EFFECT OF EARLY AMBULATION IN PATIENTS AFTER LOWER LIMB SURGERY: LITERATURE REVIEW

Faraniara Faraniara^{1*)} & Riri Maria²

¹Faculty of Nursing, Universitas Indonesia, ²Medical Surgery Departement, Universitas Indonesia, Jl. Prof. Dr. Bahder Djohan, Depok, West Java 1624, Indonesia

Abstract

Early ambulation is one of the main goals of inpatient rehabilitation aimed at reducing the negative effects of immobilization and achieving functional recovery. Many studies have proven the benefits of early ambulation in patients after lower limb surgery so early ambulation is highly recommended as a form of orthopedic treatment. Although research related to the influence of early ambulation in post-operative patients has been widely carried out, it is necessary to do further study of the research article on the benefits of early ambulation. The purpose of this study was to look at the effect of early ambulation in patients after lower limb surgery. This literature study was made by analyzing nine scientific articles published in 2010-2020 and english languange. Data obtained from the database include Proquest, Cumulative Index to Nursing and Allied Health Literature (CINAHL) and Google Scholar with keywords early ambulation, early weightbearing, lower extremity, lower limb and post surgery. The results of this literature study found nine articles that fit the inclusion and exclusion criteria. The results of the study found that early ambulation in patients after lower limb surgery affected pain, complication rates, muscle strength and length of stay. Therefore, the results of the study of this literature can be a reference in assessments related to early ambulation in patients after lower limb surgery.

Keywords: Early Ambulation; Early Weightbearing; Lower Extremity; Lower Limb; Post Surgery

Article info: Sending on March 05, 2020; Revision on Mey 19, 2020; Accepted on May 27, 2020

*) Corresponding author: Email: faraniara@ui.ac.id

1. Introduction

Lower limb injuries are common injuries in prehospital care and are included in the leading cause of morbidity in the physically active population (Distefano, Marshall, & Motte, 2014). In Indonesia, femur fractures are the most frequent, namely 39% followed by humeral fractures (15%), tibial and fibular fractures (11%) (Desiartama & Aryana, 2017). Untreated fractures can cause hypovolemic shock, especially if they are open and must be treated by controlling bleeding effectively (Montmany et al., 2015). Proper fracture management can reduce morbidity and mortality of lower limb fractures (Smeltzer & Bare, 2013).

Restoring bone function as before is a management that must be immediately achieved in order to avoid various incidences of post-surgical complications (Smeltzer & Bare, 2013). One of the rehabilitation measures in patients after lower extremity surgery that can be done to avoid various post-surgical complications is to do early ambulation (Dubljanin et al., 2014). Patients with impaired mobility as in patients after lower limb surgery need

help in ambulation (Radawiec, Howe, Gonzalez, Waters, & Nelson, 2009).

Early ambulation is a stage of activity that can be done immediately on all postoperative patients starting from getting up and sitting until the patient gets out of bed and starts walking with the help of tools according to the patient's condition and ability (Canale & Beaty, 2013). In patients postoperatively with lower limb open reduction and internal fixation, early ambulation can begin 24-48 hours after surgery (Labraca et al., 2011; Dubljanin et al, 2014). Early ambulation is highly recommended as one of the effective nursing interventions in preventing postoperative complications related to immobility and improving the quality of life of patients (Pashikanti & Ah, 2012).

One technique in carrying out ambulation that needs to be mastered by the patient is weight bearing. Weight bearing is the loading of weight on an injured leg. Early weight bearing is recommended because it can speed up the union and increase bone strength. Active exercise combined with early weight bearing is highly recommended because it can increase range of motion and restore daily activities faster than immobilized patients (Smeeing et al., 2015). The purpose of this literature review is to identify the effects of early ambulation in patients after lower limb surgery.

