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Suction dressings in total knee arthroplasty – an alternative to deep suction drainage

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A new technique is described for dressing of surgical wounds in total knee arthroplasty that is a combination of a semi-permeable dressing and suction drainage. This technique has been used in 100 consecutive cases and drainage was collected in 92. The average volume was 198 ml (range 30 to 850 ml). There was no superficial or deep sepsis. Haematoma formation causing moderate soft tissue tension and some patient discomfort was noted in 9 knees. This form of postoperative wound management retains the nursing and hygiene advantages of deep suction drainage, whilst avoiding the patient discomfort and potential complication possibilities associated with deep internal drainage.

INTRODUCTION

Suction drainage is a well-established procedure for removing excessive blood from a surgical wound (*1, 10, 19*). It has the theoretical potential of preventing wound infection by removing large volumes of fluid low in opsonins (*1*), but it has the disadvantage of being invasive and can be a cause of infection if retrograde migration of bacteria occurs along the suction tubes (*13, 18, 22*). Suction drainage has been associated with a greater blood loss, higher incidence of wound problems, it can be painful, and drains sometimes break on removal (*15, 20*). The use of drains has been questioned after surgery for fractured neck of femur and total hip or total knee replacement (*2, 3, 16, 17, 21*). On the other hand, experience has shown that in the absence of suction drains, dressings become blood-soaked, often soiling bedclothes and the patient's night wear. Blood-soaked dressings are not only unsightly but also make difficult the estimation of blood loss.

An attractive alternative to deep suction drainage is an airtight semi-permeable film dressing incorporating a suction tube, which removes and collects all blood and exudate from the surface of the wound. This appears to be both hygienic and comfortable to the patient, convenient from the nursing point of view and useful to the clinician in estimating blood loss in the postoperative period.

This paper describes the fabrication of the so-called "suction dressing" and its use in patients undergoing total knee arthroplasty.

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MATERIALS AND METHODS

Eighty-two consecutive patients undergoing a primary total knee replacement were prospectively evaluated. A total of 100 arthroplasties (11 bilateral, non-simultaneous and 7 bilateral, simultaneous) were included in the study, all performed by the senior author (A.E.S.). Primary diagnoses included osteoarthritis in 59 patients, 11 bilateral), rheumatoid and other inflammatory arthropathies in 17 patients (7 bilateral) and 6 post-trauma. There were 52 female and 30 male patients with an average age at operation of 65.6 years (range 29-85 years). There were 52 right knees. The Insall-Burstein II posterior stabilised prosthesis (Zimmer, Warsaw, Indiana) was used in 97 cases and the Rotaglide posterior stabilised prosthesis (Corin Medical, Cirencester, UK) in 3 cases. All operations were performed under general anaesthesia and without the use of a tourniquet. DVT prophylaxis was with mechanical methods only. The knee was exposed through a midline incision, components were cemented in all cases, and the patella was routinely resurfaced. All wounds were closed in layers using continuous absorbent polylactate sutures and continuous 3/0 subcuticular polylactate (Vicryl) sutures to the skin. "Suction dressings" were fabricated at the end of the operative procedure.

Fabrication of the "suction dressing"

The wound is covered with Mepore Adhesive Surgical Dressing (Mölnlycke) with the knee in 30° of flexion. Mepore has an absorbent wound pad located centrally on a piece of apertured polyester fabric coated with a layer of an acrylic adhesive. A 20 by 30 cm Tegaderm Film Dressing (3M), is laid adhesive side up and the adhesive surface is exposed. Tegaderm consists of a thin polyurethane membrane coated with a layer of an acrylic adhesive. The dressing is permeable to both water vapour and oxygen, but impermeable to micro-organisms. A 3.2 mm Portovac tube is doubled over and laid down the centre of the Tegaderm dressing so that the perforated region of the tube lies within the confines of the Tegaderm dressing (fig 1). The adhesive surface on a second 15 by 20 cm Tegaderm film dressing is exposed. The two adhesive dressings are now presented to each other, and stuck together over 5 centimeters, thus sealing the Portovac tubes. The remaining 10 centimeters of the second Tegaderm dressing is folded back on itself (fig 2). The backing card makes the dressing easy to handle. The whole dressing is then applied over the Mepore dressing, ensuring that the central "window" area is stuck down before the periphery (fig 3). Finally the backing is removed from the periphery completing the "suction dressing".

