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Review

# Early Mobilization in Surgical Intensive Care Unit: A Review

# Cerrahi Yoğun Bakım Ünitesinde Erken Mobilizasyon: Literatür Derlemesi

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**ABSTRACT**

Early mobilization encourages patients to move shortly after surgery, significantly benefiting those in surgical intensive care units (SICUs) by accelerating recovery and reducing postoperative complications. This practice enhances respiratory function, preserves muscle strength, and reduces thromboembolic risks. It also shortens hospital stays, lowering healthcare costs. Early mobilization strengthens cardiovascular and respiratory systems, prevents muscle atrophy, and regulates metabolic functions. Psychologically, it boosts morale, reduces anxiety and depression, and positively influences the healing process. Early mobilization plans must prioritize patient safety, starting with in-bed movements and progressing to sitting and standing exercises. Nurses play a critical role, providing personalized care based on individual patient needs. Numerous studies highlight early mobilization's effectiveness in reducing postoperative complications and improving overall health. However, challenges such as hemodynamic instability, pain management, and staff shortages persist. Overcoming these barriers requires a multidisciplinary approach and targeted training programs. Future efforts should focus on developing policies and procedures for broader and more effective implementation of early mobilization in SICUs. Additionally, further research should explore new methods and technologies to enhance these practices. This review aims to comprehensively examine early mobilization's definition, importance, physiological and psychological effects, applicability, implementation barriers, technological integration, and future recommendations for SICUs.

**Anahtar Kelimeler:** Early Mobilization, Intensive Care Unit, Nursing.

**ÖZ**

Erken mobilizasyon, hastaların cerrahi müdahaleden kısa bir süre sonra harekete geçmelerini teşvik eden bir yaklaşımdır. Cerrahi yoğun bakım ünitesindeki hastalar, ameliyat sonrası dönemde iyileşmelerini hızlandırmak ve komplikasyon riskini azaltmak için erken mobilizasyondan büyük fayda sağlarlar. Cerrahi yoğun bakımda bu uygulama, hastaların solunum fonksiyonlarını iyileştirir, kas gücünü korur ve tromboembolik komplikasyonları azaltır. Ayrıca, hastane yatış süresini kısaltarak sağlık hizmeti maliyetlerini düşürür. Erken mobilizasyon, kardiyovasküler ve solunum sistemlerini güçlendirir, kas atrofisini önler ve metabolik fonksiyonları düzenler. Psikolojik açıdan, hastaların moralini yükseltir, kaygı ve depresyon seviyelerini düşürür, iyileşme sürecine pozitif katkı sağlar. Erken mobilizasyon uygulamaları, hastaların güvenliği göz önünde bulundurularak dikkatlice planlanmalıdır. Yatak içinde hareketler, oturma ve ayakta durma egzersizleri ile başlayarak ilerler. Hemşireler bu süreçte kritik rollere sahiptir ve hastaların ihtiyaçlarına göre kişiselleştirilmiş bakım sunar. Erken mobilizasyonun cerrahi yoğun bakımda etkinliğini gösteren birçok çalışma mobilizasyonun postoperatif komplikasyonları azalttığını ve hastaların genel sağlık durumunu iyileştirdiğini ortaya koymaktadır. Erken mobilizasyonun önündeki başlıca zorluklar arasında hastaların hemodinamik instabilitesi, ağrı yönetimi ve personel yetersizliği yer alır. Bu engellerin aşılması için multidisipliner bir yaklaşım ve eğitim programları önerilmektedir. Bu derlemede amaç, cerrahi yoğun bakımda erken mobilizasyonun tanımını, önemini, fizyolojik ve psikolojik etkisini, uygulanabilirliğini ve uygulamadaki engellerini, teknolojiye yansımasını ve gelecekteki önerileri hakkında kapsamlı bir inceleme sunmaktır.

