



REHABILITATION PROGRAM PHASE I POST RECONSTRUCTION ACL: A CASE STUDY

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Abstract

Introduction : Anterior Cruciate Ligament (ACL) injuries are the most common knee injuries during sports. The incidence of ACL rupture ranged between 30-78 people per 100,000 people per year. Most athletes with ACL injuries undergo reconstructive surgery in hopes of returning to do some sports activities. To accelerate and optimize conditions for a return to sport, a proper rehabilitation program is needed so that the patients can return to do some sports activities. According to protocol, proper rehabilitation involves exercises to increase muscle strength, knee ROM, proprioception, accompanied by reducing pain, and inflammation.

Case Presentations : An 18 years old male patient came to physiotherapy with a diagnosis of post-ACL reconstruction. He did surgery a week before seeing the physiotherapy. The patient came with complaints of swelling and pain in the knee area. The pain increases when he bending the knee and doing activities that require support on the knee..

Management and Outcomes : Patients did 8-time therapies in 4 weeks. In one of the therapy sessions, the patient was given a rehabilitation program in the form of ice compression, ROM exercise, and isometric exercise. All of these rehabilitation programs will be evaluated with several measurement instruments, including; Pain measurement with NRS, anthropometric measurement with metline, measurement of muscle strength with MMT, and measurement of functional ability using KOOS.

Discussion : The ACL post-reconstruction rehabilitation program is divided into 4 phases. Time for 0-6 weeks after surgery is included in phase 1 or what is known as an acute condition. The purpose of the program in phase 1 is to focus on reducing the risk of postoperative complications by reducing inflammation symptoms, maintaining joint mobility, and stimulating muscle contraction. The patient is given ice compression to reduce pain and reduce edema. Furthermore, ROM exercises are given to maintain joint mobility and flexibility of the tissues around the joints. The patient is also given isometric exercise to activate the muscles around the knee to improve knee joint stabilization.

Conclusion: By providing interventions in the form of ice compression, ROM exercise, and isometric exercise, the post ACL reconstruction rehabilitation program in phase 1 can



reduce pain, reduce edema, increase muscle strength and improve the patient's functional ability.

Keywords: Anterior Cruciate Ligament Reconstruction, Physiotherapy Program, Rehabilitation program.

Introduction

Anterior Cruciate Ligament (ACL) injuries are the most common knee injuries during sports. The incidence of ACL ranged from 30-78 people per 100,000 people per year (Gans et al., 2018). For some people, this injury could be the end of their career as an athlete, and it also could delay their progress and future in athletics. (Mehran et al., 2016).

The anterior cruciate ligament itself serves as the main stabilizer of the knee joint. This ligament prevents anterior translation of the tibia to the femur, prevents excoriation of the tibia in knee flexion, and prevents hyperextension of the knee. The combination of several ACL functions provides stabilization of the knee, where this stabilization is indispensable during sports and daily activities. (Ahmed et al., 2017) Individuals with ACL injuries are usually described as a popping sound followed by pain and swelling in the knee. There is a feeling of instability in the knee and is accompanied by limitations in activities. ACL injuries occur due to direct contact with the lower leg and rotation in certain pressure so which caused ligament torn (Mohtadi & Chan, 2018).

Most athletes with ACL injuries undergo reconstructive surgery in the hope of returning to do some sports activities. However, the conditions for athletes to return to the field mostly are not really in line with the expectations (Webster & Feller, 2019). A significant decrease in muscle strength and a decrease in knee stability causes the probability of return to sport is being decreased (Ithurburn et al., 2015). To accelerate and optimize conditions for the return to sport, a proper rehabilitation program is needed so that the patients can return to do some sports activities. According to protocol, proper rehabilitation involves exercises to increase muscle strength, knee ROM, proprioception, accompanied by reducing pain, and inflammation (Ahmad, 2016).

According to Ahmad (2016) in the International Journal of Science Culture and Sport, that a proper intervention in postoperative ACL phase 1 focuses on reducing the risk of postoperative complications by decreasing inflammatory symptoms, as well as stimulating muscle contraction. This focus will be given to the patient, considering that the



patient had surgery one week before coming to the physiotherapist so that it can be categorized into phase 1. The therapist provides interventions in the form of ice compression, ROM exercise, and isometric exercise. With the aim of the patient being able to participate in the desired activity without causing instability to the knee.