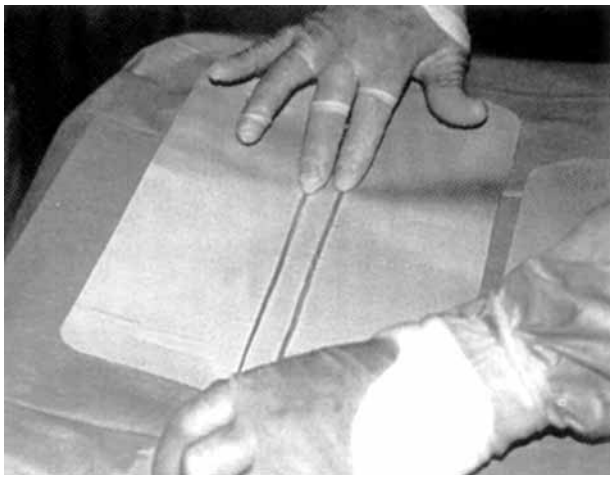

Fig. 1. — Drainage tube stuck to adhesive undersurface of Tegaderm dressing.

Fig. 2. — The two Tegaderm dressings stuck over 5 cm and sealing the drainage tubes.

The arrangement of the Tegaderm film dressing, the suction drainage tube and the Mepore dressing thus constitutes an airtight composite.

Suction was applied to the suction tube to test the dressing for air-tightness. Wall suction with a sterile collection bottle was applied to the tube of the dressing at a negative pressure of approximately 400 mm of mercury, and continuous suction was applied for approximately twelve hours. Thereafter the drainage tubes were

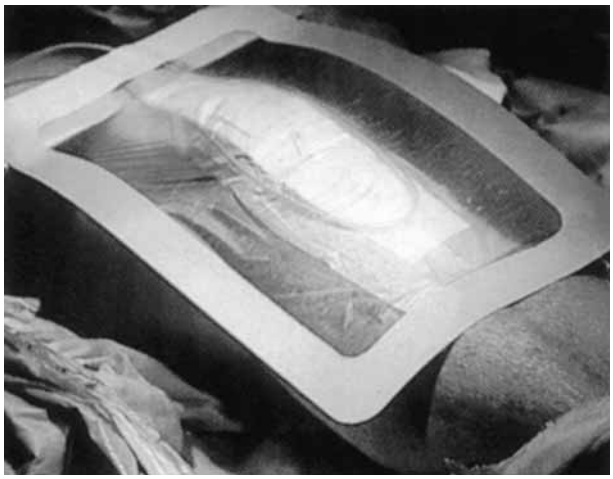

Fig. 3. — Tegaderm dressing with drainage tubes placed over Mepore Dressing, with knee in 30º of flexion.

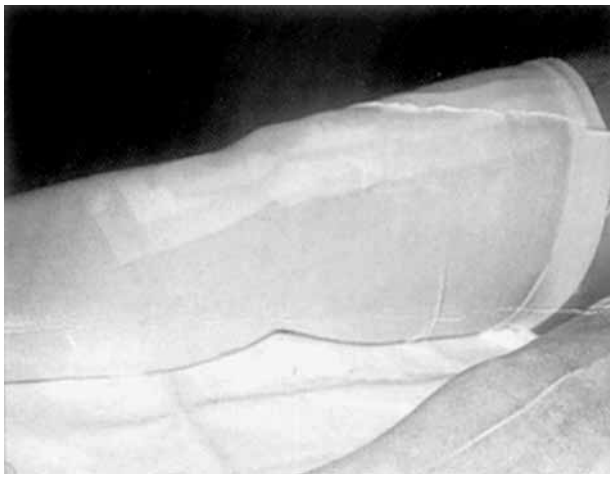

Fig. 4. — Elastic anti-thromboembolism stockings applied over suction dressing. No bulky dressings and bandages.

connected to Portovac vacuum bottles until no suction dredge occurred (fig 4). The suction dressing was regularly checked for air-tightness and if leakage was detected, an additional semi-permeable film dressing was applied. Continuous passive motion was initiated immediately in the recovery room.