2. Method

Literature study is carried out by making a summary and analysis of articles related to the research questions and objectives. The search method uses several electronic databases, namely Proquest, Cumulative Index to Nursing and Allied Health Literature (CINAHL) and Google Scholar, with keywords early ambulation, early weightbearing, lower extremity, lower limb and post surgery. Inclusion criteria: 1) articles that have titles and contents relevant to the purpose of the study; 2) english languange and full text; 3) articles published from 2010-2020. 4) the surgical area in the muscles, bones and joints. Exclusion criteria: 1) does not have a complete article structure; 2) article review.

The search resulted in 3239 research articles which were then identified for the title and abstract. A total of 3171 journals were not included in the literature review because they did not meet the inclusion and exclusion criteria. The full text of the remaining 68 articles was then independently examined until it became 12 articles. The final results of the articles that match the inclusion and exclusion criteria are 9 articles. The process of finding articles is shown in figure 1 and article summaries are shown in table 1.

3. Results and Discussion

Pain. It is undeniable that every patient who has undergone surgery will feel pain. Patients who ambulated 48 hours after surgery had worse physical and visual analogue scale on the first day after surgery than the group who started ambulation less than 48 hours (Dubljanin, 2014). This is in line with a randomized controlled trial by Labraca et al (2011) where after rehabilitation, the intervention group that performed ambulation in the first 24 hours after surgery showed improvement in pain. Pain that is felt in post-operative patients is associated with delayed ambulation. An early ambulation exercise program that is integrated with pain management is needed to achieve optimal health status.

Infection. There was no significant difference in patients who underwent early ambulation of the incidence of infection in patients after surgery for lower limb fractures. Based on research conducted by Smeeing et al (2018) there were four superficial infections in the group of patients who underwent early weightbearing and three in the late weightbearing group. Most infections occur in the sixth week after surgery but all success can be treated with antibiotics. There were no cases of severe infections requiring surgery. There were four incidents of wound healing complications in the group that delayed ambulation and one event in the group that did early ambulation but all patients were successfully treated with dressing changes (Deghan et al., 2016). Wound problems are a common problem for patients who ambulate immediately after surgery. This wound problem can be minimized by limiting ambulation to healing the skin area around the wound.

Deep Vein Thrombosis (DVT). Other complications that occur in patients who undergo early weightbearing after lower limb surgery include low grade infections, dystrophy and deep vein thrombosis (Nakao et al., 2010; Smeeing et al., 2018) and loss of reduction (Starkweather, Collman, & Schuberth, 2012). DVT is a common complication that is often encountered in patients with Total Knee Arthroplasty (TKA). Prophylaxis after TKA besides anticoagulant therapy, elastic stocking, passive motion is to do early ambulation. Plasma D-dimer levels will generally increase after orthopedic surgery such as Total Hip Arthroplasty (THA), TKA and open reduction of hip fracture. D-dimer assay is a reliable method for rulling out DVT and is used in routine screening in rehabilitation settings. TKA patients who performed early ambulation showed a decrease in D-dimer level on the seventh day (Nakao et al., 2010). Bedrest more than 3 days and accompanied by signs such as swelling of the thigh area and pain in the legs at risk of DVT. This is in line with the clinical pathway in the hospital which requires the patient to perform activities within three days after surgery (Gruendemann & Fernsebner, 2016).

Failure fixation or reduction. Research has proven that patients with relatively stable ankle fractures can perform fully weightbearing in the first 2 weeks after operative reduction without causing failure of fixation or fracture displacement (Starkweather, Collman, & Schuberth, 2012). The same thing was also found in patients with open reduction and internal fixation of unstable ankle fractures that there were no instances of fixation or reduction failure in either the group that performed early ambulation or who delayed ambulation (Deghan et al., 2016). Although the two groups in the study showed no difference in the rate of complications, the study did not explain the effect of early ambulation in the group aged 60 years or more. This study does not indicate whether there is a loss of reduction or a high level of morbidity for this age group.

