CHAPTER **20**

THE TLS DRAIN

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The TLS drain has been used at Doctor's Hospital and Northlake Regional Medical Center, Tucker, Georgia since its invention in 1974. The authors will review the indications and discuss their experience with its use.

HISTORY

Closed suction drains are by no means new, and have been used for many years.[1] Hans Willenegger in 1970, advocated the general use of suction drainage systems on a larger scale.[2] In 1981, at the first podiatric A.O. seminar in Aspen, Colorado, his famous remark of "no drain, no brain," became his quote to emphasize the importance of good wound management.

The TLS closed suction wound drainage system was developed by Kalish in 1974. Its efficiency in foot surgery was documented in a 35-case study by Miller in 1981.[3] Similar devices had originally been described by Josephs[4] and Jacoby,[5] but they had several drawbacks. The drain was first marketed by the Glassrock Corporation, and later by Porex Corporation (Fairburn, Georgia).

The drain set consists of a 30 cm fenestrated silicone drain catheter marked throughout its length with a radiopaque stripe. The drain catheters may be #10 French, or #7 French diameters. Once in the wound, the catheter is connected to a plastic-covered needle (hub) which functions to perforate a steri-vacu-container tube. This tube will collect the fluids by vacuum suction. Two sterile vacuum tubes, a trocar, a hub, and a catheter are provided in the single package (Fig. 1).

PHYSIOLOGY OF WOUND DRAINAGE

Surgical procedures of the foot and ankle can produce large volumes of bleeding and drainage that must be reabsorbed by the body, or exuded through the surgical incision. An increase in fluid accumulation at the surgical site may result in hematoma formation causing an obstruction to circulation and wound healing. Hematoma formation and eventual consolidation is the result of the iatrogenic disturbance of the interstitial fluid balance, described by Starling's principles:

- Capillary Pressure-forces fluid into the interstitium;
- Interstitial Fluid Colloid Pressure/Oncotic pressure draws fluid into interstitial space due to increased concentration of protein and blood products;
- Interstitial Fluid Pressure-pushes fluid into the capillaries;
- Plasma Fluid Osmotic Pressure-intracapillary proteins and cells draw fluid into the capillaries.

The balance of internal and external flow forces, maintains an environment compatible with normal healing. The disruption of vessels and lymphatics, and tissue excision results in the collection of proteins and cellular elements in the physiologic "dead space," and can result in hematoma formation if preventative steps are not taken.

The podiatric surgeon must be aware of these physiologic changes secondary to surgical trauma,

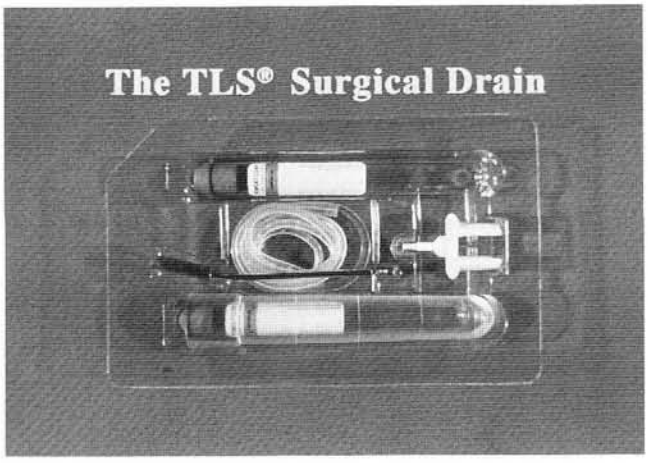

Figure 1. The TLS Drain System

and must use anatomic dissection techniques to preserve vasculature, and compression to prevent hematoma formation. Hematoma is a potential complication, even with meticulous dissection, and can result in wound dehiscence and postoperative infection (Figs. 2, 3). Closed suction irrigation drains, including the TLS drain system, assist the body in restoring the interstitial fluid balance by removing excess blood elements and fluids.

Figure 2. 12-year-old patient, one day after laceration injury with wound dehiscence secondary to underlying hematoma.

