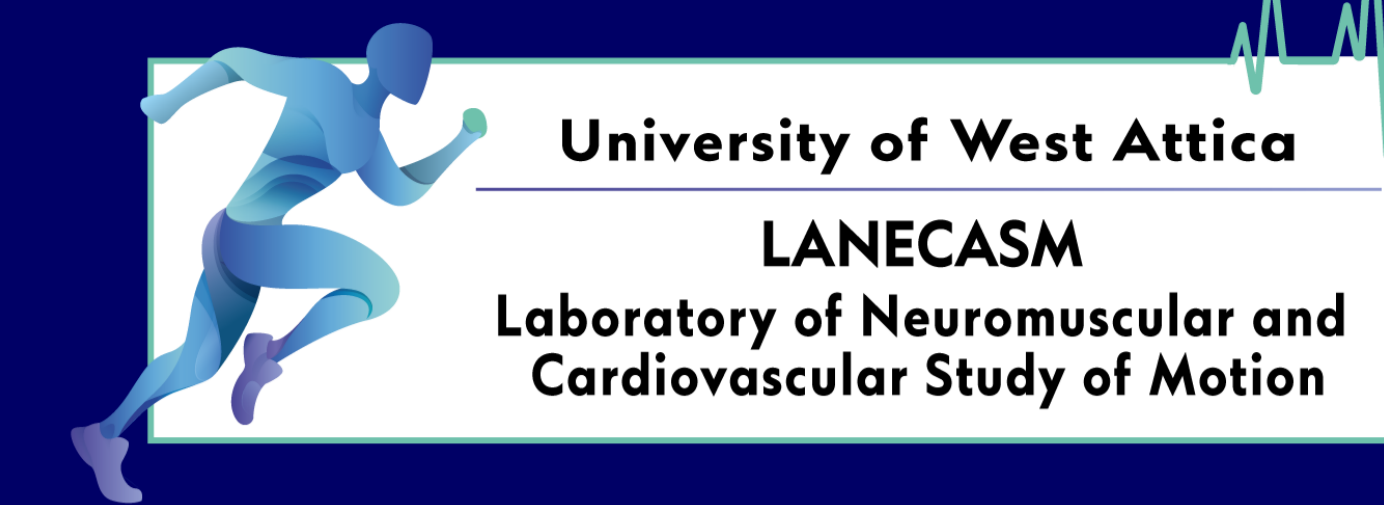


# RECOMMENDATIONS ON POST-OPERATIVE PHYSIOTHERAPY INTERVENTION OF ACETABULAR FRACTURES

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**INTRODUCTION / PURPOSE:** Surgical treatment of acetabular fractures is a challenging and demanding procedure. Acetabular surgery requires specialized surgical movements due to the complex 3D anatomy of the pelvis; the orthopaedic trauma surgeon must reconstruct the normal anatomy of the hip joint—aligning the bone fragments to restore the surface of the acetabulum, and fitting the femoral head into the hip socket. Postoperatively, specialized physiotherapy intervention in full consultation with the surgeon is required. The purpose of this study was to compile a recommendation guide for the maximum protection phase of post-operative physiotherapy for acetabular fractures.

**RESULTS:** No published complete protocols of post-operative physiotherapy intervention were found. The relevant literature contains 17 studies that describe the method of soft tissue management that should be followed to achieve an anatomical reduction of the fracture's fragments, stable internal fixation, and early mobilization. These findings were combined with specific post-operative physiotherapy recommendations, so the post-operative acetabular fractures recommendations were compiled (Tables 1-3).

**CONCLUSIONS:** Post-operative physiotherapy should aim at the rapid mobilization of the patient while protecting both the acetabulum from overload forces and the soft tissue trauma –by fracture and/or surgical approach - during a physiotherapy session. The exercises should be active within the permissible range of motion and not passive to avoid heterotopic ossification, a common post-operative complication of these fractures. This study presents detailed recommendations regarding the critical maximum protection phase of post-operative physiotherapy intervention; utilizing them may help minimize the risk of post-operative complications achieving the best possible functional outcome after an acetabular fracture.

**MATERIAL AND METHOD:** The literature review was performed in Pub med, Medline, EMBASE, AMED, and Scopus databases using relevant English keywords: acetabular fractures, Kocher-Langenbeck, Iliioinguinal, Extended Iliofemoral, Stoppa, heterotopic ossification, post-operative rehabilitation management, acetabular loadings, weight-bearing.

