Comparative study of using a surgical drain versus no drain after primary total knee replacement

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The Egyptian Orthopedic Journal; 2022 supplement, December, 57: 1-6

ABSTRACT

Background:
Surgical drains in total knee replacement is widely used. They help in reducing hematoma collection and wound problems.

Objective:
The objective of this research is to assess and contrast the disparity in postoperative blood losses and inflammatory responses among patients who have primary cemented TKA with and without the use of a drain.

Patients & Methods:
This study was carried out on forty patients the cases have been operated on in the orthopedic department of Menofia university hospital and El Menshawy general hospital and each participant in the study provided informed consent.

Results:
The mean age of the individuals in the D group was 61.6 years, ranging from 56 to 68 years. In the ND group, the average age was 62.76 years, ranging from 56 to 67 years. The pre-operative haemoglobin level in the D group was 12.83, whereas in the ND group it was 12.92. The haemoglobin levels on the second day after surgery were 8.98 and 10.54 for the D and ND groups, correspondingly. The difference between the two groups was statistically significant ($p< 0.001$). The haemoglobin levels on the 7th day after surgery were 9.08 and 9.47 for the D and ND groups, correspondingly. The difference in haemoglobin levels between the two groups was statistically significant, with a p-value of 0.042. The observed blood loss after surgery was 656.67 in the D group and 100 in the ND group ($p< 0.001$). Out of those participating in the D group, 7 had a blood transfusion after the operation, whereas just two individuals in the ND group received a blood transfusion ($p=0.011$). no documented instances of infection were existed. No statistically significant variance was seen among the two groups in terms of initial inflammatory response, ecchymosis surrounding the site, PE, DVT, and LOS.

Conclusion:
There is no added advantage of a closed suction drain over no drain usage after primary TKA. the blood loss and the need for blood transfusion were significantly more when using a drain.

Keywords: TKR, drain, no drain.

INTRODUCTION

Orthopaedic wounds, such those in Total Knee Arthroplasty (TKA) procedures, are especially prone to the formation of hematomas due to the challenges in achieving complete hemostasis during surgery. (1) Suction drains are frequently utilised in orthopaedic surgeries to minimise the occurrence of hematoma development and complications related to the wound. (2) Surgical drains serve the objective of enhancing wound healing by minimising the buildup of fluid (blood) at the surgical site. This may be associated with many benefits, such as reduced tissue edoema and skin tension, leading to improved skin perfusion and less complications related to wounds. (3)

Conversely, several studies have shown that individuals who utilise drains after surgery have a greater loss of blood and a higher likelihood of requiring a blood transfusion. This is due to the elimination of the tamponade effect, that plays a crucial role in filling the dead space inside a surgically treated wound. (4) In addition, it can cause a retrograde infection. (5,6)

The objective of the study:

in order to assess the disparity in blood loss after surgery, estimated laboratory by measuring Hb and HCT % on 2nd and 7th day postoperative. In addition, evaluation and comparing ESR and CRP for both groups on 7th day postoperative, then weekly for 3 weeks, and finally after 6 months postoperative to evaluate if there is a difference in inflammatory response between both groups.

PATIENTS AND METHODS:

This work was performed on 40 participants, the cases have been operated on in the orthopedic department of Menofia university hospital and El Menshawy general hospital, and informed consent was obtained from all participants in the research.

The study has been started from October 2020 to May 2022. Patients were randomized according to (simple) randomization which led to 20 patients treated with TKA with a drain (D group) and 20 patients treated with TKA without a drain (ND group). Randomization was done using the sealed opaque envelope method. The same knee replacement design was used; fixedbearing total knee, NexGen Knee System, Zimmer All data were collected about the studied patient as follows:

History: Personal data: Name, gender, age, occupation, history of the present symptoms, and past medical history.

Clinical examination: include body mass index and local examination of:

a- Skin: Wounds, Scars, Sinuses, Redness, Bruises, Tenderness.

b- Neurological & vascular assessment of both lower limbs. c- Limb length discrepancy

Radiological evaluation: A standing Anteroposterior and lateral views of both knees were obtained for every patient.

Inclusion criteria: Cases of primary knee osteoarthritis.

Exclusion criteria:

- Severe bone loss.
- MCL or LCL insufficiency.
- Bone tumors
- Blood diseases (bleeding tendency disorders)
- History of cardiovascular comorbidities with regular anticoagulant

Routine pre-operative laboratory investigations:

Blood picture, blood sugar, coagulation profile (INR, PTT, PT, and PC), renal and liver functions for all patients.

