Postoperative drainage of knee arthroplasty is not necessary

A randomized study of 90 patients

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We studied the management of postoperative drainage after total knee replacement (TKR). 90 primary total knee joint arthroplasties were prospectively randomized into 3 groups: a) no drain, b) an autotransfusion system, c) a standard disposable closed suction drainage system. We monitored hemoglobin and hematocrit values, drainage volume and transfusions (homologous and autologous), range of knee motion, knee swelling and hospital stay. Parameters were recorded preoperatively, days 0–8 and 4 months postoperatively. No significant differences were seen between the groups in any of the parameters measured. The results show no benefit from using postoperative drainage systems in knee arthroplasties. Savings of SEK 400 (USD 55) per patient would have resulted if drains had not been used at all.

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There is little to support the widespread use of drainage after joint arthroplasty. Several retrospective studies have suggested that wound drainage after joint replacement is not necessary (Reilly et al. 1986, Willett et al. 1988, Cobb 1990).

Recently, some prospective studies have addressed this issue in conjunction with the use of a blood retransfusion system in order to reduce the rate of postoperative homologous blood transfusions. Ritter et al. (1994) and Marks et al. (1995) found no need for drains, contrary to Simpson (1994) and Dalén et al. (1996).

In a prospective, randomized study, we assessed the need for drainage after total knee arthroplasty.

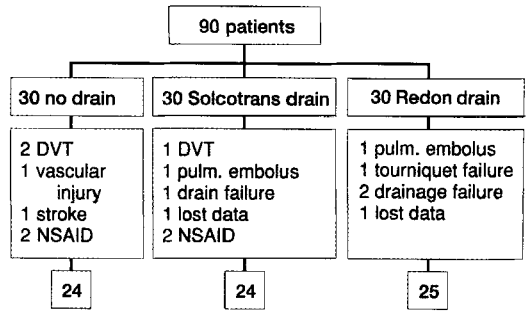
Patients and methods

The study group consisted of 90 patients (49 women) with a mean age of 72 (56–86) years, who underwent primary total knee arthroplasty because of arthrosis.

Patients who had systemic corticosteroid treatment, previous joint infection, previous adverse transfusion reactions and blood dyscrasia were excluded. Antiinflammatory drugs were withdrawn 14 days before and up to 1 month postoperatively. Patients fulfilling the inclusion criteria entered the study after giving their informed consent. The study was approved by the Ethics Committee at Uppsala University Hospital.

The patients were randomized into three groups (Figure): a) no drain, b) Solcotrans® (Solco Basle U.K. Ltd.) autotransfusion system, c) a standard disposable closed suction drainage system (Redon®). Randomization was carried out with sealed envelopes, opened just before closure of the wound. Prostheses used were Kinemax Plus (Howmedica®, Rutherford, NJ) in 21 cases, AGC (Biomet® Inc., Warsaw, IN) in 36 cases and Freeman-Samuelson (Protek® AG, Switzerland) in 33 cases.

The surgical exposure and technique, as well as the postoperative management, were identical in all patients and all knee components were fixed with Palacos® gentamicin bone cement. Epidural anesthesia was used in all cases. Postoperative analgesia was maintained by intermittent epidural infusion of bupivacain, supplemented with subcutaneous injections of



Randomization groups and reasons for drop-out.

morphine during the first postoperative days. 1 g cloxacillin was given intravenously at the beginning of the operation, and was repeated at 6 and 12 hours postoperatively. 40 mg enoxaparin was given s.c. each day during the hospital stay, beginning on the day of surgery.

The leg was raised, but not exsanguinated, before the tourniquet was inflated. The tourniquet was inflated (325–350 mmHg) before skin incision and was maintained throughout the operation. Only obviously bleeding vessels were electrocoagulated during the procedure. The tourniquet was deflated after application to the leg of an elastic compression dressing, which remained in place for 4 days. Continuous passive motion was started the first day following surgery and continued until the patient was fully mobilized.

