Original Article

Effect of Active Mobilization on Patients in the Intensive Care Unit: A Systematic Review

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Abstract

Background: Active mobilization in the Intensive Care Unit (ICU) is used to prevent the short-term and long-term functional consequences of critical illness.
Aim: To explore the effect of active mobilization on physical function, muscle strength, and quality of life-related health.
Methods: That used was electronic databases from journals that already published through ProQuest, PubMed, and ScienceDirect. Results from sistematically reviewing six selected journals suggest that active mobility affects the increased physical function, muscle strength, and health-related quality of life compared to patients with standard care. The most widely used research instrument was assessed on physical function measured by acute scale. The Functional Status Index (ACIF), muscle strength was measured by a Medical Research Council (MRC) score, and health-related quality of life was measured by the Short Form Health Survey (SF-36). The results showed that the effect of active patient mobilization in the intensive care unit did not negatively impact both long-term and short-term patients, but improved physical function, muscle strength, and health-related quality of life after discharge. The effects of physical mobility may also affect the duration in patients with mechanical ventilation, length of stay, and mental.
Conclusion: Although the review results have no consistent effect, active mobilization has no negative impact and improves mobility status such as physical function, muscle strength, and health-related quality of life during and after discharge from the hospital.

Keywords: Active mobilization, physical function, muscle strength, health-related quality of life, intensive care

Introduction

Patients who was treated in intensive care unit (ICU) often required some special treatment, resulting in immobility and bed rest (Tipping, 2017). Immobilization causes physical ineffectiveness of patients in the intensive care unit and increases the risk of muscle weakness within 24 hours, delirium and prolonged mechanical ventilation (Calvo Ayala, 2013). Prolonged immobilization can cause decubitus (Rudini, 2013), muscle atrophy that may lead to a recovery of functional status persisting 1-2 years and even worse can cause death (Hodgson, 2015; Rudini, 2013). Even after dischards from hospital, patients who have been treated in ICU have persistent functional impairment and decreased quality of life are associated with proximal weakness, muscle mass loss, and fatigue (Castro, 2015).

A research conducted in ICU Sanglah Denpasar Hospital that involving 184 non-surgical patients showed that patients with neurology 84.23%, cardiovascular 8.15%, respiration 1.65%, and others who being treated for sepsis and chronic diseases (Taofik, Senapathi , & Wiryana, 2015). While the research conducted at Cipto Mangunkusumo Hospital (RSCM), about Acute respiratory distress syndrome (ARDS), one of the most emergency disease in the field of respirology with the highest number in mortality rate and mostly required an intensive care, shown that mortality rate during treatment was 75.3% due to age factor, and the caused of ARDS (sepsis and non sepsic) and used of mechanical ventilation ≥ 48 hours (Hartini, Amin, Pitoyo, & Rumende, 2014). There are 71% of patients felt uncomfortable and immobilized during treatment (Profile Mechanically Critically, 2017). This funding suggests that adult patients who in critical condition in intensive care required intensive monitoring and care. As professional medical practitioners, it was required to pay attention to the condition of patients related to their needs during treatment, thus patients and families may feel comfort and do not have to prolong the length of stay and any further impact that may lead to death.

Some data suggest that early mobilization or physical therapy may improve physical function of people who are out of intensive care (Calvo Ayala, 2013) and prevent weakness (Hermans, 2014). Currently, the European Respiratory Society in a joint effort with the European Society of Intensive Care Medicine recommends a patients mobilization during their stay in critical care units, yet there is insufficient evidence to support the recommendations (Gosselink, 2008). Recently, there is a systematic review of interventions to improve physical function in patients who have dropped out of intensive care (Calvo Ayala, 2013) and active mobilization effects in patients with mechanical ventilation (Li Zhiqiang, 2013).

Mobilization is assumed as an easy and safe intervention and has very little side effects to improve muscle strength and physical function of the patient. Active mobilization has a positive effect on physical function and hospital outcomes in mechanical ventilation patients. Early active mobilization protocols can be started safely in ICU settings and resumed in post ICU settings (Li Zhiqiang, 2013). This active mobilization may include a combination of active exercise in bed, bedtime mobility exercises, mobility development from sitting, standing and ambulation, therapy of table tilt or lift to a chair (Schaller, 2016).

