Endovascular procedures and nursing care: managing vascular access wounds

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Summary

The common femoral artery (CFA) is frequently utilized access site for endovascular procedures, but this approach can lead to several complications, including haematomas, pseudoaneurysms, bleeding at the access site, and surgical site infections (SSI). Although appropriate management of vascular access wounds can minimize the risk of complications, SSI is still a significant concern for patients undergoing endovascular procedures. Therefore, nursing personnel must possess comprehensive knowledge of the techniques used to access CFA, potential complications, and the nursing care required to manage them effectively. Nurses play a critical role in preventing complications associated with endovascular procedures, as they can identify patients with a high risk of complications. With appropriate education, nurses can inform patients about the measures that can be taken to reduce the risk of adverse events. Regular assessment and monitoring of the wound are essential for the early detection of complications and the implementation of measures to minimize their negative effects.

Key words: common femoral artery access, endovascular procedures, femoral artery access site complications, nursing care.

Introduction

Minimally invasive endovascular procedures have revolutionized the treatment of vascular diseases, providing less invasive alternatives to traditional open surgical procedures. These techniques have reduced hospitalization times and patient discomfort, but they also carry potential complications that require careful management by nurses [1–4]. In comparison to the traditional open procedure, which involves direct surgical access to the artery followed by suturing, endovascular procedures use a puncture technique. This method may result in haemostatic pressure or the use of vascular closure devices (VCD) to manage the wound [5–8]. The most common complications encountered during diagnostic and interventional catheterization procedures involving the common femoral artery (CFA) are vascular in nature, including groin haematomas, pseudoaneurysms, arteriovenous fistulas, and bleeding at the access site [7–10]. Furthermore, surgical site infections (SSI) are still a significant concern for patients undergoing both open femoral surgical access and totally percutaneous endovascular procedures [11, 12]. Therefore, it is crucial for nurses to possess comprehensive knowledge of the various techniques used to access the femoral artery, potential complications, and the nursing care required to manage these complications effectively.

The purpose of this review article is to explore the specificity of wounds after endovascular procedures and discuss the challenges of vascular access in the era of minimally invasive procedures, with a focus on nursing care. In this article, we will examine the various techniques used to access CFA during endovascular procedures, the potential complications that can arise, and the nursing care required to manage these complications effectively, including the methods of closure used. Additionally, we will highlight the importance of continued education and training for nurses in this field, as well as the need for ongoing research to improve the safety and effectiveness of endovascular procedures.

Material and methods

During our research, we conducted an extensive search of various online databases, including PubMed and Google Scholar. To identify relevant articles, we uti-

lized a combination of search terms and phrases, such as "transfemoral access", "vascular closure devices", "endovascular procedures", "hemostatic pressure", "groin hematomas", "pseudoaneurysms", "arteriovenous fistulas", "surgical site infections", and "nursing care". A total of 145 articles were analysed, from which we selected 41 articles that were most relevant to our study. We excluded any articles that did not refer to the specific areas of interest, ensuring that our research was focused and targeted towards the specific aspects of managing vascular access wounds in the context of endovascular procedures. The selected articles were thoroughly reviewed and analysed to provide a comprehensive understanding of the challenges and best practices related to nursing care for patients undergoing endovascular procedures.

Managing vascular access wounds after endovascular procedures: techniques and challenges

Vascular access is an essential aspect of endovascular procedures that involves inserting a catheter or other medical devices through an artery or vein [13]. The common femoral artery is a commonly used access site for endovascular procedures due to its large size and easy accessibility [14, 15]. The classic method of surgical intervention entails a direct approach to the artery, with subsequent stitching [16]. On the other hand, a puncture technique is frequently employed, where the wound may be managed using haemostatic pressure or VCD [17]. Regardless of the technique used, proper management of vascular access wounds after endovascular procedures is crucial to minimize the risk of bleeding, haematoma formation, and other complications [7–10]. Accurate closure techniques are therefore necessary to ensure prompt healing and reduce the risk of complications.

Traditional open femoral artery access

Traditional open femoral artery access involves surgical incision followed by suturing, which can result in a large wound and increase the risk of complications such as infection, dehiscence, or haematoma formation. The use of sutures can also cause patient discomfort and limit mobility in the postoperative period [16]. On the other hand, the total percutaneous access technique is less invasive and reduces the incidence of complications related to the incision [18]. A multicentre, randomized, controlled trial by Nelson *et al*. comparing totally percutaneous access to open femoral exposure for endovascular aortic aneurysm repair has shown that the percutaneous approach can lead to better perioperative outcomes compared to surgical cutdown [16]. Another recent study conducted by Akbulut *et al*. found that percutaneous access for aortic endografts was associated with reduced operative time and hospital stay, without an increase in local complications [19]. In addition to vascular complications, wound complications also increase the length of hospital stay and the cost with the use of antibiotics and wound care [19].

