JACC: CARDIOVASCULAR INTERVENTIONS VOL. 11, NO. 11, 2018

Manual Versus Mechanical Compression of the Radial Artery After Transradial Coronary Angiography

The MEMORY Multicenter Randomized Trial

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ABSTRACT

OBJECTIVES The aim of this study was to compare manual versus mechanical compression of the radial artery after coronary angiography via transradial access regarding radial artery occlusion (RAO), access-site bleeding complications, and duration of hemostasis.

BACKGROUND Hemostasis of the radial artery after sheath removal can be achieved either by manual compression at the puncture site or by using a mechanical hemostasis device. Because mechanical compression exerts a more stable, continuous pressure on the artery, it could be hypothesized that it is more effective compared with manual compression regarding hemostasis time, bleeding, and RAO risks.

METHODS A total of 589 patients undergoing diagnostic coronary angiography by transradial access with a 5-F sheath were randomized in a 1:1 ratio to receive either manual or mechanical patent hemostasis of the radial artery. Radial artery patency was evaluated by color duplex ultrasonography 24 h after the procedure. The primary endpoint was early RAO at 24 h. Secondary endpoints included access-site bleeding complications and duration of hemostasis.

RESULTS Thirty-six (12%) early RAOs occurred in the manual group, and 24 (8%) occurred in the mechanical group ($p = 0.176$). There were no significant differences between the 2 groups regarding access-site bleeding complications (hematoma, 52 [17%] vs. 50 [18%]; $p = 0.749$; bleedings, 8 [3%] vs. 9 [3%]; $p = 1.000$). Duration of hemostasis was significantly shorter in the manual group (22 $\pm$ 34 min vs. 119 $\pm$ 72 min with mechanical compression; $p < 0.001$).

CONCLUSIONS Manual and mechanical compression resulted in similar rates of early RAO, although the total duration of hemostasis was significantly shorter in the manual group. (J Am Coll Cardiol Intv 2018;11:1050–8)

Transradial access (TRA) for diagnostic or interventional coronary procedures has now been adopted as the preferred vascular site approach worldwide (1,2). This has been driven mainly by the lower access-site complication rate, shorter hospital stay, patient preference, and lower costs compared with standard transfemoral access (3-7).

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Manuscript received January 25, 2018; revised manuscript received March 23, 2018, accepted March 27, 2018.

ISSN 1936-8798/$36.00 https://doi.org/10.1016/j.jcin.2018.03.042

However, TRA is not devoid of complications (8,9). Potential access-site complications during procedures performed via the TRA approach include radial artery occlusion (RAO), radial artery spasm, persistent post-procedural pain, upper extremity loss of strength, hematoma, pseudoaneurysm, and rarely arteriovenous fistula, radial artery perforation or eversion during sheath removal, hand ischemia, and compartment syndrome (8,9). Although most complications are rare and managed without surgery, early and late RAO might occur with an estimated incidence of about 1% to 10% and has been described as the "Achilles' heel" of the transradial technique (9–12).

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RAO is usually asymptomatic because of the dual blood supply to the hand, and for this reason it is often overlooked (9,10). However, the complication is not benign, as hand ischemia resulting from RAO has been reported (13–15), and patients may experience transient pain at the site of occlusion, paresthesia, or reduced limb function (16). Furthermore, in case of persistent RAO, the artery cannot be used as an access site for repeat catheterization or as an arterial conduit for bypass surgery (9,10). RAO has also been regarded as a relative contraindication for ipsilateral transulnar approach as well, because possible future site complications regarding the ulnar artery would put the patient's hand at risk for ischemia (9,10).

Endothelial injury of the radial artery and decrease in blood flow after sheath insertion and catheter propagation may create an environment prone to thrombosis, leading to RAO (17). Several risk factors for RAO have been described: the diameter of the sheath and its relationship to the size of the radial artery, post-procedural compression time, the presence of anterograde flow in the artery during hemostasis (patent hemostasis), and the use of anticoagulation (10,18–21). Although routine use of patent hemostasis, avoidance of sheath-artery mismatch, and shorter compression time have been shown to reduce the risk for RAO, the application of preventive measures to avoid it remains challenging (9,10).

Because of the superficial nature of the radial artery, hemostasis after sheath removal is achieved by direct compression at the puncture site. This can be performed either manually (firm pressure applied on the radial artery by an operator's fingers, similar to femoral artery compression) or "mechanically" (use of a device, in the form of a bracelet device that wraps around the patient's wrist, pressing the puncture site) (22). Mechanical compression is more convenient and uses fewer human resources compared with manual compression. Furthermore, because mechanical compression exerts a more stable, continuous pressure on the artery, it could be hypothesized that it is superior to manual approach regarding post-procedural access site complications such as RAO.

Many interventional cardiologists continue to believe that manual compression for femoral access should be considered the gold standard for safety and effectiveness (23). Conversely, there are only scarce data comparing these 2 hemostatic methods in transradial procedures (19,24,25). The aim of this randomized trial was to compare manual versus mechanical compression of the radial artery (although manual is less widely used) after transradial coronary angiography regarding RAO, access-site bleeding, and hemostasis duration.

ABBREVIATIONS AND ACRONYMS

ACT = activated clotting time
BARC = Bleeding Academic Research Consortium
CI = confidence interval
OR = odds ratio
PCI = percutaneous coronary intervention
RAO = radial artery occlusion
TRA = transradial access

METHODS

STUDY DESIGN AND PATIENTS. The MEMORY (Manual vErsus Mechanical cOmpression of the Radial arterY after transradial coronary angiography) trial was designed as a prospective, randomized, open-label, multicenter study. Consecutive patients referred for coronary angiography for any reason using TRA were enrolled if they fulfilled the following inclusion criteria: 1) age ≥18 years; 2) ability to provide written, informed consent; 3) use of a 5-F sheath; and 4) normal Barbeau test results and palpable ulnar pulse at the distal forearm (26). The main exclusion criteria were ad hoc percutaneous coronary intervention, and high bleeding risk (previous use of anticoagulation medication, platelet count <100,000/μl, hepatic disease, and estimated glomerular filtration rate <30 ml/min/m^2). Patients in cardiogenic shock, patients with end-stage renal disease receiving renal replacement therapy, patients at risk for hand ischemia (previous ipsilateral TRA or unpalpable ipsilateral ulnar artery), and patients with scleroderma were also excluded. Finally, inability to perform radial artery color duplex ultrasonography within 24 h after diagnostic coronary angiography and inability to tolerate heparin (history of heparin-induced thrombocytopenia) were also regarded as exclusion criteria. Patients were randomized (1:1) to receive either manual or mechanical compression of the radial artery using a software-based automatic randomization program incorporating a random block size (of 2, 4, 6, or 8) for each study center. Randomization took place after diagnostic coronary angiography with a 5-F sheath, if ad hoc percutaneous