

CLOSED SUCTION DRAINAGE AFTER KNEE ARTHROPLASTY A PROSPECTIVE STUDY OF THE EFFECTIVENESS OF THE OPERATION AND OF BACTERIAL CONTAMINATION

P. ZAMORA-NAVAS, F. COLLADO-TORRES, F. DE LA TORRE-SOLÍS

A prospective investigation was designed to determine the volume and the evolution of bleeding after closure of the surgical wound following knee arthroplasty, as well as the incidence of infection and bacterial contamination in relation with the time that the suction drain was left in place. The drain was removed either 12, 24 or 48 hours after the operation. The presence of any signs of clinical infection was recorded. The tip of the drain, 1 cm of its subcutaneous portion and a sample from the collecting bottle were studied for bacterial contamination.

In the 12-hr group, no microorganisms were isolated in cultures either from the tip, the subcutaneous portion or the bottle of the drain. In the 24-hr group, 87% of the total postoperative bleeding was collected during the first 12 hours. In two cases, the samples obtained from the tip and the subcutaneous portion of the drain were positive for *Staphylococcus epidermidis*. In the 48-hr group, 91% and 97% of the total bleeding volume was collected during the first 12 and 24 hours, respectively. In two cases, *St. epidermidis* was isolated in cultures from the subcutaneous portion of the drain. The clinical evaluation of wound healing was comparable in all three groups.

Keywords : knee arthroplasty ; drainage ; bacterial contamination.

Mots-clés : arthroplastie du genou ; drainage ; contamination bactérienne.

INTRODUCTION

Drainage of the postoperative hematoma following knee arthroplasty is a widely accepted practice. Its utility in avoiding poor evolution of the surgical wound has been well established (12). On the other hand, the presence of a foreign body

in contact with the external surface of the skin, such as a drain near the implant, is another factor to be taken into consideration. In some studies, suction drainage has been associated with an increased rate of infection (14), and the presence of the drain in the surgical wound for a period longer than 24 hours has been associated with an increase in bacterial colonization (13).

A prospective, double-blind study was designed to remove the drainage at 12, 24 or 48 hours after the operation in order to establish the bleeding curve, and also to assess the incidence of microorganism contamination in the tip, subcutaneous portion and bottle of the drain.

PATIENTS AND METHODS

Thirty-two patients undergoing total knee arthroplasty (TKA) were included in a prospective trial. In all of the cases the diagnosis was osteoarthritis, and an uncemented prosthesis was implanted (AMK®, De Puy, Warsaw, Indiana, USA). Patellar resurfacing was not done, but a lateral retinacular release was carried out in all of the patients. The patients were randomly allocated to one of three groups : group 1, where the drain was removed after 12 hours ; group 2, in which it was removed after 24 hours, and group 3, in which the drain remained for a total of 48 hours.

Spinal anesthesia was performed in all of the cases. Thromboembolism prophylaxis was administered to all of the patients : Calcium nandroparine (Fraxiparina®,

Department of Orthopedic Surgery, HGB de la Axarquía, Vélez-Málaga, Spain.

Correspondence and reprints : P. Zamora-Navas, Department of Orthopedic Surgery, HGB de la Axarquía, Vélez-Málaga, 29700 Málaga, Spain.

Sanofi Winthrop SA, Barcelona, Spain), one dose one hour before the operation and once a day for a month after the operation. The daily dose was 0.3 or 0.4 cc according to the weight of the patient.

Antibiotic prophylaxis was sodium cefuroxime (Cur-oxima®, Glaxo SA, Madrid, Spain), 1 g IV one hour before the operation followed by 6 more postoperative doses administered three times a day.

On the night before the operation, the skin was washed with povidone iodide (Betadine®, Astra Médica, Madrid, Spain) and wrapped with a sterile dressing. In the operating room the skin was washed once more. Later the surgeon prepared the skin with povidone iodine and covered the surgical zone with an antimicrobial film.

Before the last step in the preparation of the skin a tourniquet was inflated to 400 mm Hg, and it was deflated before the wound was closed to allow cauterization of bleeding vessels. A midline vertical incision was used and a medial arthrotomy allowed access to the joint.

The drain was placed inside the joint and brought out through a separate incision in the superolateral area of the joint.

The drain was removed under sterile conditions after 12, 24 or 48 hours according to the group to which the patient had been assigned.