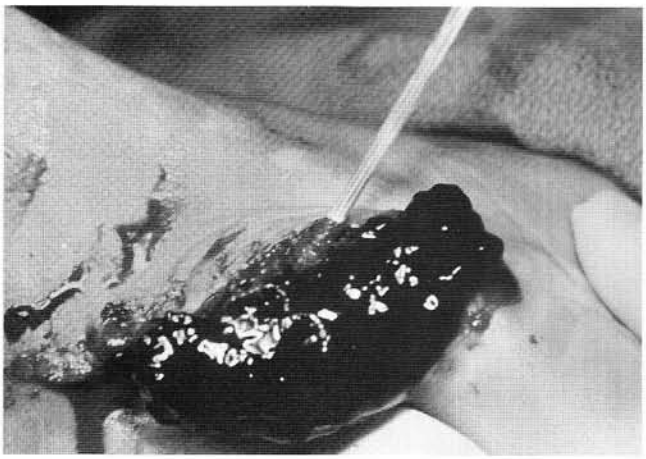

Figure 3. Drainage of the hematoma following release of sutures.

DRAIN USAGE IN PODIATRIC SURGERY

The TLS drain in both #10 French and #7 French catheter sizes has many uses in podiatric surgical procedures. Its invention was inspired by the authors' dissatisfaction with the complications after open heel spur resection: wound break-down secondary to hematoma formation. The drain has been used extensively in rearfoot and ankle surgery, as for example in over 1500 cases of triple arthrodesis performed at Doctor's Hospital and Northlake Regional Medical Center (Fig. 4). With the development of Charcot reconstruction in the mid-1980s, the drain was also widely used, especially in midfoot and medial column arthrodeses.

Figure 4. Collection of TLS tubes and an example of output following triple arthrodesis.

Forefoot indications for the use of the #7 French TLS drain include first interspace hematoma following hallux valgus surgery. In the anatomical dissection techniques postulated by Ruch et al., the first interspace is prone to iatrogenic interruption of plantar blood vessels. These hemorrhages may be secondary to severance of the abductor muscle or direct injury to the vessels which run in the floor of the first interspace. Gangrene following hematoma is an uncommon, but possible sequela that has been seen following first interspace dissection.

The authors strongly suggest surgical wound drainage and compression if oozing persists in the interspace following surgical dissection of the adductor hallucis tendon and fibular sesamoidal ligament. The routine use of local anesthetic with epinephrine and tourniquets often produces a false sense of confidence regarding potential hematoma. Tourniquets and epinephrine techniques are always followed by vasodilatation which can result in leakage and produce hematoma several hours after a surgical intervention. This may also be seen after dissection procedures for Morton's neuroma and plantar fibromatoses which frequently create large dead spaces (Fig. 5).

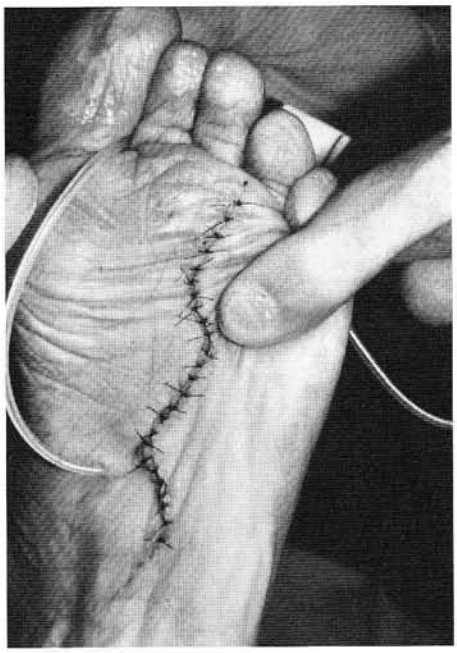

Figure 5. The use of the TLS drain system following plantar fibroma excision to fill the physiologic "dead space."

The author has also used the TLS drain extensively for postsurgical wound drainage after foot and ankle fracture repair, and other trauma surgeries, minimizing wound complications.

Calcaneal fractures, in particular, due to the vascular cancellous bone and friability of the calcaneus are strong indications for the use of the TLS drain. Recent advancements in both internal fixation (A.O. European Osteosynthesis) and rigid dynamic external fixation (Ilizarov) have not precluded the need for closed suction drainage.

CONCLUSION

It has been the authors' observation during the 20 years of experience using the TLS closed suction drainage system in foot and ankle surgery, that surgical complications have been minimized. The patients have benefitted from fewer healing delays, less scar tissue, and a lower infection rate, all leading to less pain and faster healing. This is also due in part to the gentle and anatomical handling of soft tissues. All of these factors reduce hematoma formation. In summary, the TLS drain has proven to be an effective tool, enhancing surgical outcomes.

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