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Research Article

Comparison between Closed Suction Drainage and No Drainage Following Primary Total Knee Arthroplasty

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Abstract

Objective: To compare the early outcome between closed suction drainage and no drainage following primary total knee arthroplasty.

Design of Study: It was a randomized controlled trial.

Study Duration and Settings: This study was carried at the Orthopedic Departments of Combined Military Hospital Lahore and Rawalpindi from Jan 2016 to March 2019.

Methodology: This study involved 236 patients of both genders, aged between 40 - 80 years undergoing primary unilateral total knee arthroplasty for degenerative conditions like osteoarthritis and rheumatoid arthritis. These patients were divided into two treatment groups randomly. Patients in Group-A underwent TKR with closed suction drainage while patients in Group-B underwent TKR without post-operative drainage. A signed written consent was taken from every patient.

Findings: Of the 236 studied patients, there were 49 (20.8%) males and 187 (79.2%) females with a male to female ratio of 1:3.8. The mean age of the patients was 62.5 ± 8.5 years. Both the study groups were similar in terms of mean pre-operative hemoglobin (p-value = 0.737) and mean pre-operative hematocrit (p-value = 0.524). However, the mean post-operative hemoglobin (10.57 ± 1.16 vs. 9.22 ± 1.02 g/dl; p-value < 0.001) and mean post-operative hematocrit (38.30 ± 1.65 vs. 36.54 ± 1.34 %; p-value < 0.001) were significantly higher in the non-drainage group. Similarly, the mean fall in hemoglobin (1.09 ± 1.97 vs. 2.37 ± 1.66 g/dl; p-value < 0.001), mean fall in hematocrit (2.30 ± 1.57 vs. 3.87 ± 2.47; p-value < 0.001), mean estimated blood loss (947.01 ± 218.98 vs. 1282.19 ± 320.59 ml; p-value < 0.001) and mean length of hospital stay (5.27 ± 1.45 vs. 6.25 ± 1.29 days; p-value < 0.001) were all significantly lower in the non-drainage group. Patients without post-operative drain also had significantly lower need for transfusion (32.2% vs. 46.6%; p-value = 0.024) in the post-operative period.

Conclusion: Omission of routine post-operative drainage after primary total knee arthroplasty was found superior to conventional practice of closed suction drainage in terms of decreased blood loss, decreased fall in hemoglobin concentration and lesser need for post-operative transfusion. Therefore, we advocate the drainage after primary TKA to be unnecessary and be avoided as a routine practice.

Keywords: *Primary Total Knee Arthroplasty; Post-Operative Drainage; Blood Loss*

Introduction

Total knee replacement (TKR) is widely used in the treatment of osteoarthritis and moderate or severe rheumatoid arthritis [1]. A number of strategies to reduce the need for allogenic red cell transfusion during and after TKR have been employed such as the use of thigh tourniquets, diathermy coagulation, knee positioning, clamping drains, adrenaline and saline infiltration, and computer assisted navigated TKRs [2,3]. Most bleeding in TKRs occurs post-operatively [3]. Closed suction drain is being used widely in different surgical specialties, with orthopedics not being an exception. The use of suction drain has been practiced routinely, ever since the era of Hippocrates [4]. Hypothetically, post-operative drainage prevents formation of hematoma at the operative site, decreases strain over the incision

(which subsequently reduces pain), improves wound healing and diminishes the risk of infection [5]. However, the drainage system unavoidably increases bleeding because the tamponade effect does not occur at the operative site. Additionally, it can cause a retrograde infection [5-7]. To diminish such threats, the use of a clamping drain, reduction in the drainage duration and suction pressure and auto-transfusion of drained blood are suggested [3-7]. Draining the surgical wounds has been a matter of controversy and discussion over the past few decades with more advanced sterility techniques and decreased infection rate [3,4]. Many surgeons blindly follow the practice as per their early training, though, the use of suction drains in the joint is still controversial [3,8,9].

Several studies have shown that postoperative drainage in total knee arthroplasty is not necessary, although it is still widely used by orthopedic surgeons [10]. Usage of closed suction drainage after total knee arthroplasty is a common practice in many tertiary care hospitals of Pakistan. This study compared the short-term outcome in patients with (short duration and low suction pressure) and without drain following TKR to determine if there was any difference in the post-operative hematological parameters and need for post-operative transfusion.

