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Wound drainage after total knee arthroplasty, comparative analysis

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Diseases and injuries of the knee occupy a significant place in the structure of orthopedic pathology. The main method of knee arthritis of the III–IV degree is total knee arthroplasty (TKA). Purpose. To analyze the postoperative period after TKA without wound drainage. Methods. For the study, a homogeneous group of 140 patients was selected, their age ranged from 45 to 78 years, the diagnosis was knee arthritis of the III–IV degree. Patients were divided into 2 groups: study group — the wound was not drained (73 people), comparison group — the wound was drained (67). Results. Blood loss during surgery was comparable in both groups and ranged from 80 to 340 ml, with an average of (217.59 ± 76.19) ml in the study group and (195.6 ± 67.97) ml in the comparison group. No statistically significant difference was found in both groups (p > 0.05, p = 0.16277). A comparative analysis of the course of the postoperative period revealed a shorter treatment period in the study group. Refusal to drain the postoperative wound under conditions of stable hemostasis contributed to a faster recovery of hemoglobin and erythrocyte indices. ESR and CRP levels showed a tendency towards a faster reduction in inflammation in the study group. The postoperative management used did not show any differences in the healing time of the postoperative wound. The low intensity of postoperative pain according to VAS in the study group allowed to reduce the use of analgesics and shorten the patient's hospital stay by 2 days. Therefore, TKA without drainage of the postoperative wound can be considered as the method of choice. Conclusion. TKA without drainage of the wound after surgery did not cause an increase in postoperative complications in our series of operations. In addition, it reduced pain syndrome and, according to laboratory data, reduced the indicators of the inflammatory process.

Захворювання та травми колінного суглоба займають значне місце в структурі ортопедичної патології. Основним методом лікування гонартрозу III–IV ст. є тотальне ендопротезування колінного суглоба (ТЕКС). Мета. Проаналізувати післяопераційний період після ТЕКС без дренування рани. Методи. Для дослідження провели вибірку однорідної групи із 140 пацієнтів, їхній вік коливався від 45 до 78 років, діагноз — гонартроз III–IV ст. Пацієнтів розподілили на 2 групи: дослідження — рану не дренували (73 особи), порівняння — рану дренували (67). Результати. Крововтрата під час операції була порівняна в обох групах і склала від 80 до 340 мл, у середньому в групі дослідження (217,59 ± 76,19) мл і 195,6 ± 67,97 у групі порівняння. Статистично достовірної різниці в обох групах не виявлено (p > 0,05 p = 0,16277). Порівняльний аналіз перебігу післяопераційного періоду виявив скорочення терміну лікування в групі дослідження. Відмова від дренування післяопераційної рани за умов стабільного гемостазу сприяла швидшому відновленню показників гемоглобіну й еритроцитів. Рівні ШОЕ та СРБ показали тенденцію до швидшого зменшення запалення в групі дослідження. Тактика післяопераційного ведення хворих, яку використовували, не показала відмінностей у термінах загоєння післяопераційної рани. Низька інтенсивність післяопераційного болю за даними ВАШ у групі дослідження дозволила знизити застосування аналгетиків і скоротити термін перебування хворого в стаціонарі на 2 дні. Отже можна розглядати ТЕКС без дренування післяопераційної рани як метод вибору. Висновок. ТЕКС без дренування рани після операції не спричинило збільшення післяопераційних ускладнень у нашій серії операцій. Окрім того зменшило больовий синдром і знизило, за лабораторними даними, показники запального процесу. Ключові слова. Колінний суглоб, дренаж, хірургічне лікування, тотальне ендопротезування колінного суглоба.

Keywords. Knee, drainage, surgical treatment, total knee arthroplasty

Introduction

Knee-related impairments and injuries are prevalent and frequently necessitate surgical intervention for effective management. The main method of treatment for gonarthrosis of grade III–IV is total knee arthroplasty (TKA). With the increasing number of such surgeries, the incidence of postoperative complications inevitably rises, a significant portion of which are infections [1].

Numerous studies indicate that one of the ways infection can enter the wound is through the drainage tube [1, 2, 14], and prolonged hospitalization after surgery can lead to the risk of developing a nosocomial infection.

Active drainage of the postoperative wound is widely used during various interventions and with negative pressure, the drainage activity increases. Theoretically, this leads to a reduction in postoperative hematoma, pain syndrome, and swelling, as well as accelerating wound healing and reducing the risk of infection [4]. Some authors [3–7, 16] argue that the advantages of active drainage are greatly overstated. Discontinuing drainage reduces blood loss and the risk of retrograde infection [8, 10, 12, 15].