When the dressing was yielding no more blood into the collection bottle, but not later than 48 hours postoperatively, the suction was discontinued and the suction tubes were cut off at their exit from the dressing. The open ends of the tubes were covered with another semi-permeable film dressing. The total drainage from the suction dressing was recorded.

The dressing was left for a total of 3 days or until it became uncomfortable due to the stiffness of the dried blood in the soft cloth fabric, when it was changed to a simple adhesive dressing. Patients were allowed out of bed on the second post-operative day, and could mobilise and exercise as comfortable under the supervision of a physiotherapist. The dressing was changed and the wound was carefully inspected on the third post-operative day and any problems of healing were recorded. Wounds were examined again at subsequent outpatient appointments for any signs of dehiscence or sepsis. All patients were reviewed at three months and one year after surgery.

RESULTS

Drainage was collected in 92 knees. The average volume was 198 ml (range 30 to 850 ml). In 8 knees no drainage was collected. In 28 knees the suction in the dressing was maintained for 24 hours. In 72 knees it was continued for 48 hours.

There was no superficial or deep sepsis. Minor separation of the edges of the wound at 3 days post-operation was observed in 5 knees. Contusion or swelling causing moderate soft tissue tension and some patient discomfort was noted in 9 knees. Minor prolonged oozing of serum occurred in one patient who was seen by his family doctor after discharge from hospital, given antibiotics and his wound healed primarily. Two patients developed minor blisters. Knees with no or only small amounts of drainage did not show higher incidence of wound complications. There was one major wound separation requiring resuturing in a patient who developed a haematoma, despite 500 ml of drainage.

DISCUSSION

Despite widespread routine use in orthopaedic surgery, suction drainage remains controversial as the associated risks and benefits are not well defined. In a prospective study of 489 clean hip and knee operations, Sorensen and Sorensen (*18*) detected bacterial growth in the drain tip of 56 patients, and 5 of them subsequently developed an infection. In 1988, Willett *et al* (*21*) studied the efficacy of suction drainage in total hip replacements. Deep

suction drains left after 24 hours apparently did not reduce the likelihood of haematoma formation and led in some cases to the spread of skin organisms into the wound. Zamora Navas *et al* (*22*) prospectively studied the use of closed suction drainage in knee arthroplasty, regarding the bleeding volume and the incidence of bacterial contamination in relation with the time that the drain was left in place. They found that drains left for more than 12 hours increased the risk of bacterial contamination of the subcutaneus portion of the drain and that approximately 90% of the total bleeding volume was collected in the first 12 hours after surgery. Reilly *et al* (*16*) in a retrospective review of total knee replacements with and without suction drains found a higher incidence of wound problems in the group with drains. In a prospective randomised study Widman *et al* (*20*) used erythrocyte scintigraphy to evaluate whether drainage reduced the hematoma volume after total hip arthroplasty and found that drainage did not reduce it, but increased the need for blood transfusion**.** Besides the danger of acting as a scaffold for infection, suction drains can be trapped within the wound and may break off, leaving behind a section of the drainage tube (*4, 15*).