**Anahtar Kelimeler:** Erken Mobilizasyon, Yoğun Bakım Ünitesi, Hemşirelik.

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Hemşirelik Bilimi Dergisi
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## INTRODUCTION

In the surgical intensive care unit, the term "mobilization" refers to physical activity of sufficient intensity to provide physiological benefits such as circulation, central and peripheral perfusion, ventilation, muscle metabolism and alertness (Iliadis, 2020; Castro-Avila et al., 2015). Early mobilization has been proven to provide improvement in muscle weakness and faster return to basic mobility and function (Ashkenazy et al., 2024). Early mobilization in the surgical intensive care unit is applied to maintain or restore musculoskeletal strength and function, thus aiming to improve functional and patient-centered outcomes (Hodgson et al., 2013). Early mobilization is of great importance for intensive care unit patients. Prolonged immobility in the ICU is associated with many adverse outcomes such as muscle atrophy, muscle weakness, ventilator-associated pneumonia (VAP), pressure injuries and increased risk of thromboembolic events. In addition, immobility can lead to psychological distress such as anxiety, depression and post-traumatic stress disorder (PTSD) in ICU survivors. In contrast, early mobilization reduces these risks, improves functional outcomes, shortens intensive care and hospital stays, and improves overall quality of life (Singam, 2024). Early mobilization has been observed to slightly increase muscle strength, possibly improve cognitive functions, improve activities of daily living and improve quality of life. However, it was reported to have little or no effect on mental health and no significant difference in short-term mortality (Matsuoka et al., 2023).

## DEVELOPMENT

### Points to Consider Before Early Mobilization

The necessity of having many devices and materials such as mechanical ventilators, monitors, aspiration devices, infusion and oxygen connections used in patient treatment and monitoring in the surgical intensive care unit may pose various safety risks during patient mobilization. In this process, situations such as disconnection of invasive airways, discontinuation of oxygen support, risk of infection, increased airway pressure, risk of falls and injuries should be considered. It is important to maintain asepsis during mobilization, especially to keep the connection of invasive airways intact. In addition, it is recommended that the physician accompany the procedure within the intensive care team providing mobilization. The length of infusion tubes and systems should be adjusted according to the level of mobilization, and it should be ensured that tube and infusion system connections are secure. Considering that the pressure in the airways may increase during mobilization, ventilator pressure settings should be carefully evaluated. It is important to have a chair (wheelchair) nearby where the patient can sit if needed. Considering the occupational safety risks for professionals, appropriate strategies should be developed (Adler & Malone, 2012; Anekwe et al., 2012; Conceição et al., 2017).

Criteria for stopping early mobilization should also be established. During mobilization, a change in systolic blood pressure of more than 20% compared to the resting baseline, a heart rate (HR)> 200-age (years) above the upper limit determined according to the formula, a 5% decrease in oxygen saturation compared to the resting baseline, and a breathing effort of 7 points or more on the Borg scale should be carefully monitored. In such changes, it is first necessary to reassess the situation by increasing the respiratory pressure on the ventilator by 4 mbar. If there is no improvement, you should stop mobilization. Likewise, if the physical training effort is 7 points or more on the Borg scale, reassessment should be done after a short rest (e.g. sitting on a chair for one minute). If there is no improvement, you should stop mobilization (Alaparthi et al., 2020; Anekwe et al., 2012; Raurell-Torredà et al., 2021).

Hemşirelik Bilimi Dergisi
2025, 8 (1), 113-123
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**Safety Criteria in Early Mobilization Implementation**

Mobilization of surgical patients admitted to intensive care units should be performed according to safety criteria. Patients should be evaluated comprehensively according to the criteria determined before starting early mobilization. These criteria used in early mobilization may differ between branch intensive care units and as a result of this lack of standardization, there is no consensus on the safety measures to be used to initiate mobilization (Conceição et al., 2017).

Yang et al. (2021) grouped the safety measures for early mobilization in intensive care patients under five headings: cardiovascular, respiratory, neurological, musculoskeletal and other criteria. Cardiovascular criteria include the patient's cardiac output and blood pressure and tolerability of mobilization. Heart rate and blood pressure are important in assessing cardiac reserve for mobilization. Mean arterial pressure and blood pressure fluctuation should be under control. Cardiac index and the effect of vasoactive drugs should also be considered. Respiratory criteria include the level of mechanical ventilation and oxygenation, respiratory reserve. Respiratory support can be provided during mobilization but the risk of non-compliance should be considered. Neurological criteria include mild sedation and analgesia, which may facilitate early mobilization (Yang et al., 2021).

Level of consciousness and compliance determine the patient's suitability for active mobilization. Musculoskeletal system criteria, muscle strength, require active participation and cooperation of the patient. Musculoskeletal assessment of the patient and monitoring of muscle strength is important for mobilization. Other criteria are specified as special precautions in patients with mechanical ventilation or extracorporeal membrane oxygenation. Blood values and other physiological parameters should also be taken into consideration when making the mobilization decision. It has been reported that early mobilization can be performed safely and effectively by evaluating these criteria (Tazreean, Nelson & Twomey, 2021).

