No effect of drains on the postoperative hematoma volume in hip replacement surgery

A randomized study using scintigraphy

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ABSTRACT – In a prospective randomized study we used erythrocyte scintigraphy to evaluate whether drainage reduced the hematoma volume after total hip arthroplasty. 12 patients were left without drains and 10 patients had two drains inserted, one below the fascia and one subcutaneously. We used tomographic registration (SPECT) to calculate the volume of the hematoma (erythrocytes) about 22 hours after surgery and found that drainage did not reduce the volume, but increased the need for blood transfusion.

Several reports have shown that the use of drains in total hip replacement (THR) does not reduce infections and morbidity (Willet et al. 1988, Cobb 1990, Beer et al. 1991, Acus et al. 1992, Murphy and Scott 1993, Ritter et al. 1994).

Others, using ultrasound after total hip replacement, have reported an inverse correlation between the size of the hematoma and the number of drains (Parrini et al. 1988). In an ultrasound assessment of wounds after hip surgery for proximal femur fractures, the collection of wound fluids varied from 0.9 mL on day 1 after surgery to 21 mL on day 10 (Varely et al. 1994). These volumes are much smaller than to a reported theoretical calculation of residual blood loss of 600–640 mL after hip surgery (Murphy and Scott 1993). To study the effect of drains further on the size and formation of hematomas after hip replacement surgery, we did a study using a nuclear medicine technique. The main aim was to determine whether the size of the hematoma differed between patients with or without postoperative drainage.

Patients and methods

Patients and study design

We studied 22 patients undergoing primary THR for osteoarthrosis. They were randomly allocated to one of two groups: no drains inserted or one drain inserted below the fascia and another subcutaneously. The group without drains consisted of 8 women and 4 men, mean age 69 (49–88) years. In the group with drains, 5 were women and 5 men, mean age 73 (56–84) years. The local ethics and radiation protection committees approved the study. All patients gave their informed consent.

The same surgeon (JW) operated on all patients. A cemented Charnley prosthesis was always inserted. The operations were done in the lateral position, using a modified Hardinge approach. Closed low-vacuum suction drains, Ch 14 (Bellovac), were used. Perioperative care was the same in all patients. 5000 IU of dalteparin was given sc daily, starting the day before surgery. A single dose of 2 g cloxacillin was given iv preoperatively. No patient was treated with NSAID, ASA or drugs affecting hemostasis.

The swabs were weighed and the contents of the suction bottles measured to monitor blood loss during surgery. A blood transfusion was given if the patient developed unstable vital signs or when the hemoglobin concentration was lower than 80 g/

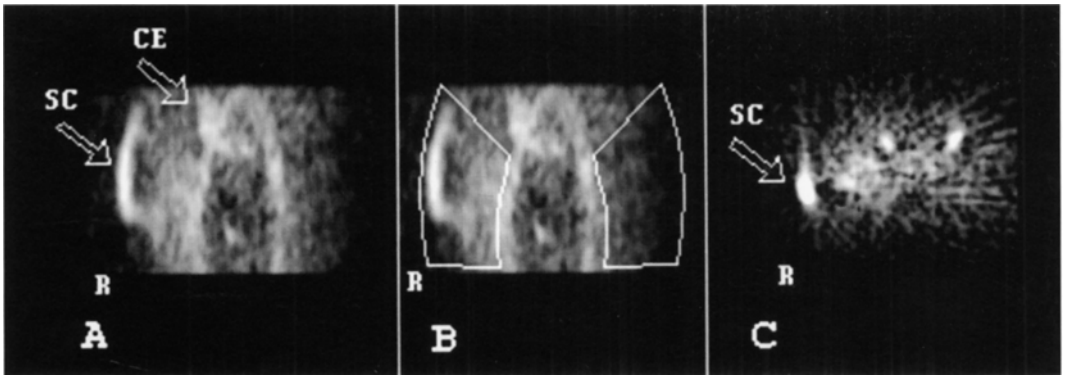

Figure 1. SPECT examination with erythrocyte scintigraphy in a 58-year-old woman 22 hours after right hip replacement without insertion of drains. (A) Added coronal sections showing activity distribution. Cecal activity (CE) and subcutaneous (superficial) activity in a part of the hematoma (SC) are indicated. (B) Same image as (A), but showing the two identical mirrored ROIs used to calculate the relative hematoma volumes (N_h and N_o, respectively). (C) One transverse section showing the subcutaneous (superficial) activity part of the hematoma (SC). In this patient, the superficial part of the hematoma was 42.5%.

L. 24 hours after surgery, the drains were removed and the postoperative blood loss was considered equal to the amount of blood drained.