Case Presentation

Subjective Examination

Patient T, aged 16 years, complained of pain in the knee with limited movement after ACL reconstruction surgery on the right leg. The patient described knee pain on movement with an intensity of 8 out of 10 on a pain scale. The pain increases when the patient bending the knee and doing some activities that require support on the knee such as squatting, going up and downstairs. The pain lessens when he gets some rest. The problem started in the middle of June in 2021, the patient experienced a traumatic fall while playing basketball with the right leg straight and opened outward, then a "pop" sound was heard and he felt like something is torn. After one month, the patient just realized the conditions of the knee so that he came to the doctor to check and do the Magnetic Resonance Imaging (MRI) and was diagnosed to rupture grade III anterior cruciate ligament dextra in Yayasan Rumah Sakit Islam Surakarta.

The goals are reducing pain during activities, maximizing muscle strength, and optimizing functional and daily activities so that they can return to playing basketball on the court.

Physical examination

Physical examination was carried out with IPPA and vital signs. On inspection, there was an incision in the right anterior knee, edema in the right anterior knee, and atrophy in the right quadriceps muscle group. On palpation found tenderness in the right knee in the area around the incision and the local temperature difference between the right and left knee where the right knee was warmer than the other one. Other vital signs such as blood pressure, respiration, pulse, and body temperature were within normal limits.

Basic movement examination is done by examining active, passive, and isometric movements against the resistance of the patient. On examination of active movement, found limitations accompanied by pain during flexion movement. Passive motion examination showed no limitation of motion or pain. Isometric examination against



resistance, the ROM is less than maximum and being accompanied by pain during flexion. When the extension, it is less than the maximum without pain.

Table 1. Pain measurement is done by Numeric Rating Scale (NRS).

PAINFUL	Score	Interpretation
Static Pain	4/10	Moderate pain
Tenderness	6/10	Moderate pain
Pain by motion	8/10	Severe pain

Information ;

0 : No pain

1-3 : Mild pain

4-6 : Moderate pain

7-10 : severe pain

Table 2. Anthropometric examination of both legs with metline

	Dextra	Sinistra
Basic Patella	40.5 cm	39 cm
5 cm↑	41.3 cm	42 cm
10 cm	43.7 cm	47 cm
15cm	48cm	51 cm
20 cm	51 cm	55.5 cm
Tibia Tuberosity	35cm	34.2 cm
5 cm↓	35.7 cm	37.2 cm
10 cm	34.6 cm	36.2 cm
15cm	31 cm	32 cm

An anthropometric examination is measuring the segments on the patient's right and left limbs using a metline. This measurement is useful to determine whether there is muscle atrophy and edema in the patient. From the measurements above, it was found that the right patella is larger than the left and there is muscle atrophy on the right extremity.

Tables. 4 Range of Motion checks

Inspection	LGS Active	Dextra	Sinistra
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<i>Knee</i>	Extension- Flexion	S: 0° - 0 - 85°	0° - 0 - 145°
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Examination of knee ROM is done to determine the patient's ability to perform active movements.

Table 3. Examination of muscle strength performance with MMT

	Dextra	muscle group	Sinistra
<i>Knee</i>	3	Extensor	5
	3	Flexor	5

Examination of the patient's right leg muscle strength obtained a value of 3 in flexion and extension movements which were interpreted as joint movements capable of resisting gravity but unable to resist resistance. In comparison to a healthy extremity, and the extension is interpreted as a joint movement, capable of resisting gravity and maximum resistance.

Functional examination, in this case, used a measurement instrument in the form of Knee Injury and Osteoarthritis Outcome Score (KOOS). KOOS consists of five sectors including Pain (nine items), symptoms (seven items), ADL function (seventeen items), sports and recreational activities (five items), quality of life (four items). All items have five answer options, namely 0 (no problem) to 4 (extreme problem). Scores are transformed to a scale of 0-100, lower scores interpret more extreme knee problems and poor functional status (Cheng et al., 2019).

Total = (Pain + Symptoms + Daily Functional Activities + quality of life + Sports) = Results

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Sector	Score
Pain	38
Symptoms	30
Daily Functional Activities	55
Quality of Life	56
Sports	50



Total	46
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After the examination using KOOS, the results obtained are 46 which can be interpreted that the patient has a fairly severe knee problem.

Management and Outcome

Table.4 Intervention Plan

No.	Treatment	Frequency, Intensity,Time,Type	Aim
1.	Icing	Pre and post exercise, Time :15 minutes	Reduce pain and swelling
2.	Patellar Mobilization	F : 2x a week I : 10 reps Q: 3 sets	Reduce joint stiffness
3.	Heel Slide	F : 2x/week I : 10 reps, 3 sets T : minutes T : Isotonic	Upgrade ROM
4.	Prone hang	F : 2x/week I : 1 set Q: 5 minutes T : Stretching	Increases ROM Activation of the gluteus medius muscle
5.	Quadriceps setting straight	F : 2x/week I : 10 reps, 2 sets T : 10 seconds/rep T : Isometric	Activation of the quariceps muscle group
6.	Hamstring Settings	F : 2x/week I : 10 reps, 2 sets T : 10 seconds/rep	Hamstring muscle group activation



		T : Isometric	
7.	Gluteus Setting	F : 2x/week I : 10 reps, 2 sets T : 10 seconds/rep T : Isometric	Gluteus medius muscle activation
8.	Ankle pump	F : 2x/week I : 20 reps, 3 sets Q :-	Reduce swelling
9.	Weight shifting	F: 2x/week I : 3 sets T : 20 seconds	Restore proprioception
10.	Straight leg raise exercise	F : 2x/week I : 10 reps, 2 sets T: hold 10 seconds at the end of the count T : Isotonic	Strengthening

Results

After 8 sessions of therapy on the patient, the results of the measurement and evaluation were as follows:

Table 1. The results of the evaluation of pain measurements with the Numeric rating Scale (NRS)

PAINFUL	T1	TA
Static Pain	6	0
Tenderness	8	0
Pain by motion	9	1

Based on the results of the evaluation above, it shows a decrease in pain in the patella as a result of the intervention from the first meeting to the last meeting.

Table 2. Evaluation results of leg circumference measurement using metline

T 1	T A
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	Dextra	Sinistra	Dextra	Sinistra
Basic Patella	43.5 cm	39 cm	40.5 cm	39 cm
5 cm↑	40.5 cm	42 cm	41.3 cm	42 cm
10 cm	42 cm	47 cm	43.7 cm	47 cm
15cm	46 cm	51 cm	48cm	51 cm
20 cm	50 cm	55.5 cm	51 cm	55.5 cm
Tibia Tuberosity	38 cm	34.2 cm	35cm	34.2 cm
5 cm↓	34.5 cm	37.2 cm	35.7 cm	37.2 cm
10 cm	33 cm	36.2 cm	34.6 cm	36.2 cm
15cm	29 cm	32 cm	31 cm	32 cm

Based on the results of the evaluation above, it shows a reduction in edema in the right anterior knee after the intervention from the first meeting to the last meeting.

Table. 3 Results of Evaluation of ROM Measurement with a goniometer

Inspection	LGS Active	T1	TA
<i>Knee</i>	Extension- Flexion	S: 0° - 0 - 85°	0° - 0 - 115°

The data above shows an increase in the range of motion in right knee flexion, as a result of the evaluation of the intervention from the first meeting to the last meeting.

Table. 4 Evaluation results of muscle strength measurement with Manual Mucle Testing

	muscle group	T1	TA
<i>Knee Dextra</i>	Extensor	3	5
	Flexor	3	5

The data above shows an increase in muscle strength, as a result of the evaluation of the intervention from the first meeting to the last meeting.

Table. 5 Evaluation results of functional and exercise measurements with KOOS

KOOS Index	T1	TA
Total score	46	75



In the KOOS measurement instrument, a higher score indicates good functional ability. From the data above, it can be concluded that there is an increase in the patient's functional ability.

Discussion

The postoperative ACL rehabilitation program is divided into 4 phases (Wilk et al., 2012). 0-6 weeks after surgery enter phase 1 or what is known as an acute condition where inflammation is still present (Bousquet et al., 2018) The purpose of the program in phase 1 is to focus on reducing the risk of postoperative complications by reducing inflammation symptoms, maintaining joint mobility, and stimulating muscle contraction. Therefore, in phase 1 the patient was given intervention in the form of ice compression, ROM exercise, and isometric exercise. (Harput et al., 2018).

Ice compression was performed for 15 minutes on the injured knee area to induce a physiological response by reducing the temperature on the skin surface and underlying tissue. Ice compression causes decreased nerve conduction velocity as well as vasoconstriction and decreased tissue perfusion. Furthermore, the contraction of the blood vessels will prevent the development of edema and local swelling in the injured knee (Engelhard et al., 2019). While ROM exercise is given to patients to maintain joint mobility and flexibility of the tissues around the joints, as well as increasing muscle tone (Buckthorpe et al., 2019). Furthermore, isometric exercise is given to the patient to activate the muscles around the knee to improve knee joint stabilization (Oranchuk et al., 2019).

Before continuing the rehabilitation into phase 2, make sure that the knee can be fully extended, the difference in flexion of the affected knee is less than 10 from the healthy side, the difference between edema in the injuries side and the healthy side is not more than 0.5 cm, the leg can be lifted in any direction, the patella is mobile, and the patient is being able to walk (with or without crutches) (Grinsven et al., 2010)

Conclusion

Post ACL reconstruction rehabilitation program in phase 1 by providing interventions in the form of ice compression, ROM exercise, and isometric exercise can



reduce pain, reduce edema, increase muscle strength and improve the patient's functional ability.

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