Drain Technique in Elective Total Joint Arthroplasty

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Abstract: The authors report a simple technique for effective management of surgical drains and their reliable removal in elective hip and knee arthroplasty. Many surgeons use surgical drains for elective total hip and knee arthroplasties and instruct residents in their use despite limited evidence to support routine use of surgical drains in noninfected cases. There are many different types of drains and equally varied methods for implantation, monitoring, and removal. Technical issues regarding use of closed suction surgical drainage postoperatively deal primarily with the questions of when to remove the surgical drain and how to manage difficulties with drain removal or breakage.

Although research supporting the routine use of drains is at best inconclusive, there is evidence that supports use of surgical drains relative to decreased dressing changes, ecchymosis, and possible hematoma formation. A patient with a drained wound is more likely to require blood transfusion but less likely to have serous leakage at the incision than a patient with an undrained wound. Wound healing, postoperative range of motion, and infection appear unaffected. When using drains, doing so in a safe and predictable fashion is paramount. It is important to place the drain in a fashion that prevents inadvertent suture retention and to have the ability to document that the entire drain has been removed, even in situations where extracting the device is difficult.

Much variation exists in the insertion, care, and removal of surgical drains. Drains may be deep or superficial, large or small, round or flat, and placed on suction or left to gravity drainage. The surgical drain should exit from an easily accessible area, and the drain holes should be placed in the most dependent portion of the wound. Some surgeons choose to secure the drain tubing as it exits the skin to prevent inadvertent removal during patient transport and movement with suture. Surgeons also tend to have nonscientific preferences on when a drain should be removed. These preferences are usually dependent on time or drainage volume and are rarely standardized or grounded by data.

Pitfalls of Drain Placement

The most problematic technical error associated with the placement of a surgical drain is accidental suturing of the drain into the surgical wound below the level of the skin, causing the drain to become incarcerated. This problem causes significant embarrassment to the surgical team and increased risk to the patient, especially if a return to the operating room is necessary to extricate the drain or tubing fragments left behind after removal. Several publications have outlined preventive and reactive techniques to address the problem. Hak proposed a method by which one could avoid accidentally suturing in a drain by maintaining the free end of the drain tethered outside of the incision during closure of the mid-portions of the wound and then using a sliding motion to evaluate for entrapment of the drain tubing prior to closing the full incision. 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 drain tubing to cut a suture through the lumen of
the drain. Namyslowski et al. described the use of an angioplasty balloon to retrieve drain fragments. A review of the literature indicates that drain entrapment is not uncommon, is likely underreported, and frequently requires additional interventions. When a drain is discovered to be entrapped, usually progressively increasing force is applied until the drain, the remaining suture, or tissue breaks. Sometimes attempts at drain removal are concluded when the patient becomes intolerant of the process or it becomes clear that the drain is so well fixed that further attempts at forcible removal should be abandoned.

In cases where the drain is incarcerated but is eventually forcibly removed, an assessment must be made to confirm that the drain did not break and leave a tail portion or fragment retained deep inside the wound. To this end, residents are typically taught to cut the drain between the drain holes. The tubing will theoretically fracture at a weak point through a hole. So, if a drain is removed and the end is through a hole, the presumption is that the drain broke and the breakage could be recognized. Deciding whether the drain broke close to the end and a fragment was left within is not always clear. Most drains are manufactured with some radiopacity so that in the event of difficult drain removal, a radiograph may be obtained to evaluate for residual drain pieces. In a situation where one cannot confirm if the whole drain has been removed, exploration of the wound may be required. Avoiding the problems of the retained drain and, perhaps more importantly, having the ability to document that the entire drain was removed has proven over time to be difficult. The following brief technique description is borne of an attempt to simplify the management of surgical drains for surgeons, residents, midlevel providers, scrub technicians, and nurses. In cases of difficult drain removal, the best means of dealing with the conundrum of whether a drain broke and whether a piece of it remains within can be mitigated by how the drain was prepared.