Incidence of union. The next problem encountered in post-operative patients is about high incidence of nonunion, especially in postoperative patients of acute jones fractures (Waverly, Sorensen & Sorensen, 2018). Fragile fractures like Jones Fracture are usually treated non operative and surgery (Thomas & Davis, 2011). The amount of variability in bone pooling, the full return of bodily functions is delayed. A retrospective study conducted by Waverly, Sorensen & Sorensen (2018) states that patients undergoing ambulation in the first 2 weeks after the Jones fracture operative fixation show the same level and better integration. Unfortunately this research does not have a comparison group, so there is still a need for better research to reduce the bias that occurs.



Figure 1. Flowchart review of articles

Tendon Pullout. In the case of patients with surgically corrected foot-drop deformities, immobilization is a conventional treatment after tendon transfer to feet. The immobilization period for foot drop correction with tibial posterior tendon transfer is four weeks and is followed by another rehabilitation for four to six weeks. The main risk of early mobilization in tendon transfer cases is tendon transfer rupture or insertion pullout. Research conducted by Rath et al (2010) revealed that there were no tendon pullout events in the mobilizing group. The rehabilitation period decreased to an average of 15 days. Unfortunately the sample used in this study is small, totaling 24 people.

Muscle strength. Ambulation exercises can increase muscle strength in patients after lower limb surgery. Research shows that TKA patients who do rehabilitation 24 hours postoperatively have shorter hospital stays and have normal gait and balance compared to groups who started rehabilitation 48-72 hours postoperatively. The earlier onset of this treatment also reduces pain and can increase muscle strength (Labraca et al., 2011). Delayed ambulation is often caused by age, the patient's desire to rest, postoperative pain, prolonged use of wheelchairs and short periods of self-training. It is important to remove these inhibitors (Nakao et al., 2010). Inpatients tend to stay in bed throughout the day during hospitalization. Even if they get out of bed, wheelchairs encourage them to remain seated and only move for rehabilitation exercises (Nakao et al., 2010).

Length of stay. It is known that untreated pain is a major health care problem, and that adequate pain control in younger adults can shorten hospital stay, facilitate rehabilitation efforts, increase patient satisfaction and cause a reduction in post-surgical complications (Dubljanin et al., 2014). A study conducted by Labraca et al (2011) states that the group that received early ambulation had a shorter two-day stay than the delay ambulation group. In Indonesia, the length of stay does not depend on the ability of patients to perform early ambulation because there is still a system of care that uses health insurance that limits the length of stay of patients such as BPJS.

Functional Outcome. Post-surgical patients will experience interference in fulfilling daily living activities. This is caused by fear to move so that the fulfillment of ADL still depends on other people. After surgery the patient is more often in bed. In addition, this could be due to the effect of the body's reaction to the anesthetics given previously (Sheppard & Wright, 2012). Assessment of health outcomes showed improvement in results at 6 weeks post surgery in the early weightbearing group compared with the delay weighbearing group in the physical and mental components. There were no differences between the two groups at 3 months postoperatively. However, at 6 months the early weightbearing group had a trend towards better results for the physical and mental components. At 12 months, the early weightbearing group had a statistically better physical component and a tendency towards better results in the mental component compared to the late weightbearing group (Dehghan et al, 2016) both statistically and a trend towards better results in the mental component compared to the late weightbearing group (Dehghan et al, 2016). A different matter was stated by Rath et al (2010) which stated that the functional outcome of patients who had early mobilization after foot-drop tendon transfer was similar to the outcome for patients in the immobilization. This might be due to the group being too small. Future studies are needed with a larger sample related to functional outcomes.

Available on: http://nursingjurnal.respati.ac.id/index.php/JKRY/index Jurnal Keperawatan Respati Yogyakarta, 7(2), Mei 2020, 87-93

