



A venturi based suction drainage system used in facelifts

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SUMMARY. A method of drainage using the Venturi suction system has been used in 3124 facelifts over an 18 year period. It has proven to be effective and safe and has reduced the degree of postoperative bruising and swelling in these patients. There have been no complications relating to the technique. © 2003 The British Association of Plastic Surgeons. Published by Elsevier Science Ltd. All rights reserved.

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Introduction

For the past 18 years a method of suction drainage using the Venturi principle has been employed following face-lift procedures.

A prospective trial using this system was instituted because of certain shortcomings found in the closed suction systems that had been used before.

These often blocked early either from blood clots or fat globules that are sucked into the holes of the suction tubing. The drains too were not reliable in cases of excessive amounts of bleeding.

Our system has been proved to be safe and effective and although it has been used mainly in facelifts and recently following flap surgery for pressure sores, it can be adapted for many other plastic surgical procedures.

The use of systems to drain wounds dates back to Hippocrates. Metal tubes, glass tubes, bone, gauze wicking and a combination of gauze and rubber were the original means of providing passive drainage that was assisted by gravity. Celsus in the 1st century AD popularized gravity assisted passive drainage of the peritoneal cavity. Capillary drainage by means of capillary attraction in small bore tubes was observed by Leonardo da Vinci, although the laws of hydrostatics explaining this phenomenon would only be elucidated three centuries later in 1805 by Thomas Young. In 1889 Heaten described air vent suction, or active drainage. This was a closed system with some form of suction attached to it.¹

Today, both passive (open), as well as active (closed), types of drainage are used albeit with very much more advanced equipment. The principles of this drainage has not changed remarkably.

Our technique introduces a concept that combines both an open and close drainage system.

Materials and methods

The Venturi effect in our system pertains to a drop in pressure within the tube created by an increased velocity of airflow. This can be explained as a dynamic consequence of Bernoulli's equation.²

Bernoulli showed that there is a conservation of energy between two points in a tube (when fluid flows through the tube) irrespective of the diameter at those two points. If there is constant flow within the tube and its diameter decreases, the velocity of the flow will increase. In order to conserve energy between the two points, the pressure must drop within the tube (Figure 1). The pressure y_2 is less than y_1 .

The dynamic consequences of Bernoulli's equation relates to our technique in the following manner (Fig. 2):

- Gas flow from the atmosphere (point 1) through the drain (point 2), is induced by a negative pressure at point 3 (wall suction).

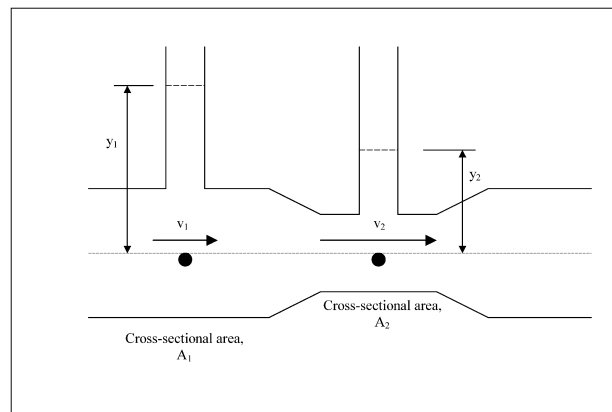


Figure 1—Diagrammatic representation of the Bernoulli equation as it relates to the Venturi suction drainage system.

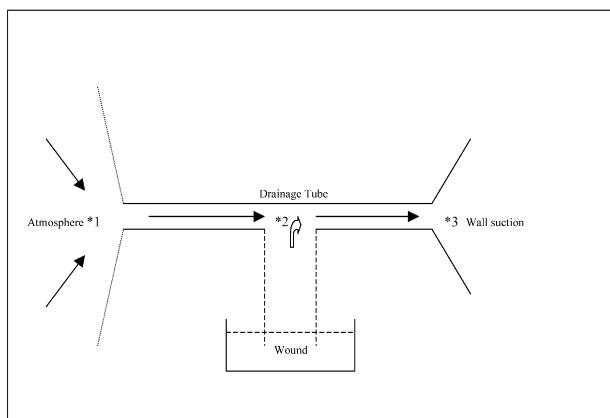


Figure 2—Diagrammatic representation of our drainage system.

- The cross sectional area of the drainage tubing at point 2 relative to point 1 is markedly smaller and thus the velocity of airflow at point 2 is greater than at point 1.
- The effect of this is a drop in pressure in the tube at point 2 and this creates the suction effect which draws fluid from the wound into the tube creating a very effective drain.

Technique applied in face lift procedures

After inserting the key skin sutures following a face lift, an 1/8 in. porta vac suction drain passes through the skin in the lower neck region in the normal manner (Fig. 3). The drain tube then runs subcutaneously and

passes out through the wound in the region of the temple. The neck end of the tube is then connected to continuous wall suction.

Post operatively the system is flushed with sterile saline introduced through the exposed temple portion. 5cc are injected at a time at 1/2–1 hourly intervals. This prevents blocking of the tube by blood clots. As no dressings are used the cheeks and neck can be gently squeezed during the time of flushing. This aids in evacuating any residual blood or serum beneath the skin flaps. It must be noted that the saline solution remains within the tubing and does not extravasate into the wound. Its function is to remove impending blood clots. There is also no pain or discomfort experience during the flushing procedure.

