

Wound Drainage in Primary Knee Arthroplasty – a Prospective Randomized Study

Drenáž u primární alopasty kolenního kloubu – prospektivní randomizovaná studie

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ABSTRACT

PURPOSE OF THE STUDY

Wound drainage in surgical interventions has a long tradition. Regarding the primary TKA there are no valid data concerning the ideal point of time for removal. The objective of this prospective randomized study was to investigate which drainage procedure should be given preference with regard to wound healing, blood loss, development of intraarticular hematomas and early postoperative function.

MATERIAL AND METHODS

We documented the ROM, the knee circumference at the upper patellar pole preoperatively and on days 2, 4 and 6 postoperatively. The blood volume and loss was calculated. As surrogate parameter for wound healing we counted the amount of days until no residual secretion was observed via the wound/drainage site.

RESULTS

The results of our investigation do not show any significant difference with regard to the mentioned parameters.

CONCLUSIONS

In our investigation, we were unable to find any significant advantage of intraarticular drainage for 48 hours over 24 hours after primary total knee arthroplasty. After uncomplicated total knee arthroplasty we recommend removing drainage after 24 hours.

Key words: knee arthroplasty, intraarticular drainage, postoperative hematomas, infection, blood loss.

INTRODUCTION

Intraarticular drainage is used in total knee arthroplasty to avoid postoperative hematomas and wound healing complications, although disadvantages of this procedure in the sense of an increased risk of infection have also been documented, leading to a controversial debate in the literature. A prolonged drainage time is accompanied by both a higher postoperative risk of infection and a higher postoperative blood loss

. Comparative data concerning the influence of different drainage applications on wound healing are lacking to date.

The objective of this prospective randomized study was therefore to investigate which drainage procedure should be given preference with regard to wound healing, blood loss, development of intraarticular hematomas and early postoperative function.

PATIENTS AND METHODS

The prospective randomized study was conducted in our department in the period from September 2009 to May 2010. A total of 63 patients (m:f 26:37; age: $67 \text{ y} \pm 10.6 \text{ y}$) undergoing primary unilateral knee arthroplasty who had a normal coagulation status in the preoperative laboratory tests (Quick's test, PTT, INR, platelet count) and did not have a known medical history of coagulation disorders were included in the study. All patients with a known coagulation disorder, a preoperatively existent long-term therapy with anticoagulants (Marcumar, ASA, etc.), and preoperatively pathological coagulation parameters were excluded. All patients gave their informed consent to participate in the study. The written approval of the local ethics committee was obtained (application number: EA2/115/09, Chairman: Prof. Dr. jur. R. Seeland).

The patients were allocated preoperatively to one of two groups (A: 1 intraarticular drain for 24 hours, B: 1 intraarticular drain for 48 hours) by a computer-assisted random generator. The surgeon was informed of the group allocation during wound closure before suturing of the joint capsule. From this point onwards, further hemostatic measures were prohibited. During the study, no changes were made either in the surgical setting of the operating theater, or in the type of wound closure, or in the dressing used.

The patients were treated with a cemented surface replacement (Refobacin® R, BioMed Deutschland GmbH, 14167 Berlin, Germany) by a total of 3 experienced surgeons. The systems used were the DePuy Sigma P.F.C. (DePuy Orthopädie GmbH, 66459 Kirel, Germany) and the Aesculap e-motion (B.Braun Melsungen AG, 34209 Melsungen, Germany). All operations were conducted without a tourniquet. Apparent bleeding was electrocoagulated intraoperatively. Postoperatively, all patients were treated with a mild compression bandage from the forefoot to the middle of the thigh. All of the patients received weight-adapted thrombosis prophylaxis with low-molecular heparins. Postoperatively, all of the patients were mobilized by an experienced physiotherapist according to a fixed, standardized schedule. In order to minimize falsifications of the amount drained as a result of changes in position due to the physiotherapy,

the drain was removed 24 hours postoperatively after the first physiotherapeutic mobilization in patients of group A, whereby the primary dressing was left in place. Correspondingly, the drain was removed after 48 hours, but before the second physiotherapy session, in the patients of group B. The compression bandage was removed from all of the patients 48 hours postoperatively, whereby it did not have to be removed prematurely in any of the patients. As a surrogate parameter for intraarticular hematoma, the knee circumference was measured preoperatively and on days 2, 4 and 6 postoperatively at the upper patellar pole. In order to get consistent data this measurement was performed by the same person during the complete study. Also, the laboratory parameters hemoglobin (g/dl) and hematocrit (l/l) were documented preoperatively and on the first and sixth postoperative days. If hemoglobin dropped to values below 8 g/dl postoperatively, we rendered the indication for transfusion of erythrocyte concentrates. The height and weight of each patient were also documented. With the aid of the values collected, first the blood volume (in liters) was calculated according to the Nadler formula, and then the blood loss in liters on the first and sixth postoperative days. The range of motion was documented in a standardized manner according to the neutral-zero method (preoperatively and on the sixth postoperative day). As a criterion for wound healing, the number of postoperative days was counted up to which the wound conditions were dry, in other words no residual secretion was observed via the drainage site or the wound.