Materials and Methods

The present study was an RCT (randomized controlled trial) carried at the Orthopedic Departments of Combined Military Hospital Lahore and Rawalpindi from Jan 2016 to March 2019. Sample size of 236 cases (118 in each group) was calculated with 95% significance level and 80% power of test considering expected mean blood loss to be 261.25 ± 48.65 ml in patients with routine post-operative drainage and 243 ± 51.3 ml in patients without post-operative drainage [10]. Patients of both genders aged between 40 - 80 years having advanced degenerative disease of knee planned for unilateral total knee replacement were included in this study. Patients with revision and complex knee arthroplasty, uni-compartmental knee arthroplasty and single stage bilateral total knee replacement were not included in the study.

The procedure was performed through a standardized technique by the senior surgeon. All the operative procedures used a midline incision and a medial parapatellar approach under a high thigh tourniquet. The femoral and tibial components were cemented, and the patella resurfaced in all cases. PCL-sacrificing posterior stabilized knee prosthesis was used in all patients. They included: Vanguard® (Biomet), Genesis II® (Smith and Nephew), PFC-Sigma (DePuy, Johnson and Johnson) NexGen® (Zimmer, Ltd., Swindon, UK). The procedures were performed either under spinal anesthesia or general anesthesia always combined with an epidural. Before the closure of the wound, the tourniquet was deflated, and hemostasis secured. After layered closure a compression bandage with the knee in extension was given, which stayed for about six hours post-operatively. Routine DVT (deep vein thrombosis) prophylaxis was not given. However, patient and attendants were instructed to start ankle movements both active and passive to facilitate calf pump till the patient was mobilized out of bed either on the same evening or next morning. Only cases with any known risk factor for thromboembolism was given Clexane 10 mg injection S/C once daily for 2 weeks.

Outcome variables were mean post-operative hemoglobin, mean post-operative hematocrit, mean fall in hemoglobin and hematocrit all measured 24 hours after surgery along with need for post-operative transfusion (post-operative Hb ≤ 8.0 g/dl) and mean duration of hospital stay which was measured in days from the day of operation till the day patient was discharged to home. Numerical variables like age, BMI, pre-operative and post-operative hemoglobin and hematocrit, fall in hemoglobin and hematocrit and length of hospital stay have been described as mean ± sd. We applied independent sample t-test to compare the mean of these variables between the study groups taking p-value ≤ 0.05 as statistically significant. Categorical variables like gender and need for transfusion has been described as frequency and percentage. We used chi-square test to compare the frequency of need for transfusion in post-operative period between the groups taking p-value ≤ 0.05 as statistically significant. All the procedures were performed by a single surgeon utilizing standard operative technique to minimize bias.

Results

The age of the patients ranged from 45 years to 75 years with a mean of 62.5 ± 8.5 years. There were 49 (20.8%) male and 187 (79.2%) female patients in the study group with a male to female ratio of 1:3.8. The BMI of the patients ranged from 22.1 Kg/m^2 to 34.7 Kg/m^2 with a mean of 28.53 ± 3.53 Kg/m^2. Majority (n = 224, 94.4%) of the patients had osteoarthritis while remaining 12 (5.1%) patients had rheumatoid arthritis (Table 1). The two study groups were homogenous in terms of mean age (p-value = 0.755), mean BMI (p-value = 0.243) and gender (p-value = 0.422) and etiologic (p-value = 0.553) groups distribution (Table 2).

Characteristics	Participants (n = 236)
Age (years)	62.5 ± 8.5
Gender	
Male	49 (20.8%)
Female	187 (79.2%)
BMI (Kg/m^2)	28.53 ± 3.53
Cause	
Osteoarthritis	224 (94.4%)
Rheumatoid Arthritis	12 (5.1%)

Table 1: *Demographic features of study participants.*

Characteristics	Drain (n = 118)	No Drain (n = 118)	P value
Age (years)	62.7 ± 8.2	62.4 ± 8.9	0.755
Gender			
Male	27 (22.9%)	22 (18.6%)	0.422
Female	91 (77.1%)	96 (81.4%)	
BMI (Kg/m^2)	28.26 ± 3.73	28.80 ± 3.32	0.243
Cause			
Osteoarthritis	113 (95.8%)	111 (94.1%)	0.553
Rheumatoid Arthritis	5 (4.2%)	7 (5.9%)	

Table 2: *Demographic features of study groups.*
Chi-square test, Independent sample t-test, No significant difference was observed (p > 0.05).