Purpose: To analyze the postoperative period after total knee arthroplasty without wound drainage.

Materials and Methods

For the study, a sample was made from a homogeneous group of 140 patients who underwent total knee arthroplasty (TKA) from early 2017 to February 2022. The study was approved by the Ethics Committee of Zaporizhzhia State Medical and Pharmaceutical University (protocol No. 14 dated 26.11.2025) in accordance with ICH GCP, the Helsinki Declaration on Human Rights and Biomedicine of 1977, and current Ukrainian legislation. All involved patients provided written and oral consent.

The age of the patients ranged from 45 to 78 years. Upon hospitalization, primary or secondary grade III–IV gonarthrosis was diagnosed. The following exclusion criteria were applied: history of deep vein thrombosis (DVT); use of any blood-thinning medications on a regular basis due to comorbidities; anemia requiring preoperative correction, including blood transfusions; exacerbation of any comorbidities after surgery; other somatic complications.

The procedures were performed by a single surgeon. The distribution of patients with the clarified diagnosis is presented in Tables 1–3. The patients were divided into two groups based on whether wound drainage was used postoperatively:

Study group: wound without drainage (patients operated on from 2019 to 2022)

Comparison group: wound drainage used (patients operated on in 2017–2018).

In the comparison group, one drainage tube (polyvinyl chloride (PVC) No. 15) was inserted into the operated joint cavity. The drainage was maintained for 1–2 days.

Both groups showed no deviations in general blood tests or coagulation profiles prior to the operation that could suggest issues with the clotting system.

Both groups were similar in terms of gender, age, primary diagnosis, implant type, and antimicrobial prophylaxis (Tables 1–3).

The body mass index (BMI) ranged from 25 to 38 with no significant differences between the patients in both groups ($p > 0.05$). No hemostatic tourniquet was used during surgery. In both groups, tranexamic acid (1,000 ml) was administered 30 minutes before the procedure, as well as antibacterial prophylaxis with amoxicillin-clavulanic acid (1.2 g) 30 minutes before surgery, continuing for 72 hours postoperatively. Thromboprophylaxis was provided with enoxaparin at a dose of 40 mg per day, starting preoperatively and continuing for 35 days post-TKA.

Postoperative pain management: Day 1 — femoral nerve block, dexketoprofen 50 mg IV twice a day, paracetamol 1000 mg intravenously three times a day, diclofenac 75 mg IM once a day; Day 2 — diclofenac 75 mg IM once a day, dexketoprofen 50 mg IV twice a day, paracetamol administered on the patient's demand for pain relief; Day 3 — only dexketoprofen remained.

A comparative analysis was conducted in the postoperative period, evaluating parameters such as general blood test values, body temperature, and pain severity according to the Visual Analog Scale (VAS). Controls were made before the surgical intervention, on the first day postoperatively, and on the day of discharge. Activation of patients in both groups occurred the following morning. Drainage was removed 24–48 hours after the intervention in the comparison group.

After TKA, patients were monitored for the development of early infectious complications in the first 6 months.

Statistical analysis was performed using the licensed package Statistica, version 13. Parametric and non-parametric statistical methods were applied. The significance of results (for data differing from the normal distribution) was assessed using non-parametric tests: Mann-Whitney U test (for two independent groups) and Wilcoxon T test (for several dependent groups).

Table 1

Distribution of patients in both groups by preoperative diagnosis

Group						p
study			comparison			
diagnosis	abs.	%	diagnosis	abs.	%	
Primary gonarthrosis	55	75.34	Primary gonarthrosis	48	71.64	> 0.05
Secondary gonarthrosis	18	24.66	Secondary gonarthrosis	19	28.36	> 0.05
Total	73	100	Total	67	100	—

Table 2

Distribution of patients in both groups by aage

Group						p
study			comparison			
Age, years	abs.	%	Age, years	abs.	%	
30–50	9	12.32	30–50	8	11.94	> 0.05
51–60	17	23.29	51–60	14	20.90	> 0.05
61–71	30	41.10	61–71	30	44.78	> 0.05
71 and over	17	23.29	71 and over	15	22.39	> 0.05
Total	73	100	Total	67	100	—

Table 3

Distribution of patients in both groups by gender

Група						p
study			comparison			
gender	abs.	%	gender	abs.	%	
Female	52	71.23	Female	51	76.12	> 0.05
Male	21	28.77	Male	16	23.88	> 0.05
Total	73	100	Total	67	—	—

Results

Blood loss during surgery was comparable between both groups and ranged from 110 to 320 mL. The average blood loss in the study group was 217.59 ± 76.19 mL, and 195.6 ± 67.97 mL in the comparison group. No statistically significant difference was found between the groups ($p > 0.05$, $p = 0.16277$).

