Evolution of intensive care medicine in the last few decades and integrating teamwork has a major impact on increasing the rate of survival of patients. All the attention of the responsible team is not only aimed at treating the underlying disease, but also to decrease complications associated with prolonged stay in the ICU. The most common complications are: deconditioning, muscle weakness, polyneuropathy, myopathy, thromboembolic complications, decubital wound, articulation stiffness, cognitive disorders, depression, anxiety and a global reduction in quality of life. Physical therapy has its place in the earliest stages of treatment of mechanically ventilated patients. The aim of this article is to review the evidence for the use of rehabilitation in ICU in the adult mechanically ventilated patients.

Early and systematically structured rehabilitation programs have been shown to be both safe and feasible for critical care populations.

Key words: early rehabilitation, mechanically ventilated patients, bed rest

INTRODUCTION

According evidence, each year, more than 1 million in USA patients who require mechanical ventilation are admitted to intensive care units (ICUs). In addition to their comorbid diseases, patients who require mechanical ventilation have many barriers to mobility and they are frequently subjected to long periods of physical inactivity. All those are need of particular medical care, intensive treatment and continuously monitoring. It refers to a seriously ill patient, hemodynamic unstable, whose life is seriously imperiled, the one who desperately needs early detection of disease as well as all necessary medical measures taken in good time. It is known that the treatment of critically ill patients has a high rate of morbidity and mortality, and occupies an important place in the health budget. Evolution of intensive care medicine in the last few decades and integrating teamwork has a major impact on increasing the rate of survival of patients. In accordance with this, all the attention of the responsible team is not only aimed at treating the underlying disease, but also to decrease complications of prolonged immobilisation and stay in the ICU.

The most common complications are pointed out, associated with prolonged stay in the intensive care rooms are reducing power, muscle weakness, shortness of breath, pain, polyneuropathy, myopathy, thromboembolic complications, decubital wound, development of articulation stiffness, problems with swallowing, cognitive disorders, depression, anxiety and a global reduction in quality of life. The patients in ICU are forced to lie immobile for some prolonged time due to hemodynamic instability itself, as well as to necessary abdominal and thoracic drains, artery and intravenous lines for infusion and parenteral nutrition, urinary catheters, nasogastric sones, mechanical ventilation that requires endotracheal tubes and hemofiltration catheters. Although immobilization should be considered as a part of therapy protocol in ICU, it could lead to severe health consequences for a general health of a patient.

Postoperative respiratory complications are common with patients who were abdominally operated particularly when disease spread to upper abdominal parts. Respiratory complications, in the form of atelectasis, bronchopneumonia and pleural hemorrhagic effusion are the most common mortality and morbidity causes after abdominal surgeries. Critical illness polyneuropathy (CIP) and myopathy (CIM) are complications of critical illness that present with muscle weakness and failure to wean from the ventilator. In the early 1980, Latronico and Bolton first described a critical illness polyneuropathy, like as a primary axonal degeneration, affecting motor nerves more than sensory nerves. Electrophysiologic studies show reductions in
amplitudes of compound muscle and sensory nerve action potentials. Lots of follow-up studies have shown significant and long-lasting physical and psychological dysfunction in survivors of critical illness that are associated with poor quality of life. Herridge et al reported 1-year outcomes in patients recovering from ARDS. Only 49% of the living had returned to work at 1 year, and the median 6-minute walk distance was less than 66% of predicted due to global muscle wasting and weakness, foot drop, joint immobility, and dyspnea. Follow-up studies of the same group registered after 5 years the same problems concerning health.

The aim of this article is to review the evidence for the use of rehabilitation in ICU in the adult mechanically ventilated, critically ill patients. Early and systematically made rehabilitation programs have been shown to be both safe and feasible for critical care populations.

