

A Single-Center Experience with Manual Compression Following Femoral Artery Puncture for Digital Subtraction Angiogram of the Brain and Spine at Punjab Institute of Neurosciences Lahore



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Abstract

Catheter-based cerebral and spinal Digital Subtraction Angiography (DSA) is the preferred imaging method for cerebrovascular diseases. It is yet unknown how manual compression helps patients undergoing transfemoral cerebral and spinal angiography achieve hemostasis. The safety of manual compression and complications among 658 patients who had cerebral and spinal catheter angiography for therapeutic and diagnostic reasons at a public hospital are reviewed in the current research.

Keywords: Acute ischemic stroke; Cerebral angiography; Spinal angiography; Cerebrovascular disease; Digital subtraction angiography (DSA); Endovascular neurology; Manual compression; Vascular closure devices (VCDs)

Background

As part of the workup for brain and spinal vascular illnesses, noninvasive vascular imaging methods including color Doppler ultrasound, CT angiography, and MR angiography have taken the role of catheter-based cerebral and spinal digital subtraction angiography (DSA) [1-3]. Many complications associated with DSA are related to access-site issues [4]. Particularly in Pakistan, the most commonly used access point is still the common femoral artery. After the surgery, manual compression is typically used to close the arteriotomy site [5]. Vascular closure devices (VCDs), on the other hand, have been used in clinical settings since the mid-1990s in an effort to increase the effectiveness and security of percutaneous treatments.[6] The devices are implanted to apply focused force to seal the vessel wall's arteriotomy. Numerous VCD varieties, such as intravascular and extravascular devices, have been created [4]. While VCDs have shown to be more effective in achieving hemostasis and allowing for earlier ambulation [7,8],

there are concerns about a higher chance of vascular issues such as arterial pseudoaneurysm and groin hematoma than with manual compression [7,8] In countries like Pakistan, manual compression offers the cheapest and most effective method for achieving hemostasis after femoral artery puncture. Approximately 5% to 10% of patients may experience vascular complications after femoral artery puncture [9], with a 1-year mortality rate of 7.5% for patients with complications compared to 1.1% for those without complications [10]. Major vascular complications such as pseudoaneurysms, hematomas, arteriovenous fistulas, and retroperitoneal bleeding are mainly attributed to technical issues and inadequate bleeding control [11]. Patients often experience immobilization of lower limbs for an extended period after the puncture, along with symptoms like backache and dysuria [12]. Therefore, an effective compression hemostasis method for the puncture site can reduce postoperative complications, improve patient comfort, shorten hospital stays, and lessen the burden on

medical staff while improving work efficiency [13,14]. Currently, the common compression hemostasis methods in clinical practice include traditional compression methods such as manual compression, bandages, and sandbags, as well as compression devices like arterial compressors and compression balloons. While traditional methods are widely used, cost-effective, and effective in stopping bleeding, they are time-consuming and labor-intensive [15]. Compression devices, on the other hand, are easier to use and save time and effort. However, they come with higher costs and are not fully utilized in clinical practice.

Materials and Methods

A retrospective review was conducted on 658 consecutive diagnostic and therapeutic cerebral and spinal angiography exams performed at the Punjab Institute of Neurosciences (PINS) between May 2023 and October 2024. The exams were carried out by angiographers with backgrounds in neurosciences at large public sector hospital. During this period, the only method for achieving post procedure hemostasis was manual compression done by the members the angiography team who were aptly trained for that.

Procedure

As per practice guidelines at our institution, if needed, mild to moderate conscious sedation is given to the patients undergoing cerebral DSA, by the attending charge nurse. General anesthesia was preferable for spine procedures. All procedures were performed on a state-of-the-art bi-plane angiography machine, Siemens Artis Zee. The angiography technique included femoral artery access in all patients with 5Fr or 6Fr sheath attached to a continuous heparinized saline infusion (5000U/L). 5Fr diagnostic catheters (Henick, SIMS I/II, Davis) were used for cerebral angiography while 4Fr Cobra catheter was used for spinal

angiography. Terumo Radifocus guide wire 0.035" (150cm or 180cm) was used. The infusion pump with an air filter flushed the catheter with heparinized normal saline (5000U/L) to prevent air embolism.