**Implementation of Early Mobilization in the Surgical Intensive Care Unit**

Patients should be thoroughly assessed for safety criteria, including cardiovascular, respiratory, neurological and orthopaedic factors, before early mobilization is started. Specific safety criteria should be followed when providing mobilization. Enhanced Recovery After Surgery (ERAS) protocols recommend early postoperative mobilization, with patients being out of bed for at least 2 hours on the day of surgery and 6 hours on subsequent days. ERAS protocols recommend the implementation of a standardized and structured mobilization program with clear mobilization goals and objectives communicated to the patient. These should include activities such as sitting, standing and walking. Patients should be closely monitored during and after mobilization, and adequate support from healthcare professionals and assistive devices should be obtained when necessary (Kırtıl & Kanan, 2023; Okcul & Oral, 2023; Tazreean et al., 2021; Thörn et al., 2022; Jasmin et al., 2023).

Early mobilization is recommended for patients in the postoperative surgical intensive care unit, especially for patients with spontaneous respiration, who can cooperate and who do not have intracranial hypertension. Mechanical ventilation and inability to cooperate can be considered as limitations for early mobilization. Early mobilization is not performed in terminally ill patients with systolic hypertension (systolic blood pressure>170mmHg), intracranial hypertension, unstable fractures, recent acute myocardial infarction or open abdominal wounds. The dose of early mobilization should be based on each patient's individual tolerance, age and previous condition. Usually mobilization is done in stages, progressing from lying to sitting, then to standing and finally to walking (Adler & Malone, 2012; Castro-Avila et al., 2015).

Hemşirelik Bilimi Dergisi
2025, 8 (1), 113-123
Doi: 10.54189/hbd.1516710

Passive mobilization is approximately 10 to 20 movements per selected joint up to twice a day. In case of joint stiffness, passive mobilization may include accessory movements or shifts to increase the range of motion. Active exercises consist of two 30-minute sessions lasting one hour per day. Active exercises should include functional movements that can form the basis for activities of daily living (for example, combining flexion, adduction and external rotation of the upper limb with elbow flexion to bring the hand to the mouth for feeding) (Green, et al., 2016). It should also include not only transfer from the lying to the sitting position, but also weight transfers sideways, forward and backward, and trunk rotation in the sitting position to ensure that this essential function is stable and can be performed safely and with adequate trunk control. Positioning and advancing, assisted verticalization with an orthostatic board can be performed twice a day for up to one hour each time, depending on the patient's hemodynamics. Sitting in a chair can also be planned twice a day for up to 90 minutes. Orthostatic posture is a recommended practice to be maintained with the help of a physiotherapist. In this position, balance should be addressed with weight transfer to both sides, front and back, along with the first step test. Patients who can stand in a balanced manner should be encouraged to start walking. Patients can also exercise with an ergometer bike in bed. The main aim of this activity is to improve cardiovascular fitness. Heart rate, blood pressure and SpO2 should be monitored. Passive ergometer exercise can be performed for 20 minutes with 20 cycles per minute. Active ergometer exercise can be performed for 30 to 40 minutes, starting with two 10-minute sessions per day (Aquim et al., 2019).

**The Role of the Nurse in Early Mobilization**

The biggest risk for the patient in early mobilization is the risk of falling and therefore nurses should be careful and experienced about the safety of the patient. Nurses can manage the process better and perform early mobilization applications more frequently thanks to their experience in planning and implementing early mobilization. The difficulties caused by patient-related factors during mobilization also provide some opportunities for nurses to gain experience. Nurses play a major role during the implementation of early mobilization with team collaboration. Nurses are with the patient throughout the entire early mobilization process and manage the process (Mohamed et al., 2020). In terms of patient safety, they provide the necessary equipment and personnel support to prevent possible risks during mobilization. The fact that mobilization studies are carried out together with therapists is among the factors that positively affect the process. The management of negative situations that may be encountered during mobilization practices and the results to be drawn from these negative situations are among the issues to be considered. Although adverse events do not occur frequently, they should be evaluated as learning opportunities and reflected in nursing practices. It is important for nurses to have knowledge about the literature and to perform evidence-based practices in the implementation of early mobilization. The use of evidence-based practices increases the safety of early mobilization programs (Noone et al., 2023; Pashikanti & Von Ah, 2012; Tazreean et al., 2021).