Table 1. Article summary									
No	Authors/Year	Study Purpose	Study Design, Sample/ Setting	Early Ambulation Protocol	Outcome Variables	Finding			
1	Dehghan et al (2016)	To campare early weightbearing and range of motion (ROM) to non weightbaearing and immobilization in a cast	RCT	Ambulation start at two weeks postoperatively with weightbearing protocol	Return to work	There was no difference in RTW. Parients in the intervention group had significantly improved functional status. There were no diffrences with regards to wound complications or infections, and no cases of fixation failure or loss of reduction			
2	Dubljanin et al (2014)	To examine the impact of postoperative pain time to ambulation following hip fracture surgery	Cohort Sample Intervention : 41 Control : 55 Setting : Serbia	Time from admission to getting out of bed. The first group included patients whose first time to ambulate was within 48 hours after surgery, while the second group included patients who first ambulated 48 hours after surgery	Pain Length of stay	Patients whose time to ambulation was =48h postoperatively were of worse physicl health, and had significantly higer VAS score on the first postoperative day, and reduce hospital stay			
3	Labraca et al (2011)	To compare the benefits of initiating rehabilitation treatment within 24 hours versus 48-72 hours after total knee arthroplasty for osteoarthritis	RCT Sample Intervention : 138 Control : 135 Setting : Spain	Ambulation was started within 48 hours post surgery in the intervention group and 72 hours post surgery in the controls. The treatment started on : in-bed sitting posture; transfer; standing; walking; isotonic musle work; learning daily activities	Muscle Strength Hospital stay Pain Autonomy Gait and Balance	The intervention group showed significantly shorter hospital stay, lesser pain, improved strength in quadriceps and hamstring muscles and high scores for gait and balance			
4	Nakao et al (2010)	To clarify the preventive effects of postoperative physical activities especially in early ambulation on DVT in patients with OA and RA after TKA	Comparative Sample Intervention : 26 Control : 11 Setting : Japan	The intervention group was the date of ambulation beginning below 7th day	DVT	Post operative early ambulation within a week kept patients with OA and RA after TKA lower level of D-dimer			
5	Rath et al (2010)	To determine whether when compared with immobilization early active mobilization after a tendon transfer for foot drop correction would (1) have a similar low rate of tendon insertion pullout, (2) reduce	RCT Sample Intervention : 13 Control : 11 Setting : India	Partial weightbearing using parallel bars during the third week of therapy (postoperative week 4 for intervention group, postoperative week 7 for the control group), and full weightbearing and gait training during the fourth week of therapy (postoperative week 5 for the intervention group, postoperative week 8 for control	Tendon pullout Rehabilitat ion time Functional outcomes	No case of tendon pullout in either group. Rehabilitation time in the intervention group was reduced by an average of 15 days. The various functional outcomes were similar in the two groups			

Available on: http://nursingjurnal.respati.ac.id/index.php/JKRY/index Jurnal Keperawatan Respati Yogyakarta, 7(2), Mei 2020, 87-93

		rehabilitation time and (3) result in similar functional outcomes		group)		
6	Starkweather et al (2012)	To assess the complications and loss of reduction who bore weight in a short leg cast within 15 days after surgical	Retrospective Sample Total : n = 126 Setting : California	Patient who walked on postoperative day 1	Complicati ons Loss of reduction	Patient who walked on postoperative day 1 had slightly more wound problems. No cases of malunion or nonunion occurred. No displacement in fracture reduction in 80 (98.8%) of 81 patients.
7	Smeeing et al (2018)	To assess if unprotected weight bearing as tolerated is superior to protected weight bearing and unprotected non weight bearing in terms of functional outcome and complication	RCT Sample Intervention A : 40 Intervention B : 33 Intervention C : 42 Setting :	Weight bearing protocol and postoperative care regimen	Return to work and sports Complicati ons Ouality of	Unprotected weight bearing showed a significant earlier return to work and earlier return to sports. There were no differences in the quality of life score and number complications
8	Starkweather et al (2012)	To assess the complications and loss of reduction who bore weight in a short leg cast within 15 days after surgical	Netherlands Retrospective	Patient who walked on postoperative day 1	life Complicati ons	Patient who walked on postoperative day 1 had slightly more wound problems. No cases of malunion or nonunion occurred. No displacement in fracture reduction in 80 (98.8%) of 81 patients
9	Waverly et al (2018)	To evaluate the interval to radiographic healing of patients who had undergone operative fixation with an early weightbearing protocol postoperatively	Retrospective Sample Total : n = 31 Setting : America	Ambulation start at 2 weeks postoperatively with weightbearing protocol	Incidence of nonunion	Early weightbearing protocols is safe and effective for use after operative fixation of acute Jones fractures. There is no incidence of nonunion