**MECHANICAL VENTILATION AND MUSCLE WEAKNESS**

Respiratory dysfunction is one of the most common causes of why critically ill patients admitted to the ICU. Physical therapy has its place in the earliest stages of treatment of patients with mechanical ventilatory support. The goal is to maintain strength of respiratory muscles, breathing dynamics, improving global whole ventilation system while ensuring the hygiene of the respiratory tract. The reduced mucociliar activity, after anesthesia and immobilization of a patient, can lead to both respiratory system dysfunctions and increased bronchial secretion. Postoperative pain caused by surgical cutting in upper parts of abdomen has negative effects on cough and expectoration, since it inhibits abdominal muscles to be engaged, which is indispensable in the process. Postoperative pain, also, prevents physical activity of a patient not only during mobilization and verticalisation, but in the lying position as well. The diaphragm inactivity is another important factor in the development of pulmonary complications. The diaphragm functionality is the most important in the successful separation of patients from mechanical ventilation. Continuous and prolonged assistance breathing, dependent on respiratory apparatus, leads to structural and contractil disorders in diaphragm itself, thus stimulating oxidative stress and apoptosis of muscular cells. It results in protein change in a muscular cell and genetic aberrations, which all have atrophy and diaphragms weakness as the consequences that follow. It is one of most significant results of the postponed patient disconnection from a mechanical ventilator. As a result of patients dependent on mechanical ventilation increased incidence of neuromuscular weakness. After 5 days of mechanical ventilation, within 25-65% of the respondents in ICU, significant muscular weakness was observed. Both, sedation and analgesia are integral part of curing a critically ill patient as they provide ventilator comfort, reduce stress and make mechanical ventilation easier, but at the same time they cause physical inactivity, and are related, in terms of both short and long-term outcome, to the reduced functional and cognitive capacity of a patient. In the period of 28 days rest of healthy young volunteers, they were lost a 0.4 kg of muscle mass and decrease power extensions thigh muscle. Protein synthesis decreases very fast, even in the very first 6 hours of muscular inactivity. Skeletal muscle fiber area decreases by 2-4% per day in the ICU.

**TASK FORCE ON PHYSIOTHERAPY**

Data from the literature tells us that if the rehabilitation start early, during ventilatory support to patients, shortens the respiratory depending period, shortens the time of stay in the ICU, accelerating discharge of patients from hospitals and increase patient functional capacity. Early walking in ICU, as a matter of great importance, has already been examined. Foss et al defined in 1972 a technique for augmenting ventilation while a patient is being ambulated and given mechanical ventilation. Foss also out lined the advantage his physical activity offers: a better sensation of a well-being and the growth in general the ability to maintain power.

Although mobilization involving gravitational stimulus and ambulation of patients who require mechanical ventilation is recommended, such mobilization is not always part of the physical therapy treatment. One reason for that inconsistency could be the lack of a standard for the physical therapy profession in ICUs due to significant differences in practice across hospitals, ICUs, countries, staffing levels, training, and expertise. Due to the lack of valid evidence from randomized controlled trials or meta-analyses was limited and most of the recommendations on the effectiveness of physical therapy in acutely and chronically critically ill patient measures and activities of physical therapy are inadequate or unbalanced when performing procedures in the ICU. Thus it became necessary to identify global guidelines on the procedures of rehabilitation, according to the characteristics of each patient individually with possible individual modification. Rehabilitation has the potential to regain lost functions, but in many ICU this therapeutic approach has not yet been accepted and physical therapy begins only when the patient is released from ICU. Critically ill patients are seen as "too sick" to tolerate physical activity at an early stage of their illness, and therefore is often prolonged patient immobilization.