**Physiological Effects of Early Mobilization**

Patients in the surgical intensive care unit may require various types of advanced life support due to the indications for hospitalization and may remain bedridden for prolonged periods. This is associated with complications such as muscle weakness, neurologic and cognitive impairment, and venous thrombosis, which prevent the patient from recovering and returning to a normal/healthy life. Therefore, it is recommended that critically ill patients start rehabilitation as soon as possible after their condition stabilizes (i.e. early mobilization) (Jasmin et al., 2023; Kırtıl & Kanan, 2023; Wang et al., 2020).

Hemşirelik Bilimi Dergisi
2025, 8 (1), 113-123
Doi: 10.54189/hbd.1516710

Early mobilization has significant positive effects on the physiological functions of patients in surgical intensive care units. These interventions provide various physiological benefits, such as maintaining muscle strength, improving cardiovascular function, shortening the duration of delirium, and accelerating overall recovery processes (Jasmin et al., 2023). In the study conducted by Zanini et al. in 2019, it was reported that the 6-minute walking test distance on the sixth postoperative day was significantly different in the groups including early ambulation and upper and lower extremity exercise, and the walking distance increased on the 30th day after discharge. It was also reported that similar improvements in lung function were obtained in all groups (Zanini et al., 2019). Schweickert et al. also showed the positive effects of early physiotherapy and occupational therapy on muscle strength and functional independence levels of patients on mechanical ventilation. According to this study, early mobilization reduces muscle atrophy and increases functional capacity (Schweickert et al., 2009).

**Psychological Effects of Early Mobilization**

Both having undergone surgery and prolonged immobility can take a huge toll on patients' psychological health. This can precipitate conditions such as depression, anxiety, cognitive disorders and post-traumatic stress disorder (PTSD). Research shows that 80% of critically ill patients in the ICU develop neuromuscular dysfunction or ICU delirium, both of which are closely linked to adverse outcomes (Kim et al., 2020; Seo et al., 2022). Moreover, survivors of critical illness often struggle with moderate to severe depression and anxiety that persists for up to two years after discharge; these rates of depression are often higher than in the general population. Cognitive impairments, although often overlooked, can persist in the long term and significantly impact the quality of life of individuals treated in the ICU. Depression and PTSD symptoms are important components of the psychological post-intensive care syndrome (PICS). These psychological sequelae have been documented to last up to five years after discharge from the intensive care unit (Hiser et al., 2023; Inoue et al., 2019; Singam, 2024).

Critically ill patients who receive active and progressive mobilization may feel freer and have hope for a better outcome or faster recovery. This can reduce their levels of anxiety, depression and stress. Research has shown that interactive video games played with the help of technological devices (e.g. virtual reality glasses) are safe and beneficial in improving physical function (Gomes, Schujmann & Fu, 2020; Hendriks & Buise, 2019).

Han et al. reported that patients receiving interactive handgrip game intervention exhibited more favorable psychological and physical outcomes compared to patients receiving routine care. A total of 127 patients were included in the study and 70 patients were randomized to the intervention group and 57 patients to the routine care group. It was reported that patients in the intervention group had lower scores in terms of depression, anxiety and stress compared to the routine care group. In addition, patients in the intervention group showed a significant increase in hand grip strength in both hands over time. These games were found to have positive effects on depression, anxiety and stress, but had no significant effect on sleep quality and delirium. However, significant physical improvements in hand grip strength were reported (Han et al., 2023).

**The Effect of Early Mobilization on Muscle Weakness Acquired in the Intensive Care Unit**

Intensive care unit acquired weakness (ICU-AW) is a type of skeletal muscle dysfunction that usually occurs after sepsis, movement restriction, malnutrition, hyperglycemia and the use of glucocorticoids or neuromuscular blocking agents (Tortuyaux, Davion & Jourdain, 2022). The incidence of ICU-AW varies depending on age, gender, primary diseases and treatment. Approximately 70% of elderly ICU patients may experience complications related to muscle atrophy. ICU-AW is

Hemşirelik Bilimi Dergisi
2025, 8 (1), 113-123
Doi: 10.54189/hbd.1516710

a serious neuromuscular complication in critically ill patients and has a global incidence of 25-31% (Colbenson, Johnson & Wilson, 2019). ICU-AW can affect respiratory and limb muscles, leading to prolonged mechanical ventilation (MV), prolonged intensive care unit (ICU) stay, higher hospital costs, increased mortality and reduced quality of life. Early mobilization (EM) is a promising intervention to combat ICU-AW, but still requires further research. Mobilization could possibly reduce the continuous immobility common in the ICU and promote muscle loading, thus contributing to both stimulation of the muscle protein synthesis pathway and suppression of catabolism (Zhou et al., 2022).