When the drain was removed the tip was cut off 1 cm from the end. In addition, 1 cm of the section of the drain which had been placed in the subcutaneous tissue was taken. Finally, under sterile conditions, a sample from the blood accumulated in the bottle was obtained. All samples were placed in thioglycolate medium and incubated at 35°C for 48 hours. Following this, culture on standard mediums was employed, followed by further 48-hr aerobic and anaerobic incubation. The microorganisms isolated were identified by standard laboratory techniques.

The evaluation of the healing of the wound was done taking into account the presence of purulent matter coming from the wound, as well as other signs of infection or a positive culture. The presence of leakage from the incision performed for the drain-tube exit after the drain had been removed was of special interest.

Statistical analysis of the results of all the observations was performed, and nonparametric tests were applied: the Wilcoxon test for independent variables, and the rank-sign test for paired variables. In the proportion analysis the exact Fisher test was applied for unpaired variables and the McNemar test for paired variables. The Spearman test was used for correlation analysis. The Kruskal-Wallis test was used as a one-

way analysis of variance. A value of $p < 0.05$ was considered as significant.

This study was approved by the Clinical Trials Committee of the hospital, where the study was to be carried out.

RESULTS

No difference was found between the 3 groups with respect to age, sex, duration of the operation, blood loss during the operation or time of application of the tourniquet.

Volume of drainage

Ten drains were removed 12 hours after the operation with a mean volume of fluid loss of 560 cc.

Twelve patients were included within the group in which the drains were removed after 24 hours, and here the mean volume of fluid was 807.5 cc. Furthermore, within the first 12 hours 87% of the total volume, with a mean of 687.5 cc, had been collected.

In the third group, which included 10 patients and in which the drain was removed after 48 hours, the mean value of the volume drained was 565 cc. Of this, 91% was drained within the first 12 hours, with a mean value of 492.5 cc. The volume for the first 24 hours was 97.28% of the total volume drained, which corresponds to a mean value of 547.5 cc.

Figure 1 shows the blood collection curve. There were no statistical differences between the

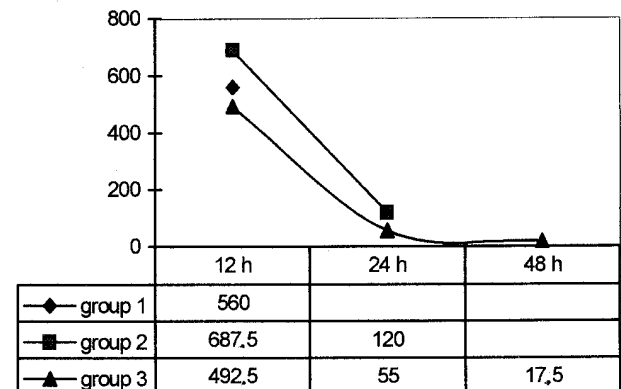


Fig. 1. — Amount of blood collected (in cc).

final blood volumes collected in each group. In the second and in the third group the amount of blood collected after 12 and 24 hours was statistically different ($p = 0.002$ and $p = 0.031$, respectively). In the third group there was no statistical difference between the volumes collected after 24 and 48 hours.

Bacterial contamination

The group where the drain was removed after 12 hours did not produce any microorganisms.

In the group where the drain was removed after 24 hours, two samples from the subcutaneous portion of the drain, as well as two samples from the tip of the drain, were positive for *Staphylococcus epidermidis*.

In the third group, *St. epidermidis* was isolated from the tip of the drain of two patients. No statistically significant difference was found in the comparison between the positive cultures of the different zones in the drain and between the groups.

No signs of deep or superficial infection were observed. No leakage of fluid from the wound or from the incision made for the drain was recorded.

DISCUSSION

The papers reporting the benefits or dangers of the use of postoperative drainage of the surgical wound disagree about their results. Some authors support its use because it helps in preventing hematoma formation in the wound and decreases the rate of healing problems and infection (12). Others have reported a lack of benefit of this procedure after total joint replacement (1, 2, 4, 10). Moreover, others have shown the additional risk presented by the insertion of a drain tube, as it provides an entry route for bacteria into the wound (8). This risk has been found to be time-related, and therefore it has been recommended not to leave the drain in place for more than 24 hours (6, 13).

In our study the mean volume of blood collected during the first 12 hours represented between 87% and 91% of the total volume collected. Ninety-seven percent of the total serosanguinous volume

drained was recorded during the first 24 hours, and only 17.5 cc corresponded to the second 24-hr period. This is in accordance with the results obtained by other authors like Willemen *et al.* (13), who found a residual drainage of 50 cc during the second 24-hr postoperative period.