Both the study groups were similar in terms of mean pre-operative hemoglobin (p-value = 0.737) and mean pre-operative hematocrit (p-value = 0.524). However, the mean post-operative hemoglobin and mean post-operative hematocrit were significantly higher in the non-drainage group. Similarly, the mean fall in hemoglobin, mean fall in hematocrit, mean estimated blood loss and mean length of stay were all significantly lower in the non-drainage group. Patients without post-operative drain also had significantly lower need for transfusion in the post-operative period. These findings have been summarized in table 3. In both study groups, we did not observe any incidence of wound-related complications or infection. However, ecchymoses around knee and down over the calf was observed in 70% (n = 83) cases of non-drained as compared to 10% (n = 12) of drained TKAs. This discoloration required reassurance to the patients and resolved spontaneously around 2 - 3 weeks' time in all cases.

Characteristics	Drain (n = 118)	No Drain (n = 118)	P value
Pre-Operative Data			
Pre-operative Hemoglobin (g/dl)	11.59 ± 1.40	11.65 ± 1.47	0.737
Per-operative Hematocrit (%)	40.42 ± 2.29	40.59 ± 1.99	0.524
Post-Operative Data			
Post-operative Hemoglobin (g/dl)	9.22 ± 1.02	10.57 ± 1.16	< 0.001*
Post-operative Hematocrit (%)	36.54 ± 1.34	38.30 ± 1.65	< 0.001*
Fall in Hemoglobin (g/dl)	2.37 ± 1.66	1.09 ± 1.97	< 0.001*
Fall in Hematocrit (%)	3.87 ± 2.47	2.30 ± 1.57	< 0.001*
Estimated Blood Loss (ml)	1282.19 ± 320.59	947.01 ± 218.98	< 0.001*
Post-operative Transfusion	55 (46.6%)	38 (32.2%)	0.024*
Length of Hospital Stay (days)	6.25 ± 1.29	5.27 ± 1.45	< 0.001*

Table 3: *Comparison of various outcome measures.*

*Chi-square test, Independent sample t-test, *Observed difference was statistically significant.*

Discussion

Blood transfusion in the post-operative period is a common surgical issue. It however comes with its associated complications like transfusion reaction and transmission of infection [11]. Therefore, measures which can reduce operative blood loss have always been hot area of research and new and novel techniques like tourniquet, minimal surgical dissection, fibrin glue, intermittent clamping of the drain and auto transfusion drains have been developed [3,4]. Post-operative drainage after primary total knee replacement is a common practice to prevent tension over the wound and enhance patient recovery by decreasing complications of flap edema and necrosis [3]. However, recent studies showed that not only this routine drainage was unnecessary rather it was associated with increased risk of retrograde infection [3,4].

In the present study, the mean age of the patients was 62.5 ± 8.5 years while the mean BMI was 28.53 ± 3.53 Kg/m^2. There were 49 (20.8%) male and 187 (79.2%) female patients in the study group with a male to female ratio of 1:3.8. Majority (n = 224, 94.4%) of the patients had osteoarthritis while remaining 12 (5.1%) patients had rheumatoid arthritis. A similar mean age of 62.11 ± 8.68 years has been reported by Raja., *et al*. [12] (2016) among patients undergoing TKR at Shifa International Hospital, Islamabad, Pakistan. They also reported female predominance among such patients with male to female ratio of 1:1.6. Jhurani., *et al*. [13] (2016) reported similar mean age of 64.0 ± 7.8 years among Indian patients undergoing TKR with male to female ratio of 1:3.4. They also reported similar mean BMI of 29.3 ± 3.8 Kg/m^2 and distribution of osteoarthritis (95.5%) and rheumatoid arthritis (4.5%) among these patients. A similar mean age of 66.7 ± 9.8 years has been reported by Keska., *et al*. [14] (2014) among Polish patients undergoing TKR. They reported similar female predominance with male to female ratio of 1:3.3 and similar mean BMI of 29.1 ± 4.4 Kg/m^2. They too observed osteoarthritis to be more frequent (77.5%) than rheumatoid arthritis (22.5%) among these patients. Leao., *et al*. [15] (2016) reported similar mean age of 62.8 ± 6.1 years in Brazil with male to female ratio of 1:3.4. Again, similar mean age of 64.5 ± 7 years has been reported by Basaran., *et al*. [16] (2016) in Turkish patients undergoing TKR. However, they reported much higher female predominance with male to female ratio of 1:7. A similar female predominance has been reported by Majeed., *et al*. [17] (2013) in UK who reported a male to female ratio of 1:3.2.