Closure techniques for open femoral procedures

To overcome the challenges related to surgical cutdown, various closure techniques have been developed for open femoral procedures. These techniques aim to minimize wound size, decrease patient discomfort, and reduce the risk of complications [20, 21]. One commonly used technique is the use of skin adhesive agents, which can be used alone or in combination with sutures to provide a strong, flexible, and water-resistant bond [22]. Research by Ge *et al*. indicates that tissue adhesives can create functional connections between damaged tissues and implanted biomaterials [23]. Many studies have shown that millions of patients worldwide have surgical wounds or incisions that require proper closure, accelerated healing, and tissue regeneration [24]. While traditional open surgery can benefit from surgical sutures and mechanical tissue fusion, both carry the risk of intolerance and toxicity [24, 25]. Additionally, the use of haemostatic agents, such as fibrin sealants or collagen-based products, can achieve haemostasis and provide additional wound support, especially when it comes to the arteriotomy [26, 27].

Puncture technique in endovascular procedures

In contrast, the puncture technique used in endovascular procedures involves a small incision and the use of haemostatic pressure or VCD to manage the wound [17]. The advantage of this technique is that it results in a smaller wound and allows for faster patient recovery. However, prior studies have reported a range of 2–7.9% for total vascular complication rates, which include bleeding and other vascular complications, following femoral puncture for percutaneous interventions, which have been linked to longer hospital stays, greater nursing requirements, and increased in-hospital and long-term rehabilitation costs [28, 29].

Closure techniques for puncture wounds

Various closure techniques have been developed for puncture wounds to reduce the risk of complications and improve patient outcomes [19]. Traditionally, femoral access site haemostasis is typically achieved through manual compression, where the puncture site is compressed with a sandbag or manual pressure to achieve haemostasis. However, this technique has several draw-

backs, including patient discomfort during compression, the potential for a vasovagal reaction, prolonged immobilization, and the risk of bleeding [30, 31].

Another technique is the use of haemostatic devices, such as collagen-based or synthetic plugs, that can be inserted into the puncture site to achieve haemostasis [32]. Vascular closure devices are commonly used to manage puncture wounds and have seen advancements over time that have brought about improved patient comfort and decreased incidences of local complications [33]. These devices are placed over the puncture site and use various mechanisms to achieve haemostasis, including the application of sutures, the use of a collagen plug, or the application of a bioabsorbable implant [24, 31]. Schulz-Schüpke *et al*. conducted the largest randomized study comparing VCDs with manual compression for achieving haemostasis. Results from the study showed that VCDs were not inferior to manual compression based on the incidence of vascular complications within 30 days. Additionally, VCDs significantly reduced the time required to achieve haemostasis in patients undergoing diagnostic procedures [20].

Overall, the choice of closure technique depends on various factors, including the type of procedure, patient anatomy, and the surgeon's preference. Nurses must be knowledgeable about these techniques and the potential complications associated with them to provide effective wound care and recognize early signs of complications. With this knowledge, nurses can help to prevent complications and promote the best possible outcomes for patients.

Complications associated with femoral access endovascular surgery

Endovascular surgery is considered a safe and effective method in the health care environment. Tang *et al*., in a study comparing endovascular and open surgery for peripheral arteries, state that endovascular surgery provides patients with better outcomes, has a lower risk of complications, and allows for faster recovery [34]. However, it is a fact that endovascular procedures carry the risk of many complications, even leading to death [35].

Trinidad *et al*. [11], in a study assessing factors related to wound complications, found that 2.6% of patients who underwent endovascular abdominal aortic aneurysm repair due to acute dissection of the ascending aorta had wound complications, most of which (94%) were caused by infection. Of these patients, 68% had a SSI, 21% had a deep incisional SSI, and 5% developed an organ-space SSI. Wound dehiscence occurred in 6% of these patients. The most common pathogens responsible for SSI in vascular patients are presented in Table 1.

Complications result in longer hospital stays and, therefore, an increase in patient care costs [11, 12, 36]. Studies conducted by Roos *et al*. indicate that up to 22% of patients required reintervention during observation after endovascular aortic repair [37].

During procedures performed through the CFA, the most common site of bleeding was found to be the access site. Other vascular complications include vascular perforations, which require additional peripheral and surgical interventions, as well as the development of groin haematomas. In addition, Ben-Dor *et al*. mentioned the possibility of acute limb ischaemia, manifested by the loss of pulse or thrombosis. Cases of pseudoaneurysms developing at the access site and bleeding from the femoral artery, which is the access site to the retroperitoneal space, are also known [8, 9].