All patients were followed according to a custom-made protocol. Measurements included hemoglobin concentration, hematocrit level, total drainage bleeding, blood transfusions, autologous blood reinfusions, range of knee motion, knee swelling and hospital stay. Knee swelling was measured as knee circumference 1 cm above the patella, with the knee in relaxed extension. Measurements were recorded preoperatively, daily on days 0–8 and at the 4-month follow-up.

In patients randomized to the autotransfusion group, instructions and specifications from the manufacturer were followed. Two drains were connected to the collection unit and placed under continuous suction at 20 cm H_2O. Acid citrate dextrose-anticoagulant (ACD-A) was not added to the collection unit. Blood collection continued for a maximum of 6 hours or until the unit was full. If more than 300 mL was collected, the drainage was reinfused to the patient. If less than 300 mL was collected, the drainage was not reinfused and collection continued with a standard closed suction drainage system. Patients in the non-retransfusable drain group had two standard drains inserted and connected to a closed suction system device. Drains in both groups were maintained for 24 hours postoperatively.

A decrease in the hemoglobin level of more than 30% from the preoperative value or a level of less than 90 g/L was the indication for postoperative transfusions.

Statistics

Analysis of variance (ANOVA) for repeated measurements, when appropriate, was used to analyze differences between treatment groups, regarding hemoglobin, hematocrit level and knee motion, knee swelling, hospital stay and duration of operation. Regarding the number of transfused blood units (300 mL), the Kruskall-Wallis test was used, because of an uneven distribution. Results were considered significant when $p < 0.05$.

Table 1. Hemoglobin (g/L) and hematocrit, EVF (%) values. Mean (95% confidence interval)

	No drain n 24	Autotransfusion drain n 24	Standard drain n 25
Hemoglobin			
preoperatively	142 (137–147)	138 (133–142)	143 (138–148)
postoperatively			
day 0	118 (112–123)	118 (114–123)	118 (113–122)
day 1	116 (111–122)	115 (110–119)	116 (112–119)
day 2	111 (105–117)	111 (106–117)	110 (105–116)
day 3	109 (104–115)	109 (103–115)	110 (105–114)
day 8	114 (109–118)	110 (105–115)	114 (110–119)
Hematocrit (EVF)			
preoperatively	41 (40–43)	40 (38–41)	41 (39–42)
postoperatively			
day 0	34 (32–36)	34 (33–36)	34 (32–35)
day 1	33 (32–35)	33 (32–34)	33 (32–34)
day 2	32 (30–34)	32 (30–34)	31 (30–33)
day 3	32 (30–33)	32 (30–33)	31 (30–32)
day 8	33 (32–34)	32 (30–33)	33 (31–34)

No differences between groups, hemoglobin p = 0.8, hematocrit p = 0.9

Results

Of the 90 knee arthroplasties included in the study, 73 remained for further analysis. Patients with deep vein thrombosis, drainage failure, lost study values and those who, by mistake, were given non-stereoidal antiinflammatory drugs (NSAID) were excluded. Reasons for drop-out did not differ between the groups (Figure).

The pre- and postoperative hemoglobin concentrations and hematocrit levels were similar in the three groups (Table 1).

25/73 patients received a total of 53 units of homologous blood, while 48 patients did not require transfusions (Table 2). The number of homologous transfused blood units did not differ between the groups (Table 2). 20 patients in the autotransfusion group were autotransfused an average of 424 (300–650) mL of drainage, without detectable adverse reactions. The

Table 2. Blood unit transfusions (300mL/unit). Number of patients

	Number of blood units				
	0	1	2	3	4
No drain	17	1	6	–	–
Autotransfusion	16	–	6	2	–
Standard drain	15	2	6	–	2

No differences between groups, p = 0.8

Table 3. Clinical and bleeding data. Mean (95% confidence interval)

	No drain n 24	Autotransfusion drain n 24	Standard drain n 25
Age	70 (67–74)	71 (69–74)	72 (69–75)
Men/women	11/13	4/20	9/16
Duration of operation, minutes	93 (87–98)	97 (91–104)	96 (90–101)
Hospital stay, days	11 (10–12)	11 (10–12)	12 (10–13)
Mean total drainage bleeding (mL)	–	881 (710–1051)	737 (565–909)
Mean volume of autotransfused blood (mL)	–	353 (274–432)	–

