

Impact of strengthening exercises on hip stability and functional mobility in patient with posterior hip dislocation

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Abstract:

Background: The most common cause of posterior hip dislocation, a rare but dangerous orthopaedic injury, is high-energy trauma from car crashes. Restoring hip stability, avoiding comorbidities, and improving functional results all depend on early reduction followed by systematic physiotherapy rehabilitation.

• **Case Description:** Four weeks following closed reduction of a severe posterior hip dislocation experienced in a car accident, a 24-year-old male patient arrived at the Orthopaedic and Physiotherapy Department. The patient experienced severe pain (VAS 8/10), limited hip range of motion, muscle weakness (MMT 3/5), poor gait, and decreased functional mobility at the time of the initial evaluation. A 20-second Timed Up and Go (TUG) test and a Harris Hip Score of 55 were used as functional outcome measures.

• **Intervention:** The patient participated in an eight-week, five-day structured physiotherapy rehabilitation program that included range-of-motion exercises, balance training, gait training, and functional mobility exercises in addition to progressive hip and core strengthening exercises (bridging, straight leg raises, clamshells, hip abduction, quadriceps and gluteal setting exercises, knee raises, and hip flexor/extensor strengthening).

• **Result:** The patient showed significant improvement after rehabilitation. Hip flexion improved from 70° to 120°, hip abduction from 20° to 45°, muscular strength grew from MMT 3/5 to 5/5, TUG improved from 20 to 10 seconds, and the Harris Hip Score climbed from 55 to 90. Pain decreased from 8/10 to 2/10. Significant improvements were also seen in gait pattern, hip stability, and independence in daily life activities.

• **Conclusion:** In a patient with posterior hip dislocation, a planned physiotherapy program that prioritized progressive strengthening exercises successfully enhanced hip stability, muscle strength, range of motion, discomfort, gait, and functional mobility. This case emphasise how crucial early, closely monitored therapy is to a successful functional recovery following a catastrophic posterior hip dislocation.

•**Keywords:** case study, functional mobility, hip stability, strengthening activities, rehabilitation, and posterior hip dislocation.

1. Background:

The femur head is forced out of the acetabulum posteriorly in a posterior dislocation of the hip. About half of the time, this is linked to a fracture of the acetabulum's posterior lip, in which case it is referred to as a fracture dislocation. Because of its robust ligaments and bony structure, the hip, a ball and socket joint, is naturally stable and can withstand large increases in mechanical stress. The acetabulum's depth, the joint capsule, the surrounding ligaments, and muscle support are anatomical elements that contribute to the stability of the hip. The iliofemoral ligament is one of the main ligaments protecting the joint from directed forces. Because the posterior ligaments are stronger, it is loaded posteriorly. In 90% of instances, a posterior dislocation is the most prevalent presentation of hip trauma.

The rectus femoris, gluteal muscles, and short external rotators provide dynamic muscular support. Understanding the vasculature is crucial because hip trauma can cause avascular necrosis (AVN) by dislodging the femoral head and cutting off blood flow. The lateral femoral circumflex artery runs anteriorly, while the medial femoral circumflex artery runs posteriorly, forming a ring around the femur's neck from branches of the external iliac artery. The medial femoral circumflex artery provides the main blood supply to the femoral head.

The injury is caused by force applied along the femur shaft when the hip is flexed. It happens in auto accidents and takes a reasonably strong force to dislocate a hip. The car's driver is propelled forward, and his knee collides with the dashboard. The force is transferred up the femoral shaft, causing the hip to dislocate posteriorly. As a result, dashboard injury is another name for it.

Age, ethnicity, and gender are significant risk factors for these kinds of injuries; among adult males between the ages of 30 and 40, the incidence is twice as high in women. Sciatic nerve injuries, femoral head fractures, and acetabulum fractures are common associated injuries. The risk of avascular necrosis and secondary osteoarthritis increases with delayed therapy, thus early reduction is crucial.

Clinical features are: An isolated posterior dislocation of the hip is easy to diagnosed. The patient presents with a history of severe trauma followed by pain, swelling and deformity (flexion, adduction and internal rotation). There is shortening of the leg. One may be able to feel the head of the femur in the gluteal region. The injury is sometimes missed, especially when associated with other more obvious injuries such as fracture of the shaft of the femur.

According to a 2014 National Highway Traffic Safety Administration report, over 2.3 million motor vehicle-related injuries occurred among mostly younger drivers, an increase of 11% since 2013. A 2012 summative analysis by Woo and Morrey discovered that in over 10,000 main total hip replacement procedures, the dislocation rate was 3.2%. By 2030, dislocation rates for original surgeries could reach 10%, while revision rates could reach 28%, according to other studies. According to Epstein, males aged 16 to 40 accounted for the bulk of hip dislocations caused by auto accidents. According to other researchers, motor vehicle collisions cause 70–100% of posterior hip dislocations. However, only 12 of

all traumatic hip dislocations were caused by motorcycles, according to a report by et al. Because the hip joint is so stable, posterior hip dislocations are uncommon injuries in the general population. However, it is the most prevalent kind of acute hip dislocation, making up between 85 and 90 percent of all cases.

