

Management Leg Positioning After Total Knee Arthroplasty: An Evidence-Based Nursing Practice

Adelina Vidya Ardiyati^{1*}, Debie Dahlia², Dikha Ayu Kurnia²

¹ Department of Medical-Surgical Nursing, School of Nursing, Faculty of Health Science, Islamic State University UIN Syarif Hidayatullah Jakarta

² Department of Medical-Surgical Nursing, Faculty of Nursing, Universitas Indonesia

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Corresponding author:

Ns. Adelina Vidya Ardiyatii,
M.Kep.,Sp.Kep.,M.B

Faculty of Health Science, Islamic State University UIN Syarif Hidayatullah Jakarta, Jl. Kertamukti no.5 Ciputat, Tangerang Selatan, Banten, Indonesia.
Phone: +62217401925.

Email: adelinavidya@uinjkt.ac.id

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Abstract

Total Knee Arthroplasty (TKA) is an effective surgical treatment in moderate to severe knee arthritis patients. This surgical intervention can cause blood loss of up to 1000cc, decreasing hemoglobin levels and post-operative functional abilities. There are many methods to reduce the amount of blood loss after TKA surgery. One of the most effective and efficient methods is positioning the knee flexion 45° for 24 hours post-operative TKA. This case series aims to present applying evidence-based leg positioning after TKA. Ten samples met the inclusion criteria, such as patients with knee osteoarthritis stage III and IV and underwent TKA (Total Knee Arthroplasty) surgical procedures. The results show that all respondents are female, most of them are <60 years old (60%). BMI in the overweight category is 70%, the amount of Hidden Blood Loss is 420cc-700cc, 30% of respondents have post-op Hb levels <10gr/dl, and 60% have a ROM value of 90° on day 5 Post Operation. The Implementation of EBN Knee flexion position for 24 hours post-TKA effectively reduces the amount of blood loss. It improves the patient's functional ability by facilitating the patient to start rehabilitation exercises early.

Keywords: leg positioning, knee flexion, total knee arthroplasty, hidden blood loss

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INTRODUCTION

Osteoarthritis is inflammation of the joint area accompanied by structural damage. Symptoms of knee osteoarthritis (OA) are ubiquitous in the elderly population worldwide, and the morbidity is up to 30%, especially in rural areas (1). Total knee arthroplasty (TKA) is an effective surgical management method for moderate to severe arthritis patients. However, this surgical intervention can be associated with the potential for significant blood loss and the need for postoperative blood transfusion (2). Several studies reported blood loss related to TKA surgery could reach 1000 ml, about 20% of the total body blood volume, and the need for blood transfusions after TKA surgery can reach 40%(3). Blood loss also affects the recovery of knee range of motion (4).

Several preventive techniques are reported to reduce the amount of blood loss after TKA surgery. It includes various drainage protocols or clamping drain management, use of tourniquets, pharmacological methods (protocols for administering fibrin, adrenaline, and tranexamic acid), and limb positioning management (4). Among the various techniques used to prevent massive blood loss after TKA surgery, keeping the knee flexed postoperatively has been identified as an effortless and cost-effective way to reduce blood loss and transfusion requirements and increase ROM after TKA surgery (5). Position of knee flexion after TKA surgery in a certain period has been reported in several journals does not affect the incidence of DVT and surgical wound infection (2).

As an essential part of the process of care and recovery of post-operative TKA patients, nurses have a role in meeting fluid needs, perfusion, and mobilization. Post-TKA surgery patients have the risk of losing significant amounts of blood, which impacts the need for blood transfusions after surgery, and a decrease in post-TKA Hb levels can be at risk of causing nursing diagnosis ineffective peripheral perfusion the patient. Post-TKA surgery patients are also at risk of physical mobility barriers in the future; the

ability to maximize the range of motion in post-TKA patients will be longer if the management is not carried out correctly. So that leg positioning becomes an appropriate nursing intervention to reduce the amount of blood loss, reduce the need for blood transfusions, and facilitate early rehabilitation exercises with the optimum knee range of motion.

OBJECTIVE

This Case Series describes the amount of blood loss, hemoglobin level, and knee range of motion in total knee arthroplasty patients after receiving management leg positioning with knee flexion 45° for 24 hours Post Operation.

METHOD

This study is the Case series that uses a five-stage implementation of Evidence-Based Nursing (EBN). The first stage is to ask the PICO (Problem: Total Blood Loss, Intervention: Knee Flexion, Comparison: Knee Extension, and Outcome: Blood Loss) questions, and the question is "Is the knee flexion after Total Knee Arthroplasty can reduce Total Blood loss?"

