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Brief communication (Original)

The comparison of wound drainage after TKA between postoperative cast immobilization and non-immobilization: a randomized controlled trial

Vajara Wilairatana, Saran Tantavisut, Aree Tanavalee, Srihatach Ngarmukos, Yongsak Wangroongsub
Department of Orthopedics, Faculty of Medicine, Chulalongkorn University, Bangkok 10330, Thailand

Background: Many previous studies concluded that postoperative splint did not significantly decrease volume of blood loss in suction drainage. However, the splints in their studies were not rigid. We applied long leg cast, that was more rigid and subsequently may reduce blood loss in suction drainage.
Objectives: This study compared the blood from suction drainage after total knee arthroplasty between postoperative cast immobilization and non-immobilization.
Methods: A consecutive series of 142 knees in 142 osteoarthritis patients who required total knee arthroplasty were divided in long leg cast group and non-cast group (webril and elastic bandage wrapped) by close seal envelopes. Both groups removed their restrained at three days post operation. The volumes of blood from suction drainage in both groups were recorded for 24 hours after operation. Maximum knee flexion and wound complication were also evaluated.
Results: There were 69 knees in cast group and 73 knees in non-cast group. The mean±SD of blood loss in cast group was 324.7±129.3 ml and non-cast group was 546.8±122.2 ml. The mean difference in blood lost between cast and non-cast group were 222.1 ml (range from 180.4 to 263.8 ml.). Using unpaired t-test, there was a significant difference of wound drainage between both groups ($p < 0.05$). More maximum knee flexion at eight weeks postoperative was gain in cast group ($p < 0.05$). Wound complications were increase in non-cast group but not statistically significant ($p = 0.497$).
Conclusion: The immobilized knee with long leg cast after total knee arthroplasty can decrease blood loss from suction drainage. Therefore, we recommended using long leg cast after total knee arthroplasty as another technique that safely reduces blood loss without compromise to postoperative range of motion in patient who need blood saving as critical.

Keywords: Blood loss, cast, immobilization, range of motion, total knee arthroplasty, wound complication

Total knee arthroplasty (TKA) is associated with significant blood loss, which is composed of visible blood loss from the surgical field, wound drainage, and blood loss into the surrounding tissue [1, 2]. Many studies in the past concluded that postoperative splint did not significantly decrease volume of blood loss in suction drainage [3, 4]. However, the splints in their studies were not rigid (i.e., soft splint, knee brace, or slab). In our practice, we apply long leg cast, which made from plaster of Paris to cover from mid-thigh to the foot. Cast is logically more rigid and better inhibit knee movement that produce bleeding from surgical trauma and subsequently reduce blood loss in suction drainage. The purpose of this study is to measure postoperative blood loss from suction drainage and to compare maximum flexion ability and wound complication between the patient with postoperative knee immobilization with long leg cast and knee without cast.

Correspondence to: Associate Professor Vajara Wilairatana, MD, Department of Orthopedics, Faculty of Medicine, Chulalongkorn University, Bangkok 10330, Thailand. E-mail: wvajara@gmail.com

Materials and methods

Between December 2007 and November 2009, 142 cases of the TKA were evaluated in 142 patients. The patients who had previous fracture or deformity around the knee, inflammatory joint disease, coagulation impairment from disease or any medication were excluded from study. The patients

were randomly allocated into 2 groups by close seal envelopes, which were opened immediately after skin incision was completely closed. Group A was TKA with postoperative immobilization with long leg cast and group B was TKA with postoperative webril and elastic bandage wrapped from mid thigh to foot. The legs were elevated at 40^{O} and the knees were positioned in full extension in both groups.

All operations were performed under spinal anesthesia by single senior surgeon who had an experienced of performing TKA more than 1,000 cases. The arthrotomy was done through standard medial parapatellar approach. Intramedullary guide was used for distal femoral bone cut and finally the distal femoral drilled hole was occluded with autograft bone plug. Extramedullary guide was used for proximal tibial cut and all patellar were resurfaced. NexGen LPS-Flex (Zimmer, Warsaw, IN, USA) prostheses with palcos genta bone cement were applied for all patients. The tourniquet was used with pressure 350 mmHg and was released after long leg cast or elastic bandage was completely applied to the patient. The knees were fitted with suction drainage (Hemovac drainage) and kept the drain clamped for 1 hour postoperatively then was left opened until it was removed at 24 hours postoperatively. The amount of blood in suction drainage during 24 hours postoperative period was recorded. Rehabilitation protocol was the same in both groups, the patients were encouraged to walk as tolerate with walker on postoperative day 2 then an elastic bandage or long leg cast were removed at postoperative day 3. Maximum knee flexion was recorded at preoperative period and 8 weeks postoperatively. These were taken with goniometer by arthroplasty fellow who was blinded to patient allocation. Wound complications were evaluated as separation of the skin margins or prolong drainage necessitating an alteration in the normal postoperative course.

