



The Effect of Intensive Medical Rehabilitation on the Functional Capacity of TNI Soldiers with Chronic Phase of Lower Extremity Injuries

Rifqi Averrouza

Medical Rehabilitation Department, dr. Suyoto Hospital, Rehabilitation Center Ministry of Defense of the Republic of Indonesia

Correspondence email: comuda02@gmail.com

Abstract

Rehabilitation plays a crucial role in the recovery of patients, improving their quality of life and reducing the risk of complications by restoring a person's functional capacity after experiencing an injury. Chronic musculoskeletal injuries that are not handled optimally have the potential to cause disability for soldiers, making it impossible for soldiers to return to duty according to their main duties. Lower extremity injury is related to the potential reduction in a person's functional capacity, related to their functions, namely mobility, fitness, strength and agility. Active military soldiers with chronic lower extremity injuries underwent an intensive-structured medical rehabilitation program 3 times a week for 8 weeks. At the end of the rehabilitation program, statistically significant differences were found in the increase in cardiorespiratory fitness capacity and agility compared to pre-intervention. Even in chronic conditions, intensive medical and structural rehabilitation programs in cases of lower limb injuries can significantly increase functional capacity in assessing cardiorespiratory fitness and agility in accordance with TNI soldier fitness standards.

Keywords: Disability; Musculoskeletal; Rehabilitation; Functional Capacity

Introduction

TNI soldiers are at risk of experiencing lower extremity musculoskeletal injuries as a result of their duties and type of work. Chronic injuries that are not handled optimally have the potential to cause disability so that soldiers cannot return to duty according to their main duties. According to data from the Rehabilitation Center of the Ministry of Defense, it was found that there were 5943 TNI soldiers who experienced disabilities of various degrees.¹ A large portion of musculoskeletal injuries, especially those of the lower extremities and spine, are related to the type of physical activity carried out daily. Musculoskeletal disorders are among the leading causes of disability and chronic pain worldwide, and their impact is expected to increase in the coming years.²

Reports reveal that the most costly and disabling injuries are those involving articular (joint) surfaces, especially those of the ankle/foot. Patients with such injuries exhibit residual physical and psychosocial problems, even at one year post-trauma. Because they involve weight-bearing surfaces and major articulating joints, hip, knee, and ankle fractures often result in prolonged reductions in mobility.³ In this context, the role of musculoskeletal



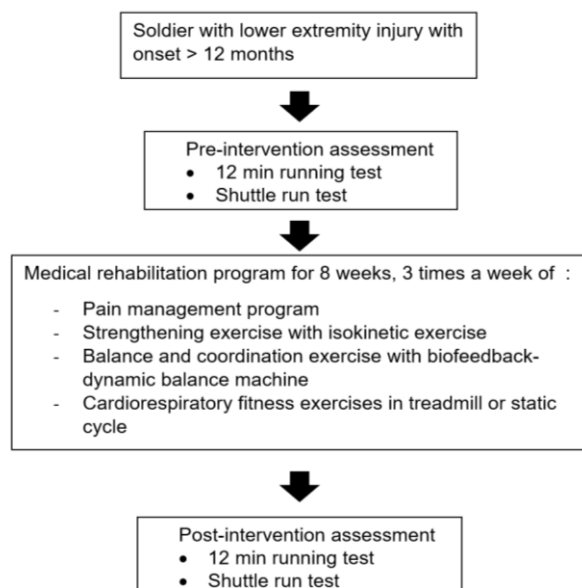
rehabilitation is crucial, both in the prevention of disability and in the promotion of functional recovery.²

A rehabilitation program is a method to restore a person's functional capacity after experiencing a musculoskeletal injury. Rehabilitation plays a crucial role in the recovery of patients, improving their quality of life and reducing the risk of complications and readmissions. Another challenge in musculoskeletal rehabilitation is the need for individualized treatment plans. Each patient has unique needs and requires a tailored approach to their rehabilitation.²

Methods

Subjects are active TNI members undergoing an integrated post-injury rehabilitation program. Inclusion criteria were patients who had a lower extremity injury with an onset of > 12 months, were able to run for 12 minutes with tolerable pain (NRS < 3), and were able to perform the shuttle test, and underwent an intensive - structured medical rehabilitation program 3 times a week for 8 weeks. Medical rehabilitation programs include pain management programs, strengthening exercises with isokinetic strengthening machine, balance and coordination exercises with biofeedback-dynamic balance machine, and cardiorespiratory fitness exercises in treadmill or static cycle. The training program given, in terms of intensity, repetitions and sets, is individualized according to the problems experienced by the subject.

Subjects underwent a 12-minute running test and shuttle test before participating in the rehabilitation program. In the 12 minute running test, the subject is instructed to run a 400 meter track, and the distance covered will be recorded for 12 minutes. The shuttle run is done by running through 2 cones by forming a figure 8 track and then recording the time needed to complete the test. Both tests are fitness test methods that are routinely carried out on TNI soldiers, to describe functional capacity for cardiorespiratory fitness and agility.