Nonetheless mobilization in the ICU affects mortality and morbidity remain unclear, it is important to determine whether mobilization during critical conditions produces benefit or harmful effects. Thus, this systematic review aims to determine the effect of active mobilization in comparison to standard of patients care in intensive care settings to improve physical function, muscle strength, and quality of life related to health.

Aim of the study

The purpose of this systematic review is to gain an understanding of the effect of active mobilization on patients in intensive care compared to standard care. In addition, this systematic review helps in synthesizing studies empirically, as of to identify: (1) the form of active mobilization intervention, (2) an instrument to measure the effect of active mobilization, (3) the effect of active mobilization on patients in intensive care.

Methodology

Method for systematic review of PRISMA guidelines (Electronic Supplementary Material (ESM) 1, Table 1) (PRISMA Guide, 2009) and Cochrane Handbook (Moher., 2009). The systematic review started with a reviewer looking for several journal articles that have been published through electronic databases such us: PubMed, PreQuest, and ScienceDirect web. Some keywords are used in troubleshooting process (Table 1 PICOT), article filtering strategy has been detailed in PRISMA flow chart (Figure 1).

Inclusion criteria were a randomized control trial (RCT) written in English, the type of participants were adult patients (≥18 years), admitted to the ICU for more than 24 hours, mechanical ventilation> 48 hours. The excluded participants had neurovascular disorders , head injury, burns, spinal cord injuries, and fractures, patients that were ndiagnosed with septic shock that unresponsive to maximal treatment. Titles and abstracts are filtered by reviewer, any discrepancy is resolved by consensus with the second reviewer. Abstracts of articles that considered relevant by

title were checked, fully qualified text articles and uncertain eligibility taken and reviewed by reviewers 1 and 2. After reviewing full text articles, if eligibility is unclear or missing information, the authors will be contacted by email. Data extracted by researchers, disagreements resolved by using consensus with second reviewers (Moher et al., 2009). If in any condition where data extraction is unclear or further details are required, the study authors are contacted via email to clarify the results. One of the studies included was co-authored by two authors on this systematic review, therefore two independent external reviewers completed data extraction and biased assessment risk.

Research Results

We identified 79 articles from all databases (PubMed, ScienceDirect, and ProQuest) with the search strategy presented in Figure 1. After filtering the article in accordance with the purpose of systematic review, the filtered article (n = 17) then performed duplicate expenses (n = 6), the deletion by the reason of manuscript as much (n = 4), and there are articles issued because the research included in qualitative synthesis (n = 1) so that qualified quantitative there are 6 articles Figure 1.

From 6 articles that have selected depicted that the research was conducted in various countries, such us Australia, China, Columbia, England, Germany and Israel. The research method used was randomized controlled trial (RCT) (n = 6). This research article published between 2013 to 2018, all samples in this study were adult patients aged ≥18 years who were admitted to the intensive care unit ≥ 24 hours under certain conditions.

Form Intervention of Active Mobilization

Results of the 6 article shown that each study has little differences in the form of active mobilization intervention for patients in ICU. There are studies which conducting active mobilization gradually; level 0 (no mobilization), level 1 (range of motion exercises), level 2 (sitting), level 3 (standing), and level 4 (ambulation) (Schaller., 2016) . While other articles of active mobilization are same but done without stages; balance of sitting, balance of standing, ambulation from bed to seat, ambulation from chair to bed, active and passive range of motion, (Schaller., 2016; Kayambu., 2015; Yosef Brauner., 2015; Morris., 2016; Dong., 2016; McWilliams., 2018).

Another active mobilization intervention was done by sitting out of bed, right and left hand grip using a dynamometer, knee flexion extraction exercises and extension, hip flexion, elbow flexion and shoulder flexion (Kayambu., 2015; Yosef Brauner., 2015; Morris., 2016).