The Second stage is conducting a journal search using electronic databases, namely ScienceDirect, ProQuest, Springer link, PubMed, Wiley, limited to English-language journals and within the year of publication from 2015 to the present. The third stage is assessing the article found, based on an initial search of the database used resulted in 14 pieces of literature that focused on the effectiveness of the leg position after TKA.

From these 14 articles, a conformity analysis was carried out by looking at the journal's title, abstract, and relevance to the problem. This process eliminates 11 articles and produces 3 articles that meet the literature criteria. Then the author selects 2 articles with the highest quality and the appropriate type of intervention. A critical appraisal was then carried out using tools

from CEBM Oxford University from these two articles.

The fourth stage is the implementation of EBN. The ethics committee approved this study, and we obtained informed consent from all patients after explaining the benefits and risks of the study. This case series was carried out on 10 respondents with a total sampling, between February 2021 and Mei 2021, including patients diagnosed with stage III or IV degenerative osteoarthritis of the knee who underwent TKA (Total Knee Arthroplasty) surgical procedures, while the exclusion criteria were having a history of trauma to the knee, having a history of surgery on the knee, polyarthritis patients: Rheumatoid arthritis, patients with neuromuscular disease, patients with hip disorders, metabolic bone disease, severe medical conditions: Neoplasm, chronic atrial fibrillation.

Implementation of EBN was carried out to the affected leg was elevated 45° at the hip using an orthopedic pillow with 45° of flexion at the knee when the patient arrives at the ward for 24 hours. Measure total variable blood lost by calculating the amount of blood that comes out through the drain at 24h, 48h, and 72 hours after surgery. Hb levels were measured preoperatively and at 48 h postoperatively. The ROM was measured at five days postoperatively. Characteristics of the respondent are analyzed using univariate analysis in proportions or percentages, and Variable total blood loss, Hb Level, and ROM are reported in descriptive graphs.

Case Presentation

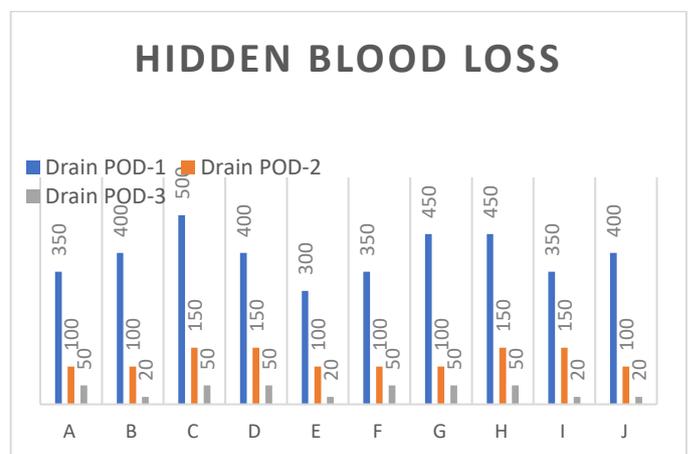
The result of Implementation EBN knee flexion 45° for 24 hours Post Operation Total Knee Arthroplasty are described as follows:

	F	%
Gender		
Woman	10	100%
Man	0	0%

Age		
<60 years old	6	60%
>60 Years	4	40%
Body Mass Index		
18.5 - 24.9 (Ideal)	2	20%
25.0 - 29.9 (Overweight)	7	70%
30.0 - 34.9 (Obesity)	1	10%
Comorbid		
There is not any	6	60%
Hypertension	4	40%

The table above shows that all respondents involved in the implementation of EBN are women, namely 100%, 40% of respondents are over 60 years old, most of the respondents have a BMI value of more than 25 who fall into the Overweight category, which is 70%. Of all respondents, 40% had co-morbidities, namely hypertension, and 60% had no co-morbidities.

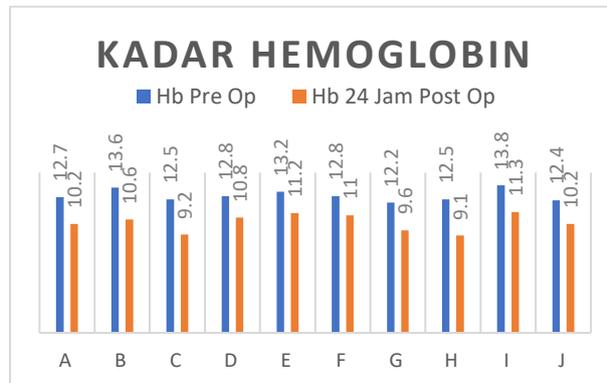
Graph 1. Analysis of the application of EBN to Hidden Blood Loss based on the amount of blood that comes out through drain (n=10)



The graph shows that after application of EBN knee flexion 45° for 24 hours Post TKA operation, the amount of blood in the drain on the first day of surgery was 300-500cc. On the 2nd day, the number of drains decreases by 100-150cc. Whereas in the 3rd day, the amount of blood that comes out through the drain progressively reduced