- Base line of ESR, and CRP was recorded for both groups.
- Electrocardiogram (ECG) for all patients.
- Reservation of 2 units of packed RBCs**.**

Methods:

Epidural spinal anaesthesia was administered to all participants. A pneumatic tourniquet had been utilised in all instances and was deflated prior to closure in order to control bleeding. Prior to cementing, a bone plug had been utilised to seal the distal femoral entrance. No other techniques were utilised for minimising blood loss, such as the administration of tranexamic acid locally or systemically, infiltration of saline adrenaline, or hydrogen peroxide. Group D used the closed suction drain. Each participant received a postoperative compression dressing that was thick. Both groups adhered to comparable pain management procedures.

Participants having a postoperative haemoglobin level of ≤ 8 g/dL or less were advised to get a blood transfusion. (7) The main measure of the outcome evaluated was the levels of haemoglobin and HCT on the second and seventh days after the surgery (8,9). The secondary outcome measures evaluated the inflammatory response by monitoring the levels of CRP and ESR on the 2nd and 7th days after surgery, weekly for the next three weeks, and ultimately at 6 months postoperative. (10) Complications (infection, DVT, PE, and postoperative length of stay were all assessed.

Approach :

The surgical procedure utilised in all instances included an anterior midline incision and a medial parapatellar approach.

Closure:

Fig 1: A- D (drain group). B- ND (no drain group)

Closure of arthrotomy then subcutaneous layer. Skin closure by stables. For Group D, a negative suction drain was applied before the closure of the arthrotomy. (Fig 1) The drain was implanted via a distinct aperture located a few centimetres apart from the primary incision. The drain is equipped with a sharp trocar that is connected to the tube. The trocar was utilised to penetrate the skin inside, emerging via the proximal end of the stab incision, in nondependent area. The drain

was secured to the skin with a stay-stitch. For group D the suction drainage was usually removed after 24 hours after the operation. The sum of blood loss was calculated after 24 hours before removal. The wound was covered postoperative with two gauzes (30x30) and adhesive plaster strip, then cotton and crepe bandage was applied from the foot till midthigh. The cotton and crepe bandage were removed 24 hours postoperative to allow easy ROM. Ice packing was advised postoperatively to decrease swelling.

Postoperatively:

The patient was mobilized from the bed as early as possible. Full weight bearing was allowed the next day postoperatively with a walker. All patients have been prescribed Enoxaparin (40 mg SC/24 hours) 12 hours after surgery and continued for 35 days. All patients included in the study received a specific regimen of antibiotics, which was 1st generation cephalosporin injection for 2 days followed by an oral antibiotic (Amoxicillin clavulanic acid) for 5 days.

Follow-up:

Post-operative blood loss was assessed in both groups by measuring the **Hb and HCT % on the 2nd and 7th day postoperative**; and clinically by measuring blood loss in the drain for the drain group. For the no-drain group; Visible blood loss following surgery was evaluated by calculating the rise in the proportion of blood saturation in dressings during exchanging it on the 2nd postoperative day using a visual guide table.

ESR and CRP (quantitative) were measured on the 7th postoperative day and then once weekly for the next 4 weeks and finally 6 months postoperatively to evaluate if there is a difference in inflammatory response between both groups, presence of hyperemia around the wound, and surgical site infection.

Statistical analysis of the data:

The qualitative data has been presented utilising numerical values and percentages. The quantitative data were characterised utilising the range (minimum and maximum), mean, standard deviation, and median. The significance of the obtained results was judged at the 5% level.

RESULTS:

The mean age of the individuals in the D group was 61.6 years, with a range of 56 to 68 years. In the ND group, the mean age was 62.76 years, with a range of 56 to 67 years. The mean preoperative haemoglobin (Hb), postoperative Hb, HCT levels on the second and the seventh days, clinical blood loss, and the number of individuals requiring blood transfusions are summarized in (Table 1).