Instrument to measure Active Mobility Effect

The most widely used research instrument for assessing the effect of active mobility is the effect on physical function using functional status care index (n = 2), muscle strength with the Medical Research Council (MRC) (n = 3) (Kayambu., 2015; Schaller., 2016; Yosef Brauner., 2015) and health quality with the Short Form Health Survey (SF-36) (n = 3) (Kayambu., 2015; Schaller., 2016 ; Morris., 2016; Dong., 2016). In this review there is one study of SOFA instrument use for early rehabilitation assessment (McWilliams, 2018).

In assessing the physical function (basic ADL ability), 5 studies reporting active mobility affect the occurrence of physical function improvement in contrast to standard therapy, physical function was measured by different measuring instruments (ACIF, SOFA, FPI), (Dong. 2016; Kayaku., 2015; Schaller., 2016; McWilliams., 2018; Morris, 2016; Yosef Brauner., 2015) and 1 study reported active mobilization decreased duration of mechanical ventilation use (Dong., 2016).

The effect of active mobilization on muscle strength of patients from all 6 studies reported muscle strength measured by a Medical Research Council (MRC) score, the implementation of active mobility may increase muscle strength in standard therapy, such as seating ambulatory capabilities (Dong., 2016; Kayambu., 2015 ; Schaller., 2016; McWilliams., 2018; Morris, 2016; Yosef Brauner., 2015).

In the active mobilization group, the average change in interleukin-10 increases (Kayambu., 2015). While the quality of life related to health from 6 studies, 4 studies measuring the quality of the Short Form Health Survey (SF-36), the results showed that early mobilization shortened length of stay at hospital (Dong., 2016; Kayambu., 2015; Morris., 2016), however 1 study reported a patient

mortality rate after 3 months out of hospital (Schaller., 2016).

Effect of Active Mobilization on Patients in intensive care

Interventions range from 1 to 8 days after admission to the ICU. Therapy is administered at least daily in the intervention group and ranges from an average of 15 to 31 minutes of therapy per day (Dong., 2016; Kayambu., 2015; Morris, 2016). One study used protocols to guide intervention therapy (gradually) (Schaller, 2016), while another article, the implementation of mobilization was adjusted to every patient condition (Dong., 2016; Kayambu., 2015; McWilliams., 2018; Morris., 2016; Yosef Brauner., 2015).

The results showed that the effect of active patient mobilization in intensive care did not negatively affect both long-term and short-term patients, yet could improve physical function, muscle strength, and health-related quality of life after discharge (Dong., 2016; Kayambu). , 2015; Schaller., 2016; McWilliams., 2018; Morris, 2016; Yosef Brauner., 2015). Mobilization in patients with weakness in the ICU can shortens length of stay, improves patient mobility as well as increased physical functioning that will decrease the risk of systemic infection after dischard from hospital (Kayambu., 2015; Schaller., 2016; Morris., 2016). Active mobilization can enhance the effect of active mobility of patients who undergo an intensive care. This can be seen in physical function, muscle strength, length of stay, duration of mechanical ventilation and quality of life related to patient health after discharge from ICU and directional treatment may shorten patient duration in intensive care (Kayambu., 2015; Schaller., 2016).

Discussion

The results from several research articles that have been analyzed emphasize that active mobility in intensive care patients was important to be noted because long-term care and restriction of motion would have an impact on muscle weakness resulted in prolonging the long of stay of patients (Schaller et al, 2016). The analysis reported that active mobilization had no effect on mortality or side-effects but this intervention enhanced bodily functions when directed (Schaller., 2016; Morris., 2016). The effects of active mobilization were not only seen in physical abilities, ambulatory abilities, and health quality, but also can be seen in mental, length of stay, and duration of mechanical ventilation (Schaller., 2016; Morris., 2016). Studies on mobilization and rehabilitation shown that mobilization could improve quality of life at 2, 3 and 6 months after treatment (Kayambu., 2015; Morris., 2016; Schaller., 2016).