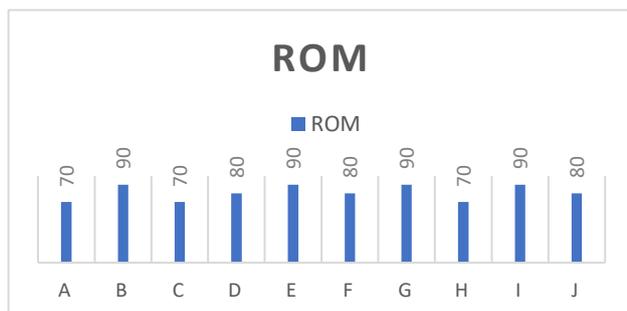
to 20cc. Respondent C has the highest total drain, which is 700cc.

Graphics 2 Analysis of the application of EBN on Hb levels pre and 24 hours post-operation (n=10)



The graph above illustrates the Hb value of all patients before surgery which was above 12 g/dl, with the highest pre-op Hb level being 13.8 g/dl and the lowest being 12.2 g/dl. The Hb value was checked within 24 hours of Post Operation can be seen in the graph above. There was a decrease to below 10 g/dl in 30% of respondents.

Graphics 3. Analysis of the application of EBN to the degree of ROM assessed on the patients' last day in the hospital.



Most of the patients who underwent TKA surgery in this observation were more than 50 years old, all of them were female, and most were in the overweight category based on BMI. This data aligns with other studies that say that several risk factors influence knee osteoarthritis. Factors include old age, female gender, overweight (6).

Many studies have been applied for knee flexion positions in post-operative TKA patients. It showed that decreasing blood loss, the incidence of transfusion, and facilitating the early mobilization of post-operative TKA patients. In the meta-analysis research conducted by Wu et al. of 9 RCTs, it was found that the knee flexion position can significantly reduce the total blood loss when compared to the knee extension position (5). In more detail, Carlson said that the knee - flexion position (45°) reduces total blood loss, drainage volume and increases the Range of Motion (7). A meta-analysis conducted by Wang et al. found that positioning the knee flexion 45° for 24 hours postoperatively significantly reduced total blood loss (P < 0.00001), hidden blood loss (P < 0.00001), and transfusion requirements (P = 0.003), and increased the range of motion ability within one week after surgery. surgery (P < 0.00001)(8).

a) Hidden Blood Loss

Hidden blood loss that comes out through the drainage describes the amount of bleeding entering the tissue. Although using a tourniquet can reduce intraoperative blood loss, it can also increase the risk of hidden blood loss, which can include bleeding in the surrounding tissue and accumulation in the articular cavity (6). Research conducted by Yang et al. in the knee flexion intervention group and the control knee extension group on the hidden blood loss parameter, the knee flexion results proved effective in reducing hidden blood loss after TKA surgery with a P-value of 0.000 (9).

The amount of blood loss that comes out through the drain in this observation is in the range of 420 cc - 700 cc by applying the knee flexion position of 45° using an orthopedic pillow for 24 hours post-TKA surgery. The knee position is closely related to the tension of the popliteal vessels. Knee flexion position 45° Postoperative TKA can reduce popliteal vascular pressure, increasing venous return. This process is

reported to reduce total blood loss, including extra blood into the tissues and residual blood in the joints, which can minimize intra-articular pressure and tension in the capsule area, thereby accelerating the restoration of joint range of motion (2). Ischemic conditions lead to persistent local reactive hyperemia, lasting several hours after the release of the tourniquet. In addition, the increased fibrinolytic activity associated with tourniquet-induced ischemia leads to bleeding into local tissues after the TKA procedure. This condition will increase bleeding into the tissue around the surgical area in the 24-hour postoperative period (3).

Differences in total blood loss can be influenced by several factors such as type of anesthesia, surgical procedure, duration of surgery, implant size, co-morbidities, and anticoagulant therapy (10). All TKA patients used spinal anesthesia and underwent surgery with the same procedure, namely in the supine position, then a tourniquet in the femoral area. An incision such as a medial parapatellar approach performed femoral and tibial preparation (cutting, chamfering, and sizing). The tibial installation was completed, and femoral components using a prosthesis with the same brand, TKR Set 'Smith & Nephew,' lasted 1.5 to 2 hours. All patients reported having PT APTT values within normal limits before undergoing surgery and receiving anticoagulant therapy "Rivaroxaban" 10 mg started 6 hours after surgery and taken for 14 days.