In a prospective randomised trial, Beer *et al* (*2*) analysed fifty patients who underwent bilateral simultaneous total hip or total knee replacements with a suction drain placed on only one side. There was no difference between the two sides with regard to wound drainage and circumferential limb swelling. In patients who had total knee replacements, return of active function of the quadriceps and range of motion were also not influenced by the use of drains. In the largest relevant study, Ritter *et al* (*17*) prospectively randomised 275 consecutive total knee and 140 total hip replacements for either suction drainage or no post-operative drainage. They found no differences with respect to the amount of transfused blood, haemoglobin levels and daily range of motion during the first seven post-operative days. Niskanen *et al* (*12*) prospectively, randomized 58 patients with primary hip and 39 patients with primary knee arthroplasty into groups with postoperative closed-suction drainage and without drainage. They found no difference in wound healing, postoperative blood transfusions complications, or range of motion. In a prospective, randomised study of 104 hip arthroplasties Gonzalez Della Valle *et al* (*6*), found that closed suction dressing is of no benefit in primary, uncomplicated THA and that the course of healing of wounds was more uneventful in patients without drains. Esler *et al* (*5*) prospectively randomised 100 patients undergoing total knee replacement into groups with a closed-suction drain and without a drain. They found the total blood loss to be significantly greater in those with a drain and found no difference in the postoperative swelling or pain score, or in the incidence of pyrexia, ecchymosis and infection. Mengal *et al* (*11*) in a prospective, randomised study of 152 hip and 104 knee replacements, found no significant difference between drained and non-drained arthroplasties regarding swelling, recovery of motion, wound healing and other local or systemic complications. Blood loss was not significantly different in the non-drained hip arthroplasties compared to the drained ones. On the contrary, total blood loss and transfusion requirements were significantly greater in patients with knee replacements that were not drained compared to the drained patients. Kim *et al* (*8*) in a prospective study of 48 patients (96 hips) with primary simultaneous bilateral total hip arthroplasty used a suction drain unilaterally. They found significant increased incidence of wound drainage, soaked dressings requiring reinforcements, ecchymosis, and erythema about the wound in the group without drainage. In a similar study of 69 patients (138 knees) with primary simultaneous bilateral total knee arthroplasty Kim *et al* (*7*) used a suction drain unilaterally. They found that the knees with no drains had a higher incidence of drainage from the wound, had soaked dressings requiring dressing reinforcements, and had more ecchymosis and erythema around the wound. However, the final results regarding quadriceps strength range of motion, and wound complications were not affected significantly by nonuse of closed suction drainage. The incidence of infection in the two groups was not statistically different but the authors suggest that suction drainage may reduce deep infection. Parker *et al* (*14*) recently published a

meta-analysis of 18 randomized studies that included patients submitted to elective hip and knee arthroplasty and compared those managed with closed-suction drainage with those managed without a drain. These studies involved in total 3495 patients with 3689 wounds. They concluded that closed suction drainage increased the transfusion requirements after elective hip and knee arthroplasty and that the only benefit of drain use was the reduced need for a dressing change due to the reduced amount of blood leaking through the wound. They also suggested that additional studies are needed, before definite conclusions regarding the influence of drain use on wound infection, could be made.

The use of intermittent suction drainage appears as an attractive compromise between the use of conventional drains and no drainage at all (*9*). Clamping the drains and unclamping them for a brief period of time every couple of hours could reduce external blood loss by inducing haemostasis due to a temporary tamponade effect. The superiority of this technique compared to non-drainage, regarding local complications such as haematoma or haemarthrosis formation, remains to be proved.

The advantages of the suction dressing are obvious. Because of the lack of internal suction, unnecessary bleeding is avoided. The fabric element in the dressing collects the blood or exudate from the surface of the wound by capillary action. The suction drain removes the fluid from the dressing and collects it in the suction apparatus for measurement. The wound is kept dry and hygienic by the semi-permeable layer of the dressing preventing contamination from external sources. The adhesive nature of the barrier element obviates the need for circumferential dressings or bandages. Blood exuding from the wound into the dressing is aseptically aspirated into the collection bottle and in cases of excessive drainage, may give an indication for transfusion. Furthermore, the small bulk of the "suction dressing" allows the immediate application of anti-embolism stockings over it in the operating room. Once the aspiration of blood from the wound has ceased, the suction tube need not be removed from the dressing but can simply be cut off and the open ends sealed by applying a small adhesive dressing. This obviates the need for an early change of dressing. Finally, the use of this technique avoids the presence of foreign material in the wound and thus decreases the possibility of reverse contamination. The "suction dressing" technique has become standard post-operative practice in large orthopaedic wounds at the Droitwich Knee Clinic.

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