For this reason, the members of the working group of the European Respiratory Society and European Society of Intensive Care Medicine met several times to identify the field of work and to make safe and feasible recommendations in ICU for clinical procedures of physical therapy. Within psychiatrist evaluation, physical examination is less focused on the medical diagnosis, is more focused on the physiological defects and functional level of critically ill patient. Still et colleagues presented overview of safety issues before mobilizing critically ill patients.
PHYSIOTHERAPY INTERVENTIONS IN INTENSIVE CARE UNIT

Physical therapists should be an integral part of the interdisciplinary team in the ICU involved in the implementation of this program, because physical therapists are in a unique position with skills and expertise to assess neuromuscular function accurately and to provide the appropriate rehabilitation techniques. Dong et al performed a randomized controlled trial and they included 60 intubated patients who were intubated more than 48 hours and less than 72 hours. Patients were randomized into two groups. Rehabilitation group had twice daily the training time (heading up actively, transferring from the supine position to sitting position, sitting at the edge of the bed, sitting in chair, transferring from sitting to standing, and ambulating bedside). Patients in the rehabilitation group had shorter days to first out of bed (3.8±1.2 d vs. 7.3±2.8 d; P=0.00), duration of mechanical ventilation (5.6±2.1 d vs. 12.7±4.1 d; P=0.005) and length of ICU stay (12.7±4.1 d vs. 15.2±4.5 d; P=0.01) compared with the control group.

Physical therapy in the ICU could include any of the following therapeutic interventions: positioning; education; manual hyperinflation; percussion; vibration; suction; cough; range of motion, strengthening, and/or breathing exercises; and mobilization.

Early mobility in the ICU can lead to the following positive outcomes:

- Minimizing complications of bed rest
- Promoting improved function for patients
- Promoting weaning from ventilatory support as a patient’s overall strength and endurance improve
- Reducing length of hospital stay
- Reducing overall hospital cost
- Improving patients’ quality of life

Early postoperative rehabilitation involves applying strategies and skills of both respiratory physical therapy and early mobilization, that begins on the very first postoperative day, as soon as the hemodynamic stability of a patient is gained, and lasts until the patient is dis-
missed from hospital. Respiratory physical therapy includes diaphragmatic excursions and exercises for diaphragm breathing, forced expirium and inspirium, expectation strategies and drainage positions. The aim is to increase cleansing of airways, to expand lungs, to improve respiratory function as well as to prevent possible lung complications. Although, hand massage techniques, tapping and vibrations of the chest can be a part of rehabilitation protocol unless airways cleansing is insufficient, they are not recommended to be applied after severe surgery, since a great number of drains is present. Positioning the patient and mobilization can ensure optimum hygiene airways and increase oxygenation. One of the basic measures of physical therapy which achieves an increase in gravitational stress associated with the redistribution of fluid through the organic systems. Upright posture increases lung volume and gas exchange and reduces compression on the heart. Upright position of a patient, after surgeries, should begin as soon as the hemodynamic stability is attained. It is important to take into consideration a cardiologic and respiratory reserves of a patient, as well as hemoglobin level, well before both rehabilitation and mobilization plan is made. Mobilization should include gradually planned exercises that a patient can tolerate. To prepare the patient for verticalization, surgical wound should be immobilized with bandage or special belts, while drains, urinary catheters, nasogastric sones must be tightly fixed for patient’s body. Besides, oxygen tubes and catheter lines should be extended if necessary. Positioning the patient for verticalization, surgical wound should be immobilized with bandage or special belts, while drains, urinary catheters, nasogastric sones must be tightly fixed for patient’s body. Besides, oxygen tubes and catheter lines should be extended if necessary. It is also important to administer effective anlectic therapy for reducing postoperative pain in order to enable proper verticalization and initial training to cough and expectorate, with the aim of cleansing bronchial stem.

Experts in the field of rehabilitation have tried to improve thigh muscle strength in patients on mechanical ventilation and attempted neuromuscular electrical stimulation (NMES) in ICU. There is little evidence that confirms efficiency NMES. At the other side, other studies confirmed the safety and effectiveness of using NMES in ICU to prevent muscle atrophy. This is the procedure of physical therapy that is performed when the patient is not able (included sedation or impairment a state of consciousness) to participate in active exercises.