A meta-analysis of 23 randomized controlled trials (RCTs) involving 2,308 critically ill patients reported that early mobilization reduced the incidence of ICU-AW at hospital discharge ($p=0.013$) and increased the number of patients who could stand and walk unassisted. It was also reported that early mobilization reduced muscle atrophy, ventilation, length of hospital stay and ventilator-associated pneumonia and improved patients' responses to inflammation and hyperglycemia (Zhang et al., 2019). Similar studies suggest that early mobilization may reduce the incidence of ICU-AW and improve functional capacity (Colbenson et al., 2019; Hashem, Parker & Needham, 2016; Zhang et al., 2019).

**Challenges and Barriers in Early Mobilization**

Barriers to early mobilization in a surgical intensive care unit include the physical structure of the unit, physiological and psychological conditions of the patients, awareness of the nurses and inadequate resources of the unit (Alaparthi et al., 2020, Zhang et al., 2022). Some of the barriers include hemodynamic instability, presence of invasive connections, changing sleep patterns, safety of patients, lack of communication and teamwork among various professionals, lack of professional human resources, insufficient time, delirium, excessive sedation, risk of musculoskeletal injuries, and excessive stress in the workplace for employees (Alaparthi et al., 2020).

In the study by Zhang et al. it was reported that most nurses had a neutral and negative attitude towards early mobilization. The biggest reason for this is the nurse's concern for the safety of the patient. Nurses' concerns include dislodging vascular lines, nasogastric tubes and urinary catheters and, more importantly, the artificial airway causing life-threatening hypoxia. However, to eliminate these concerns, it is important that early mobilization is performed by appropriately trained personnel (Zhang et al., 2022).

Early mobilization is easier if the patient is awake and cooperative, and therefore the use of sedation should be minimized to facilitate mobilization. Other important factors that appear to be associated with successful early mobilization include adequate pain management and early recognition and management of delirium (Kim et al., 2020; Seo et al., 2022). Another consideration is the availability of adequate staff and equipment to facilitate early mobilization. Physiotherapists should be an integral part of the interdisciplinary team for early mobilization in the ICU. It is also important to have at least one intensive care nurse present (Anekwe et al., 2020; Hodgson et al., 2013).

In the qualitative study by Anekwe et al. barriers to early mobilization and related areas were grouped. These barriers include limited personnel in terms of environmental context and resources, lack of time, limited equipment for early mobilization, poor communication between care providers, and the unpredictable nature of the ICU environment. It was also reported that the main barrier to early mobilization outcomes was the belief that some clinicians (especially physicians) were not sufficiently convinced of the potential benefits of early mobilization or that there was insufficient evidence or data to guide early mobilization implementation. In the knowledge domain, limited knowledge about the benefits of early mobilization, safety parameters of early mobilization, early mobilization procedures, and harmful consequences of immobility were identified as barriers. In the area of memory, attention and decision processes, lack of ability to recall,

Hemşirelik Bilimi Dergisi
2025, 8 (1), 113-123
Doi: 10.54189/hbd.1516710

selectively focus and choose care pathways that would provide optimal health benefits for the patient was identified as a barrier (Anekwe et al., 2020).

**Overcoming the Challenges of Early Mobilization**

The barriers to early mobilization in surgical intensive care patients are multifaceted and patient-related barriers are at the forefront. Successful implementation of early mobilization may be possible with the use of strategies to overcome barriers (Dirkes & Kozlowski, 2019). Major themes that facilitate early mobilization are mentoring, trust and expertise, encouraging healthcare workers, additional staff to provide early mobilization, sedation break/holiday, organization of the environment, cultural changes to promote early mobilization, good communication to plan early mobilization and clear safety criteria. Minor themes are workload flexibility and time management, clear eligibility criteria, environment, education, participation, and changes in clinicians' attitudes about getting help from the team to perform early mobilization intervention (Hashem et al., 2016; Lago et al., 2022).