We observed that the mean post-operative hemoglobin (10.57 ± 1.16 vs. 9.22 ± 1.02 g/dl; p-value < 0.001) and mean post-operative hematocrit (38.30 ± 1.65 vs. 36.54 ± 1.34%; p-value < 0.001) were significantly higher in the non-drainage group as compared to patients having routine post-operative closed suction drainage. Similarly, the mean fall in hemoglobin (1.09 ± 1.97 vs. 2.37 ± 1.66 g/dl; p-value

< 0.001), mean fall in hematocrit (2.30 ± 1.57 vs. 3.87 ± 2.47; p-value < 0.001), mean estimated blood loss (947.01 ± 218.98 vs. 1282.19 ± 320.59 ml; p-value < 0.001) and mean length of hospital stay (5.27 ± 1.45 vs. 6.25 ± 1.29 days; p-value < 0.001) were all significantly lower in the non-drainage group which resulted in significantly lower need for transfusion in the post-operative period (32.2% vs. 46.6%; p-value = 0.024). Our results are comparable to those of Raja., *et al.* [12] (2016) who reported similar significant difference in the mean post-operative hemoglobin (10.38 ± 1.29 vs. 9.94 ± 0.73 g/dl; p-value = 0.041), mean length of hospital stay (5.72 ± 1.07 vs. 6.84 ± 1.06 days; p-value = 0.049) and frequency of post-operative transfusion (36.0% vs. 72.0%; p-value = 0.0004) between non-drainage and drainage groups respectively after TKR at Shifa International Hospital, Islamabad, Pakistan. Shah., *et al*. [18] at Liaquat National Hospital, Pakistan reported similar significant difference in mean post-operative hemoglobin (9.95 ± 0.77 vs. 9.30 ± 0.82 g/dl; p-value < 0.001) and mean fall in hemoglobin (2.00 ± 0.97 vs. 2.71 ± 1.04 g/dl; p-value < 0.001) between non-drainage and drainage groups after TKR. Sharma., *et al*. [19] (2016) reported similar significant difference in mean length of hospital stay (5.12 ± 1.65 vs. 6.21 ± 1.74; p-value = 0.0006) between these two groups in Indian patients undergoing TKR. Keska., *et al*. [14] (2014) reported similar results in a trial involving Polish patients undergoing TKR in terms of mean operative blood loss (1479 ± 459 vs. 1580 ± 484 ml; p-value < 0.05), mean fall in hemoglobin (0.7 ± 0.6 vs. 1.1 ± 0.8 g/dl; p-value < 0.05), mean fall in hematocrit (2.2 ± 2.1 vs. 3.2 ± 2.4%; p-value < 0.05) and frequency of post-operative transfusion (39.0% vs. 53.0%; p-value < 0.05). Ovadial., *et al*. [20] in 1997 (15.4% vs. 50.0%; p < 0.05), Esler., *et al*. [21] in 2003 (38.0% vs. 62.0%; p-value = 0.036), Cao., *et al*. [22] in 2011 (22.0% vs. 64.0%; p-value < 0.001) reported similar difference in the frequency of post-operative transfusion between non-drainage and drainage after TKR. Jenny., *et al*. [23] in 2001 (1264 ± 669 vs. 1431 ± 827 ml; p-value = 0.022), Cao., *et al*. [22] in 2011 (535 ± 295 vs. 853 ± 331 ml; p-value < 0.001) and Liu., *et al*. [10] in 2014 (243 ± 51.3 vs. 261.25 ± 48.65 ml; p-value = 0.048) also reported significant difference in mean blood loss between the groups.

The observations made in the present study are in line with the already published research and favor the omission of drain in the post-operative period to decrease the blood loss and subsequent need for blood transfusion. In the present study, no patient developed infection or other wound complications like flap necrosis or dehiscence in either group.

Conclusion

Omission of routine post-operative drainage after primary total knee arthroplasty was found superior to conventional practice of closed suction drainage in terms of decreased blood loss, decreased fall in hemoglobin concentration and lesser need for post-operative transfusion. Therefore, we advocate the drainage after primary TKA to be unnecessary and be avoided as a routine practice.

Bibliography

1. Walters JL., *et al*. "The journey to total hip or knee replacement". *Australian Health Review* 36.2 (2012): 130-135.