All of the data collected were entered in Microsoft Excel 2003 (Microsoft, Vermont, USA) and evaluated with the aid of XLStat 10 (Addinsoft, Germany). A level of significance of 0.05 was assumed for statistical analysis. The Mann-Whitney U-test for comparison of unmatched nonparametric samples was used for statistical evaluation. A power analysis was performed prior to the study in order to calculate the sample size. As criterion for the calculation we stated a difference of one day in terms of wound healing as clinically significant. Based on this we calculated a sample size of 23 each group with a power of 95%. This calculation was performed with the aid of G*Power 3.1.2 (Franz Faul, university of Kiel, Germany).

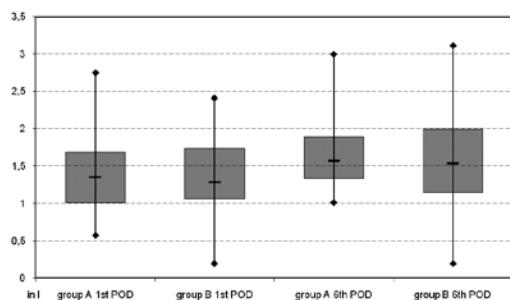


Fig. 1. Blood loss (calculated in l) on the first and sixth postoperative days of the two groups.

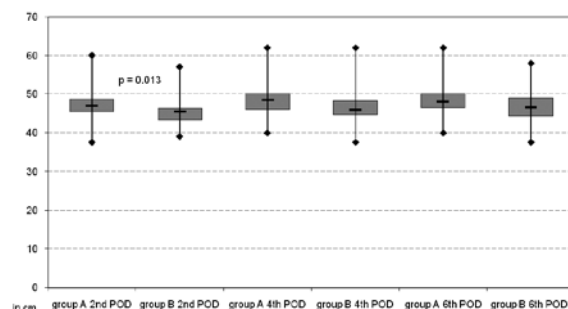


Fig. 2. Circumferences of the two groups (in cm) on the second, fourth and sixth postoperative days.

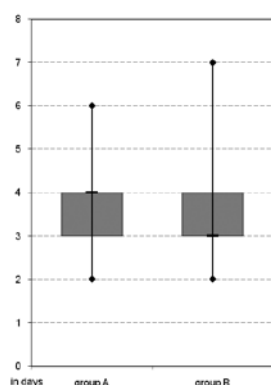


Fig. 3. Days up to dry wound conditions.

RESULTS

Data were collected from a total of 63 (m:f 26:37; age: $67 \text{ y} \pm 10.6 \text{ y}$) patients. None of the patients withdrew their consent prematurely or were removed from the population prematurely due to exclusion criteria. We did not observe any postoperative infections, wound healing disorders or mechanical complications in our patient population. None of the patients had to be surgically revised or punctured as a result of a postoperative hematoma. Three patients from group A (1 drain for 24 hours; 9.68%) and four patients from group B (1 drain for 48 hours; 12.9%) received a blood transfusion due to a relevant drop in hemoglobin (to $< 8 \text{ g/dl}$) over the postoperative course. We did not find a significant difference in the calculated blood loss between the two groups either on the first or on the sixth postoperative day (group A: first postoperative day: $1.41 \text{ l} \pm 0.54 \text{ l}$; sixth postoperative day: $1.66 \text{ l} \pm 0.47 \text{ l}$; group B: first postoperative day: $1.35 \text{ l} \pm 0.49 \text{ l}$; sixth postoperative day: $1.54 \text{ l} \pm 0.74 \text{ l}$; see Figure 1). The patients of group A showed a significantly greater knee circumference (absolute circumferences, see Figure 2) on the second postoperative day compared with group B (group A: $47.53 \text{ cm} \pm 4.56 \text{ cm}$; group B: $45.53 \text{ cm} \pm 4.24 \text{ cm}$; $p = 0.013$), although this no longer significantly differed at the measuring points of the fourth (group A: $45.48 \text{ cm} \pm 5.14 \text{ cm}$; group B: $46.64 \text{ cm} \pm 4.78 \text{ cm}$) and sixth (group A: $48.42 \text{ cm} \pm 4.98 \text{ cm}$; group B: $46.66 \text{ cm} \pm 4.55 \text{ cm}$) postoperative days. Regarding wound healing, there was no significant difference between the two groups (group A: 3.58 ± 0.89 days; group B: 3.5 ± 0.92 days, see also Figure 3). A post hoc calculation (G*Power 3.1.2, see also the “patients and methods” section) with a power of 95% and our standard deviation of 0.92 and 0.89 days showed that, based on our data, if there exists a difference in the two groups it would be < 0.8 days. In group A a function of Ext/Flex (passive): $0^\circ \pm 0^\circ / 4.19^\circ \pm 9.5^\circ / 81.77^\circ \pm 13.2^\circ$ and Ext/Flex (active): $0^\circ \pm 0^\circ / 4.7^\circ \pm 5.6^\circ / 72.7^\circ \pm 13.7^\circ$ was seen, and in group B a function of Ext/Flex (passive): $0^\circ \pm 0^\circ / 2.5^\circ \pm 4.21^\circ / 82.19^\circ \pm 20.12^\circ$ and Ext/Flex (active): $0^\circ \pm 0^\circ / 4.1^\circ \pm 4.48^\circ / 73.6^\circ \pm 20.25^\circ$