Return to Work and Sports. To assess how much time it takes for patients to return to work can be measured in post-fracture lower limb patients who are employed at the time of injury (Dehghan et al, 2016). There was no significant difference between the groups of patients who performed early ambulation and those who were late in carrying out ambulation in terms of readiness when they were ready to return to work. Postoperative patients with lower extremity fractures can return to work starting from 6 weeks post surgery (Dehghan et al, 2016). Patients who did unprotected weightbearing returned to work and exercised more quickly in the 9th week than patients who did weightbearing using cast or non weightbearing (Smeeing et al., 2018).

Quality of life. When individuals feel they have achieved their position in life starting from well-being, functional abilities physical and emotional or social well-being, the individual can be said to be able to achieve a good quality of life. Patients who experience a fracture not only require physical recovery, but also need to pay attention to their emotional well-being (Tutton, 2013). Achieving emotional well-being requires support from both family and health services (Wiseman, 2016). In relation to early ambulation, based on research it turns out there is no significant difference in quality between unprotected weightbearing, of life weightbearing with cast and non weightbearing groups after 12 weeks and 1 year (Smeeing et al., 2018).

4. Conclusions and suggestions

Based on the review of nine articles that have been done, early ambulation has a positive influence on pain, deep vein thrombosis, muscle strength and length of stay. Although it is allegedly there are some effects of early ambulation that are less significant, individuals still need to make ambulation training as one of the actions that can improve health outcome. The results of this literature review can be a reference in assessments related to early ambulation in patients after lower limb surgery. Ambulation exercises are very dependent on the conditions and intentions of inpatients. It is very important to educate inpatients regarding early ambulation after surgery and obtain preoperative informed consent for post-operative rehabilitation programs.

5. References

- Canale, S. Terry., & Beaty, James H. (2013). *Campbell's Operative Orthopaedics* (12th ed.). Philadelphia : Elsevier
- Dehghan, N., McKee, M. D., Jenkinson, R. J., Schemitsch, E. H., Stas, V., Nauth, A., Kreder, H. J. (2016). Early Weightbearing and Range of Motion vs Non-Weightbearing and Immobilization After Open Reduction and Internal Fixation of Unstable Ankle Fractures:

A Randomized Controlled Trial. *Journal of Orthopaedic Trauma Publish Ahead of Print*. https://doi.org/10.1097/BOT.0000000000057 2