**TECHNIQUE**

This technique has been primarily used in elective total knee and total hip arthroplasties. In these cases, hematoma formation can be particularly problematic for rehabilitation and early return of range of motion, and prolonged drainage and/or ecchymotic wounds are concerning for patients and surgeon alike. When using a drain, it should be purposefully cut to leave the same number of holes each time. For example, the senior surgeon (D.C.M.) cuts all drains to leave 6 full holes available for drainage at the distal end of the drain tubing. A single cut is made between the sixth and seventh drain holes. This simple technique adds predictability to drain placement and removal. When removing the drain, the end is inspected. If 6 full holes are present, the entire drain has assuredly been removed and there is no question of retained fragments.

Avoiding the problems of the retained drain and, perhaps more importantly, having the ability to document that the entire drain was removed has proven over time to be difficult. The following brief technique description is borne of an attempt to simplify the management of surgical drains for surgeons, residents, midlevel providers, scrub technicians, and nurses. In cases of difficult drain removal, the best means of dealing with the conundrum of whether a drain broke and whether a piece of it remains within can be mitigated by how the drain was prepared.

**Knee**

After placement of components and thorough irrigation of the wound, the drain tubing is prepared. The distal end of the drain tubing is cut between the sixth and seventh holes. A sharp-tipped trocar is inserted through the tissue from the deep surface of the lateral capsule through the soft tissue and out through the skin, exiting in a safe zone suprolateral to the knee joint. The exiting tubing is cut just distal to the trocar at an angle to facilitate placement into a hemovac wound reservoir bifid connector. The end of the drain tubing with holes is re-cessed into the lateral gutter of the knee, and the joint capsule is closed with interrupted absorbable sutures or a running v-lock absorbable suture. Care is taken to leave drain tubing just inside the wound (the black marking point that precedes the drain holes should not be visible). Following completion of skin closure, the slack in the drain tubing is pulled until the black marking dot signifying the beginning of the drain holes is just visible at the skin surface. The ability of the drain to slide to the black marking point without restriction confirms that the drain was not sewn into the surgical wound. A sterile dressing is applied, and the drain tubing is connected to the hemovac connector and then to the hemovac reservoir on suction or gravity drainage.

**Hip**

As in the knee, the drain is prepared by cutting between
the sixth and seventh holes and is placed, after thorough irrigation, into the subfascial space. The trocar should exit distally and lateral in a safe zone. Again, slack should be left in the drain, and the black marking dot should not be visible. The fascia, subcuticular tissue, and skin are closed per routine. Confirmation that the drain is not entrapped is made by removing the slack from the drain until the black marking dot is just outside the skin. A dressing is applied, and the drain tubing is connected to the hemovac reservoir.

Postoperative Treatment

The surgical drain is placed on suction or dependent drainage, and output is recorded. If output seems excessive, the drain can be clamped, and a compressive dressing may be applied for 30 to 45 minutes. On postoperative day 1, the surgical drain is removed regardless of output. The theory here is that the drain is used to evacuate the postoperative bleeding and the problems with prolonged drain use are avoided. In addition, the often difficult decision as to whether the output is conducive to removal is eliminated. The worst case scenario is that output persists into the closed undrained space, which is no worse than not using a drain at all. At the time of removal, the drain tubing holes are counted and documented to ensure complete removal, and the dressing is changed. Antibiotics, usually a first-generation cephalosporin, are used postoperatively for 24 hours or less.

To date, while using these techniques, no drain-associated complications have been encountered, and questions of drain retention or concerns regarding complete drain removal have been eliminated.

Conclusion

The techniques described herein for placement and removal confirmation are easily applied and make the use of drains easier and more predictable. For those who choose to use surgical drains, the authors believe the majority of drain problems can be avoided with a structured drain preparation and removal protocol.

Although this report focuses on the experience of a joint replacement surgeon, this style of drain care can be extrapolated to almost every case in which a drain can be used. Consistently preparing surgical drains the same way every time simplifies the drain implantation and removal process. Cutting the same number of drain holes into the surgical drain tubing is an easy alteration to most drain preparation regimens and greatly simplifies confirmation of adequate removal in entrapped drains. In the rare case when a longer drain is desired, the number of holes left should be documented in the surgical record. Other means of simplifying drain care include checking the drain excursion prior to leaving the operating room or using precut or specially fabricated drains. This simple technique adds reproducibility and predictability to the process of drain care for surgeons who choose to use surgical drains.

References