Is patent hemostasis after radial access truly valuable?

IAN C. GILCHRIST, MD, FSCAI
Penn State University College of Medicine Heart & Vascular Institute, MS Hershey Medical Center
Hershey, Pennsylvania

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Patent hemostasis implies applying just enough pressure to prevent bleeding through the vascular puncture, but not so much as to cause complete collapse of the vessel under pressure, producing cessation of flow distally. Like many so-called new concepts in medicine, it is really a practice that has existed long before the TR Band (Terumo Interventional Systems); it is part of good vascular practice. Since the 1700s, surgeons have used various types of tourniquets to control hemostasis, such as the tourniquet of Jean Louis Petit with its screw-down pressure plate (Figure 1) or Harvey Cushing’s pneumatic tourniquet. Both tourniquets are ancestral to modern devices in the radial access field. Over time, we have repeatedly learned that best practice in hemostasis is a balance between applying just enough pressure to avoid blood loss but not so much pressure as to cause tissue necrosis or nerve damage with our devices.

Practices of patent hemostasis, perhaps not under this nomenclature, were suggested and practiced for years to control femoral access bleeding. Manual compression after removal of percutaneous access has always included evaluation of the distal pulses to ensure that perfusion was maintained. Likewise, instructions for the use of compression devices, such as FemoStop (St. Jude Medical, Inc.), also advocate monitoring of the distal pulses and titrating the device pressure to maintain those pulses. Both of these practices are patent hemostasis approaches applied to the femoral artery. Analogous approaches to hemostasis at the level of the brachial artery after percutaneous access, with either a titrated sphygmomanometer or rubber tourniquet to apply enough pressure for hemostasis yet continue intact radial and ulnar pulses, are also other forms of patent hemostasis.

Patent hemostasis, along with procedural anticoagulation and minimizing catheter size, is an important part of hygienic measures that interventionists should practice to minimize radial artery occlusion. Despite evidence that this method works and can drive radial artery loss to < 1%, many operators continue to practice “laissez-faire” hemostasis, which means tightening the wrist tourniquet and leaving it on, untitrated, for a fixed period of time. After all, radial occlusion is asymptomatic, and patent hemostasis does add some extra work for the nurses. I have heard other operators claim that radial occlusion is not a problem as they check pulses on discharge, and in general, they are present. These claims often fail to withstand a practice audit by Doppler ultrasound when subjected to formal study.

Preventing radial occlusion is important not only for symptom control, but also remains critical as the United States joins the rest of the world’s cardiology community in a radial-first approach to standard interventional procedures. Coronary artery disease and other atherosclerotic manifestations throughout the vascular system are chron-
ic diseases, and the need for reaccess of the vascular space is common. The radial artery cannot be treated as just a one-time-use access.

The recently published MATRIX trial showed that only 57 patients with acute coronary syndrome treated transradially are needed to prevent one major bleed or death. The MATRIX trial, along with the consistency of previous randomized and registry-type research, defines the radial approach as the evidence-based preferred vascular access. European guidelines are already reflecting this reality—can the United States guideline committees be far behind? It will be a real shame if a cavalier operator should cause the loss of a radial pulse by not using patent hemostasis, resulting in that patient losing the opportunity to utilize this access in the future. Such loss should be considered an error of execution and is preventable if one takes the effort to use patent hemostasis.

Is patent hemostasis really valuable? It is not just valuable to prevent radial artery occlusion, but is a fundamental technique for maintaining the safest approach in the vast majority of invasive cardiovascular procedures. One does not crush a femoral artery to the point of limb ischemia, nor the brachial artery. What would lead one to believe that crushing the radial artery to the point of occlusion would be anything but a bad idea? The practice of using patent hemostasis anywhere in the vascular tree when using compressive hemostasis is best practice and should be considered the standard of care. The practice of patent hemostasis is one of the best methods to ensure continued safe vascular access for our patients.

In the end, it is important to know that a palpable pulse at discharge does not mean the radial artery is patent. In fact, the occluded radial artery has up to 70% of the mean arterial pressure due to collateral circulation. Until a routine collection of data and reporting of findings is requested, the diligence to assist in the radial patency lies in the hands of the individual operator. Patent hemostasis is one way in which we can improve long-term patency, ensure the radial artery is available for future procedures, and further improve patient satisfaction. Engaging the team, including the physicians, the catheterization technicians, and the nursing staff in the recovery suite, will allow us to improve our patency rates and, I would offer, improve quality. Is patent hemostasis valuable? You bet!


JENNIFER A. TREMMEL, MD, MS
Assistant Professor of Medicine (Cardiovascular Medicine)
Clinical Director of the Women’s Heart Health Program
Stanford Medical Center
Stanford, California

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Until we have a cure for repeat revascularization, we need to do all we can to keep the radial artery open. Radial access has many advantages over femoral access, but it also imposes a new issue, namely radial artery occlusion (RAO). The reported incidence of RAO is quite variable, but is probably somewhere around 10%. However, when particular evidence-based steps are taken to reduce RAO, we see an incidence of < 1%. These steps include (1) minimizing sheath size, (2) using adequate anticoagulation, and (3) achieving patent hemostasis. Performing these three steps should be routine in every cath lab. It seems that most labs are doing well with the first two steps, but falling short on achieving patent hemostasis.

Simply putting on the hemostatic device and walking away is insufficient. Feeling the radial pulse once the hemostatic device is in place is also insufficient, because this pulse may actually be arising from the ulnar artery and going around the palmar arch rather than coming from the radial artery. Instead, a pulse oximeter with plethysmography needs to be placed on the index finger, and the hemostatic device needs to be applied with the least amount of air or pressure possible to achieve hemostasis. Once in place, the operator needs to occlude the ulnar artery and evaluate the plethysmograph to confirm patency of the radial artery. Ideally, you will see a reverse Barbeau A, B, or C waveform. If the plethysmograph shows a flat line (reverse Barbeau D), an attempt should be made to decrease the amount of air/pressure in the device. This requires using a device that allows fine-tuning of air/pressure. If you’re using a device that can’t be fine-tuned, get a new device.

Sometimes, you won’t be able to get better than a reverse Barbeau D in the cath lab. It’s okay, because upon arrival to recovery, it should be standard protocol in all radial patients that the reverse Barbeau test be repeated. If the patient now has a reverse Barbeau A, B, or C, great! If not, another attempt should be made to decrease the amount of air/pressure while maintaining hemostasis. Generally, we are able to achieve patent hemostasis upon arrival to recovery if we were unable to achieve it in the cath lab. If not, we repeat our attempts every 15 minutes until successful. Once patent, it is also important to have periodic checks to confirm that the radial artery remains patent. We do this once per hour until discharge. In the very rare situation that the radial artery is not patent by discharge, we will reverse the hemostatic device, occluding the ulnar artery for up to 1 hour to get the radial artery open. Low-molecular-weight heparin can also be given for several days postdischarge if the radial artery remains occluded.

As the number of radial (and repeat radial) procedures increases, we need to be ever more diligent about preventing RAO. It is well known that early occlusion (≤ 24 hours) is associated with late occlusion (≥ 30 days), whereas early patency nearly guarantees late patency (99.1%). Therefore, take some time to ensure that your cath lab is following the current best practices for preventing RAO, including achieving patent hemostasis, and stay attuned for updates in this ever-evolving area of radial access.