Red blood cell labeling and scintigraphic examination

The patients' erythrocytes were labeled in the operating room (Callahan et al. 1982). At the end of surgery, they were given about 20 µg of stannous chloride per 10 kg body weight iv from a DTPA-labeling vial dissolved in physiological saline (TechneScan DTPA, Mallinckrodt Medical B.V., Petten, The Netherlands). 20–30 min later, 6 mL venous blood was drawn into a syringe containing 600 MBq of pertechnetate mixed with CPD solution. After 10 min of gentle agitation, the mixture was reinjected at the time of wound closure.

The relative postoperative hematoma volume was assessed about 22 hours after surgery. A tomographic gamma camera examination (SPECT) both thighs was made, using a dual-head large field-of-view gamma camera (Biad XLT, Trionix Inc., Twinsburg, OH, USA). It was equipped with low-energy high-resolution parallel hole collimators operating on a 128 × 128 matrix. Data, acquired during 30 min at 90 steps over 360° with the patient supine, were corrected on-line as regards energy, linearity and uniformity. The 2D-projections were prefiltered with a 2D Hamming filter (cut-off frequency 1.40 cycles/cm). Consecutive non-overlapping transverse and coronal sections, with a nominal width of 5.3 mm, were constructed, using a ramp filter and filtered back-projection. Correction was made for attenuation (Chang 1978), but not for photon scattering.

Evaluation

All coronal (frontal) sections showing patient activity were added into one image, used for numerical evaluation. Apart from activity in the urinary bladder and cecum, the image was considered to represent the distribution of labeled erythrocytes. In addition to the large vessels and weak visualization of the soft tissues, radioactivity of the hematoma with varying configuration and intensity from patient to patient was always seen. A Region-of-Interest (ROI) enclosing the hematoma with a small margin was manually drawn, and the total number of recorded events (N_h) calculated (Figure 1). The background events (N_o) were determined by positioning an identical, but flipped (mirrored) ROI at the corresponding location on the contralateral, unoperated side. In most patients, the ROI was placed laterally to the iliac and femoral arteries and veins. No pathological changes were seen in the contralateral hip or thigh. The relative hematoma volume, V, related to the blood volume of the contralateral side, was assessed by the ratio: $V=100\ (N_h-N_o)/N_o\ \%$.

In all operated thighs, we found a lateral region of increased activity. In the transverse sections, it appeared as a superficial, thin, more or less

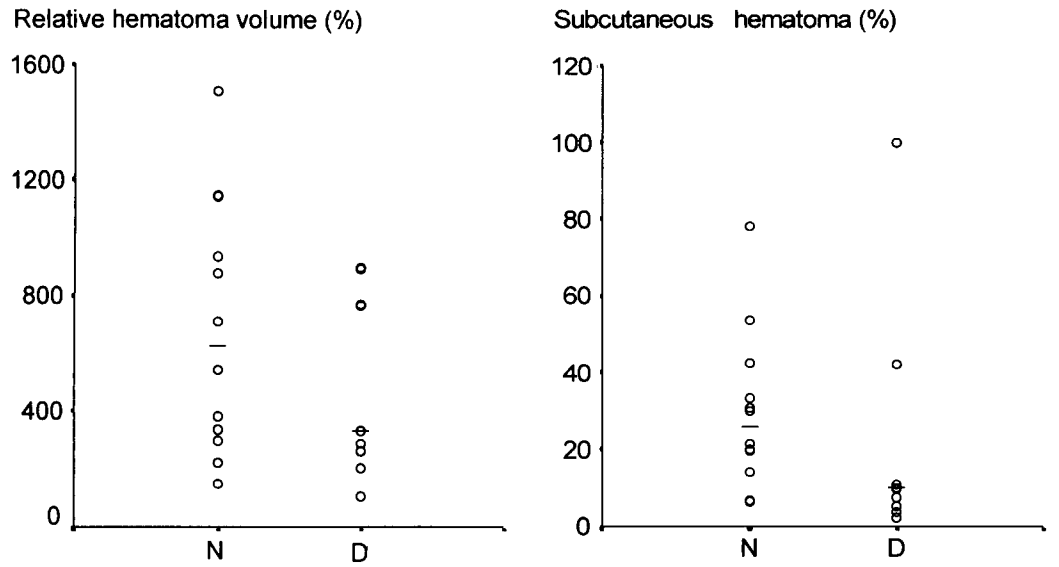

Figure 2. Hematoma (erythrocyte) volume in patients undergoing hip replacement and with (D) or without (N) drains. The relative hematoma volume (V) is compared to the unoperated side (left) and the subcutaneous hematoma is presented as a percentage of the relative hematoma (right). – median.

semicircular, well-demarcated region of activity on the operated side, which varied in size among the patients (Figure 1). In all these sections, this activity was enclosed by a series of ROIs where it was visible. The number of events in these ROIs was added and related to (N_h-N_o) as a percentage. This was considered the superficial part of the hematoma.