Investigation: The acetabulum is separated from the femoral head. Shenton's line is disrupted because the thigh is internally twisted, obscuring the lesser trochanter. Any bony chip from the head or the posterior lip of the acetabulum must be searched for. It could be helpful to compare from the other normal side.



Anteroposterior screening hip X-rays should be performed on patients. The femoral head is displaced laterally and superiorly in this pelvic view. A cross-table lateral view can help confirm posterior dislocation. To find intra-articular fragments, find hidden fractures, and assess the acetabular wall's involvement following reduction, a CT scan is required. When it comes to the initial evaluation of individuals with multiple injuries, MRI has limitations. Analyse the vascularity of the femoral head and the integrity of the labrum. Bone Scan: Its role in hip dislocation is questionable and negligible.

2. Management:

- Closed reduction: Under general anaesthesia, the hip is reduced by manipulation and the patient is put supine on the floor. An assistant holds the pelvis tightly as the surgeon bends the hip and knee at a 90-degree angle and pulls along the femur's long axis. This usually results in a loud clunk of reduction, after which the hip can move freely in any direction. For three weeks, the hip is abducted and the leg is kept in mild traction.

- Open reduction might be necessary when: (i) Failure of closed reduction (ii) If an intra-articular loose fragment prevents precise reduction; and (iii) If the acetabulum fragment is big and originates from the acetabulum's weight-bearing portion. When such a fragment is present, the hip becomes unstable. Reducing pain and oedema, protecting the hip, restoring range of motion, strengthening the hip and core muscles, enhancing stability, balance, and gait, and regaining functional mobility are all goals of physiotherapy. Protected weight-bearing, mild range of motion, progressive strengthening, gait/balance training, functional exercises, hip precautions, and a gradual return to everyday activities are all part of the treatment; problems such as avascular necrosis, stiffness, and repeat dislocation are monitored.

•**Aim of the study:** To ascertain whether gradually strengthening the hip and surrounding muscles improves joint stability, lessens pain, increases muscle strength, restores functional independence, and makes it easier to safely resume daily activities without experiencing pain or functional limitations.

3. objectives:

- 1) To evaluate hip stability both before and after a program of strengthening exercises.
- 2) To increase mobility that is functional.
- 3) To ascertain how pain intensity is affected by strengthening exercises.
- 4) To increase range of motion (ROM) at the hip joint.
- 5) To evaluate alterations in weight bearing capacity and gait pattern throughout rehabilitation

• Scope of the study:

This study concentrated on the application of a strengthening training program for hip stability and functional mobility in patients with posterior hip dislocations.

After the dislocation is reduced, the study focuses on rehabilitation to restore normal hip function.

Pain, muscular strength, hip range of motion, balance, gait, and functional mobility are all thoroughly assessed both before and after the intervention.

To increase dynamic hip stability, the rehabilitation program mostly comprises of progressive strengthening exercises for the hip abductors, extensors, flexors, and core stability muscles.

Additionally, the study assesses how strengthening exercises can improve joint stability, boost muscular strength, and reduce pain.

• Case description and assessment:

Four weeks following closed reduction of a severe posterior hip dislocation experienced in a car accident, a 24-year-old male patient arrived at the Orthopaedic and Physiotherapy Department. Within six hours of the accident, closed reduction under anaesthesia was successfully completed, followed by protected weight bearing, after radiographic testing verified posterior hip dislocation. The patient reported hip stiffness, muscle weakness, mild pain (VAS: 6/10 while activity and 2/10 at rest), and trouble with walking, stair climbing, prolonged standing, sit-to-stand, squatting, sitting cross-legged, and other activities of daily living. Upon examination, he showed signs of an antalgic gait and decreased weight bearing on the injured limb. Hip flexor (3+/5), extensors (3/5), abductors (3/5), adductor's (4-/5), and rotators (3+/5) were weak, and there was mild gluteal muscular atrophy, discomfort across the posterior hip, and limited hip range of motion. With a Harris Hip Score (HHS) of 58/100, a Lower Extremity Functional Scale (LEFS) of 32/80, and a Timed Up and Go (TUG) test of 18 seconds, the functional evaluation showed low functional status, decreased walking speed, shortened strides, and impaired balance. To enhance hip stability, muscle strength, functional mobility, and independence in everyday activities, an organised strengthening exercise program including balance and gait training was started.

•**uniqueness of the study:-** The effectiveness of a planned strengthening exercise program in lowering pain and stiffness and enhancing hip stability and functional mobility after traumatic posterior hip dislocation makes this study unique. The rehabilitation program concentrated on increasing the strength of the gluteal muscles, hip abductors, extensors, flexor, quadriceps, hamstrings, and core muscles in

addition to range of motion and functional mobility exercises because posterior hip dislocation is a relatively rare but serious injury. Five days a week, for six to eight weeks, the therapy was administered.