If swelling is noticed in the cheek or neck region which is evidence of a haematoma, the amount of flushing and pressure on the cheeks is increased allowing evacuation of the blood.

After 4 h, flushing is discontinued and the tubes in most cases remain patent for 24 h after the operation when it is removed. This is done by cutting the emerging neck tubing with a sterile scissors and pulling the tube out from the temple end.

Results

This form of drain has been used by two authors for the last 18 years. It has been employed in 3124 facelifts, that is 6248 drains were used.

Post-operative haematomas arose in 38 sides (0.61%). All of these could be milked out through the drain in

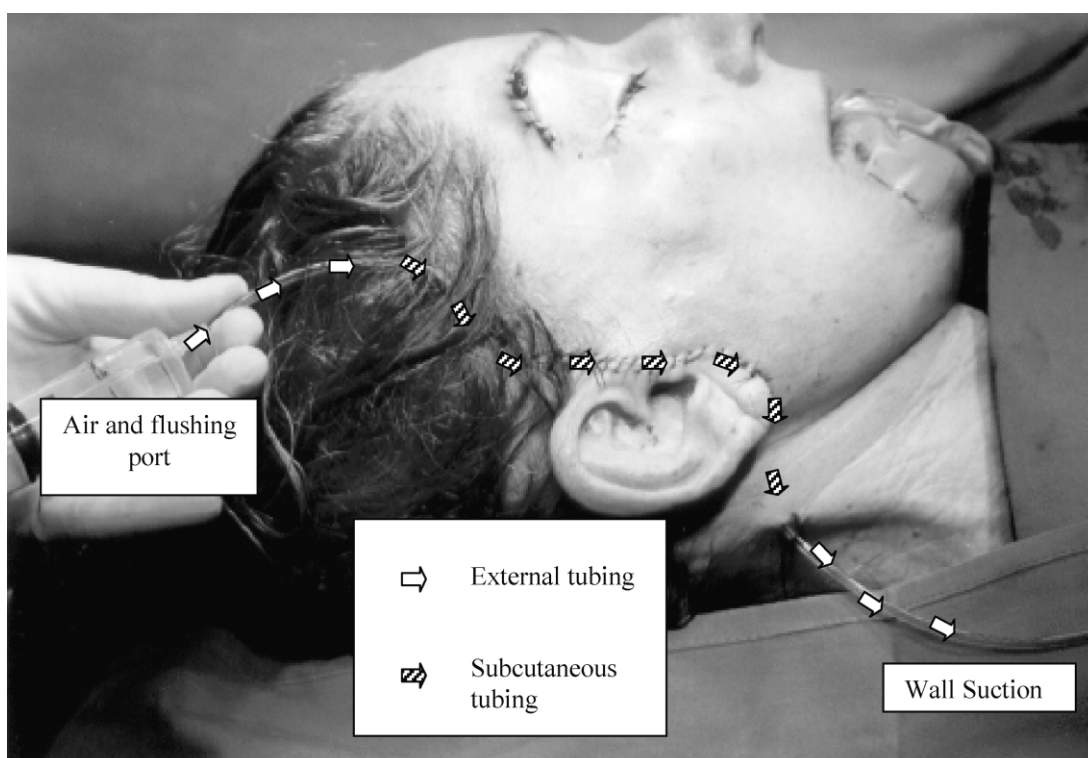


Figure 3—Tubing in place at the end of a facelift operation. Five cc of sterile saline is injected into tube at the temple end at 1/2–1 hourly intervals.

the first 24 h, with no patients requiring exploration in the operating theatre.

A total of 49 (0.78%) patients developed some post-operative wound infection, these were all suture related. There were no major infections.

Following removal of the drainage systems, swabs for bacterial culture were taken from residual fluid found in the tubing. This was carried out randomly in 20 patients. In 77% of the patients no bacterial growth was found and in 23% of patients, a scanty growth of gram negative bacteria were isolated. No pathogenic bacteria were found.

Discussion

The advantage of this technique is that it is very simple. It is proven to be so effective that the amount of bruising seen after a facelift procedure has been reduced radically. This could be attributed to the efficiency of the system which removes almost all accumulated blood. By leaving the face unbandaged, one can detect evidence of early haematoma formation and because of the continued patency of the suction tubing the excessive blood can be milked out by gently squeezing the cheeks and neck. This has an advantage over closed suction systems where tubing frequently becomes blocked from blood clots or fat globules.

The postulated drawback of introducing an infection into the wound by leaving one end out when irrigating has not materialized. Even the residual fluid found in the tube itself has failed to show significant bacterial growth in the specimens tested.

For the last three years the Venturi Suction Technique has been employed after flap repair in pressure sores. In these cases a 1/4 in. porta vac suction drain is left in place with one end connected to the wall suction and the other end left exposed through the skin in which sterile saline has been injected. In these cases the drainage

system is left in place for 3 to 4 days and flushing is carried out for 48–72 h.

In this series there were 32 ischial, 6 sacral and 5 trochanteric ulcers. There has been no haematoma or infection in these patients following its use.

Conclusion

A wound drainage system based on the Venturi principle has reduced the incidence of blockage of the tubing by blood clots or fat globules. It has been found to be extremely effective, minimizing post-operative bruising and allowing any accumulation of blood to be expressed. No patients have required exploration for haematomas following the operations in this series. The possibility of the introduction of infection using this system has been excluded.

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