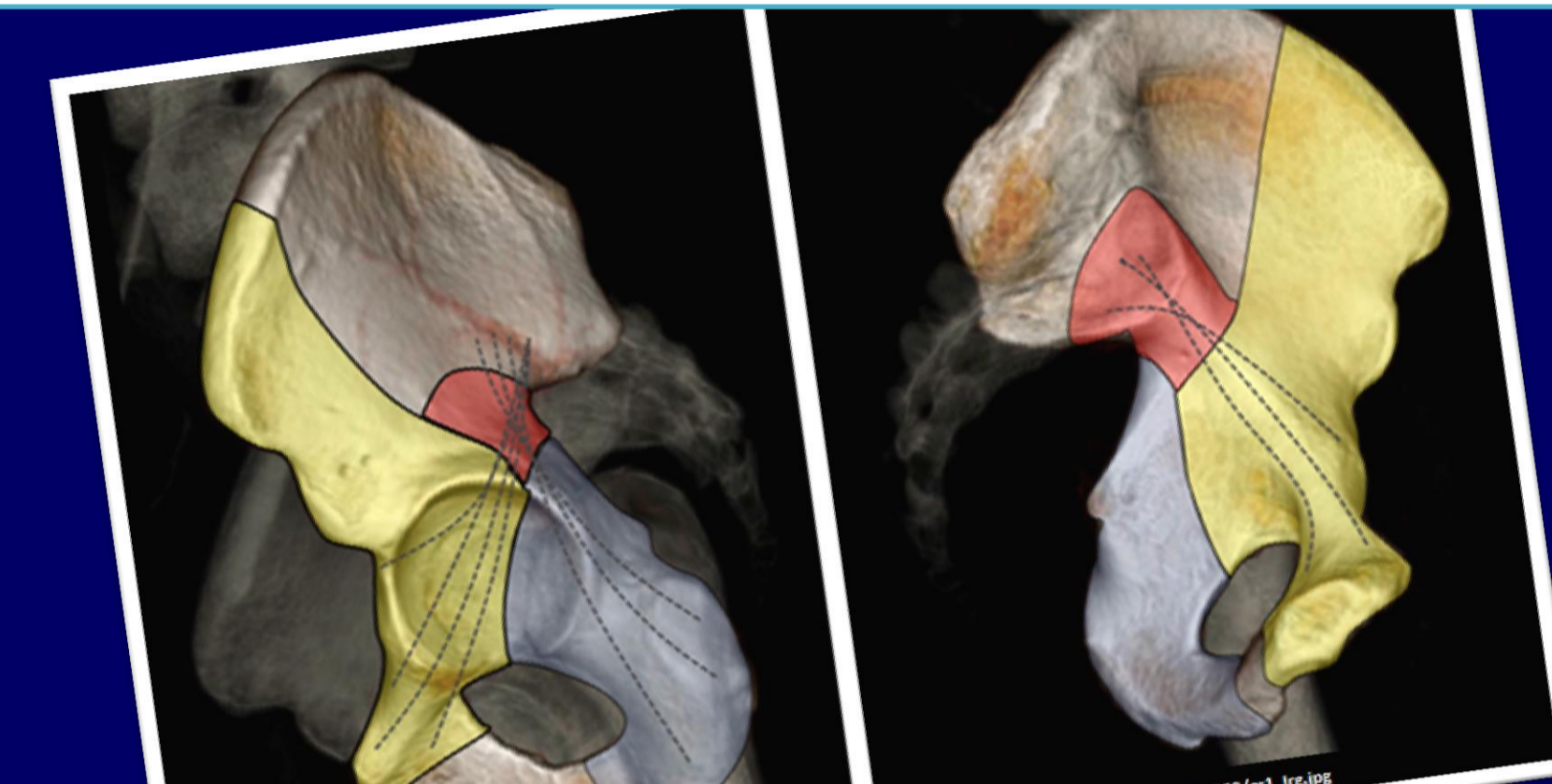


Table 1\_ Acetabular Fractures: Considerations for Post-operative Evaluation

Fracture Type	Surgical approach	Soft Tissue Injury (due to fracture type and/or surgical approach)	Possible nerve injury (due to intraoperative traction or compression)
<ul style="list-style-type: none"> <li>Posterior acetabular column fractures</li> <li>Posterior acetabular wall fractures</li> <li>T-type transverse fractures</li> </ul>	Kocher-Langenbeck	<ul style="list-style-type: none"> <li>Superior gluteal artery/vein</li> <li>Medial femoral circumflex artery</li> <li>Gluteus maximus muscle</li> <li>Gluteus medius muscle</li> <li>Gluteus minimus muscle</li> <li>External rotators muscles</li> </ul>	<ul style="list-style-type: none"> <li>Sciatic nerve</li> <li>Superior gluteal nerve</li> </ul>
Heterotopic Ossification: 12%			
<ul style="list-style-type: none"> <li>Anterior column fractures</li> <li>Two-column fractures</li> <li>T-type fractures</li> </ul>	Iliioinguinal	<ul style="list-style-type: none"> <li>Femoral artery</li> <li>External iliac artery/vein</li> <li>Abdominal muscles</li> <li>Obturator muscle</li> <li>Pectineus muscle</li> </ul>	<ul style="list-style-type: none"> <li>Lateral cutaneous nerve</li> <li>Obturator nerve</li> <li>Femoral nerve</li> </ul>
Heterotopic Ossification: 1.5%			
<ul style="list-style-type: none"> <li>Neglected two-column fractures</li> <li>Complex acetabular fractures</li> </ul>	Extended Iliofemoral	<ul style="list-style-type: none"> <li>Superior gluteal artery/vein</li> <li>Gluteus maximus muscle</li> <li>Gluteus medius muscle</li> <li>Gluteus minimus muscle</li> <li>Abdominal muscle</li> <li>Rectus femoris muscle</li> <li>External rotators muscles</li> </ul>	<ul style="list-style-type: none"> <li>Sciatic nerve</li> <li>Lateral cutaneous nerve</li> </ul>
Heterotopic Ossification: 24%			
<ul style="list-style-type: none"> <li>Fractures of the anterior column,</li> <li>Two-column fractures,</li> <li>T-type fractures (if quadrilateral surface is involved)</li> </ul>	Anterior Intrapelvic (STOPPA)	<ul style="list-style-type: none"> <li>Urinal bladder</li> <li>Superior gluteal artery/vein</li> <li>Rectus abdominis muscle</li> <li>Transverse abdominus muscle</li> <li>Iliopsoas muscle</li> <li>Internus Obturator muscle</li> </ul>	<ul style="list-style-type: none"> <li>Obturator nerve</li> <li>Sciatic nerve</li> </ul>
Heterotopic Ossification: 1,9%			

During post-operative evaluation, the following should be checked:

- The pain's presence, feeling, and intensity (e.g., burning sensation numbness, throbbing pain).
- The temperature of the operated limb in comparison with the contralateral limb.
- Any changes in skin texture (thin or shiny) of the operated limb compared to the contralateral limb.
- The presence of lymphatic edema.
- The perception of sensation across the nerve's distribution that is assessed.
- The muscular contractions or the active motion of the muscles group across the nerve's distribution that is assessed.

Table 2\_ General Principles of Post-operative Physiotherapy Intervention for Patients with Pelvis-Hip Fractures

Respiratory Physiotherapy (if necessary)	<ul style="list-style-type: none"> <li>Teaching diaphragmatic breathing</li> <li>Teaching exhalation, cough, and secretion drainage</li> <li>Perform coordinated upper extremity exercises and breathing</li> </ul>