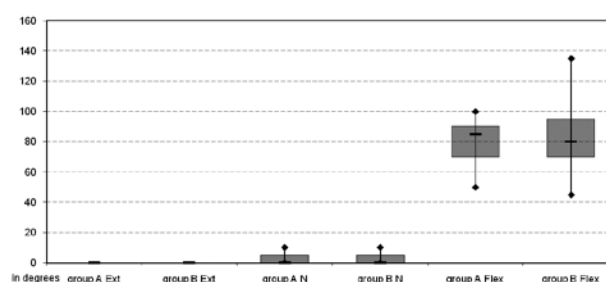


Fig. 4. Passive range of motion postoperatively (Ext: max. extension; N: neutral position; Flex: max. flexion.)

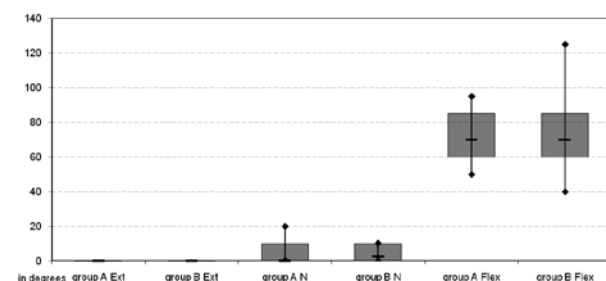


Fig. 5. Active range of motion postoperatively (Ext: max. extension; N: neutral position; Flex: max. flexion.)

(see also Figures 4 and 5). A significant difference could not be found for any of these measurements.

DISCUSSION

The use of a postoperative wound drain in surgical interventions has a long tradition and their benefit has been shown by several authors.

The results of our investigation do not show any significant difference for postoperative wound drainage with regard to wound healing, early postoperative function, blood loss or development of intraarticular hematomas.

As early as 1961, Waugh and Stinchfield conducted a study on 200 patients and showed that postoperative wound drainage achieves a nonsignificantly lower risk of infection after a wide range of orthopedic interventions and that drains prevent the development of postoperative hematomas. However, Willemen et al. showed that wound drainage for more than 24 hours leads to an increased risk of retrograde contamination with bacteria. This retrograde colonization was confirmed by several further studies. In a follow-up investigation of 208 hip prostheses, Acus et al., like Hallstrom et al., showed that blood loss and the related frequency of transfusion was higher in patients with drainage than without. Many authors even conclude from their investigations that there is no significant advantage of postoperative drainage after orthopedic interventions.

With regard to postoperative blood loss, we were also unable to find any significant difference, whereby our results are in line with those of Crevoisier et al., but contradict those of Murphy et al. and Hallstrom et al.. Only on the second postoperative day is the intraarticular hematoma of the patients receiving drainage for 24 hours significantly greater ($p = 0.013$) than that of the patients receiving drainage for 48 hours, which can be attributed to the fact that the second group received drainage for a further 24 hours. However, this difference is no longer detectable on the fourth postoperative day. Regarding wound healing we were not able to find a significant difference. Using a post hoc calculation based on our data, we can state, that if there exists a difference it would be less than 0.8 days. This is not clinically significant, because it would not lead to an alteration in therapy.

CONCLUSION

In our investigation, we were unable to find any significant advantage of intraarticular drainage for 48 hours over 24 hours after primary total knee arthroplasty. In none of the parameters investigated was there any evidence of an advantage of a prolonged drainage period, although it entails the risk of retrograde bacterial colonization. Therefore, on the basis of our results and the available literature, after uncomplicated total knee arthroplasty we recommend removing drainage after 24 hours.

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