Table (1): summary of postoperative blood loss results

Variable	Group D (with drain)	Group ND (no drain)	P-value
Pre-operative Hb	12.83	12.92	0.174
Post-operative Hb on 2nd day	8.98	10.54	<0.001
Post-operative HCT on 2nd day	27.88	33.31	<0.001
Post-operative Hb on 7th day	9.08	9.47	0.042
Post-operative HCT on 7th day	28.59	30.82	0.002
Blood transfusion (number of patients)	7	2	0.011

A statistically substantial difference was existed in postoperative blood loss and the need for blood transfusion between the two groups. In the drain group, the blood loss and the number of patients who needed transfusion were significantly more.
There was no significant difference between the two groups concerning the behavior of ESR and CRP as an indicator of inflammatory response. (Table 2,3,4) (Fig 2,3)
Ecchymosis around the wound was recorded in 1 patient (5%) in group D and 5 participants (25%) in group ND with no statistically substantial variation ($p = 0.145$) and resolved completely in all participants by the 4th week without any signs of wound infections. There were no recorded instances of infections, DVT, or PE. The mean postoperative LOS for both groups was 2.98 ranging from 2 to 4 days.

Table 2: Shows a summary of ESR and CRP readings on 7th postoperative day.

	Group										P value
	D group					ND group					
	Mean	SD	Median	Minimum	Maximum	Mean	SD	Median	Minimum	Maximum	
ESR 1st hour 7th Day	44.33	17.54	47.50	14.00	73.00	46.37	16.38	44.00	12.00	85.00	0.668
ESR 2nd hour 7th Day	86.47	28.57	92.50	28.00	130.00	89.73	30.40	90.00	24.00	144.00	0.722
CRP 7th Day	28.02	13.97	24.65	11.00	64.00	34.83	19.89	26.00	6.00	75.00	0.222

Table3: Showing a summary of ESR and CRP on the 4th postoperative week

	Group										**P value**
	D group					**ND group**					
	Mean	SD	Median	Minimum	Maximum	Mean	SD	Median	Minimum	Maximum	
ESR 1st hour 6th month	17.48	9.45	20.00	14.00	30.00	14.30	7.82	15.00	9.00	28.00	0.480
ESR 2nd hour 6th month	30.45	18.33	32.00	20.00	44.00	28.96	14.96	25.00	18.00	38.00	0.685
CRP 6th month	7	3.14	6.30	1.00	7.14	5.65	3.61	13.00	.00	5.00	0.032

Table 4: Showing a summary of ESR and CRP on the 6th postoperative month

	Group										**P value**
	D group					**ND group**					
	Mean	SD	Median	Minimum	Maximum	Mean	SD	Median	Minimum	Maximum	
ESR 1st hour 4th Week	19.48	9.45	16.00	6.00	39.00	20.28	7.82	18.00	9.00	36.00	0.514
ESR 2nd hour 4th Week	37.55	18.33	32.00	12.00	70.00	37.96	14.96	35.00	18.00	68.00	0.748
CRP 4th Week	7.65	3.14	6.30	5.00	15.14	14.00	3.61	13.00	11.00	18.00	0.036

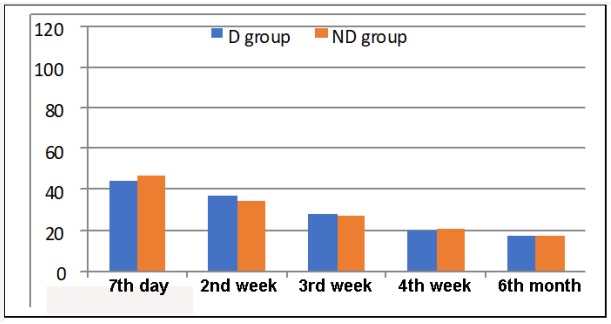

Fig 2: Showing means CRP in both groups during follow-up.

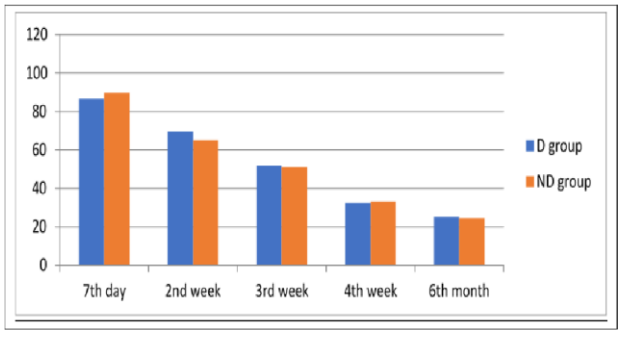

Fig 3: Showing means ESR 2nd hour follow-up in both groups.

