Minimally invasive surgical technique for tethered surgical drains

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ABSTRACT

A feared complication of temporary surgical drain placement is from the technical error of accidentally suturing the surgical drain into the wound. Postoperative discovery of a tethered drain can frequently necessitate return to the operating room if it cannot be successfully removed with nonoperative techniques. Formal wound exploration increases anesthesia and infection risk as well as cost and is best avoided if possible. We present a minimally invasive surgical technique that can avoid the morbidity associated with a full surgical wound exploration to remove a tethered drain when other nonoperative techniques fail.

Key words: Arthroplasty, complication, drain, orthopedic, surgery, tethered
MeSH terms: Surgical procedures, drainage, suction, surgical complications

INTRODUCTION

Surgical drain placement has its earliest roots dated back to Hippocrates (460-377 BC). In orthopedic surgery, as well as other surgical specialties, surgical drains are mainly used to prevent fluid collections and to provide outflow for infections. The use of surgical drains has been controversial. Bjerke-Kroll et al. suggested that the use of surgical drains in arthroplasty increases blood loss, transfusion requirements, and overall costs. However, when the decision is made to use surgical drains, attention to detail and technique is of the utmost importance. Specifically, during surgical wound closure, a surgical drain may be inadvertently pierced by a suture needle causing tethering of the drain to the surgical wound. Attempts at the removal of this tethered drain at bedside may be unsuccessful or result in breakage causing a drain fragment to be left in the wound. Retention of such drain fragments may not cause direct harm but often causes distress, embarrassment, and may result in litigation. There have been several articles describing the preventive and removal techniques of such tethered drains. This article describes a minimally-invasive surgical technique for tethered drain removal when nonsurgical measures fail.

SURGICAL TECHNIQUE

This technique evolved when a tethered drain was discovered on 1st postoperative day following revision total hip arthroplasty. Standard bedside removal techniques failed forcing a decision either to pull hard enough to break the drain and leave a retained drain fragment or return to the operating room for formal wound exploration. Before exposing the patient to the morbidity associated with formal wound exploration, a new technique was suggested. This article demonstrates the technique involving a standard 400 cc three spring Davol closed wound suction evacuator with a PVC drain (Bard Medical, Covington, GA, USA) [Figure 1a] and a 7.4 mm inner diameter ×13.5” working length closed tendon stripper (Smith and Nephew, Andover, MA, USA) [Figure 1b].

The patient is placed in the supine position on a radiolucent table and anesthesia is provided via conscious sedation.
Fluoroscopy is utilized, and images of the entire drain are confirmed before the start of the case. Standard bedside removal techniques are once again attempted. Once tethering is confirmed the surgical drain is removed from its suction canister and cut so that enough tail can be prepped and drapped into the surgical field [Figure 2a]. The area is prepped and draped as per protocol. The drain is marked with a marking pen at the level of the skin. The skin and soft tissues along the course of the drain are anesthetized with 20 ml of 1% lidocaine without epinephrine. A surgical blade is used to incise the skin parallel to the path of the surgical drain making sure it is large enough to allow passage of the tendon stripper. The tail of the surgical drain is pulled to expose enough sterile drain from underneath the skin and then grasped with a clamp at the level of the skin to prevent retraction [Figure 2b]. Care is being taken not to cause breakage of the surgical drain. The tail distal to the marked line is then cut and removed [Figure 3a]. The surgical drain is threaded through the opening of the tendon stripper and grasped with another clamp while the clamp at the level of the skin is removed. The tendon stripper is advanced underneath the skin and guided along the path of the surgical drain. The tendon stripper is provided with a clockwise and counter clockwise alternating rotation while gentle traction is applied to the surgical drain paying attention to any resistance, much like would be done for harvesting hamstring tendons during an anterior cruciate ligament reconstruction [Figure 3b and c]. Advancement of the tendon stripper continues until the level of tether is reached, which can be identified by a distinct resistance and lack of easy advancement. At the level of tether, controlled pressure is applied to the tendon stripper along with gentle rotation and pushed passed the restrictive barrier, cutting the suture, and freeing the drain [Figure 4a and b]. The drain is easily pulled from the wound and inspected for breakage. Fluoroscopy is used to confirm complete removal of the surgical drain, and that drain fragments were not retained [Figure 5a and b].

After the success of this technique in the operating room, it was taken to the cadaver laboratory for simulation.

The same type of drain that was used above was sutured to tissue via silk suture with multiple knots in a cadaver hip specimen. The technique described previously was utilized and Figures 2-4 shows the cadaver simulation. Successful release of the tethered drain utilizing this technique was confirmed in the cadaver laboratory for simulation.