On the other hand, the bacteriological study did not show any evidence of a significant increase in the contamination of the different locations of the drainage system. Despite the fact that in the group where the drain was left in place the least time, all the samples were negative, and in the other two groups, two samples in each were positive, no statistical difference was found.

Therefore, no correlation between the duration of the presence of the drain tube and the contamination index was shown, contrary to what was proved by authors like Sorensen and Sorensen (11) after six days or even Willemen *et al.* (13) after the first 24 hours.

In all of the cases the isolated microorganism was *St. epidermidis*. Slime-producing strains of this bacteria are able to colonize smooth surfaces, including prostheses and bone cement, as has been shown previously (3, 5). This finding disagrees with papers previously published, where *St. aureus* (7, 11, 14) or coagulase-negative staphylococci were the germs isolated (9).

With reference to the risk of infection, we have not found any additional risks in maintaining the drainage for 48 hours instead of 24. However, the volume of blood collected is not significant enough to justify prolongation by a further 24 hours. Furthermore, this drain interferes with the movement of the patient, the work of the nurses and the initiation of continuous passive motion of the knee.

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SAMENVATTING

P. ZAMORA-NAVAS, F. COLLADO-TORRES, F. DE LA TORRE-SOLÍS. Suctie en drainage na knie-arthroplastie.

Een prospectief onderzoek werd ontworpen om na te gaan of het volume en de evolutie van de bloeding na sluiten van de chirurgische wonde na knie-arthroplastie, alsmede de invloed van infectie en bacteriële contaminatie gerelateerd naar de tijd dat de suctiedrainage was behouden. De drain werd verwijderd 12, 24 of 48 uur postoperatief. De aanwezigheid van klinische tekens van infectie werd genoteerd. De tip van de drain, 1 cm

van zijn subcutane positie, en een staal van de verzamelfles werd nagekeken om bacteriële contaminatie. In de 12-uren-groep werden geen micro-organismen geïsoleerd. In de 24-uren-groep werd 87% van de totale postoperatieve bloeding verzameld in de eerste 12 uur. In 2 gevallen kon van de tip, van de subcutane positie van de drain, positieve culturen voor staphylococcus epidermidis worden bekomen. In 48-uren-groep waren er 91% en 97% van de totale bloedingsvolume verzameld gedurende de eerste 12 en 24 uur respectievelijk. In 2 gevallen werd eveneens staphylococcus epidermidis geïsoleerd in de culturen van de subcutane positie van de drain. De klinische evaluatie van de wondheling was vergelijkbaar in de 3 groepen.

RÉSUMÉ

P. ZAMORA-NAVAS, F. COLLADO-TORRES, F. DE LA TORRE-SOLÍS. Le drainage aspiratif après arthroplastie du genou. Etude prospective de l'efficience du drainage et de la contamination bactérienne.

Les auteurs rapportent les résultats d'une étude qui avait pour but de déterminer les pertes sanguines et leur évolution après arthroplastie du genou, ainsi que l'incidence d'infection et de contamination bactérienne, en fonction de la durée pendant laquelle le drain aspiratif était laissé en place. Le drain a été enlevé 12, 24 ou 48 heures après l'opération. On a recherché tout signe possible d'infection ainsi que toute contamination bactérienne au niveau de l'extrémité du drain, au niveau d'un segment de sa portion sous-cutanée et au niveau d'un échantillon du sang prélevé dans le flacon d'aspiration.

Dans le groupe où le drain était enlevé après 12 heures, aucune croissance bactérienne n'a été observée ni sur l'extrémité du drain ni sur sa portion sous-cutanée, ni sur le liquide d'aspiration. Dans le groupe où le drain était enlevé à 24 heures, 87% de la perte sanguine totale postopératoire ont été obtenus pendant les 12 premières heures. Dans deux cas, la mise en culture de l'extrémité du drain et de sa portion sous-cutanée ont montré un staphylococcus epidermidis. Dans le groupe où le drain était enlevé à 48 heures, les proportions de la perte sanguine totale enregistrée après 12 et 24 heures étaient respectivement de 91% et 97%. Dans deux cas, un staphylococcus epidermidis a été isolé de la portion sous-cutanée du drain. L'évaluation clinique des plaies opératoires a été comparable dans les trois groupes.