Evaluation of Sensation	<ul style="list-style-type: none"> <li>The constant check of limb sensation is considered essential until the post-operative inflammation reduces.</li> </ul>
Prioritization of Kinesiotherapy Program	<ul style="list-style-type: none"> <li>The session begins with basic exercises – activities of the trunk (strengthening of the back muscles modified per occasion abdominal exercises) with caution of the contracting muscles around the operated acetabular area</li> <li>It continues with exercises on the healthy limb and the foot, ankle and knee joints of the fractured limb</li> <li>The exercises for increasing the range of motion and strength of the fractured area are performed last</li> </ul>
Kinesiotherapy of the operated limb	<ul style="list-style-type: none"> <li>Kinesiotherapy should be starting from the most peripheral joints, first the foot, then the ankle and the knee, and finally the hip joint.</li> </ul>
Ambulation - Gait	<ul style="list-style-type: none"> <li>Compressing socks is considered necessary before the patient rises from the bed, stands, and walks; ambulation depending on the patient's overall clinical image, and can be attempt only when the surgeon allows it.</li> <li>The proper way to sit on bed and a chair must be taught.</li> <li>The proper way to rise from the bed and the chair must be taught.</li> <li>The surgeon determines the commencement and progress of weight-bearing during gait, depending on the fracture's severity and post-operative stability.</li> <li>The amount of weight loading is determined by the surgeon.</li> <li>Initially, the patient must use a walking aid, like a walker, which provides a large base of support and safety during walking.</li> <li>During partial weight-bearing, the patient learns to walk with the 3 phase gait pattern: Walker-Operated Limb-Healthy Limb</li> <li>Depending on the progression of weight-bearing, the patient is trained to walk with elbow crutches. The crutch is placed to the contralateral -the operated limb- arm.</li> <li>When attempting the training of "ascending/descending stairs", it is advised that:                             <ul style="list-style-type: none"> <li>- During ascent, the healthy limb precedes the operated, and then the walking aid follows.</li> <li>- During descent, the patient firstly uses the walking aid, followed by the operated limb, and then the healthy one.</li> </ul> </li> </ul>
Electrotherapeutic Modalities and Physical Agents	<ul style="list-style-type: none"> <li>During the rehabilitation period, the Transcutaneous Electrical Neuro-Stimulation (TENS) is used for pain relief.</li> <li>During the maximum protection phase, frequent use of cold packs, both during the day and after the exercise program, reduces inflammation and pain.</li> <li>In later stages, before kinesiotherapy, hot packs are suggested to achieve muscle relaxation and reduce muscle stiffness and resistance.</li> </ul>
Rehabilitation progress	<ul style="list-style-type: none"> <li>The duration of the Maximum Protection phase, the level of exercises' difficulty and the kinesiotherapy program's progress are determined by the type of acetabular fracture, the surgical technique, patient's age, and general health status. Special attention should be given to the functional ability of the patient (e.g., gait capability without pain, ability to accomplish essential activities of daily living, etc.).</li> <li>The main goal of the physiotherapy intervention is the overall patient's rehabilitation, achieving the pre-trauma health status.</li> </ul>

