Improved hybrid technique for vascular access and closure

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Abstract

PURPOSE: To present a technique for vascular access that features minimal surgical visualization of the target vessel, fast and safe access using an open Seldinger technique under tactile and visual control, and suture closure. TECHNIQUE: After minimal surgical access to the target vessel, exposing only the anterior wall, 4 preliminary 5-0 polypropylene transmural single sutures are placed in the horizontal plane, 2 on either side of the proposed entry point. If the anterior wall is calcified, the sutures are placed more laterally or medially in a suitable plaque-free area. The vessel is then accessed via an open Seldinger technique in the midline between the 4 sutures, and the corresponding sheaths are inserted over the wire. At the end of the procedure, the sheath and wire are removed, and with digital pressure on the vessel distally, the access site is washed out in antegrade fashion. All 4 sutures are then pulled tight by an assistant, and the surgeon ties all the sutures sequentially. Over a 4-year period, this technique has been used in 536 accesses involving the common femoral (n = 500) and iliac (n = 32) arteries and the abdominal aorta (n = 4). Up to 24-F sheaths were introduced. Mean time for vascular access was 9.0 +/- 3.3 minutes. There were no access-related early complications detected in routine postprocedural imaging and clinical evaluation. CONCLUSION: The "Surgiclose" technique, which is easy to learn and applicable to all vessels, provides a fast, easy, and reliable remote vascular access. It combines the best of both surgical and interventional access techniques, affording minimal surgical access and maximal safety.
Improved Hybrid Technique for Vascular Access and Closure

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Purpose: To present a technique for vascular access that features minimal surgical visualization of the target vessel, fast and safe access using an open Seldinger technique under tactile and visual control, and suture closure.

Technique: After minimal surgical access to the target vessel, exposing only the anterior wall, 4 preliminary 5-0 polypropylene transmural single sutures are placed in the horizontal plane, 2 on either side of the proposed entry point. If the anterior wall is calcified, the sutures are placed more laterally or medially in a suitable plaque-free area. The vessel is then accessed via an open Seldinger technique in the midline between the 4 sutures, and the corresponding sheaths are inserted over the wire. At the end of the procedure, the sheath and wire are removed, and with digital pressure on the vessel distally, the access site is washed out in antegrade fashion. All 4 sutures are then pulled tight by an assistant, and the surgeon ties all the sutures sequentially.

Over a 4-year period, this technique has been used in 536 accesses involving the common femoral (n=500) and iliac (n=32) arteries and the abdominal aorta (n=4). Up to 24-F sheaths were introduced. Mean time for vascular access was 9.0±3.3 minutes. There were no access-related early complications detected in routine postprocedural imaging and clinical evaluation.

Conclusion: The “Surgiclose” technique, which is easy to learn and applicable to all vessels, provides a fast, easy, and reliable remote vascular access. It combines the best of both surgical and interventional access techniques, affording minimal surgical access and maximal safety.

Key words: vascular access, endovascular aneurysm repair, vascular closure technique, Seldinger technique, hemostasis

Complications due to surgical and percutaneous vascular access are well known. Surgically-induced access complications can occur during circumferential preparation, arteriotomy, clamping, and wall closure.1–12 Clamping and/or closure of the vessel can lead to plaque disruption, local dissection, stenosis, and even acute thrombosis. As a consequence, early or late complications, such as bleeding, aneurysm formation, occlusive disease, or acute limb ischemia, may occur. Purse-string sutures may lead to stenosis, particularly in smaller vessels. Furthermore, classical surgical access (with circumferential vessel dissection) can be quite difficult and time consuming, especially in patients who have multiple previous groin interventions and/or heavily calcified vessels. In a percutaneous access, complications can happen during puncture or application of closure devices.13–21

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We present a fast, easy, and reliable hybrid technique for remote vascular access and closure that combines the advantages of surgical and interventional approaches. This “Surgiclose” technique can be applied to any vascular access site, including the aorta and veins.