- Desiartama A, Aryana I G N W. (2017). Gambaran Karakteristik Pasien Fraktur Femur Akibat Kecelakaan Lalu Lintas pada Orang Dewasa di Rumah Sakit Umum Pusat Sanglah Denpasar Tahun 2013. E-Jurnal Medika. Mei; 6(5):1-4.
- Distefano, L. J., Marshall, S. W., & Motte, S. De. (2014). Landing Error Scoring System (LESS) Items are Associated with the Incidence Rate of Lower Extremity Stress Fracture, 2(7), 2014. https://doi.org/10.1177/2325967114S00080
- Dubljanin-Raspopovic E, Markovic-Denic L , Zivkovic K, Nedeljkovic U , Tomanovic S, Kadija M, Tulic G, B. (2014). The Impact of Postoperative Pain on Early Ambulation After Hip Fracture, ACI Vol. L. https://doi.org/10.2298/ACI 130106 ID
- Gruendemann, Barbara, J., & Fernsebner, B. (2016). Buku ajar keperawatan perioperatif volume 2. Jakarta: EGC
- Labraca, N. S., Castro-Sánchez, A. M., Matarán-Peñarrocha, G. A., Arroyo-Morales, M., Sánchez-Joya, M. del M., & Moreno-Lorenzo, C. (2011). Benefits of starting rehabilitation within 24 hours of primary total knee arthroplasty: randomized clinical trial. https://doi.org/10.1177/0269215510393759
- Montmany, S., Rebasa, P., Luna, A., Hidalgo, J. M., Cánovas, G., & Navarro, S. (2015). Source of Bleeding in Trauma Patients With Pelvic Fracture and Haemodynamic Instability. Cirugía Española (English Edition), 93(7), 450–454. doi:10.1016/j.cireng.2015.01.005
- Nakao, S., Takata, S., Uemura, H., Nakano, S., Egawa, H., Kawasaki, Y., Kashihara, M., Yasui N. (2010). Early ambulation after total knee arthroplasty prevents patients with osteoarthritis and rheumatoid arthritis from developing postoperative higher levels of Ddimer. The Journal of Medical Investigation 57, 146–151.
- Pashikanti, L., & Ah, D. Von. (2012). Impact of Early Mobilization Protocol on the Medical-Surgical Inpatient Population An Integrated Review of Literature, 87–94. https://doi.org/10.1097/NUR.0b013e31824590e 6
- Radawiec, S. M., Howe, C., Gonzalez, C. M., Waters, T. R., & Nelson, A. (2009). Safe Ambulation of an Orthopaedic Patient, 28(2), 24–27
- Rath, S., Schreuders, T. A. R., Stam, H. J., Hovius, S. E. R., Selles, R. W. (2010). Early active motion versus immobilization after tendon transfer for foot drop deformity: a randomized clinical trial. Clinical Orthopaedics and Related Research 468, 2477–2484

Available on: http://nursingjurnal.respati.ac.id/index.php/JKRY/index Jurnal Keperawatan Respati Yogyakarta, 7(2), Mei 2020, 87-93

- Sheppard, Mandy & Wright, Mike. (2012). Principles and Practice of Hight Dependency Nursing. China: Elsevier
- Smeeing DPJ., Houwert, R. M., Briet, J.P., Kelder, J. C., Segers, MJ. M., Verleisdonk, EJM. M. (2015). Weight-Bearing and Mobilization in the Postoperative Care of Ankle Fractures: A Systematic Review and Meta-Analysis of Randomized Controlled Trials and Cohort Studies. PloS ONE 10(2): e0118320.doi:10.1371/journal.pone.0118320
- Smeeing, D. P. J., Houwert, R. M., Briet, J. P., Groenwold, R. H. H., Lansink, K. W. W., Leenen, L. P. H., van der Zwaal, P., Hoogendoorn, J. M., van Heijl, M., Verleisdonk, E. J., Segers, M. J. M., Hietbrink, F. (2018). Weight-bearing or non-weightbearing after surgical treatment of ankle fractures: a multicenter randomized controlled trial. European Journal of Trauma and Emergency Surgery. doi:10.1007/s00068-018-1016-6
- Smeltzer, S., & Bare, B. (2013). Buku ajar keperawatan medikal bedah Brunner &

Suddarth (8th ed). Jakarta: EGC

- Starkweather, M. P., Collman, D. R., & Schuberth, J. M. (2012). The Journal of Foot & Ankle Surgery Early Protected Weightbearing after Open Reduction Internal Fixation of Ankle Fractures. *The Journal of Foot & Ankle Surgery*, 51(5), 575–578. https://doi.org/10.1053/j.jfas.2012.05.022
- Thomas JL, Davis BC. (2011). Treatment of Jones fracture nonunion with isolated intramedullary screw fixation. J Foot Ankle Surg 50:556-568
- Tutton, E., Achten, J., Lamb, S. E., Willett, K., & Costa, M. L. (2013). A qualitative study of patient experience of an open fracture of the lower limb during acute care, 522–526. https://doi.org/10.1302/0301-620X.100B4.BJJ-2017-0891.R1
- Wiseman, T., Foster, K., & Curtis, K. (2016). The experience of emotional wellbeing for patients Wiseman, T., Foster, K., & Curtis, K. (2016). The experience of emotional wellbeing for patients with physical injury: A qualitative follow-up study. Injury. https://doi.org/10.1016/j.injury.2016.03.021