Volume of blood loss from suction drainage and range of motion at 8 weeks were analyzed with unpaired student t-test. Wound complication was analyzed by Chi square test. This project is conducted in accordance with the Helsinki Declaration [5] and approved by our institutional research committee.

Results

There were 69 patients allocated in group A and 73 patients in group B. **Table 1** shows epidemiologic data of both groups. The mean age in group A and B are 68±8.3 years and 69.3±7.2 years respectively. Average wound length is 15±1 centimeters.

Data about blood loss from suction drainage in both groups can be seen in **Table 2.** The mean difference (95% CI) in blood loss between group A and group B is 222.14 cc (range from 180.39- 263.8 cc). Using unpair t-test, there is a significant difference in volume of wound drainage between group A and group B ($p < 0.05$).

Table 3 shows the knee motion at preoperative period and after 8 weeks postoperative TKA. The mean difference of postoperative knee motion in both groups (95% CI) is 6.2 degree (range 3-9.4 degree). Using unpaired t-test, there is a significant difference in knee range of motion between both groups ($p < 0.05$).

Table 1. Baseline data

	Group A (n = 69)	**Group B (n = 73)**
Sex		
Male	5 (7.2%)	6 (8.2%)
Female	64 (92.8%)	67 (91.8%)
Male : Female	1 : 12.8	1 : 11.2
Weight(kg)		
Mean±SD	65.08±10.5	65.5±10.4
Height (m)		
Mean±SD	1.55±0.1	1.54±0.1
Body Mass Index (Kg/m^2)		
Mean±SD	26.7±3.9	27.3±4.2
Side of TKA		
Right	33 (47.8%)	41 (56.2%)
Left	36 (52.2%)	32 (43.8%)

Table 2. Postoperative Blood drainage after TKA

	Cast (n = 69)	Non Cast (n = 73)
Mean±SD (ml)	324.7±129.3	546.85±122.2
Range (ml)	60–640	300–960

Table 3. Postoperative Knee range of motion at 8 weeks

Full flexion (degree)	Cast (n = 69)	Non Cast (n = 73)
Preoperative Mean±SD	92.4±14.3	90±15.8
8 week postoperative Mean±SD	108.4±9.8	102.2±9.3

There was no wound complication in group A but we found 2 cases in group B who had wound edge necrosis. Both patients were treated by conservative treatment and resolved without any further problem. Using Fisher's Exact test, there is no statistical difference of wound complication between both groups (p = 0.497). In this series, we did not use any thrombotic prophylaxis and there were no case of symptomatic deep vein thrombosis or pulmonary embolism.

Discussion

There are many previous studies about postoperative TKA immobilization [3, 4]. However, they used less rigid splints, which allow knee to move some degree. In our study, we used long-leg cast that can provide more stability. To the best of our knowledge, this is the first study that reports on the results of postoperative TKA immobilization with long leg cast.

The proper period of suction drainage in TKA is one of the controversial topics in orthopedic practice [6-12]. Willemen et al. [7] reported randomized prospective study to compare close suction drainage of 24 hours versus 48 hours. They found that 85% of the blood loss occurred in the first 24 hours. Culture from the drain tips were positive in 25% of drains that were removed at 48 hours, but none of those removed at 24 hours. In our series, we removed drain after 24 hours and no infection was reported.

In this study, the total volume of postoperative 24-hour suction drainage was significantly decreased in cast immobilization group. This effect is influenced from the restriction of postoperative knee motion in the first 24 hours. These kept the injured soft tissue from operation to the least motion possible then lead to less production of further blood loss and enhance stability of blood clot.

We found that short-term immediate postoperative immobilization did not affect knee motion at eight weeks postoperative. This finding is contrast to results of many studies about continuous passive motion after TKA, which believe in joint adhesion or quadriceps contracture in postoperative splinted knee [13-15].

The wound complications in group A was less than group B but not significantly different. This may be explained by a conclusion from Johnson et al [16] studied that when knee was positioned in extension the oxygen tension at wound edge was better than flexion. In group B which patients could freely flexion their knee as tolerate since postoperative day 2 may lead to surgical wound complication. However, oxygen tension is only one factor in wound complication issue. The limitations of this study are no evaluation about pain, patient's satisfaction, blood transfusion, thromboembolic incidence, and knee function.

Postoperative cast immobilization after TKA may be useful as another technique that safely reduces blood loss without compromise postoperative range of motion. It can be used alone or complimentary with other blood saving technique [17]. However, there are some expenses for using the cast and may incur an uncomfortable and additional expenses by the patients.

The authors have no conflicts of interest to report.

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