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SCIENTIFIC LETTER

Remote endovascular treatment of femoral pseudoaneurysms in hostile groins: technical note

Tratamiento endovascular remoto de pseudoaneurisma femorales en inglés hostiles: nota técnica

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Background

Pseudoaneurysms (PSAs) are false aneurysms that typically arise due to the inappropriate closure of arterial wall perforations during endovascular procedures. Femoral pseudoaneurysm (F-PSA) has an incidence ranging from 0.2% to 7.0% for all procedures, with therapeutic coronary angiography contributing a vast number of these complications[1-3].

Risk factors correlated with post-interventional F-PSA have been classified into procedure-related or patient-related factors. Patient-related factors include scars in the groin and body mass index (BMI) > 28 kg/m^2. The latter represents a particularly at-risk population for complications after open inguinal procedures, and therefore, the obese are not ideal patients for open repair of F-PSA. Furthermore, obesity presents a challenge for manual compression, which, when performed improperly, poses a significant risk factor for developing a pseudoaneurysm[1].

Obese patients and those with hostile groins (including previously operated, history of radiation, close infection, skin candidiasis, or prominent skin folds) represent a population in which all measures should be taken to reduce the possibility of F-PSA. However, suppose iatrogenic F-PSA arises despite such measures. In that case, these groups must be considered "non-ideal candidates" for open surgery, as they carry an increased risk for postoperative complications (blood transfusion and re-exploration, surgical wound infection, lymphatic fistula, distal arterial embolization, seroma, wound dehiscence, neuropraxia, and venous thrombosis)[1].

When an F-PSA is detected, a treatment plan must be established expediently. In the case of symptomatic F-PSA, progression, skin breakdown, hemodynamic instability, and pseudoaneurysm rupture are the primary concerns. As such, symptomatic F-PSAs classically have undergone surgical repair. However, the ultrasound-guided compression therapy (USGCT) represented an easy-to-perform and rapid alternative management strategy[1].

In the case of unsuccessful USGCT, the following widely accepted step is thrombin injection. Thrombin is injected into the new-formed sac under ultrasound guidance, producing rapid thrombosis of the PSA. However, in cases of either short neck of the PSA or failure after the first attempt of thrombin injection, a surgical procedure is indicated[1].

In selected patients at higher risk of developing complications, we propose a technique of Keeping the EndovasculaR Balloon in place during thrombin Injection (KERBI). This employs a left brachial approach for endovascular balloon placement and ultrasound-guided thrombin injection.

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The ideal candidate for this technique is a patient with a hostile groin or with an obese body habitus in whom a surgical procedure is otherwise indicated due to failure of thrombin injection on the first attempt (or the previous attempts). The KERBI procedure should not be attempted in patients with sepsis, large F-PSA with associated neuropathy, distal ischemia, or skin/tissue necrosis; open surgery is the preferred approach in these patients.

Technique

- The left brachial artery approach allows anterograde recanalization of the target vessel, in this case, the common femoral artery. The sequence performed is as follows:
- The left brachial artery is accessed via a cut-down approach and controlled with vessel loops or ultrasound-guided (USG) punction. In the case of the cut-down approach, the coaxial double sheath technique with 7 fr + 4 fr sheath can be used. For USG punction, we recommend a 4 fr sheath later changed to a long 4 fr sheath (45-55 cm).
- Successive steps are performed to catheterize the ipsilateral iliac artery. The coaxial double sheath technique is helpful for a better control.
- An angiogram is performed to determine the level of the PSA.
- A balloon is placed at the level of the PSA but is not yet deployed. The balloon should not be oversized to avoid angioplasty of the artery. The balloon should be centered at the level of the fugue with 1.5 cm both proximally and distally.
- Under ultrasound, the pseudoaneurysm is localized, interrogating the area. This process should allow the surgeon to study the pseudoaneurysm's anatomy and the surrounding area comprehensively.
- Local anesthesia is applied to the skin and subcutaneous tissue at the area of the thrombin injection.
- Once the technician locates the pseudoaneurysm sac, the balloon is deployed, covering the hole in the artery. A needle is then advanced into the sac while aspirating. The needle should be advanced parallel to the probe and under ultrasound visualization.
- Once blood returns and the needle appears within the pseudoaneurysm sac, saline confirmation can be performed under color flow Doppler.
- After the location of the needle within the pseudoaneurysm has been verified, an ultrasound-guided thrombin injection is performed in the usual fashion.
- Following thrombosis of the pseudoaneurysm sac, the balloon is deflated. Patency of the adjacent artery and vein must be confirmed, and all endovascular devices must be removed, followed by the closure of the brachial approach.

Discussion

Iatrogenic PSAs are increasingly common due to the trend toward using endovascular techniques. The alternatives to treat this complication are well known. Despite these therapeutic options, some cases could be solved with less morbidity[1].

Alternatively, using a brachial approach, the KERBI technique transfers the problem to a less-problematic anatomical territory in patients with hostile groin or marked obesity. Performing an ultrasound-guided puncture of the brachial artery represents a more straightforward option for interventional cardiologists, neurologists, or radiologists in the cath lab setting to fix complications without requiring open surgical intervention or participation of surgical teams.

Surgical repair of PSAs has been associated with a high incidence of post-operative complications ranging from 16% to 71%. In adverse anatomical conditions, the complication rate becomes closer to the upper part of this range.[4]

It is essential to highlight that we intend to reduce the rate of potential complications but to do so without adding any other specific morbidity. Therefore, the right upper extremity use is not justified, as it carries an increased risk of morbidity and mortality. This is explained by the confluence of the right common carotid artery and right brachial artery, which branch from a common trunk, the brachiocephalic; this presents an unacceptable risk of neurological events.

Surgical wound infections, either superficial or deep, are the main concerns when approaching a hostile groin or obese patients. In addition, it is essential to highlight that our technique could be performed with local anesthesia, which means to avoid the risks associated with general anesthesia[4].

Conclusion

Iatrogenic femoral pseudoaneurysm is a well-known complication of endovascular procedures. Its management ranges from observation to open surgical repair based on several factors. All efforts should be made to avoid the open surgical approach in hostile groins, resulting in a higher complication rate. In selected patients, the KERBI technique is an alternative to consider. This comprises a left brachial approach for the endovascular placement of a balloon and Keeping the

EndovasculaR Ballon in place for Injection of thrombin under ultrasound guidance. This technique excludes sepsis, neuropathy associated with the PSA, distal ischemia, or skin/tissue necrosis.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that no patient data appear in this article.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

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