TECHNIQUE

Arterial access to the common femoral artery (CFA) is described to illustrate the technique. The CFA is minimally exposed through a small longitudinal incision below the inguinal ligament. Four preliminary 5-0 polypropylene (RB-2 needle) transmural single sutures (3 to 4-mm bites) are placed in the horizontal axis at a distance of 1 to 2 mm (Fig 1A). Spacing between the inner 2 sutures may be increased up to 2 to 4 mm when larger (>20 F) sheaths are used. If the anterior wall is calcified, the sutures are placed more laterally or medially after a suitable plaque-free area is identified by digital palpation. The vessel is then punctured with a 70-mm-long, 18-G angiographic needle with snap-on wing (0.38-inch maximum guide diameter) in the midline between the 4 sutures, and the corresponding sheaths are inserted over the wire (Figs. 1B and 2A,B). At the end of the procedure, the sheath and wire are removed, and distal embolization is prevented by digital compression on the vessel distally and antegrade washout. Immediately thereafter, all 4 sutures are pulled tight by an assistant, and the surgeon ties all the sutures sequentially.

Figure 1 ◆ Illustration of the Surgiclose technique. (A) Two preliminary sutures are placed on either side of the intended access point. (B) The guidewire is placed through the puncture hole. After sheath removal, (C) the knots are tied and cut short. In the event of persistent bleeding, a continuous suture (D, E) is run from the outside to the center of the vessel. (F) The continuous suture is tied and cut short.

Figure 2 ◆ Intraoperative presentation of the Surgiclose technique. (A) An 8-F sheath is inserted. (B) The 24-F sheath is introduced for stent-graft placement. (C) Sheath removed after the procedure, knots tied and cut, no bleeding.
(Fig. 1C, 2C). If there is further bleeding, a continuous suture is placed from the outer edges to the midline (Fig. 1D–F).

There are 3 contraindications to the Surgiclose technique: stents in the CFA precluding transparietal sheath introduction, target vessel dissection in which the guidewire and sheath have to be introduced within the true lumen under direct vision, and circumferentially calcified target vessels along its accessible course.

In the last 4 years, we have employed the Surgiclose technique in 138 thoracic and 346 abdominal endovascular aortic repairs involving 536 arterial accesses: 500 CFAs, 32 iliac artery, and 4 abdominal aortas. Up to 24-F sheaths were introduced according to the needs of the procedure. The technical success rate was 99.1% (531/536 arteries). The 5 failures involved a circumferentially calcified CFA (access was obtained through another access vessel), a kinked external iliac artery (converted to a standard arteriotomy), and 3 instances of a torn suture after removal of the sheath early in our experience. The latter event necessitated digital control of the bleeding site, further dissection, and standard suturing of the artery. In 34 (6%) of 536 access sites, a continuous suture was necessary from the outer edges to the midline to control bleeding.

Mean time for vascular access was $9.0 \pm 3.3$ minutes (range 5–22). There were no access-related early complications, such as stenosis, dissection, thrombosis, pseudoaneurysm, or bleeding detected in routine post-procedural imaging and clinical evaluation. Superficial infections were detected in 10 (2%) access sites and lymphatic fistulae in 29 (5%).

**DISCUSSION**

The Surgiclose technique combines the advantages of both surgical and interventional access procedures. The interventional part of the procedure allows minimal surgical access and exposure of the target vessel without circumferential dissection. Therefore, tissue trauma is minimized, and the target vessel is maximally preserved. The open access, although small, allows good visualization to select the best puncture site, aided by digital palpation as needed. Plaques and side branches can be avoided, and local complications, such as dissection, major (intra- or postoperative) bleeding, pseudoaneurysm formation, vessel wall destruction, and stenosis, are prevented by placing 4 transmural stitches at the optimal site under tactile and visual control. Furthermore, open exposure and puncture allows varying the angle and force of wire and sheath introduction. Contrary to purely percutaneous procedures, the puncture site can be inspected at the end of the procedure and bleeding controlled with certainty. Moreover, distal embolization from thrombus formation on sheaths or in vessels can be avoided by intentional antegrade washout after distal vessel occlusion by simple digital pressure.

Although developed for remote vascular access in stent-graft patients, the Surgiclose technique has the potential for broader use. At our institution, this technique has been adopted in cardiovascular surgery at arterial and venous cannulation sites for cardiopulmonary bypass with the same success as for stent-graft patients.

**Conclusion**

The Surgiclose technique guarantees a minimally invasive, fast, easy, and reliable remote vascular access in endovascular procedures. The technique is easily learned and applicable to all vessels. It combines the best of both surgical and interventional access technique, providing minimal access and maximal safety. This technique has become our choice for all patients undergoing endovascular aortic repairs or arterial and venous cannulation.

**REFERENCES**