DISCUSSION:

Surgeons should reassess the utilisation of a drains in arthroplasty due to its controversial nature. McManus et al. utilised Tc-99m-labeled red blood cells to observe that a significant quantity of red blood cells migrated into the joint space. The tissue compartment was incapable of returning the cells to the systemic circulation, resulting in a subsequent decrease in haemoglobin levels. (11) Bleeding finally ceases when the joint gap and muscle compartment get saturated with blood. When a drain is inserted between the joint space and muscle compartment, bandages are unable to get soaked, hence preventing more bleeding into the drain until it is taken out.

Our research demonstrated a substantial decrease in both Hb and HCT levels among individuals with a drain. The postoperative blood loss that is visible and the quantity of blood transfused to individuals who do not have drains are much less compared to those who have drains. In a systematic study conducted by Parker et al. (5),

researchers have documented comparable results when examining the effectiveness of closed suction drainage following TKA surgeries. The analysis included 36 trials, which examined a total of 5,697 surgical wounds. The findings of the investigation didn't reveal any advantages associated with the application of the drain. The blood loss and the need for blood transfusion were much higher when drains were used, resulting in a higher transfusion rate. Our investigation offers further data to substantiate the findings of the prospective, randomised trial on drainage in knee arthroplasty conducted by Li et al. (17) A research was conducted on 100 knee arthroplasties. Esler et al. likewise reported comparable results regarding haemorrhage and the need for blood transfusion. (18).

However, despite the findings of Adalberth et al, Gaurav et al, Zhang et al, and Wang et al., who didn't observe any added advantages when utilising a drain following knee arthroplasty, they didn't record any disparities in terms of blood loss and blood transfusion among the groups with drains and those without drains. The potential reason for reducing postoperative blood loss may lie in the use of several techniques, such as using elastic compression dressing for a duration of 4 days after surgery, as shown in the study conducted by Adalberth et al. (20). Additionally, the administration of intravenous Tranexamic acid, as demonstrated in the studies conducted by Gaurav et al., Zhang et al., and Wang et al., might also contribute to this reduction. (12,13). According to a meta-analysis conducted by Yang et al., it was shown that intravenous TXA effectively decreased blood loss and the need for blood transfusions during knee arthroplasty. This conclusion was based on data from 15 randomised controlled trials (RCTs). (14) Waugh and Stinchfield have proposed the utilisation of suction draining in orthopaedic procedures, contending that the incidence of infection was greater in patients who did not undergo drain insertion. (20) Subsequently, several studies have raised concerns about the impact of drain use on infection rates. No significant variance in infection incidence was seen in the present investigation due to the absence of any identified infections. The same findings were shown in two investigations conducted by Li et al. (17) and Esler et al. In Zhang et al.'s meta-analysis, no significant distinction was found between drainage and non-drainage in terms of infection incidence. (15,16) In their case-control research, Minnema et al. determined that the utilisation of closed suction drainage was linked to the occurrence of SSI after TKA. They suggested that refraining from using surgical drains in individuals undergoing TKA might decrease the likelihood of infection. (18,19) The postoperative inflammatory response was evaluated by measuring CRP and ESR on the second and the seventh days after surgery, and then weekly until the 4th week after surgery. There was no statistically significant variation seen among both groups in terms of the behaviour of ESR and CRP as indications of the inflammatory response after surgery. The ESR and CRP measurements showed a decreasing trend in both groups.

No statistically significant differences were seen between the groups in terms of postoperative LOS, DVT, or PE. The presence of erythema surrounding the wound was seen more often among individuals who did not have a drain, but this difference wasn't statistically significant. Furthermore, the erythema totally healed in all individuals by the fourth week.

CONCLUSION:

Based on our observations and results, There is no additional benefit of using a closed suction drain compared to not using a drain following TKA. The use of a drain resulted in a notable increase in the loss of blood and a requirement for blood transfusion. There were no notable disparities seen in the inflammatory responses, infection rates, or ecchymosis around the site, Length of stay, DVT, and PE.

Strengths

This study is a randomized prospective controlled study. Also, the relatively long follow-up period is a good advantage to our study.

Weaknesses

A small sample size may affect on accuracy and reality of the results.

Future recommendations and research

A larger sample size is needed to identify factors that predict outcomes and different management strategies to achieve the best outcome.

Conflict of interest:

The authors declared that there were no conflicts of interest and no financial support for this work.

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