2. Katz JN. "Appropriateness of total knee replacement". *Arthritis and Rheumatology* 66.8 (2014): 1979-1981.

3. Healy WL., *et al*. "Complications of total knee arthroplasty: standardized list and definitions of the Knee Society". *Clinical Orthopaedics and Related Research* 471.1 (2013): 215-220.

4. Nikolaou VS., *et al*. "Common controversies in total knee replacement surgery: Current evidence". *World Journal of Orthopedics* 5.4 (2014): 460-468.

5. Abuzakuk T., *et al*. "Autotransfusion drains in total knee replacement. Are they alternatives to homologous transfusion?" *International Orthopaedics* 31.2 (2007): 235-239.

6. Si H., *et al*. "No clear benefit or drawback to the use of closed drainage after primary total knee arthroplasty: a systematic review and meta-analysis". *BMC Musculoskeletal Disorders* 17 (2016): 183.

7. Yin D., *et al*. "Tourniquet and closed-suction drains in total knee arthroplasty. No beneficial effects on bleeding management and knee function at a higher cost". *Orthopaedics and Traumatology: Surgery and Research* 103.4 (2017): 583-589.

8. Zhang S., *et al*. "Early removal of drainage tube after fast-track primary total knee arthroplasty". *Journal of Knee Surgery* 30.6 (2017): 571-576.

9. Martin A., *et al*. "Relevance of wound drainage in total knee arthroplasty--a prospective comparative study". *Zeitschrift fur Orthopadie und ihre Grenzgebiete* 142.1 (2004): 46-50.

10. Liu X-H., *et al*. "The effect of drainage tube on bleeding and prognosis after total knee arthroplasty: a prospective cohort study". *Journal of Orthopaedic Surgery and Research* 9 (2014): 27.

11. Su EP and Su S. "Strategies for reducing peri-operative blood loss in total knee arthroplasty". *Bone and Joint Journal* 98.1 (2016): 98-100.

12. Raja A., *et al*. "Comparison between closed suction drainage and no drainage following total knee arthroplasty in a tertiary care setting in Pakistan". *Cureus* 8.10 (2016): e842.

13. Jhurani A., *et al*. "Effect of closed suction drain on blood loss and transfusion rates in simultaneous bilateral total knee arthroplasty: a prospective randomized study". *Knee Surgery and Related Research* 28.3 (2016): 201-206.

14. Kęska R., *et al*. "Outcome in primary cemented total knee arthroplasty with or without drain: A prospective comparative study". *Indian Journal of Orthopaedics* 48.4 (2014): 404-409.

15. Leao MG de S., *et al*. "Does the suction drain diameter matter? Bleeding analysis after total knee replacement comparing different suction drain gauges". *Revista Brasileira de Ortopedia* 51.5 (2016): 547-554.

16. Basaran HS., *et al*. "Usage of Positive pressure hemovac drain following total knee arthroplasty: reduce blood loss or not". *SM Journal of Orthopedics* 2.1 (2016): 1027.

17. Majeed H., *et al*. "Blood transfusion after total knee arthroplasty comparison of drainage versus non-drainage". *Journal of Hematology and Thromboembolic Diseases* 1 (2013): 114.

18. Shah KAS., *et al*. "Does draining the post-operative hematoma have an impact in TKA patients". *Biomedical Journal of Scientific and Technical Research* 1.5 (2017): 2-6.

19. Sharma GM., *et al*. "Use of closed suction drain after primary total knee arthroplasty - an overrated practice". *SICOT J* 2 (2016): 39.

20. Ovadia D., *et al*. "Efficacy of closed wound drainage after total joint arthroplasty. A prospective randomized study". *Journal of Arthroplasty* 12.3 (1997): 317-321.

21. Esler CN., *et al*. "The use of a closed-suction drain in total knee arthroplasty. A prospective, randomised study". *Journal of Bone and Joint Surgery. British Volume* 85.2 (2003): 215-217.

22. Cao L., *et al*. "No clear advantage to use of wound drains after unilateral total knee arthroplasty: a prospective randomized, controlled trial". *Journal of Arthroplasty* 26.4 (2011): 519-522.

23. Jenny JY., *et al*. "No drainage does not increase complication risk after total knee prosthesis implantation: a prospective, comparative, randomized study". *Knee Surgery, Sports Traumatology, Arthroscopy* 9.5 (2001): 299-301.

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