Closed suction drainage after hip arthroplasty

Prospective study of bacterial contamination in 81 cases

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In a prospective study we analyzed the volume of drainage, the contamination of the drain track, and drain tip in 81 primary total hip arthroplasties in 78 patients. The drain was removed when the drainage from midnight to the following morning was 20 mL or less. The drainage in the first 12 h and in total was reduced in cases with a drain period of 24 h, compared to cases with a drain period of 48 and 72 h. 4 cases had a positive culture from the wound before closure. 5 cases had a positive culture from the tip of the drain, and 6 from the drain track. The most frequently isolated microorganism was coagulase-negative *Staphylococcus*. The positive cultures from the drain track and tip were not correlated to the duration of drainage. 68 drains were removed within 48 h with no risk of developing wound complications.

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Submitted 92-07-20. Accepted 92-12-19

Deep closed suction drainage (CSD) in total hip arthroplasty (THA) has been questioned during recent years. Beer et al. (1991) and Hadden and McFarlane (1990) found no advantage in the routine use of suction drains in uncomplicated THA as regards wound problems.

We have used CSD as a routine, and have in a prospective study evaluated a regime, where the drain was removed, when the volume of drainage was less than 20 mL during the last 12 h from midnight, to find a safe and short drainage period. The purpose was to analyze the volume of drainage as a function of time, and the influence of the duration of drainage on the bacterial contamination of the drain track and drain tip, and the frequency of complications following closed suction drainage in primary total hip arthroplasty.

Patients and methods

From October 1, 1990 to March 31, 1991, a total of 92 THAs were performed in our department. 9 revision cases were not included and 2 patients where the drain was accidently pulled out were excluded. Hence, 81 primary THAs in 78 patients were included in the study. The median age was 67 (47–83) years. 76 prostheses were cemented (Richards, ITH) using Palacos cement without antibiotics, and in 5 cases uncemented implants were used (Howmedica, PCA). 75 cases were operated on due to primary arthrosis, 3 due to rheumatoid arthritis, 2 congenital hip dislocation, and 1 due to necrosis of the femoral head after a nonoperated femoral neck fracture.

The posterior approach was used in an operation room with a horizontal laminar air-flow system. Spinal and general anesthesia were performed in 58 and 23 cases, respectively. Prophylactic antibiotics were administered to all patients: Kloxacillin (Ekvacillin), 2 g was given intravenously on induction of anesthesia followed by 1 g 6 and 12 h, postoperatively. Flucloxacillin (Heracillin), 500 mg was given orally 3 times a day on the following days after surgery and until the drain track was dry. Standard heparin 5000 iu was given twice a day, subcutaneously.

On the night before surgery the patient was washed with chlorhexidin (Hibiscrub), and at operation the skin around the hip and thigh was prepared by iodine. The operative area was covered with an antimicrobial film (Iodophor). The operating team wore double gloves, and an overall impermeable to bacteria. The median duration of the operation was 75 (55–120) min, and the median blood loss was 625 mL and 500 mL for spinal and general anesthesia, respectively.

The drain was brought out through a separate wound stab, and connected to a closed suction drainage system (Handy-vac). Before closure of the wound a culture sample was taken along the drain. The drain was removed by the authors under sterile conditions, when the volume of drainage was less than 20 mL during the last 12 h from midnight. At removal, the tip of the drain was cut off approximately 2 cm from the end, and placed in Stuart's medium. A sample from the drain track was taken. The median duration of the drain period was 1.8 (1–4) days.

Table 1. Drainage (mL) in the first 12 hours postoperatively and in total, after 81 hip arthroplasties

Period (hours)	n	Drainage[a]	
		0–12 h	total
24	33	215 (150–250)	215 (170–255)
48	35	300 (250–400)	425 (350–570)
72	10	355 (250–480)	540 (425–650)
96	3	360[b]	830[b]

[a] In parentheses, 95 percent confidence limits of the median. [b]The number of patients was too small to justify calculation of confidence limits.

Samples from wounds and drain tracks were spread on 10 percent aerobic and anerobic blood agar plates, and were incubated at 37 °C aerobically and anerobically. The drain tips were inoculated in 0.3 percent natrium-thiogluconate and were examined after 24 and 48 h. In case of positive culture a sample was spread on agar plates, as described. The agar plates were examined after 24 and 48 h by our microbiology consultant. The isolated microorganisms were identified by routine methods. In case of phagetyping, the identification was performed at the National Serum Institute, Copenhagen.

Wound healing was evaluated with special reference to the formation of subcutaneous hematoma and infection, which were assessed clinically before discharge, usually on the 12th day postoperatively. The criteria for infection were purulent matter in the wound, or signs of infection including positive culture.

Statistics

For unpaired variates, the Mann-Whitney rank sum test was used, and the Spearman test for correlation analysis. The Kruskal-Wallis test was used as a one-way analysis of variance by ranks. $P < 0.05$ was considered as significant.

The study was approved by the Regional Ethics Committee.

Results

68 drains were removed within the first 48 h (Table 1). The drainage in the first 12 h and as a total were reduced in cases with a drain period of 24 h, compared to cases with a drain period of 48 and 72 h (Table 1). The peroperative blood loss and the duration of the operation had no influence on the drainage in the first 12 h.