• **Intervention:**

• **Bridging exercise:** The patient was placed in a supine position with their arms by their sides, their feet flat on the bed hip-width apart, and their knees flexed. To stabilise the pelvis and direct the movement, the therapist stood next to the afflicted hip. The patient was told to tense their gluteal and abdominal muscles, raise their pelvis until their hips, knees and shoulders were all in a straight line, hold that posture for five to ten seconds, and then gradually drop their pelvis back to the beginning position. The workout was done for five days, two to three sets, and ten repetitions.

• **Straight leg raise in a supine position:** The patient was placed in a supine position with their arms resting by their sides and both knees straight. The therapist guided the movement and stabilized the pelvis by standing next to the afflicted leg. The patient was told to carefully remove the afflicted leg from the body and then, while maintaining a straight knee, return it to the initial position. This strengthens the gluteus medius and keeps the hips stable while walking.

• **Straight leg raises in side lying:** The patient was placed side-lying with the afflicted leg on top of the unaffected side. To stabilise the pelvis and keep an eye on the patient's movement, the therapist stood behind them. The patient was told to slowly raise the higher leg toward the ceiling and then return it to its initial position.

• **Standing hip abduction:** The patient held a nearby support for balance while standing straight. To guarantee appropriate mobility and stabilise the pelvis, the therapist stood next to the afflicted leg. The patient was told to carefully raise the afflicted leg away from the body's midline before putting it back in its initial position. Weights or resistance were used to advance the activity as tolerated.

• **Knee raises:** Stand while gripping a chair or other sturdy object. While maintaining an erect trunk, raise one leg toward the chest, then gradually lower it back. Hip flexor strength and stability are enhanced by this workout.

• **Hip flexor and extensors:**-Hold onto a chair or other close support while standing. Return to the starting position after swinging one leg forward and holding it for three to five seconds. The same leg should then be swung backward, held for three to five seconds, and then swung back. This exercise strengthens the hip flexor and extensors and expands hip range of motion.

• **Quadriceps setting:** The patient was lying supine with both legs straight. To watch the quadriceps contraction, the therapist stood next to the afflicted limb. The patient was told to clench their thigh muscles, hold that position for five to ten seconds, and then release the tension. The workout was done three times a day, ten to fifteen times.

• **Gluteal setting:** The patient's legs were relaxed and they were resting supine. In order to watch and assist the patient's gluteal muscle contraction, the therapist stood next to them. The patient was told to contract their buttocks, hold the position for five to ten seconds, and then release the tension. The exercise was done ten to fifteen times.

• **Clamshell exercise:** The patient was lying on their unaffected side with their feet together, hips and knees slightly bent. In order to stabilise the pelvis and stop the trunk from rotating, the therapist stood behind the patient. The patient was told to maintain their feet together, raise their upper knee without turning their pelvis, and then gradually return it to the beginning position. Hip abductors and external rotators are strengthened by this workout.

Ankle weight can be added to any exercise as therapy progresses.

•Result:

After eight weeks of a planned physiotherapy rehabilitation program that included strengthening exercises, range-of-motion exercises, balance training, and functional mobility exercises, the patient demonstrated notable progress. Pain progressively subsided. The patient's muscle strength improved, hip range of motion increased, and daily activity independence was restored. Moreover, the intervention decreased gait deviation and improved hip stability.

Outcomes measures pre assessment post assignment

Pain (VAS)	8/10	2/10
Hip flexion ROM	70°	120°
Hip abduction ROM	20°	45°
Muscle strength MMT	3/5	5/5
TUG test	20 sec	10 sec
Harris hip score	55	90
Hip extension	10°	20°
Hip internal rotation	10°	30°
Hip extension rotation	20°	40°

4. Discussion:

Pallia et al. (2002) and Przylinska et al. (2019) both highlight the significance of early and organised physiotherapy rehabilitation after hip injury, and the results of our case study are in line with their findings. While Przylinska et al. found that early mobilisation, muscle strength, and progressive weight bearing enhance functional recovery and independence following hip injuries, Pallia et al. emphasized that progressive strengthening, range of motion, and functional exercises are crucial for restoring hip stability and permitting a safe return to activity in athletes. Similarly, in this instance, a patient with posterior hip dislocation experienced a considerable improvement in hip stability, muscular strength, and functional mobility following an organised strengthening program that included quadriceps and gluteal strengthening, bridging, clamshell, hip abduction, and resistance exercises. The results are similar and demonstrate the value of strengthening activities in attaining successful rehabilitation following posterior hip dislocation, even though the earlier research comprised sportsmen and elderly patients, respectively.

5. Conclusion:

This case study shows how a patient with posterior hip dislocation saw a significant improvement in hip stability and functional mobility following a systematic physiotherapy rehabilitation program that

focused on strengthening exercises. Hip and core strengthening exercises, such as bridging exercises, knee rises, clamshell exercises, gluteal and quadriceps settings, straight leg raises with resistance, and functional activities, were part of the treatment. The patient made significant progress after eight weeks of rehabilitation. Hip flexion range of motion improved from 70° to 120°, hip abduction range of motion rose from 20° to 45°, and the VAS pain score dropped from 8/10 to 2/10. The grade of muscle strength (MMT) increased from 3/5 to 5/5. The Timed Up and Go (TUG) exam was reduced from 20 to 10 seconds.

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