Blood test results on the first postoperative day and the day of discharge showed significant changes. Hemoglobin levels were significantly higher in patients without drainage during the postoperative period (Table 4). Erythrocyte values were significantly different in favor of the study group, indicating less blood loss (Table 5). No cases of early periprosthetic infection were recorded in either group.

Interestingly, the dynamics of inflammatory markers (ESR and CRP) after surgery showed significant differences. Before the intervention, these markers did not differ significantly between the two groups. After surgery and on the day of discharge, inflammation markers were significantly lower in the group that did not have postoperative drainage (Tables 6 and 7).

The decrease in inflammatory markers in the comparison group was associated with blood loss through the drainage. The amount of exudate varied greatly: day 1 from 80 to 230 mL, day 2 – from 50 to 110 mL, with an average range of 130 to 340 mL of postoperative blood loss.

Body temperature in the study group throughout the hospital stay ranged from a minimum of 36.3 °C to a maximum of 37.9 °C. In the second group, it ranged from a minimum of 36.5 °C to a maximum of 39.1 °C. The maximum body temperature in the drainage-free group was significantly lower (Table 8). Moreover, 80 % of patients in the comparison group experienced a single temperature rise to 38–39 °C after drainage removal.

Pain assessment using the VAS showed that in the study group, the maximum pain score was 5, while in the comparison group, it was 8 (controls were

Table 4

Hemoglobin levels (g/L) before and after surgery in patients of both groups

Indicator	Hemoglobin		
	before surgery	one day after surgery	on discharge
Mean ± standard error (M ± m): – Without drainage; – With drainage	 134.38 ± 3.41 137.42 ± 3.58	 121.81 ± 4.19 120.96 ± 4.84	 119.81 ± 3.25 111.62 ± 3.68
Mann-Whitney U test (p)	p > 0.05 (p = 0.658362)	p > 0.05 (p = 0.153830)	p < 0.05 (p = 0.0002458)

Table 5

Erythrocyte levels (×10¹²/L) before and after surgery in patients of both groups

Indicator	Erythrocytes		
	before surgery	one day after surgery	on discharge
Mean ± standard error (M ± m): – Without drainage; – With drainage	 4.35 ± 0.07 4.28 ± 0.06	 4.12 ± 0.05 4.01 ± 0.04	 3.69 ± 0.06 3.56 ± 0.05
Mann-Whitney U test (p)	p > 0.05 (p = 0.0582)	p < 0.05 (p = 0.000299)	p < 0.05 (p = 0.00015727)

Table 6

ESR (mm/h) before and after surgery in patients of both groups

Indicator	Erythrocyte sedimentation rate		
	before surgery	one day after surgery	on discharge
Mean ± standard error (M ± m): – Without drainage; – With drainage	 10.38 ± 1.26 9.89 ± 0.94	 51.83 ± 4.18 67.08 ± 5.61	 48.72 ± 4.11 59.25 ± 3.39
Mann-Whitney U test (p)	p > 0.05 (p = 0.164)	p < 0.05 (p = 0.000076)	p < 0.05 (p = 0.000045)

Table 7

CRP levels (mg/l) before and after surgery in patients of both groups

Indicator	C-reactive protein		
	before surgery	one day after surgery	on discharge
Mean ± standard error (M ± m): – Without drainage; – With drainage	 6.48 ± 3.98 7.65 ± 2.11	 88.25 ± 16.98 97.18 ± 15.43	 48.76 ± 8.37 74.4 ± 9.16
Mann-Whitney U test (p)	p > 0.05 (p = 0.095839)	p > 0.05 (p = 0.000593)	p < 0.05 (p = 0.000279)

made before the surgical intervention, on the first postoperative day, and on the day of discharge).

Patient activation was initiated the morning after surgery. Patients moved with crutches, bearing the maximum load on the operated leg under the supervision of a physical rehabilitation specialist. The activity level in patients without drainage was significantly better (on average, 2 days earlier) (Table 9).