79 patients received prophylactic antibiotics for a median of 4 days. 2 patients had drainage from their drain track at discharge, and for this reason they received antibiotics for 12 and 14 days, respectively; they developed neither a superficial nor a deep infection. Positive cultures were obtained from the wound before closure in 4 out of 81 operations (Table 2). 5 cases had a positive culture from the tip of the drain, and 6 from the drain track. The most frequently isolated microorganism was a species of the coagulase-negative *Staphylococcus*. None of the isolated *Staphylococcus* had identical phagetyping. The positive cultures from the wound were not correlated to the duration of the operation. The positive cultures from the drain track and tip were not correlated to the duration of the drain period.

Table 2. Details of positive cultures in 13 patients

Case	Days of drain	Wound	Drain tip	Drain track
1	3	*Streptococcus faecalis*	*Streptococcus faecalis*	–
2	2	*Enterobacter cloacae*	–	–
3	2	CN *staphylococcus*	–	–
4	1	CN *staphylococcus*	–	–
5	1	–	CN *staphylococcus*	–
6	1	–	CN *staphylococcus*	–
7	1	–	*Streptococcus faecalis*	*Streptococcus faecalis*
8	1	–	α-haemolytic *Streptococcus*	–
9	2	–	–	CN *staphylococcus*
10	3	–	–	*Bacillus* species
11	1	–	–	CN *staphylococcus*
12	2	–	–	CN *staphylococcus*
13	3	–	–	*Streptococcus faecalis*

CN Coagulase-negative.

None of the patients developed superficial infections, and no deep infections were observed during the first year. Subcutaneous hematoma developed in 2 cases, who had a drain period of 1 and 4 days and a total drainage of 290 and 430 mL, respectively. They did not require additional surgery, and the stay in hospital was not prolonged.

Discussion

Experimental and clinical studies have shown that CSD reduces the retrograde migration of bacteria along the drain tract and the frequency of infection, compared to simple conduit drains (Cruse and Foord 1973, Raves et al. 1984). Jepsen et al. (1969) and Lidwell (1961) believed that the use of a drain in a clean operation wound potentiates the rate of postoperative infections by providing a route for entry of bacteria into the wound. This has been supported in an experimental animal model, where Magee et al. (1976) found that the presence of drains damaged the host's defenses and dramatically enhanced the infection rate. Our material was too small to discuss the incidence of infections, as the rate was low.

The drainage following primary THA has only been investigated in few studies. Willett et al. (1988) found that 79 percent of the drainage occurred in the first 12 h, and that the mean loss was 372 mL. This is in accordance with our study, where the mean loss for all patients was 355 mL the first 12 h, and the total mean loss was 385 mL.

Few authors have investigated the contamination of the suction drain. Sørensen and Sørensen (1991) found in 489 cases of clean orthopedic operations that the risk of positive drain-tip cultures and infection of the wound increased when the drainage time was longer than 6 days. Other studies have pointed out a risk of contamination of the drain after 48 h (Willet et al. 1988, Willemen et al. 1991). Willet et al. (1988) found a risk of ingress of skin microorganisms into the wound, and concluded that the suction drain should be removed at the earliest time, and certainly before 24 h following THA. In our study there was no correlation between the period of drainage and the presence of microorganisms on the drain tip or the drain track. Explanations for this could be the short drain period, as 68 of the 81 drains were removed within 48 h, and prophylactic antibiotics were given until the drain track was dry.

The most frequently isolated microorganisms have been coagulase-negative staphylococci and *Staphylococcus aureus* (Lindgren et al. 1976, Willet et al. 1988, Sørensen and Sørensen 1991). We isolated coagulase-negative staphylococci in 7 cases, but no *Staphylococcus aureus*. The coagulase-negative staphylococci have been isolated from the majority of the cases suffering from deep hip joint sepsis (Lidwell et al. 1987, Berry et al. 1991). Bacteria may ascend along the drain during drainage. In particular, slime-producing strains of *Staphylococcus epidermidis* are able to colonize smooth surfaces, including the prosthesis and bone cement, thus protecting the bacteria against host defense and antimicrobial therapy (Christensen et al. 1982, Gristina and Costerton 1985, Oga et al. 1988, Kotilainen et al. 1991).

Hadden and McFarlane (1990) found no difference in their clinical outcome between the drained and the non-drained groups. Moreover, they found no evidence of ectopic bone formation in any patient. Cobb (1990) found that the drained cases had more complications in a randomized study after surgery for femoral neck fractures. Beer et al. (1991) showed that insertion of a drain did not influence the postoperative course or the rehabilitation of the patient, which also has been documented for uncomplicated total knee arthroplasty (Reilly et al. 1986).

Only 2 of our cases developed subcutaneous hematomas, and none of these had wound problems. This is in contrast to Magnussen et al. (1986), who found that 26 percent of the patients developed an ultrasound-detected subcutaneous hematoma following hip surgery; they found a relationship between poor wounds and subcutaneous hematoma.

Acknowledgements

We thank TJ Ravn, Department of Microbiology, Sønderborg County Hospital, for performing identification of microorganisms, and Statens Serum Institut, Copenhagen, for performing phagetyping.

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