This systematic review found an increasing of mobility from all articles that supported the use of early mobility to increase walking distance. We found no differences between the groups in other steps of functional status (Kayambu., 2015; Morris., 2016; Schaller., 2016). These results are found in RCTs where the interventions are ergometers cycle and electrical muscle stimulation, retrospective studies and quasi-RCT. On the other hand, no RCT measured muscle strength found significant differences between groups (Kayambu., 2015; Morris, 2016). All reported health-related quality of life and all improvements found on physical function items of SF-36 (Dong., 2016; Kayambu., 2015; Schaller., 2016; McDilliams., 2018; Morris., 2016; Yosef Brauner., 2015). We also found improvements in the function and role of physical components of these results in two measured RCTs (Kayambu., 2015; Morris., 2016).

There were mixed results on the effects of active mobilization, yet no significant effects were found in this study, including the number of ADLs achieved both in the ICU and after discharge from the hospital. Active mobilization does not have any side effect, in fact this strongly supports the safety and feasibility of patients with mechanical ventilation of critical patients in ICU (Kayambu et al., 2015). In this systematic review, from these 6 articles the effect of mobilization pretty much can be affected by age, sepsis, medication, apache, surgery and other complications (Dong., 2016; Kayambu., 2015; Schaller., 2016; McWilliams., 2018; ., 2016; Yosef Brauner., 2015).

Some studies found that patients who have active mobilization report positive, and do not show any differences between such groups (McNelly et al., 2016). An early rehabilitation study reported that active mobilization for patients in intensive care found that patients in the intervention group had higher functional ability than the control group at

the 12th month (Denehy et al., 2013; Bagshaw et al., 2015; McNelly et al., 2016)

Figure 1: PRISMA Flow diagram

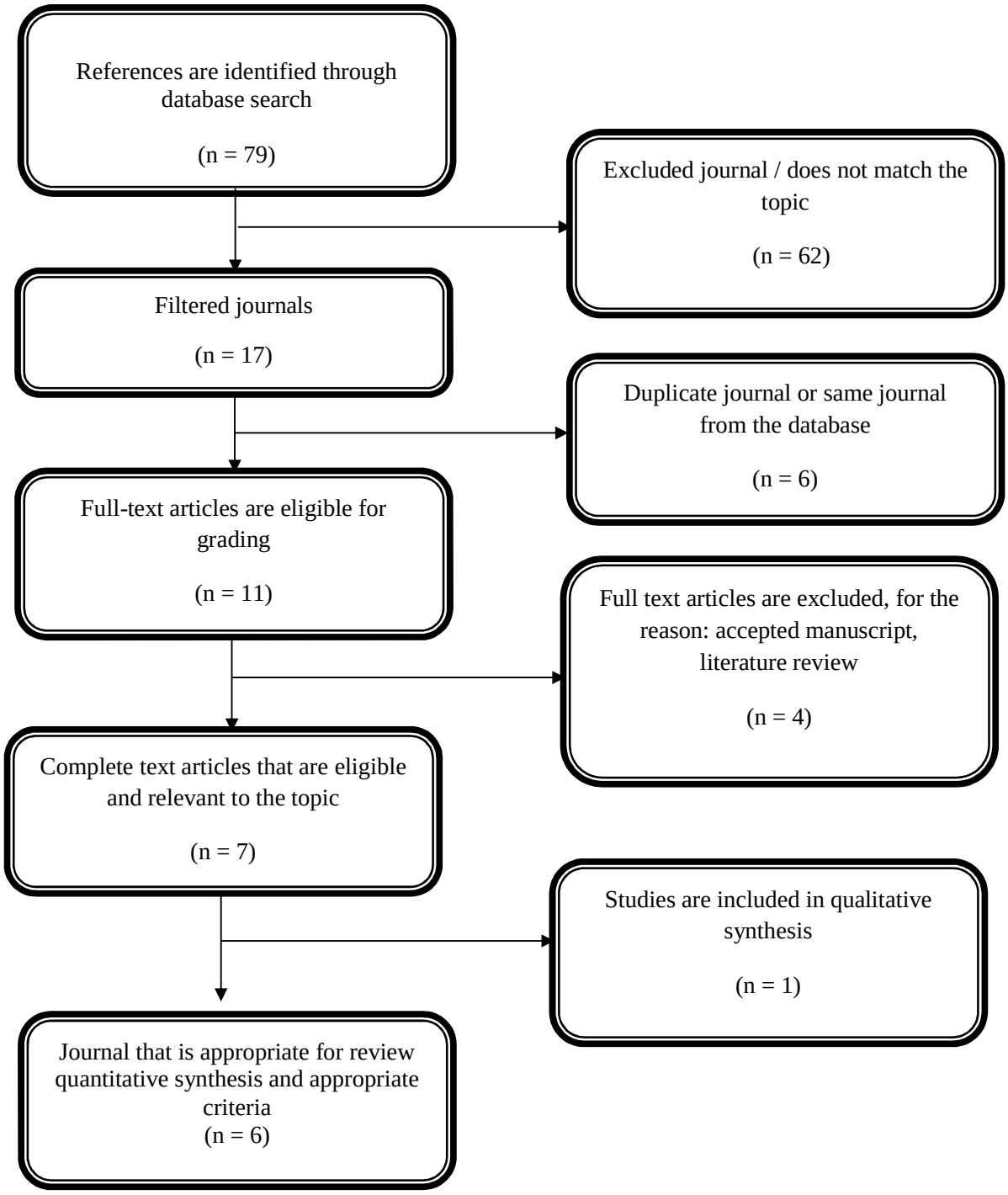

Table 1. Active mobilization, physical function, muscle strength, health-related quality of life, intensive care

No	Journal (year)	Title	Country	Aim	Respondents	Data collection	Result
1	Kayambu et al (2015)	Early physical rehabilitation in intensive care patients with sepsis syndrome: A randomized clinical trial (RCT)	Australia	To determine whether early physical rehabilitation improves the physical function and associated outcomes in patients with sepsis syndrome	Patients treated in the ICU were 50 patients	Respondents of 50 ICU-treated patients were recruited with double-blinded RCTs, (26 respondents of exercise group and 24 respondents of standard care).	• The results showed that in the exercise group there was an increase of physical function, with significant value p = 0,04 and physical role at 6 months after hospital return p = 0,005 (SF-36). • While in the standard treatment group, muscle strength was found to be significant value p = 0.24 (MRC). The mean change of interleukin-10 increased in the active mobilization group with a significant value of p = 0.04, no significant difference with interleukin-6. • Implementation of early physical rehabilitation may improve patient self-reported physical functioning and systemic anti-inflammatory effects.
2	Dong et al (2016)	Benefits of early rehabilitation therapy for patients	China	To evaluate the benefits of early rehabilitation	Patients treated in ICU were	Respondents of 106 patients who had undergone CABGs	• The results showed that significant value of early rehabilitation therapy

		with prolonged mechanical ventilation after coronary artery bypass surgery: A prospective randomized clinical trial (RCT)		therapy in patients with prolonged mechanical ventilation after coronary artery bypass surgery (CABG)	106 patients undergoing CABG.	enrolled between June 2012 and May 2015 were recruited with prospective RCTs (53 respondents from rehabilitation group early and 53 control group respondents).	reduced duration of mechanical ventilation with p value <0.01, length of hospitalization with p value <0.01), and length of stay in ICU p value <0.01 for patient which requires more than 72 hours of prolonged mechanical ventilation. • Kaplan-Meier analysis showed that the number of patients remaining in mechanical ventilation in the early rehabilitation group was greater than in the control group after 7 days of rehabilitation therapy (logrank test: P <0.01). • These results provide evidence to support the implementation of early rehabilitation therapy in patients requiring prolonged mechanical ventilation after CABG.
3	Morris et al (2016)	Rehabilitation of standard and length of hospitalization of patients with acute respiratory failure: A randomized clinical	Columbia	To compare standardized rehabilitation therapy (SRT) with the usual care intensive care unit (ICU)	300 patients treated in ICU with acute respiratory failure were.	Respondents as many as 300 patients treated in ICU with respiratory failure require mechanical ventilation to be recruited by RCT test	• The results showed no difference in duration of ventilation or ICU care. There was no effect on the 6 month evaluation either with a grip value of p =

		trial (RCT)		with acute respiratory failure.		from October 2009 to May 2014, with a follow-up of 6 months, (150 SRT group respondents and 150 respondents usual care).	0.23, and handheld power dynamometer value p = 0.82. • Among all hospitalized patients with acute respiratory failure either SRT with usual care did not lower the hospital's LOS.
4	Williams et al (2018)	Early and advanced rehabilitation in mechanically ventilated Patients in critical care: A feasibility randomized controlled trial	England	To evaluate the feasibility of early and advanced rehabilitation for patients with mechanical ventilation for ≥5 days and to assess their impact on possible long-term outcome measures for use in the definitive trial.	Patients treated in intensive care units were 103 of 128 eligible patients	Respondents were 103 eligible patients, recruited with RCT tests of previous and advanced rehabilitation for patients treated in critical care between June 2016 and September 2017	• The results of this study indicate that patients given earlier mobilization interventions (8 days vs. 10 days) had a significant value of p = 0.035, with a higher SOFA score in first mobility, this phase indicating an acute state in the patient's illness. • The intervention group also achieved higher mobility levels in the critical care value of p = 0.016, with 73% able to walk after discharge from the hospital. • This research has been successfully conducted in ICU by implementing quality improvement initiatives in the previous mobilization.

5	Schaller et al (2016)	Early mobilization that leads to goals in the surgical intensive care unit: A randomized clinical trial (RCT)	Germany	To test whether early mobility leads to increased mobility, decreased length of stay of intensive care unit surgery (SICU), and increased patient functional independence in hospitals.	200 Patients treated in intensive care surgical units.	Respondents were 200 patients, recruited by RCT test, (96 patients in the standard control / care group, 104 intervention groups).	• The results of this study indicate that the intervention increased the mobilization rate (SD 1 • 0), in the control group, p <0,0001), the 7-day average SICU degradation (SD 5-12) in the intervention group in the control group , p = 0.0054), and increased functional mobility at hospital discharge, p = 0.0002). • More reported adverse events in the intervention group (25 cases [2 • 8%]) than in the control group (10 cases [0 · 8%]). • No serious adverse events were observed prior to discharge, 25 patients died (17 [16%] in the intervention group, eight [8%] in the control group). 3 months after discharge from hospital 36 patients died (21 [22%] in intervention group, 15 [17%] in control group).
6	Brauner et al (2014)	The effect of physical therapy on muscle strength,	Israel	The purpose of this study was to evaluate the	18 Patients treated in ICU who	Respondents as many as 18 patients were recruited with	• The intensive care group also required shorter intensive care than the

		respiratory muscle and functional parameters in patients with intensive care unit weakness.		effects of intensive physical therapy protocols on patients in intensive care units who experienced weakness, in terms of strength muscle, respiration and functional index.	requiring mechanical ventilation for 48 hours.	prospective randomized trial, (9 control group patients and 9 intervention group patients)	routine care group (P = 0.043). • It is possible that intensive therapy protocols can facilitate early recovery processes in patients with weakness.

Conclusions

Active mobilization in patients in intensive care improves body function, the effect of active mobilization can be seen; in the patient's physical function, muscle strength, walking ability, sitting both during treatment and after discharge from the hospital. Subsequent research in the knowing the effects of active mobilization of the hospital and measure the factors that inhibit the mobilization of patients in intensive care.

A systematic review of the effects of active mobility in patient care, and preventing side-effects in patients during treatment was crutially important to conduct. This research may help to increase the understanding as well as a protocol for profesional medical practitioners in intensive care unit to perform care. In addition, it also helps other medical personnel to collaborate in achieving good service quality. This study shows that it has no negative effect on active mobilization, but this intervention greatly affects the patient's functional status. But still need proof of security in the long run.

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