**Discussion**

The true incidence of tethered drains is not known since it is an uncommon event. However, when it does occur, it
can cause embarrassment to the surgical team and increase the risk to the patient as well as increase cost if a return trip to the operating room for formal wound exploration is needed. Several articles have previously discussed the preventive and removal techniques of tethered drains. Lazarides et al. described the use of a Steinmann pin to extract a drain by inserting the sharp end of the pin into the lumen of the surgical drain to cut the suture. Namyslowski et al. described the use of an angioplasty balloon to retrieve drain fragments, whereas Rue and Johnson described a technique to remove a snared silicone drain by twisting the drain five to seven turns while gentle in-line traction was applied. This article describes a new technique to remove a tethered drain in a minimally-invasive fashion. The technique of using a tendon stripper to engage a tethered surgical drain, to our knowledge, has not been previously described in the literature. It demonstrates an unconventional application of a common instrument found in almost every hospital operating room.

This technique utilized conscious sedation in addition to local anesthesia in the operating room setting. Application of this technique however can theoretically be attempted at the bedside with adequate local anesthesia and aseptic technique. Previous studies have suggested that infiltration of local anesthetic into the skin wound and around the surgical drain tube or into the surgical drain tube itself provides a painless and comfortable experience to the patient during drain removal. These studies however do not involve that of a tethered drain. Another area of concern when injecting local anesthetic into the drain itself...
is the theoretical risk of infection, especially in the setting on an arthroplasty.

In this article, we demonstrate the technique utilizing fluoroscopic guidance, which can help locating the site(s) of tethering as well as provide confirmation of complete drain removal; however, this is not necessary. Although this article describes its use in a hip arthroplasty case, this technique can be easily adapted to other areas of the body with a tethered drain and by varying the size of the tendon stripper. However, one must be cautious of drain location and have knowledge of the surrounding anatomical structures. Specific contraindications to this procedure may include those drains that are placed in deeper planes near critical structures or near nerves and major blood vessels where introduction of a tendon stripper may cause injury. Another consideration is the type of suture utilized at the tether site. For example, in hip cases, a common site of tether is at the fascia lata level where it is common practice to utilize a continuous running stitch. If this type of stitch is cut, then this may compromise wound closure of the deep layers resulting in increased chances for wound complications and other sequela. A continuous running stitch without barbs or additional interrupted stitches to reinforce closure may be another contraindication to this technique. In conclusion, we present a minimally-invasive surgical technique for tethered drain removal that can avoid the need for a formal wound exploration, which increases anesthesia and infection risk as well as cost.

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Conflicts of interest
There are no conflicts of interest.

References
1. Gaines RJ, Dunbar RP. The use of surgical drains in orthopedics. Orthopedics 2008;31:702-5.
2. Robb H. The management of the drainage tube in abdominal surgery. Johns Hopkins Report. 1891;2:184.
3. Moss JP. Historical and current perspectives on surgical drainage. Surg Gynecol Obstet 1981;152:517-27.
4. Bjerke-Kroll BT, Sculco PK, McLawhorn AS, Christ AB, Gladnick BP, Mayman Dj. The increased total cost associated with postoperative drains in total hip and knee arthroplasty. J Arthroplasty 2014;29:895-9.
5. Hak Dj. Retained broken wound drains: A preventable complication. J Orthop Trauma 2000;14:212-3.
6. Tammelleo A. Piece of Penrose drain left in patient: “Accidental” & “intentional” distinction. Regan Rep Med Law 1996;29:3.
7. Lazarides S, Hussain A, Zafiropoulous G. Removal of surgically entangled drain: A new original nonoperative technique. Int J Curr Med Sci Pract 2003;10:63-4.
8. Namyslowski J, Halin NJ, Greenfield Aj. Percutaneous retrieval of a retained Jackson-Pratt drain fragment. Cardiovasc Intervent Radiol 1996;19:446-8.
9. Jaafar S, Vigdorchik J, Markel DC. Drain technique in elective total joint arthroplasty. Orthopedics 2014;37:37-9.
10. Rue JP, Johnson CA. Technique for removal of snared silicone drains. Orthopedics 2000;23:543-5.
11. Yiannakopoulos CK, Kanellopoulos AD. Innoxious removal of suction drains. Orthopedics 2004;27:412-4.
12. Hutchinson RH, Salem G. Painless removal of suction drains. Ann R Coll Surg Engl 2014;96:488.
13. Pelissier P. Painless postoperative period and drain removal using local anesthesia. PlastReconstrSurg 2003;111:514-5.