The thing that distinguishes each patient is the size of the prosthesis used and the co-morbidities that the patient has. Gao said that implant size influences total blood loss (11). In his research, he divides prosthesis implants into two sizes: small (1.5; 2; 2.5) and large (3:4:5). In this observation, TKR patients who had large femoral and tibial implants were reported to have total blood loss compared to TKR patients who used small implants (10).

However, a larger implant size will require a larger incision and leave more bleeding. Another difference is the co-morbidities that the patient has. Patients who reported having comorbid hypertension

experienced perioperative blood loss tended to be higher than other patients with normal blood pressure. The condition of hypertension coupled with old age can decrease arterial tone and the condition of capillary blood vessels that break easily, causing more significant perioperative blood loss(11).

b) Hemoglobin levels

Hb levels after TKA surgery in 30% of patients showed numbers below 10 g/dl, 2 patients received 250 cc PRC transfusions, and one other patient received sangobion therapy 1 cap/12 hours with a Hb level of 9.6 g/dl. Hidden blood loss is the leading cause of decreased Hb levels after TKA surgery (11). Applying the knee flexion position for 24 hours Post TKA surgery can reduce the amount of Hidden blood loss by increasing the extravasation of blood into the tissues and residual blood in the tissues joints. Therefore, a decrease in hidden blood loss will affect the patient's hemoglobin level within a safe range (2).

Arthroplasty procedures require the removal of substantial bone mass, thereby causing bleeding in the surface area of the bone (12). This condition is followed by erythrocytes that enter the interstitial space and become involved in the systemic circulation resulting in a further decrease in hemoglobin levels. In addition, fat in the bone marrow, bone cement, and bone fragments that enter the blood circulation causes capillary damage. The free fatty acids produced can damage erythrocytes. This mechanism is reported to be the main reason for the decrease in postoperative hemoglobin. The reduction of post-operative Haemoglobin levels allows the body to initiate repair and compensation mechanisms(13).

Monitoring post-operative Hb levels are crucial to avoid anemia conditions, decreased ability to heal surgical wounds, reduced ability to perform physical activities, and others (5). A study conducted by Yang et al. showed the effectiveness of leg position in osteoarthritis patients who underwent TKA surgery. The results found

that there was a significant difference between the 2 study groups in Pre-Post Operation Hb levels with a p-value of 0.005. there was no difference in the incidence of transfusion between the two study groups ($P > 0.05$) (8). Study Wu et al. also showed no significant difference between the knee flexion group and the knee extension group on the incidence of transfusion (5).

c) Range of Motion

The degree of Range Of Motion on the 4th day after TKA surgery was reported to reach 90° in some patients. This condition is related to the patient's ability to initiate mobilization and activities as before. The ROM ability influences the degree of range of motion ability before the patient underwent TKA surgery and the patient's functional status. In addition, the perception of pain felt by the patient helps choose the right time to perform TKA surgery. When the knee joint is still functioning, it will show a better Range of Motion result after surgery (4). Research conducted by Yang et al. said that after six weeks of post-operative rehabilitation of TKA, it was reported that the knee flexion intervention group had better ROM, reaching 100° compared to the knee extension group ($P = 0.04$). However, six months after TKA surgery, ROM ability was reported to show no significant difference between the joint range of motion between the intervention group and the control group (P -value 0.121) (9). according to Wu et al., knee flexion position after TKA only helps reduce the amount of blood loss and improve the recovery process in the early postoperative period (5).

After undergoing knee joint replacement surgery or TKA, there is a tendency for patients to be afraid to start moving their limbs, especially the operated area. Long-term immobilization conditions will stimulate muscle atrophy, especially in the lower extremities. Muscle strength will decrease by 1-1.5% per day during immobilization and up to 5.5% per day if immobilized due to cast, drain, or fracture placement.

According to Eldawati research, the muscles are not given a load after ten days, or the patient is immobilized. It will decrease muscle strength in the first four days, and if the patient is on bed rest for six weeks, it will result in a reduction of half of the muscle strength (3).

Minimizing blood loss will help restore the functional Range Of Motion because the amount of blood that enters the joint area becomes less and helps reduce swelling to reduce the load on the quadriceps area and allow the patient to start early mobilization exercises. In addition, patients also need less time to regain optimal health levels; this condition is essential for patients to begin exercising (12) immediately.

CONCLUSION

Position of knee flexion 45° for 24 hours Post-surgery TKA can control the amount of blood that comes out through the drain (Hidden Blood Loss), increasing the ability of knee flexion (Range of Motion) on the 4th postoperative day, reaching 90° in 40% of respondents, and facilitates early mobilization. Recommendation for the future research to measure Knee flexion Range of Motion before TKA that can affect a functional range of motion after implementation leg positioning, and involve the level of Prothrombin Time (PT) dan Activated Partial Thromboplastin Time (APTT) to measure blood clotting factors which can affect the amount of post-TKA blood loss

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