figure 2**

.  (Bryn Hospital, [Photograph of Right Pseudo aneurysm])

In addition to that, aortic pseudo-aneurysms rupture when the impediment of the aorta fails to withstand the weight created by the systolic pressure of the blood. Small, restricted stress concentration areas, like at the ascending groin and the segment enclosed by the Pseudo-aneurysm and the iliac bifurcation, are most likely to rupture. The mechanical stress can go past the entry of rupture, leading to a ruptured femoral pseudo-aneurysm. Relatively higher mortality and morbidity rate are related to ruptured Pseudo-aneurysm. From the research, about 89% of the individuals admitted to medical facilities for ruptured pseudo-aneurysms tend to die within two hours. Severe back pain and extreme abdominal pain are the symptoms of abdominal aortic ruptures, depending on the rupture location.

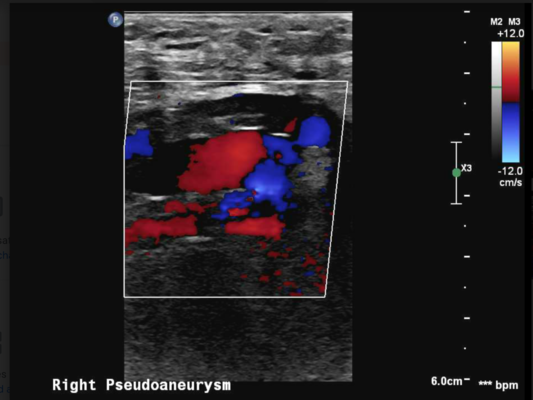
**Figure 3**

(Bryn Hospital,[Photograph of right pseudo aneurysms neck])

**Diagnostic procedures**

The case study mentioned at the beginning of the paper shows that one test is used to diagnose pseudo-aneurysms. The patient underwent an aorto-iliac ultrasound examination, in which pseudo-aneurysms were found. The pseudo-aneurysms were measured on ultrasound and found to measure 4.03 x 1.56 centimetres and residual lumen measuring 3.31 x 0.85 centimetres. However, four main examinations may be combined to arrive at a more accurate diagnosis of pseudo-aneurysms (Shiina, Hagaki & Ohtake, 2018). Routine physical examination is done before other tests to check the palpable pulse in the abdomen. The responsible physician will have to order the following investigations if pseudo-aneurysms are suspected usually. Usually, abdominal ultrasound is the next step in determining pseudo-aneurysms. This can provide information on the size of the pseudo-aneurysms and the residual lumen, as well as the presence or absence of mural thrombus. Moreover, computed tomography may or can be used to determine the shape and size of the pseudo-aneurysms, whereas magnetic resonance imaging may be used to visualize the pseudo-aneurysms and intraluminal thrombus. It also helps in determining the size of the aorta (Kapoor et al.,2009).

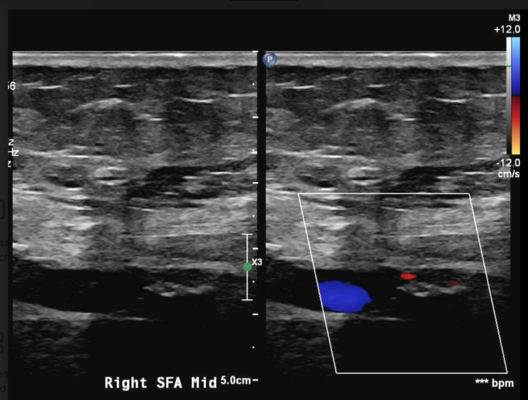
**Figure 4**

(Bryn Hospital,[photograph of right pseudo aneurysms])

**Treatment**

Femoral artery pseudo-aneurysms caused by endovascular access were exclusively treated by surgical means, but recently, the paradigm has shifted to relatively less invasive measures (Tisi & Callam, 2013). Various options for managing it include ultra guide compression, ultra-guided thrombin injection, and surgical repair. Ultrasound-guided thrombin injection is the most effective method for treating pseudo-aneurysms that can be accessed. Studies have reported a relatively higher success rate of 98% for femoral pseudo-aneurysms with one first treatment, even while the patients are on antiplatelet agents. Embolization and PE are the risks of the procedure. Ultrasound-guided injection of thrombin is not preferred for pseudo-aneurysms below 1 centimetre due to the theoretical dangers of arterial embolization (Shah et al.,2011).

**Figure 5**

(Bryn Hospital, [Photograph of right SFA mid])

Surgical treatment and management of femoral pseudo-aneurysms are recommended for those who did not succeed in at least one unsuccessful duplex-guided thrombin injection or compression (Tisi & Callam, 2013). However, suppose surgical repair is required. In that case, blood must be crossed and typed. Those available in the immediate entry into the pseudo-aneurysms before conducting a successful distal and proximal control can cause a lot of bleeding. Visceral artery pseudo-aneurysms are managed and treated by endovascular criteria first, reserving surgery if it fails. Aortic pseudo-aneurysms are preferably treated with endovascular aneurysm repair or thoracic endovascular aortic repair.

The patient mentioned in the case study underwent right femoral artery pseudo aneurysm repair. She was brought into the operating, placed in supine position. General anesthetic was administered, prepped and draped and universal time out was performed. Longitudinal incision was made in the right groin, dissection taken down to the inguinal ligament. Common femoral artery was dissected out at the inguinal ligament and vessel oops placed around, proceed to dissect through the soft tissue entering the hematoma. Finger was placed over the sidewall of the common femoral artery where it was bleeding. Dissect out distally vessel oops were placed distally. Common femoral artery was heavily calcified. Patient was heparinized with 4000 units of heparin and the artery was then repaired with interrupted 5-0 prolene suture. Vessel oops was then released. Pulse were found to be palpable and the hemostasis were found to be good.

**Conclusion**

The patient was symptomatic, which is familiar with pseudo-aneurysms. Due to a physician referral, the patient had an aorto-iliac ultrasound where pseudo-aneurysms were found. The pseudo-aneurysms were found to exceed the standard measurement. The surgeon recommended endovascular aortic surgery to keep the pseudo-aneurysms from further growing and to help in reducing the risk of rupture. The patient underwent surgery that went well with no significant complications (Tisi & Callam, 2013). The patient has been doing well since treatment. The treatment received by the patient was the best option. The patient was examined, had tests performed, diagnosed, and obtained complete treatment quickly.

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