Results

A total of 15 TNI soldiers who suffered lower extremity injuries were included in study, consist of 11 subjects with soft tissue injuries to the knee, and 4 subjects with post injury due to long bone fracture in the lower extremities. The average onset of injury experienced by the subjects was 48 months before joining the program. In the 12 minutes running test, there was a significant increase ($p < 0.05$) in distance traveled pre-intervention (mean: 1653 m) compared to post-intervention (mean: 2239 m). In the shuttle run agility test, there was a significant increase in pre-intervention time (mean: 8.09 seconds) compared to post-intervention (mean: 6.19 seconds) ($p < 0.05$).

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| Samples, n | 15 | |
| Age ((years); Med; min – max) | 28 ; 23 – 44 | |
| Onset of injury ((months); Med; min – max) | 48 ; 12 – 72 | |
| 12 min run test ((meter); Mean SD) | | |
| Pre-intervention | 1653 ± 289.8 | |
| Post – intervention | 2239 ± 355.5 | $p < 0.05$ |
| Shuttle run ((seconds); Mean SD) | | |
| Pre-intervention | 8.09 ± 1.35 | |
| Post – intervention | 6.19 ± 0.69 | $p < 0.05$ |

Discussion

Musculoskeletal injuries are a detriment to military readiness and the primary cause of limited or missed duty days every year. For individuals with high physical demands, limitations in the ability to move their body could lead to greater risk of injury. Rigorous physical activities can subject a person to large forces, and someone with a healthy neuromusculoskeletal system is better equipped to absorb and redistribute those forces. In one study, 37.3% subjects with original lower-extremity injury, sustained a time-loss injury during the 1-year follow-up period.⁴ In this study, we found subjects with the majority of knee joint soft tissue injuries involving ACL injuries and/or meniscus injuries. This is understandable because soldiers in their duties and training carry out many activities that require acceleration - deceleration functions and high impact activities.

Lower extremity injury is related to the potential reduction in a person's functional capacity, related to their functions, namely mobility, fitness, strength and agility. Rehabilitation following a sports injury is critical to ensure full recovery, minimize time away from sports, and avoid reinjury. Post-injury rehabilitation programs need to consider each phase of the injury, which among other things aims to promote tissue healing, prevent immobilization complications, maintain and improve physical fitness status, and prepare for return to activity / sports activity. The training program provided must at least include

flexibility, strength, agility and cardiorespiratory endurance training. The incomplete rehabilitation of a prior injury can lead to numerous ailments^{5,9}.

Lower extremity injury was associated with reduced aerobic exercise capacity and a higher fatigue index with respect to anaerobic exercise capacity.⁵ In this study, it was found that there was a significant increase in cardiorespiratory capacity in the 12 minute running test, with an average of 1653 m pre-intervention compared to 2239 m post-intervention. Based on the category table from Cooper's assessment, by category there was an increase in classification based on age group, from poor to average category.

Persons with higher aerobic capacities should be able to consume more oxygen than those with lower aerobic capacities, and their bodies are likely to be more efficient at circulating oxygen to all systems and producing energy. Persons in the top levels of a fitness spectrum may not be as susceptible to microtraumas and may recover better from injury than their less-fit counter-parts. On one studies suggest that improving relative aerobic capacity by 1 metabolic equivalent of task (approximately 3.5 mL/kg/minute) reduces the risk of any injury by 14%. These findings illustrate the importance of fitness in reducing the risk of injury in physically demanding occupations and support the need to provide dedicated resources for structured fitness programming and the promotion of injury prevention strategies to people in those fields.⁶

Meanwhile, for the agility test, there was a significant increase in the mean between pre and post intervention. Injuries to the lower extremities are known to have an impact on reducing dynamic balance capacity. By adding strengthening exercises to the rehabilitation program, there was an improvement in dexterity abilities, not only with balance training alone. The explanation of this because of enhanced neuronal coordination, including a selective activation of motors units, synchronization, selective activation of muscles, and increased recruitment of motor units. There is some evidence that proprioceptive and balance exercise improves outcomes in individuals with ACL-deficient knees. Improvements in joint positions position sense, muscle strength, perceived knee joint function, and hop testing were reported following proprioceptive and balance exercise.^{10,11}

That proprioceptive and balance training might improve lower limb strength more than a strength-based training program is an interesting notion and requires further investigation. It could be speculated that proprioceptive and balance training might enhance neuromotor recruitment, thus enhancing muscle strength¹¹. Moreover, the decrement of the dynamic balance performance may indicate that, before returning to competitions, the rehabilitation protocol should be more focused on dynamic balance exercises.^{7,8}

Rehabilitation is the restoration of optimal form (anatomy) and function (physiology). It is a method created to enhance functional capacity, fitness, and performance while minimizing the loss associated with acute injury or chronic disease. The rehabilitation process should begin as soon as possible after an accident, and it should be integrated into a continuum with other therapeutic interventions including the use of pharmaceutical

medications. Many injuries may occur because the rehabilitation of a previous injury was not complete.⁹

Conclusion

Intensive medical and structural rehabilitation programs in cases of lower limb injuries, even in chronic conditions, can significantly increase functional capacity in assessing cardiorespiratory fitness and agility in accordance with TNI soldier fitness standards.

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