To facilitate quality improvement projects, reported barriers were organized into four categories in the study by Dubb et al: Patient-related barriers, including patient symptoms and conditions; structural barriers, including human and technical resources; ICU culture-related barriers, including habits, attitudes and context within ICUs and institutions; and process-related barriers, including how services are delivered and clinician functioning. Strategies to overcome patient-related barriers include using an interdisciplinary approach to improve early mobilization, developing and implementing protocols, and defining inclusion and exclusion criteria for mobility. Strategies to overcome structural barriers include developing and implementing protocols, increasing staffing, purchasing equipment, establishing interprofessional protocols, staff training, regular interprofessional staff meetings, and changes to clinical documentation to allow better assessment of early mobilization of patients. Overcoming barriers related to ICU culture requires education, changing decision-making processes, improving interprofessional coordination and increasing nurse and physiotherapist involvement. Strategies to overcome process-related barriers include organizing interprofessional meetings and rounds, sharing clinical responsibilities and collaborating with the team to promote early mobilization (Dubb et al., 2016).

**Early Mobilization and Technology in Intensive Care**

The treatment and recovery process of patients in intensive care units has changed significantly in recent years thanks to technological developments. This change is especially evident in early mobilization applications (Needham et al., 2010).

Early mobilization means getting intensive care patients on their feet as soon as possible and including them in the rehabilitation process. In traditional approaches, patients usually stayed in bed for a long time and became weak. However, in recent years, technological advances have made early mobilization safer and more effective (Tipping et al., 2017) For example, robotic rehabilitation devices can support some of the patient's body weight to help them stand and move. Moreover, thanks to wearable technologies, patients' physical activity and daily mobility can be monitored more closely and the recovery process can be managed more effectively (Schaller et al., 2016).

Neuromuscular electrical stimulation (NES) and cycle ergometry are appropriate technologies for the early stages of rehabilitation of critically ill patients. NES provides passive contraction of muscles with low-voltage electrical impulses. Bicycle ergometers are stationary bicycles that allow patients to exercise and can modify the exercise with built-in mechanisms. Both technologies allow for personalized rehabilitation protocols. It is important to use both passive (NES) and active (bicycle ergometry) technologies in the early mobilization process. NES and bicycle ergometry are suitable for

Hemşirelik Bilimi Dergisi
2025, 8 (1), 113-123
Doi: 10.54189/hbd.1516710

early rehabilitation even in sedated patients. Technological aids support ambulation by improving safety and efficiency in intensive care units (Ferre et al., 2021).

Early mobilization practices provide several benefits in ICU patients. These include reducing muscle weakness, improving lung function, preventing pressure injuries, preserving cognitive functions such as delirium, and shortening the duration of hospitalization (Dirkes & Kozlowski, 2019; Schweickert et al., 2009). Considering all these advantages, it can be said that early mobilization practices in intensive care units have gained more importance with technological developments. Increasing the awareness of healthcare professionals on this issue and disseminating early mobilization protocols will positively affect the recovery process of intensive care unit patients (Adler & Malone, 2012).

## CONCLUSION

In surgical intensive care units, early mobilization, which means encouraging patients to move as soon as possible, can be considered as an important recovery factor. This approach aims to accelerate the recovery process of patients in the postoperative period and reduce the risk of complications. Studies show that early mobilization benefits the physiological status of patients in many ways. Benefits such as improving respiratory function, maintaining muscle strength and reducing thromboembolic complications positively affect the recovery process of patients. In addition, early mobilization, which also contributes to the regulation of metabolic functions, generally helps the patient's body functions to return to normal. From a psychological point of view, early mobilization increases the morale of patients and reduces anxiety and depression levels. The increase in hope and motivation levels of patients during the recovery process leads to a faster recovery. This contributes to patients becoming stronger both physically and mentally.

However, successful implementation of early mobilization and ensuring the safety of patients requires careful planning and training. Obstacles such as hemodynamic instability, pain management and staff shortage may make it difficult to perform this practice effectively. A multidisciplinary approach and training programs play an important role to overcome these difficulties. The coordinated work of nurses, physiotherapists, physicians and other health professionals ensures the effective implementation of early mobilization. In addition, training programs for staff contribute to the safe and efficient implementation of this practice. In the future, it is important to develop policies and procedures for more widespread and effective implementation of early mobilization in surgical intensive care units. To this end, further research is recommended and the integration of new implementation methods and technologies should be encouraged.

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Hemşirelik Bilimi Dergisi
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