Statistics

The study was planned for 10 patients in each group. To compensate for dropouts, we sealed 24 envelopes with 12 patients in each group. 2 randomized patients refused to participate and we closed the study when 22 patients had been included, giving 10 and 12 patients in the groups. Differences between means were tested with the Student's t statistic (unpaired) and in distributions with the chi-square statistic (exact test). We compared the scintigraphic uptake with the Mann-Whitney U-test.

Results

The relative hematoma volume (V) varied widely with an apparent overlap between the groups. In the patients without drains the mean relative volume was higher (623% vs 330%), but the difference was not significant (Figure 2, Table).

In 2 patients, the examinations were done before and after removing the bandage. The findings were the same on both, confirming that the superficial activity did not represent activity in the bandage. In both groups, we also found considerable variation of the superficial part. In those without drains, the activity in the superficial part was higher than in the patients with drains, although the difference was not significant (Figure 2, Table). The intraoperative blood loss was the same in both groups, but the total blood loss, of course, was higher in the drained group, since this included the drained blood. The group with drains needed more blood transfusions (Table).

2 patients, 1 in each group, developed deep infections.

Discussion

In a previous study, it has been suggested that suction drains do not reduce the wound hematoma, but increase total blood loss (Waugh and Stinchfield 1961). In THR, total blood loss was higher in

Patients' height and body weight. Intraoperative blood loss, transfusion data and relative hematoma volume in 22 patients undergoing surgery for primary hip replacement with or without wound drains

	Drains not used (n=12)	Drains used (n=10)	P-value
Height	171 (9) [c]	169 (7) [c]	0.6 [a]
Body weight	75 (11) [c]	75 (19) [c]	0.9 [a]
Mean blood loss during surgery (mL)	624 (130) [c]	747 (136) [c]	0.2 [a]
Blood loss in drains(mL)	–	1025 (462) [c]	
Total recorded blood loss (mL)	624 (130) [c]	1759 (567) [c]	0.0001 [a]
Patients transfused (number)	6	9	0.07 [b]
Volume of transfused blood, mean in entire group (mL)	235 (184) [c]	823 (581) [c]	0.03 [a]
Relative hematoma volume, V (%)	623 (296–1141) [d]	330 (200–887) [d]	0.2 [e]
Superficial part of hematoma (%)	26 (14–43) [d]	9.8 (3.1–42) [d]	0.06 [e]

[a] Student's t-test.
[b] Chi-square exact test.
[c] Mean (95% CL).
[d] Median (95% CI).
[e] Mann-Whitney U-test.

a drained group than in an undrained one, but the theoretical calculation of the residual hematoma was almost the same in both groups (Murphy and Scott 1993). In another study where both hips were operated on in the same session, one side was drained after surgery and the other was not (Kim et al. 1998). The undrained side had a higher number of soaked dressings and more hematomas (measured by ultrasound). It has been suggested that the use of suction drains is unnecessary after uncomplicated joint arthroplasty (Beer et al. 1991).

We used a nuclear medicine technique to study the efficacy of drains in THR. Although accurate, one can measure only erythrocyte volume, not whole blood volume. The tomographic method, which includes a correction for photon attenuation, can be used as a measure relative to the normal side to compare the two methods—i.e., drainage or no drainage. Theoretically, the failure to correct for scattered photons increases the calculated volume relatively with increases in hematoma volume. The influence of this phenomenon, however, is considered small and should have little effect on the findings. Suction drains produce maximal drainage volumes during the first 24 hours (Willet et al. 1988) and our measurements were made at 22 hours.

The relative hematoma volumes in the patients without drains were not significantly larger than those with drains. Because of the small number of our patients, it is not possible to exclude a type II error in the statistical analysis. Nevertheless, the large overlap in the relative hematoma size between the two groups indicates that the effect of drains in the individual patient may be disregarded in clinical practice.

The characteristic superficial activity proved to be a constant finding and was interpreted as a part of the hematoma. The subcutaneous activity was therefore also analyzed. This activity may be related to hematoma activity (N_h-N_o) since it is more strictly defined and no similar activity was seen on the contralateral side. We found a borderline significance between the groups in the superficial parts ($p = 0.06$). However, the distribution pattern varied between the groups. In the group without drains, the superficial fraction was evenly distributed over a wide range, while among the patients with drains, it exceeded 10% of the whole hematoma in only 2 patients. In one of these patients, who showed 100% superficial activity, the relative hematoma volume was only 4%, therefore the calculation of the superficial part is uncertain. Consequently, if the hematoma volume is smaller when using drains, this may apply in particular to the subcutaneous part.

Since the total external blood loss in the group with drains was higher and the hematoma in the

group withut drains was about the same as in group with drains, this may represent a higher total blood loss in the latter, an interpretation supported by their need for a higher volume of blood transfusion. By evacuating the blood and keeping small vessels open, drain suction may be working actively against the formation of a tamponade, which stops the bleeding.

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