Note: During the session, the physiotherapist should train the patient in the correct exercise starting position to perform all the exercises correctly and safely.

Table 3\_ Acetabular Fractures: Physiotherapy Intervention Recommendations

Fracture Type	Surgical Approach	Physiotherapy Intervention Recommendations during the Maximum Protection Phase of Post-operative Physiotherapy	Weight-bearing of the Fractured Limb
<ul style="list-style-type: none"> <li>Posterior column fractures</li> <li>Posterior wall fractures</li> <li>T-type transverse fractures</li> </ul>	Kocher-Langenbeck	<p><b>Avoided:</b></p> <ul style="list-style-type: none"> <li>Hip extension &gt; than 0° (hyperextension)</li> <li>Hip internal rotation</li> <li>Straight Leg Raise (SLR)</li> <li>Active hip abduction beyond the medial line*</li> <li>Assisted hip adduction beyond the medial line*</li> <li>Sitting position*:</li> <li>- hip joint's ankle &gt; 75° for the first 4 postoperative weeks</li> <li>- hip joint's ankle &gt; than 90° for the first 6 postoperative weeks</li> </ul> <p><b>Suggested:</b></p> <ul style="list-style-type: none"> <li>Ankle Pumps</li> <li>Free active dorsiflexion/plantar flexion of the ankle</li> <li>Isometric contractions of the quadriceps [Active (myometric &amp; plyometric) exercises of the quadriceps can begin from a sitting position (if allowed) usually in 5-7 days, postoperatively]</li> <li>Knee extension from 30° to 0° (from supine position)</li> <li>Active triple flexion: hip flexion (&lt; 75°), knee flexion and dorsiflexion of the ankle</li> <li>Assisted or active hip abduction up to the medial line</li> </ul>	<ul style="list-style-type: none"> <li>The loading of the operated limb during gait is defined exclusively by the surgeon, and it depends on the fracture type, the osteosynthesis stability, and the fracture's healing progress.</li> <li>Initially, the loading of the operated limb can be prohibited (single leg gait) or be confined to 5% -10% of the body weight (touch-down bearing) or up to 10-15kg for the first 8 weeks.</li> <li>During gait, on the Maximum Protection Phase, a walker device is suggested, as it offers stability and safety.</li> <li>Afterwards, the weight loading is progressively increasing, according to the surgeon's instructions.</li> </ul>
<ul style="list-style-type: none"> <li>Anterior column fractures</li> <li>Two-column fractures</li> <li>T-type fractures</li> </ul>	Iliioinguinal	<p><b>Avoided:</b></p> <ul style="list-style-type: none"> <li>Flexion and rotation movement of the trunk</li> <li>Hip extension &gt; than 0° (hyperextension)</li> <li>Straight Leg Raise (SLR)</li> <li>Hip internal rotation</li> </ul> <p><b>Suggested:</b></p> <ul style="list-style-type: none"> <li>Ankle Pumps</li> <li>Free active dorsiflexion or plantar flexion of the ankle</li> <li>Isometric contractions of the quadriceps [Active (myometric &amp; plyometric) exercises of the quadriceps can begin from a sitting position (if allowed) usually in 5-7 days, postoperatively]</li> <li>Knee extension from 30° to 0° (from supine position)</li> <li>Active triple flexion: Hip flexion (&lt; 75°), knee flexion and dorsiflexion of the ankle</li> <li>Assisted or active abduction up to the medial line</li> <li>Isometric contractions of the Gluteus Maximus [Active (myometric &amp; plyometric) exercises of the gluteus maximus can begin after the first 6 postoperative weeks</li> <li>Isometric contractions/assisted movements of the rest of the muscles that cause movement at the hip joint (if allowed)</li> </ul>	