Nursing personnel play a crucial role in preventing complications of endovascular procedures and the need for repeat procedures that expose patients to the risk of losing their health and life. Sürme *et al*. in a study assessing knowledge and practice in wound healing found that over half of the nurses had not regularly educated themselves on wound healing, and nearly half had not practiced wound healing regularly [38]. After the surgical procedure, the patient is transferred to the postoperative ward, where they are monitored and observed by nurses. Knowing the natural progression of colonization, infection, and sepsis and the multidisciplinary approach to wound treatment, they can significantly reduce the risk of complications in patients. Regular assessment and monitoring of the wound are crucial for the early detection of possible complications

Table 1. The most common pathogens responsible for surgical site infections in vascular patients

Pathogen	The number (%) of pathogens
Staphylococcus aureus	32.7
Coagulase-negative staphylococci	8.1
Pseudomonas aeruginosa	7.8
Escherichia coli	7.5
Enterobacter spp.	6.0
Klebsiella (pneumoniae/oxytoca)	4.5
Enterococcus faecalis	4.5
Proteus spp.	3.6
Enterococcus spp.	3.3
Streptococcus spp.	3.3
Serratia spp.	3.0
Enterococcus faecium	2.4

Spp. – subspecies

and the implementation of actions that reduce their negative effects.

Risk factors and vulnerable populations for postoperative complications after femoral access endovascular surgery

There are many risk factors known for the occurrence of postoperative complications. Women are among the individuals who are particularly vulnerable [11]. In an analysis conducted by Jeon-Slaughter *et al*., which examined differences between genders in the 12-month outcomes of patients who underwent intravascular intervention due to symptomatic peripheral arterial disease, it was shown that women had to undergo more frequent revascularization procedures than men [39]. Individuals with higher body mass index are also particularly susceptible to postoperative complications. Obesity is associated with a disrupted immune response and increased inflammation, which can increase the likelihood of infection. Excess body mass also makes proper care more difficult [40–42]. Smoking can also lead to numerous complications. Fan Chiang *et al*. showed that smoking was associated with a significantly increased risk of wound dehiscence, SSI, increased frequency of reintubation, and significantly increased in-hospital mortality. Hospital stay was longer for smokers than for non-smokers [11, 43]. Patients with diabetes, kidney failure, and respiratory diseases, as well as dialysis patients, are also particularly susceptible to SSI. Patient dependence has also been recognized as a predisposing factor. Prolonged operation time is also a predisposing factor [11, 42, 44]. Knowing the risk factors for postoperative complications, nursing staff can identify patients who are particularly vulnerable to complications after the procedure and provide them with special care. With appropriate education, they can also educate patients on what actions should be taken to minimize the risk of adverse events.

Preventing postoperative complications in endovascular surgery: nursing recommendations for wound care management

Wound care is an important clinical activity that involves not only changing dressings but also educating the patient [45, 46]. There are several recommendations that nursing staff can implement on the ward to minimize the risk of postoperative complications, including infections at the surgical site associated with intravascular procedures. Szewczyk *et al*. have developed recommendations for the prevention of SSI during the postoperative nursing care on surgical wards. According to these guidelines, the patient should be transported for the procedure in a designated clean bed with clean bed linen, because it is considered to be the most hygienic means of transport. It is also recommended to maintain normothermia during the perioperative period, because hypothermia can disrupt wound healing and increase the risk of infection at the surgical site [47, 48]. According to the Centres for Disease Control and Prevention guidelines, glycaemic control should be implemented during the perioperative period, and glucose levels should be maintained below 200 mg/dl in both diabetic and non-diabetic patients. Patients undergoing endotracheal intubation under general anaesthesia with normal lung function should receive increased FiO2 values during the operation and in the postoperative period after extubation. Sterile dressings applied to a wound closed with primary sutures should be removed within 48 hours of the procedure under microbiologically safe conditions, preferably using a touchless aseptic technique. If there is an increased risk of wound infection, specialized postoperative dressings should be used. If there is a suspicion of SSI, material should be taken from the wound for microbiological examination. It is also important to remember to wash and disinfect hands in designated areas and to encourage the patient to take a bath soon after the procedure. Patient education on how to properly monitor and care for the surgical site is also extremely important.

According to Donebandin, the quality of healthcare can be defined as the type of care that strives for the maximum measurable benefit to the patient, taking into account the expected benefits and losses that accompany the care process in all its elements [49, 50]. Nursing staff, through their continuous contact with the patient, significantly influence the quality of healthcare. By adhering to recommendations for the prevention of SSI, nursing staff not only contribute to reducing the risk of postoperative complications of endovascular procedures but also significantly improve the quality of healthcare.

Conclusions

The choice of closure technique for femoral access can have a significant impact on wound healing and patient outcomes in endovascular procedures. Open femoral access with suturing and closure techniques can result in larger wounds and increase the risk of complications such as SSI and dehiscence. In contrast, the puncture technique with haemostatic pressure or VCD can result in smaller wounds and faster patient recovery but carries a risk of vascular complications. Therefore, the type of procedure chosen must be carefully considered, taking into account patient anatomy, risk factors, and potential risks and benefits. Nurses play a crucial role in wound care and must be knowledgeable about the different closure techniques and associated complications, to provide effective care and

recognize early signs of complications. By doing so, nurses can help to ensure optimal patient outcomes and improve overall quality of care.

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