In order to improve outcomes mechanically ventilated patients, Barton and colleagues performed and published a randomized controlled study involving early exercise using a bedside bicycle ergometer in patients with expected prolonged stays in ICUs. The study included 90 patients - 45 in each group and most of them (84%) were intubated and mechanically ventilated. Inclusion in study began on the fifth ICU day. Both groups received respiratory physiotherapy and a daily standardized passive or active motion session of upper and lower limbs. Treatment group performed a passive or active exercise training session for 20 min/day, using a bedside ergometer. The 6-min walk distance at hospital discharge was higher in the intervention patients (196 m vs 143 m, P, .05). The quadriceps force at hospital discharge was better in the intervention group (2.37 N/kg vs 2.03 N/kg, P, .05).

Leading physiatrists still do not know the optimal duration and frequency of acute rehabilitation. Parker and colleagues published in BMC Medicine the results randomized controlled trial that included 996 patients divided into two publicly-funded Australian metropolitan rehabilitation facilities. Physiotherapy and occupational therapy delivered in two groups: first group, from Monday through Friday (5 days) received physical therapy, the other group received rehabilitation from Monday through Saturday (6 days). Functional Independence Measure - FIM, quality of life - EQ-5D questionnaire and length of stay at discharge, functional independence and quality of life were assessed at 6- and 12-month follow-up. This increased dose of rehabilitation in the intervention group resulted in greater functional independence and quality of life at discharge, with a trend towards significant improvement at six-month follow-up. The length of stay for the intervention group was shorter by two days (95% CI 0 to 4, P = 0.10).

Fig.2. Step in rehabilitation - Sitting on the edge of the bed mechanically ventilated patient

We presented early mobilization mechanically ventilated patient in Surgical ICU in Emergency Centre in Belgrade who was suffering from acute pancreatitis. Belgrade, 2014.

CONCLUSION

Early ICU mobilization requires a multidisciplinary team approach. Rehabilitation team which is composed of a doctor and physiotherapist, involved in the process of treating critically ill patients, whether it be acute, subacute or chronic stage of the disease. The activities are aimed at the prevention and treatment of consequences of prolonged bed rest. The role of this team and their presence in the ICU vary from hospital to hospital. Studies have demonstrated when rehabilitation starts early for mechanically ventilated patients is safe and feasible, improves patients outcomes and brings improvement in financial terms.

SUMMARY

RANA FIZIKALNA TERAPIJA KOD KRITIČNO OBOLELIH PACIJENATA NA MEHANIČKOJ VENTILACIJI

Evolucija intenzivne medicine u poslednjih nekoliko decenija i integriranje timskog rada imaju veliki uticaj na povećanje stope preživljavanja teških bolesnika. U skladu s tim sva pažnja odgovornog tima nije usmerena samo na lečenje osnovne bolesti već i na tretman smanjenja kompleksija prolongiranog boravka u Jedincama intenzivnog lećenja (JIL). Najčešće komplekse koje se izdvojile su: dekonđicioniranost bolesnika, mišićna slabost, polineuropatija, miopatija, tromboembolijske komplekse, dekubitalne rane, razvoj kontrakturna, kognitivni poremećaji, depresija,
Early physical therapy in mechanically ventilated, critically ill patients

 ankioznost i globalno smanjenje kvaliteta života. Fizikalna terapija ima svoje mesto u najranijim fazama lečenja bolesnika sa mehaničkom ventilatornom potporom. Cilj ovog članka je da razmotri dokaze o korišćenju rehabilitacija u JIL-u kod odraslih pacijenata na mehaničkoj ventilatornoj potpori. Rani i sistematski strukturirani rehabilitacioni programi su se pokazali kao bezbedni i izvodljivi u populaciji kritično oboljelih bolesnika

Cljučne reči: rana rehabilitacija, pacijenti na mehaničkoj ventilaciji, prolongirano mirovanje

LITERATURE: