IHS
ISSN: 2798-7094
Innovation in Health for Society

Submitted
10/7/2023
Revised
13/7/2023
Accepted
21/7/2023
Published
21/7/2023

LEARNING IN CLINICAL CASES

A case report of knee meniscal tear due to combat sports injuries

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https://doi.org/10.31603/ihs.9602

Abstract
A knee meniscus tear is a sports injury that commonly occurs due to sudden twisting movements. This condition causes various levels of musculoskeletal pain. This case report aimed to evaluate exercise therapy to reduce pain in patients with lateral meniscus tears. We presented a 26 years old female patient diagnosed with a lateral, medial meniscus tear and left lateral meniscus tear due to a combat sports injury. Physiotherapy interventions were given in ice packs, Transcutaneous Electrical Nerve Stimulation (TENS), and Ultrasound (US) to reduce pain. Our study concluded that physiotherapeutic intervention reduced the pain due to the integument rupture and vice versa, increasing the range of motion and thigh muscle strength.

Keywords: Pain management; case report; physiotherapy; healthcare professionals; innovation in musculoskeletal care

Introduction

A knee meniscus tear is a common injury that occurs in adults 40 years of age and younger (Skou & Thorlund, 2018). Knee meniscus tears are a prevalent injury, particularly among individuals who participate in sports or engage in physical activities **(Figure 1)**. The meniscus is a crescent-shaped piece of cartilage that acts as a shock absorber between the thigh bone (femur) and the shin bone (tibia) in the knee joint (Luvsannyam, Jain, Leitao, Maikawa, & Leitao, 2022). These tears can occur due to sudden changes in direction, rapid deceleration, or direct impact to the knee. Depending on the severity and location of the tear, the symptoms can range from mild pain and swelling to significant instability and limited range of motion in the affected knee (Bhan, 2020). Individuals with a meniscus tear may experience various symptoms, including pain, stiffness, and difficulty in bending or straightening the knee. In some cases, the knee may also feel "locked" or unable to fully extend, and the person may experience a clicking or popping sensation when moving the joint (Mordecai, Al-Hadithy, Ware, & Gupte, 2014). Prompt medical attention is crucial, as untreated meniscus tears can lead to further damage to the knee joint and the development of osteoarthritis over time. Treatment options may include rest, ice, compression, and elevation (RICE), as well as physical therapy exercises to improve range of motion and strengthen the surrounding muscles. In more severe cases, surgical intervention, such as meniscus repair or partial removal, may be necessary to alleviate the symptoms and prevent long-term complications (Lento & Akuthota, 2000).

Knee meniscus tears are one of the most common knee injuries, with an estimated incidence of around 60 to 70 per 100,000 people per year (Bhan, 2020). These injuries are particularly prevalent among active individuals, such as athletes and those who participate in high-impact sports. Studies have shown that meniscus tears account for approximately 10-20% of all knee injuries, with the incidence being higher in certain sports, such as football, soccer, and basketball, where sudden changes in direction and high-impact movements are common (Keyhani et al., 2020). The risk of meniscus tears also increases with age, as the cartilage becomes more brittle and less flexible over time. Older adults, particularly those over the age of 50, are more susceptible to degenerative meniscus tears, which can occur without a specific traumatic event. Early recognition and proper management of knee meniscus tears are essential to prevent long-term complications and ensure a successful recovery. Meniscus tears can also be associated with sports injuries (Luvsannyam, Jain, Leitao, Maikawa, & Leitao, 2022). According to Skou & Thoulund,

2018 states the annual incidence of meniscus tears is 112 to 172 injuries per 100.000 people between the ages of 15 and 40 years. Knee meniscus tears are one of the most common knee injuries, with an estimated incidence of around 60 to 70 per 100,000 people per year. Approximately 12% to 14% of these injuries occur in athletes (Logerstedt et al., 2018), which is in line with the increasing public participation in sports and the availability of advanced diagnostic tools (Luvsannyam et al., 2022). The meniscus of the knee consists of two fibrocartilaginous discs that have a unique biomechanical composition, enabling them to improve joint alignment and stabilization, handle load transmission, and act as a shock absorber. The difference in the location of the capsular and ligament attachments explains the difference between the concavity and the locations of the medial and lateral meniscus. The medial meniscus is more prone to root tears, whereas the lateral meniscus has a less stabilizing role and receives less pressure in the posterior horn than the medial meniscus. In a study by Kurzweil, Cannon, and DeHaven (2018), there were 575 meniscus tears, with 75% being medial meniscus tears.

Figure 1. Illustration of sport leading injury (*Courtesy of unsplash.com*).

Treatment of meniscus tears can be done non-operatively or through meniscectomy (Luvsannyam et al., 2022). According to Bhan (2020), total meniscectomy will become the gold standard in the management of meniscal tears. However, patients after receiving meniscectomy experience flattening of the femoral condyle and narrowing of the joint space, which accelerates the patient's early degeneration (Luvsannyam et al., 2022). On the other hand, according to Skou and Thorlund (2018), exercise therapy is feasible and effective in managing meniscal tears in middle-aged or young adult patients. Physical therapy exercise programs given to patients with attention to strength training and functional exercise can achieve good muscular stabilization (Yahya & Rahman, 2022). Acute trauma to the torn meniscus of the knee causes pain, which can limit the range of motion of the joints and reduce leg muscle strength in patients (Skou & Thorlund, 2018). It took 3 months in 3 phases to restore functional activity properly and return to exercise in patients. In phase I, the focus is on reducing knee effusion, phase II optimizes range of motion, restores coordination and muscle function, and phase III stimulates activities in daily life and return to sports (van der Graaff et al., 2022). This study applies the provision of physiotherapeutic interventions in the form of

cryotherapy, Transcutaneous Electrical Nerve Stimulation (TENS), Ultrasound (US), and exercise therapy in patients with sports injuries to the right medial lateral meniscus and left lateral meniscus tear, which aims to reduce pain, increase joint range of motion, and leg muscle strength so that it can delay or even prevent surgery.

The primary objective of this study is to investigate the efficacy of exercise therapy in managing the symptoms and functional impairments associated with meniscus tears in patients who have sustained these injuries through participation in combat sports. Specifically, the study aims to evaluate the effects of a structured exercise therapy program on three key outcome measures. Firstly, the researchers will assess the impact of the exercise intervention on the patients' self-reported pain levels, as meniscus tears can be a significant source of pain and discomfort, particularly during weight-bearing activities and joint movements. Secondly, the study will measure the changes in the patients' knee joint range of motion before and after the exercise therapy. Meniscus tears can often limit the joint's ability to move through a full, pain-free range, and restoring this range of motion is crucial for regaining normal function. Thirdly, the researchers will examine the effects of the exercise program on the strength of the quadriceps and hamstring muscles, which play a crucial role in stabilizing the knee joint and supporting the meniscus during physical activities. Strengthening these muscle groups can help compensate for the loss of meniscal function and improve overall joint stability. By focusing on these three key outcome measures, the researchers aim to provide a comprehensive assessment of the benefits of exercise therapy for patients with meniscus tears sustained through combat sports participation. The findings of this study could help guide the development of more effective, conservative treatment strategies for managing these common knee injuries and potentially reduce the need for more invasive surgical interventions.

Method

This research method uses a case report study which was carried out at the Ara Physio Clinic Tangerang. The patient is Ms. V, a 26-year-old office employee who has a hobby of combat sports. The patient suffered an injury one week ago while exercising combat. In the last fight, the patient made a jumping and rotating movement in an inappropriate position, then a sound was heard in the knee joint. Patients feel pain that interferes with daily activities and sports. After carrying out specific tests in the form of the Apley's Test, Mc Murray Test, and Thessaly Test, it was then confirmed with an MRI. The results obtained by the patient were medically diagnosed with a right lateral medial meniscus tear and a left lateral meniscus tear. The patient came to the clinic without using a walker, with an antalgic walking pattern. The results of the static inspection examination showed that the general condition of the patient's feet was good, there were no differences in color on the two legs. On dynamic inspection, there is an expression of holding back pain when the patient walks and when the knee is moved in full flexion, during the walking phase the patient has difficulty in the loading response to mid-stance phase and the swing phase. The patient has undergone therapy 2 times with the provision of physiotherapy interventions in the form of ice packs, TENS, US, and therapeutic exercises. Cryotherapy/ice packs are used to reduce acute pain in sports injuries. TENS is used to reduce acute pain and help reduce proprioceptive pain that affects limitations in movement. Ultrasound is used to increase local blood flow, stimulate inflammatory mediators, and reduce pain.

The exercise therapy includes exercises to increase muscle strength and range of motion of isometric and isotonic joints through muscle contraction. The training sessions provided include pumping ankle exercise, quadriceps isometric exercise, hamstring isometric exercise, hip strengthening exercise, ankle strengthening exercise, pelvic bridging exercise, single leg stance, and gait exercise. Measurement of pain was done using the Numeric Rating Scale (NRS), measurement of the range of motion of the joints using a goniometer, and measurement of muscle strength using a sphygmomanometer.

Results

The primary complaint that arose after the patient's combat sports injury was the emergence of pain due to the torn meniscus in both the right and left knee. This pain was a direct consequence of the acute trauma sustained during the patient's last training session, where a sudden jumping and rotating movement in an inappropriate position led to audible sounds in the knee joint. The examination of the patient's pain levels using the NRS revealed significant findings. In the right knee, the patient reported tenderness pain with an NRS score of 7 out of 10. This indicates a moderate to severe level of pain at rest. Additionally, when the right knee joint was moved, the patient experienced motion pain with an NRS score of 8 out of 10, suggesting a high level of discomfort and limited range of motion. Similarly, in the left knee, the patient also exhibited tenderness pain with an NRS score of 6 out of 10, indicating a

moderate level of pain at rest. When the left knee joint was moved, the patient experienced motion pain with an NRS score of 7 out of 10, reflecting a significant limitation in joint mobility and a high degree of discomfort. These pain assessment results highlight the significant impact of the meniscus tears on the patient's overall knee function and quality of life **(Table 1)**. The combination of tenderness and motion-related pain in both knees likely contributed to the patient's difficulty in performing daily activities and engaging in their usual combat sports training regimen. Understanding the severity and location of the patient's pain is crucial for guiding the appropriate treatment approach and monitoring the effectiveness of the subsequent physiotherapy interventions.

Table 1. Evaluation results of pain measurement using the NRS

Pain	T0	T1	T2
Silent Pain			
Dextra	0	0	0
sinistra	0	0	0
Tenderness			
Dextra	5	4	3
Sinistra	4	4	2
Motion Pain			
Dextra	6	5	2
Sinistra	6	4	1

The physiotherapy modalities used to reduce the patient's pain included ice packs (Cryotherapy), TENS and US. In the right (dextra) knee, the tenderness pain decreased from an initial value of 5 at T0, down to 4 at T1, and further down to 3 at T2. In contrast, the left knee experienced a decrease in tenderness pain from an initial value of 4 at T0, but did not show any decrease at T1. However, at T2, the tenderness pain in the left knee decreased to a value of 2. Regarding the movement-related pain in the right knee, there was a decrease from an initial value of 6 at T0, which then decreased to 5 at T1, and significantly dropped to 2 at T2. For the left knee, the movement pain decreased from 6 at T0, down to 4 at T1, and then dropped significantly to 1 at T2. The increase in the range of motion of the joints after the exercise therapy, as measured using a goniometer **(Table 2)**. These results demonstrate the effectiveness of the physiotherapy interventions, including cryotherapy, TENS, and ultrasound, in reducing both the tenderness and movement-related pain experienced by the patient in both the right and left knees. The significant improvements observed at the later time points (T2) suggest that the combination of these modalities, coupled with the targeted exercise therapy, was successful in managing the patient's pain and improving joint mobility.

At the initial assessment (T0), the range of motion measurements for the right (dextra) knee joint were as follows: flexion 0°, extension 0°, and total range of motion 110°. In comparison, the initial (T0) range of motion measurements for the left knee joint were: flexion 0°, extension 0°, and a total range of 124°. After the second therapy session (T2), the range of motion measurements for the right knee joint had improved, with flexion 0°, extension 0°, and a total range of 127°. Similarly, the left knee joint range of motion also showed significant improvement at T2, with flexion 0°, extension 0°, and a total range of 130°. These results indicate that the exercise therapy program, which included passive exercises, active exercises, pumping ankle exercises, and static contractions, was effective in increasing the range of motion in both the right and left knee joints. Additionally, the patient was found to have weakness in the left and right thigh muscles. To address this, the exercise therapy incorporated specific strengthening exercises, such as quadriceps isometric exercises, hamstring isometric exercises, hip strengthening exercises, ankle strengthening exercises, pelvic bridging, gluteus strengthening, single leg stance, and gait training. The combination of the range of motion exercises and the targeted muscle strengthening activities aimed to improve the patient's overall knee joint function and stability, which had been compromised due to the meniscus tears sustained during the combat sports injury.

After being given the exercise therapy program, the patient's muscle strength showed improvements, which were measured using a sphygmomanometer. In the right (dextra) hip, the initial muscle strength measurement at T0 was 50 mmHg. After the exercise therapy, the muscle strength in the right hip increased to 60 mmHg at T2 **(Table 3)**. Similarly, the left thigh muscle strength was measured at T0, with a result of 58 mmHg. Following the exercise therapy, the left thigh muscle strength increased to 61 mmHg at T2 **(Table 4)**. These results demonstrate the

effectiveness of the targeted exercise therapy in improving the muscle strength in both the right hip and left thigh of the patient. The increases in muscle strength, as measured by the sphygmomanometer, indicate that the exercise program was successful in addressing the identified muscle weakness in these areas. The improvements in muscle strength, coupled with the increased range of motion observed in the previous section, suggest that the comprehensive physiotherapy intervention, including the exercise therapy, was effective in enhancing the patient's overall knee joint function and stability, which had been compromised due to the meniscus tears sustained during the combat sports injury.

Table 2. Evaluation of the range of motion of the knee joint with a goniometer.

	Dextra	Sinistra	Difference
T0	S: 0º - 0º - 110º	S: 0º - 0º - 124º	S: 0º - 0º - 19º
T1	S: 0º - 0º - 118º	S: 0º - 0º - 127º	S: 0º - 0º - 9º
T2	S: 0º - 0º - 127º	S: 0º - 0º - 130º	S: 0º - 0º - 3º

Table 3. Evaluation of right thigh muscle strength with a sphygmomanometer.

T0	T1	T2
40-90 = 50mmHg	40-93 = 53mmHg	40-100 = 60mmHg

Table 4. Evaluation of left thigh muscle strength with a sphygmomanometer.

T0	T1	T2
40-98 = 58mmHg	40-100 = 60mmHg	40-101 = 61mmHg

Discussion

The rehabilitation approach for soft tissue injuries has undergone several updates, evolving from Ice, Compression, Elevation (ICE) to Rest, Ice, Compression, Elevation (RICE), then to Protection, Rest, Ice, Compression, Elevation (PRICE) and Protection, Optimal Loading, Ice, Compression, Elevation (POLICE). However, the previous acronyms focused primarily on the acute injury management stage and overlooked the subacute and chronic stages of tissue healing. The latest update has covered the entire spectrum, including the acute care rehabilitation series (PEACE) and the subacute management (LOVE), as fully described in the research by Dubois and Esculier (2020). Acute trauma from torn meniscus causes pain in patients, thereby limiting the range of motion of the knee joints, reducing muscle strength in the lower extremities, and leading to functional instability involving the lower limbs (Skou & Thorlund, 2018). Providing exercise therapy to patients is crucial for maintaining and increasing muscle stabilization, enabling them to carry out their daily functional activities properly and minimizing the occurrence of early degeneration of the knee joint (Kise et al., 2016). The use of TENS can inhibit the activity and excitability of central nociceptive neurotransmission. The pulsed electric current generated by a standard TENS device is applied to the entire surface of the skin using surface electrodes, either at the location of pain or over the proximal nerve bundles, with the aim of stimulating the peripheral nerves to reduce pain (Johnson et al., 2022). The addition of ultrasound intervention aims to help increase vasodilation in blood vessels, thereby enhancing the supply of nutrients to the soft tissues and facilitating the repair of damaged tissue. The heat and mechanical effects of ultrasound also cause physiological tissue damage, resulting in an inflammatory reaction followed by the release of substances like the "P" substance, prostaglandins, bradykinin, and histamine, which stimulate the thin myelinated nerve fibers and cause pain. The stimulation of the "P" substance accelerates the proliferation process, thereby expediting the healing of the injured tissue (Kusuma & Fatmarizka, 2022).

The pain resulting from the injury can lead to decreased activity and movement in the legs, which can cause swelling due to the lower venous blood pressure compared to arterial pressure, which is affected by gravity (Epley, 2000). Incorporating a well-designed warm-up routine into your exercise regimen is essential for optimizing performance, enhancing safety, and promoting overall musculoskeletal health **(Figure 2)**. Providing ankle pumping exercises with the legs elevated is proven to be more effective than a supine position or a higher head position in pumping blood back to the heart, utilizing the force of gravity to prevent blood pooling in the lower limbs (Toya et al., 2016). The pumping exercise is performed without any rest periods, as short rest periods can cause small blood collections in the legs (Toya et al., 2016). Other studies have also explained that the pumping action can increase

blood pressure and cardiac output, facilitating metabolism and increasing joint range of motion by reducing pain (Pristianto et al., 2019). The limited joint range of motion due to pain affects muscle strength. Evaluation of thigh muscle strength can be measured using a sphygmomanometer while the patient is lying down, with the cuff placed on the upper thigh, approximately 1-2 cm above the knee. The patient is instructed to perform an isometric contraction and hold it for 5 seconds, and the reading on the sphygmomanometer is recorded as the thigh muscle strength (Melyana et al., 2021).

Figure 2. Illustration of warming up (*Courtesy of unsplash.com*).

The strength of the quadriceps muscle group plays a crucial role in knee joint function. Quadriceps isometric exercise is proven to be more effective than quadriceps isotonic exercise in increasing quadriceps muscle strength, and this strengthening can help reduce pain intensity. Strong muscles can stabilize joints, weaken the shock transmitted to the joints, and minimize the effects of impact by spreading the force to a wider area (Anwer & Alghadir, 2014). Providing exercise therapy can increase the strength of isometric thigh muscle contractions, as the exercises are performed repeatedly until maximum tension is reached within a certain period (Erickson et al., 2019). The hamstring muscle group is also important for knee joint function, as it is active during the final 25% of the gait cycle, providing forces in hip extension and resisting knee extension. Isometric exercises on the hamstring can build muscle mass, strength, and bone density, compared to isotonic hamstring exercises, which can cause late-onset muscle pain that interferes with the patient's activities (Widodo et al., 2022). Previous study has also shown that isotonic hamstring exercises for three weeks did not result in improvements in pain or function (Cacchio et al., 2011). Pelvic bridging training aims to increase the activity of the body's stabilization muscles, starting from the back muscles, quadriceps, hamstring, and gluteus. Muscle enhancement can assist in maintaining joint stability, as described in previous literature (Yoon et al., 2018). Joint instability affects the patient's gait pattern, so gait training is needed. Gait training aims to improve movement patterns during walking and running, increase movement efficiency, and reduce the risk of injury, recurrence, and progression. Gait training can be modified according to the conditions and needs of each patient (DeJong & Hertel, 2018). Overall, the exercise therapy provided has the

principle of activating and increasing muscle contraction, leading to an increase in muscle strength in the lower limbs.

Exercise therapy activates muscle work and speeds up metabolism, improving blood flow and nutrient delivery to the muscles, thereby facilitating muscle regeneration and meeting the energy needs for increasing muscle strength in the lower limbs (Kusuma & Fatmarizka, 2022). Exercise therapy is a powerful tool that can activate muscle work and speed up metabolism. During exercise, the muscles are directly engaged, causing them to contract and work against resistance or body weight. This repeated muscle activation and contraction lead to increased muscle work, which helps to build strength, improve muscle tone, and enhance overall muscular function. The increased muscle activity during exercise also triggers the body's metabolic processes. When the muscles require more energy to fuel their work, the body's metabolic rate rises to meet this demand. This elevated energy requirement leads to increased oxygen consumption, enhanced cardiovascular function to deliver more oxygen and nutrients, and elevated production of ATP, the primary energy currency of the body. Additionally, the body starts to break down stored fats and carbohydrates to provide the necessary energy, further contributing to the increased metabolic rate. The improved blood flow and nutrient delivery to the working muscles during exercise therapy are also crucial factors. The cardiovascular system is stimulated, leading to increased blood circulation that delivers more oxygen, glucose, and other essential nutrients to the muscles. This enhanced nutrient supply supports muscle recovery, repair, and growth, further amplifying the benefits of the exercise therapy. By activating muscle work and speeding up metabolism, exercise therapy plays a vital role in improving overall physical fitness, strength, endurance, and metabolic health. This makes it an essential component of comprehensive rehabilitation and injury management programs, as it helps to restore and enhance the body's functional capabilities.

Conclusion

The study concluded that physiotherapy modalities and exercises applied to the lower extremities can help reduce pain in both knees of post-traumatic patients, increase the range of motion of the joints, and strengthen the thigh muscles. However, this study has a weakness in measuring muscle strength, as it only focuses on isometric contractions, which cannot fully describe muscle strength in the thigh. Future research could include measuring isotonic muscle contractions to provide a more comprehensive assessment of thigh muscle strength. Additionally, this research was conducted over only two sessions, which limits the ability to assess the effectiveness of the therapy. Furthermore, this study focused solely on strengthening the muscles of the lower extremities. Future studies should consider incorporating neuromuscular and aerobic exercises with a longer research period to evaluate both the short-term and long-term effects of the exercise therapy.

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Author's perspective

Key points

- A knee meniscus tear is a common injury that occurs in sports
- Physiotherapy modalities and exercises applied to the lower extremities can help reduce pain in both knees of post-traumatic patients
- Exercise therapy is a powerful tool that can activate muscle work and speed up metabolism

Potential areas of interest

- How can the healthcare professionals be involved in this exercise therapies?
- What supportive factors lead to improve healing of meniscal tears?

How to cite this article (APA style)
Masitha, S., Fatmarizka, T., & Abdurrasyid, A. (2023). A case report of knee meniscal tear due to combat sports injuries. Innovation in Health for Society, 3(2), 65-73. https://doi.org/10.31603/ihs.9602