Although the use of drainage during knee joint surgeries is no longer a routine technique, our study revealed other effects associated with active drainage. All patients were verticalized and learned to walk the following day after surgery. However, the extended duration of vertical positioning in the study group and the absence of problems related to the presence of a drainage tube showed a reduction in pain according to the VAS and, accordingly, a lower use of "on-demand" analgesics.

Patients in the study group did not require additional pain relief compared to the control group, where paracetamol 1000 mg was administered additionally (as needed) for 2–3 days. This allowed them to be discharged from the hospital an average of 2 days earlier

(Table 9). During the dressing changes, 12 patients in the study group had small subcutaneous hematomas, which did not affect the healing time of the postoperative wound. During subsequent follow-up in the first year after surgery, no signs of infectious complications were observed in either group.

Thus, the absence of wound drainage after total knee arthroplasty was shown to provide stable hemostasis, without resulting in an increase in complications or delayed healing of the postoperative wound.

Discussion

The use of drains after elective surgical procedures is increasingly becoming a topic of discussion. There are no clear criteria for their application that would allow general recommendations to be made. K. Zhou et al. suggest that in uncomplicated knee arthroplasties, wound drainage can be avoided [16]. H. W. Jones et al. noted the ineffectiveness of reinfusing drainage erythrocytes [8]. The most common argument in favor of drainage is the risk of hematoma formation and the potential for infection. However, most experts today no longer support this concern [1, 2, 11, 13]. All studies and everyday experience indicate an increase in blood loss due to the use of drains. Reinfusion of autologous erythrocytes from drainage blood has not shown high effectiveness [8, 9, 11]. M. Basilico et al. argue that postoperative drainage after TKA is a routine procedure for orthopedic surgeries and is considered a useful practice in the postoperative period, but the use of drains remains controversial [2]. A systematic review of 30 studies on TKA [2] did not find significant advantages associated with the use of wound drainage after arthroplasty. In terms of pain, blood loss, swelling, postoperative range of motion, wound complications, deep infection, and hospital stay, there were no benefits of drainage.

In our study, the comparative analysis of the postoperative course in the early period after knee arthroplasty revealed a shorter hospital stay in the group without joint drainage. Patients in the study group were shown to mobilize faster due to reduced pain levels, as there was no fear of pulling the drainage tube while walking. The presence of a drain bottle psychologically limited the movement of patients in the comparison group (as reported by the majority). The refusal to use drainage after the postoperative wound, under conditions of stable hemostasis, helped achieve better recovery dynamics in terms of hemoglobin and erythrocyte levels in patients. Changes in ESR and CRP levels indicated a trend toward faster reduction of inflammation in patients without wound drainage. The postoperative management approach did not show differences in wound healing times between the groups. The lower intensity of postoperative pain in the study group, according to the VAS, allowed for a reduction in the use of analgesics and shortened the hospital stay by 2 days.

Our study aimed to clarify the issue of wound drainage after knee arthroplasty. Based on the results presented, knee arthroplasty without postoperative wound drainage can be considered a preferred method for postoperative management. Indeed, some patients with coagulation disorders or infection risks may still require drainage. However, we generally refrain from using wound drainage after TKA.

Conclusion

Knee arthroplasty without the use of wound drainage after surgery did not lead to an increase in post-

Table 8

Maximum body temperature after surgery in patients of both groups

Indicator	Maximum body temperature (°C)
Mean ± standard error (M ± m): – Without drainage; – With drainage	 37.12 ± 0.40 37.47 ± 0.58
Mann-Whitney U test (p)	p < 0.05 (p = 0.00000002692225707)

Table 9

Duration of hospital stay after surgery

Indicator	Time (day)
Mean ± standard error (M ± m): – Without drainage; – With drainage	 2.89 ± 0.16 4.69 ± 0.13
Mann-Whitney U test (p)	p < 0.05 (p = 0.0000000)

operative complications in our series of operations, reduced pain syndrome, and, according to laboratory data, lowered markers of the inflammatory process.

Conflict of Interest. The authors declare no conflict of interest.

Prospects for Further Research. Identifying methods to shorten the period of early medical rehabilitation with full weight-bearing on the operated limb.

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WOUND DRAINAGE AFTER TOTAL KNEE ARTHROPLASTY, COMPARATIVE ANALYSIS

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