<ul style="list-style-type: none"> <li>Neglected two-column fractures</li> <li>Complex acetabular fractures</li> </ul>	Extended Iliofemoral	<p><b>Avoided:</b></p> <ul style="list-style-type: none"> <li>Active contraction of the abdominal muscles</li> <li>Active or assisted hip abduction</li> <li>Active or assisted hip adduction</li> <li>Hip Flexion &gt; 30° (triple flexion)</li> <li>Hip Extension &gt; 0° (Hyperextension)</li> <li>Isometric Contraction of the Gluteus Maximus</li> <li>Straight Leg Raise (SLR)</li> <li>Assisted and active hip adduction beyond the anatomic line*</li> <li>Hip rotation*</li> <li>Sitting position:</li> <li>- hip joint's ankle &gt; 75° for the first 4 weeks*</li> <li>- hip joint's ankle &gt; than 90° for the first 6 weeks*</li> </ul> <p><b>Suggested:</b></p> <ul style="list-style-type: none"> <li>Ankle Pumps</li> <li>Free active dorsiflexion or plantar flexion of the ankle</li> <li>Isometric contractions of the quadriceps [Active (myometric &amp; plyometric) exercises of the quadriceps can begin from a sitting position (if allowed) usually in 5-7 days, postoperatively]</li> <li>Knee extension between 30°- 0° (from supine position)</li> <li>Isometric contractions/assisted movements of the rest of the muscles that cause movement at the hip joint (if allowed)</li> </ul>	
<ul style="list-style-type: none"> <li>Fractures of the anterior column,</li> <li>Two-column fractures,</li> <li>T-type fractures (if quadrilateral surface is involved)</li> </ul>	Anterior Intrapelvic (STOPPA)	<p><b>Avoided:</b></p> <ul style="list-style-type: none"> <li>Active contraction of the abdominal muscles</li> <li>Internal Leg rotation</li> <li>Leg Abduction</li> <li>Straight Leg Raise (SLR)</li> <li>Leg Extension &gt; than 0° (hyperextension)</li> </ul> <p><b>Suggested:</b></p> <ul style="list-style-type: none"> <li>Ankle Pumps</li> <li>Free active dorsiflexion or plantar flexion of the ankle</li> <li>Isometric contractions of the quadriceps [Active (myometric &amp; plyometric) exercises of the quadriceps can begin from a sitting position (if allowed) usually in 5-7 days, postoperatively]</li> <li>Knee extension from 30° to 0° (from supine position)</li> <li>Active Triple Flexion: Leg flexion (&lt;90°) knee flexion and dorsiflexion of the ankle (without contracting the abdominal muscles)</li> <li>Isometric contractions/assisted movements of the rest of the muscles that cause movement at the hip joint (if allowed)</li> </ul>	

\* exercises that are avoided due to surgical dislocation of the femoral head and/or major trochanter osteotomy

**ADDITIONAL NOTES**

- The kinesiotherapy exercises that are suggested during the Maximum Protection Phase of Physiotherapy are indicative. The program can be modified following the surgeon's instructions concerning both the fracture and soft tissue healing.
- The entire kinesiotherapy program is being conducted according to the patient's pain tolerance.
- In complex acetabular fractures in which a combination of surgical approaches was performed, the postoperative recommendations depend on the combination of those approaches.
- Strengthening exercises of the upper extremity should be added to the physiotherapy program to achieve a more effortless gait with the walking aid without having the patient overload the operated limb.
- Free active exercises and strengthening exercises of the gluteus maximus require hip hyperextension, a movement that must be avoided for at least the first 6 postoperative weeks. In addition, in surgical approaches (e.g., extended Iliofemoral) where the gluteus maximus has been injured, isometric exercises must be avoided until the surgeon approves them.

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Ευθεικτική Βιβλιογραφία:

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