No differences between groups' hospital stay, p = 0.6

Table 4. Knee swelling (mm) and range of motion (degrees). Mean (95% confidence interval)

	No drain	Autotransfusion	Standard drain
Knee swelling			
preoperatively	449 (430–468)	447 (426–467)	429 (417–441)
day 8	491 (472–510)	475 (455–495)	463 (449–476)
4 months	453 (433–472)	448 (428–468)	435 (422–450)
Range of motion			
preoperatively	99 (91–106)	102 (97–107)	102 (49–61)
day 8	55 (50–60)	56 (51–62)	55 (49–61)
4 months	105 (100–109)	98 (93–103)	106 (100–112)

No differences between groups, p = 0.8 for range of motion, p = 0.2 for swelling.

mean transfused volume in the whole group was 353 mL (Table 3).

The range of motion and knee swelling preoperatively, on day 8 and at 4 months did not differ between the groups (Table 4). Furthermore, we found no dfifferences in hospital stay or duration of operation between the groups (Table 3).

Discussion

Waugh and Stinchfield (1961) advocated the use of suction drainage after orthopedic surgery to reduce hematoma formation and wound problems. Since then, some authors have recommended that closed drainage of an operative wound should be abandoned (Reilly et al. 1986, Cobb 1990, Beer et al. 1991, Ritter et al. 1994). The only prospective study to evaluate the use of common closed wound-drainage systems, as compared to no drains at all, was performed by Beer et al. (1991), who evaluated 38 patients with simultaneous bilateral total knee replacement. They found no advantage in using postoperative wound-drainage systems.

Several methods have been employed to lessen the need for homologous blood transfusions. Hypotensive anesthesia, autologous predonation (Woolson et al. 1987) and intraoperative autotransfusion using a cell-saver (Semkiw et al. 1989) have all proved effective in some degree. Marks et al. (1995) compared the advantage of the Solcotrans® auto-transfusion system with the Hemovac® disposable drainage system in a randomized controlled trial and found that the Solcotrans® system did not reduce the need for homologous blood transfusions. Ritter et al. (1994) prospectively randomized 415 total hip and knee joint replacements to either the Solcotrans autotransfusion system or no postoperative drainage. They found no difference in the amount of transfused blood or the preoperative and postoperative hemoglobin levels, and concluded that postoperative wound-drainage is not necessary in primary knee and hip replacements. Contrary to this, Simpson (1994) found, in a randomized prospective study involving 24 patients, that only 3/12 patients with the Solcotrans® autotransfusion system were in need of postoperative blood transfusion compared to 10/12 in the control group given standard suctions drains.

In our series, the use of an autotranfusion system did not reduce the need for homologous blood transfusions. Although 20 of 24 autotransfusion patients received a reinfusion of mean 0.4 L drainage blood, the need for homologous blood did not differ from the other groups. This accords with the results of Ritter et al. (1994) and Marks et al. (1995) but is contrary to other studies. Gannon et al. (1991), Simpson (1994) and Dalén et al. (1996) reported a reduction in homologous blood transfusions, when using an autotransfusionsystem.

The discrepancies between the series are difficult to explain. Gannon et al. (1991) released the tourniquet before wound closure, while Dalén et al. (1996) released it after, and Simpson (1994) does not mention

when he released the tourniquet. Some studies do not say whether the prostheses were cemented. Cementless arthroplasties are more prone to postoperative bleeding (Martin et al. 1992).

Release of the tourniquet prior to skin closure, to achieve wound hemostasis is widely used (Gannon et al. 1991, Marks et al. 1995) but may lead to a potential loss of reinfusable blood, and has been considered ineffective in limiting postoperative blood loss (Burkart et al. 1994). In this study, we released the tourniquet after wound closure and after application to the leg of an elastic compression dressing.

Non-drained knees may develop hematomas, leading to intraarticular fibrosis, and subsequently a decreased range of motion. Our study, as well as a retrospective study of Reilly et al. (1986), does not support this, we found no difference between the study groups with respect to range of motion at the time of discharge or at the 4-month follow-up.

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