Post-Procedure

Manual compression for 10-20 minutes was used to furnish hemostasis. Manual compression after a femoral artery puncture is a method of hemostasis that involves applying firm pressure over the puncture site to stop bleeding: Index finger is placed about 2 cm above and slightly to the side of the puncture site on the arterial pulse. Middle and ring fingers are placed on the artery above the puncture site. Artery is compressed between the fingers, with the index and middle fingers in the front and the femoral head in the back. Fingers are directly kept over the puncture site so that the skin entry point is under vision and bleeding can be checked. Pressure is maintained for 10- 20 minutes, depending on the size of the arterial cannulation. Hands can be switched or help can be taken from someone else expert in maintaining pressure. All patients were shifted to a High Dependency Unit (HDU) post-procedure with mandatory bed rest for 6 hours. Post-procedure groin (femoral artery puncture site) dressing, peripheral vascular examinations, and neurological examinations were done every 15 minutes for the first hour, then every 30 minutes for the next 2 hours, and finally hourly for the following 3 hours.

Post Procedure Complications

Post procedure groin hematoma developed immediately at the puncture site in 4 patients (0.61%). One patient (0.15%) developed groin hematoma 10 hours after the procedure. All of these 5 cases were promptly and successfully managed with sustained and prolonged manual pressure for 30 minutes.

Table 1: Type of Procedure.

TYPE OF PROCEDURE	DIAGNOSTIC PROCEDURE	THERAPEUTIC PROCEDURE	
1st May 2023-31stDecember 2023	106	18	124
1st January 2024-31st October 2024	377	157	534
Total	483	175	658

Discussion

In this large-scale, single-center, review of patients who underwent diagnostic and therapeutic digital subtraction angiography via transfemoral access, we affirmed the safety of manual compression for securing hemostasis after the procedure. Although vascular closure devices (VCDs) have been utilized for around 20 years, there has been ongoing debate about their use. While initial randomized controlled trials showed consistent benefits of VCD use over manual compression in terms of the principal reasons, these trials were not adequately powered to assess safety endpoints such as bleeding at the access site, the

development of a pseudoaneurysm, or other vascular issues. Similarly, a more recent systematic review was unable to allay safety worries related to VCD. In order to achieve prompt hemostasis, manual compression involves directly applying pressure to the site of the femoral artery puncture. According to research, manual compression can effectively stop severe bleeding and encourage the development of clots when done appropriately. According to a study by Koster et al. [16], manual compression effectively stops bleeding in about 95% instances and significantly lowers the risk of hematoma and pseudoaneurysm [16]. However, the duration and technique of compression are critical. The consensus suggests

a compression duration of 10-15 minutes for standard-sized catheters, [17] and a study by Tzeng et al. [18] found that patients with insufficient compression times had a greater likelihood of problems, suggesting that longer periods may be required for larger catheters or individuals with coagulopathy [18].

Manual compression has drawbacks despite its advantages. Complications include hematoma, pseudoaneurysm development, and ongoing bleeding might arise from inadequate compression. According to a systematic review by De Luca et al. [19], a sizable percentage of these problems are caused by insufficient compression [19]. On the other hand, as Achenbach et al. [20] found, severe compression can result in ischemia, tissue damage, and nerve injury [20]. Balancing the applied pressure is thus crucial to mitigate these risks. Compared to manual compression, alternative hemostatic techniques including hemostatic patches and mechanical compression devices may be more advantageous. It has been demonstrated that mechanical devices limit outcome variability by providing constant pressure [21]. Likewise, hemostatic patches may improve hemostatic effectiveness by combining pressure with clot-promoting substances [22].

When compared to manual compression alone, mechanical devices and patches may lower the occurrence of problems, according to a comparative study by Morrow et al. [23]. The decision between manual compression and these substitutes, however, frequently comes down to variables like patient-specific circumstances, cost, and availability. When evaluating the efficacy of manual compression, factors including diabetes, peripheral vascular disease, and anticoagulant medication necessitate customized methodologies. In order to maximize hemostasis and reduce complications, a study by Ranganathan et al. [24] highlights the necessity of modified protocols based on patient-specific characteristics [24]. In addition to comparing manual compression to mechanical devices and hemostatic patches in a variety of patient populations, future research should concentrate on optimizing compression techniques according to catheter size, patient demographics, and anticoagulant use. Improvements in compression technologies and materials may lead to increased safety and efficacy, but more study is required to examine the effects of compression time and pressure intensity on clinical results [25].

Conclusion

At a tertiary care public sector hospital in Lahore, Pakistan, manual compression is still a vital component of post-femoral artery catheterization therapy, helping to ensure hemostasis and minimize problems. Its use, however, necessitates carefully weighing the dangers and advantages.

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