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Traumatic Arthritis of the Hip Joint Following Hip Dislocation and Acetabular Fracture: A Comprehensive Review.

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Abstract
Post-traumatic arthritis (PTA) of the hip is a debilitating consequence of high-energy injuries such as hip dislocations and acetabular fractures, predominantly affecting younger and active individuals. The condition arises from both mechanical and inflammatory damage to joint structures, leading to progressive degeneration. Total hip arthroplasty (THA) is the definitive treatment for end-stage PTA, offering significant pain relief and improved function. However, THA in post-traumatic settings presents unique challenges due to altered anatomy, previous surgical interventions, and increased risk of complications such as infection, implant loosening, and heterotopic ossification. This comprehensive review examines the etiology, pathophysiology, risk factors, surgical considerations, and outcomes of THA in PTA patients, drawing insights from key clinical studies. It emphasizes the importance of individualized preoperative planning, advanced surgical techniques, and patient education to optimize results. Future directions include the use of patient-specific implants, robotic-assisted surgery, and biologic therapies aimed at enhancing long-term outcomes. A multidisciplinary, evidence-based approach is crucial for improving care and quality of life in this complex patient population.
Keywords: *Post-traumatic arthritis, total hip arthroplasty, acetabular fracture, hip dislocation, surgical complications*

INTRODUCTION

Post-traumatic arthritis (PTA) of the hip is a degenerative joint condition that arises following traumatic events such as acetabular fractures and hip dislocations. These types of injuries compromise the integrity of the cartilage, labrum, and surrounding soft tissues, triggering inflammation and gradual joint deterioration over time [1]. Unlike primary osteoarthritis, which generally affects older individuals, PTA is more common in younger, physically active patients who have sustained high-impact trauma, including motor vehicle accidents or significant falls. The resulting injury activates a cascade of pro-inflammatory cytokines—such as interleukin-1 (IL-1), interleukin-6 (IL-6), and tumor necrosis factor-alpha (TNF-α)—which contribute to cartilage breakdown and programmed cell death of chondrocytes, thereby expediting joint degeneration [2]. Affected individuals often report persistent pain in the hip, joint stiffness, limited range of motion, and a decline in overall quality of life. Initial conservative interventions may offer temporary symptom relief; however, many cases ultimately progress to advanced stages that necessitate surgical management [3]. Total hip arthroplasty (THA) is considered the most effective solution for late-stage PTA, offering substantial improvement in pain and mobility. Nevertheless, performing THA in post-traumatic cases presents additional complexity due to factors such as anatomical deformity, pre-existing scar tissue, residual implants, and compromised bone structure [4]. These challenges not only increase the risk of intraoperative and postoperative complications but also lead to more variable surgical outcomes. This review draws upon key studies to explore surgical techniques, patient outcomes, and common complications associated with THA in PTA cases, with the aim of informing and enhancing clinical decision-making [5].

Etiology and Pathophysiology

Post-traumatic arthritis (PTA) of the hip arises through a combination of mechanical injury and biological disruption following traumatic events, most notably hip dislocations and acetabular fractures. These injuries initiate a cascade of degenerative changes that progressively impair joint function, leading to persistent pain, stiffness, and reduced mobility. Posterior hip dislocations, which are among the most common, occur when the femoral head is forcefully ejected from the acetabular cavity—often as a result of high-impact trauma such as vehicle collisions or significant falls. This type of injury typically results in articular cartilage damage, labral tearing, and capsular rupture, all of which destabilize the joint. Vascular compromise, especially involving the medial femoral circumflex artery, can also occur, reducing blood flow to the femoral head and increasing the risk of avascular necrosis (AVN), thereby expediting cartilage breakdown [6].

Acetabular fractures disrupt the bony socket of the pelvis where the femoral head articulates. If these fractures are not anatomically realigned and stabilized, they often lead to step-offs, malunion, and joint asymmetry. Even subtle discrepancies in joint alignment can disturb normal weight-bearing mechanics, resulting in uneven stress distribution. This promotes localized cartilage erosion, remodeling of the subchondral bone, and eventual collapse of the joint surface. These mechanical imbalances significantly accelerate hip degeneration [7].

The initial trauma to the joint structures also triggers a localized inflammatory response characterized by the release of cytokines such as IL-1, IL-6, and TNF-α. These pro-inflammatory mediators activate destructive enzymatic pathways, notably matrix metalloproteinases (MMPs), which degrade the cartilage matrix. They also induce apoptosis in chondrocytes and promote inflammation in the synovial membrane, thereby impairing the joint's ability to repair itself. Additionally, oxidative stress, immune cell activation, and metabolic alterations in the subchondral bone further contribute to the progression of joint destruction and the development of post-traumatic osteoarthritis (PTOA) [8,9]

Epidemiology and Risk Factors

Post-traumatic arthritis (PTA) of the hip is a major contributor to long-term disability, particularly among younger, active individuals. In contrast to primary osteoarthritis, which typically develops gradually with age-related degeneration, PTA is directly linked to a specific traumatic incident, often involving high-energy forces. Common causes include motor vehicle collisions, falls from elevated surfaces, athletic injuries, and workplace accidents—events that frequently lead to hip dislocations or fractures of the acetabulum. Epidemiological data show that between 20% and 50% of individuals who experience substantial joint trauma eventually develop PTA, although the incidence varies based on injury severity, the effectiveness of early treatment, and individual patient characteristics. The likelihood of developing PTA is notably increased in cases involving intra-articular fractures, disrupted joint alignment, or cartilage damage sustained at the time of injury [10].Several risk factors have been consistently identified as contributing to the development of PTA of the hip:

Delayed hip reduction: Performing hip reduction within six hours of dislocation is essential to restoring femoral head perfusion and preserving cartilage integrity. When reduction is postponed, the likelihood of developing avascular necrosis (AVN) and irreversible cartilage damage rises significantly, both of which are major contributors to PTA.

Improperly managed or poorly healed fractures: Inadequate alignment or suboptimal fixation of fractures can result in lingering joint deformities, uneven biomechanical loading, and premature cartilage deterioration, thereby accelerating arthritic changes [11].

Avascular necrosis (AVN): AVN is a critical risk factor for PTA, typically arising from disrupted vascular supply to the femoral head during the initial trauma or subsequent surgical intervention. This condition causes collapse of the subchondral bone and progressive degeneration of the overlying cartilage.

History of surgical procedures: Surgeries such as open reduction and internal fixation (ORIF) can introduce multiple complications, including altered joint kinematics, retained metal implants, fibrous scarring, and a heightened risk of postoperative infections—all of which elevate the chances of future joint degeneration and complicate revision surgeries.

Polytrauma and multi-system injuries: As noted by Weber et al., patients with traumatic hip dislocations often present with additional injuries such as pelvic ring fractures, head trauma, or fractures of the limbs. These associated conditions can interfere with early mobilization and rehabilitation, delaying definitive orthopedic care and raising the risk of long-term joint dysfunction and degeneration [12].

Residual joint misalignment or instability: Minor step-offs or incongruities remaining after reduction or fixation can lead to abnormal stress concentrations on specific areas of the joint cartilage, hastening its breakdown and promoting the onset of arthritis.

Recurrent mechanical overload: Patients who return to strenuous physical activity without sufficient recovery or rehabilitation place excessive repetitive stress on the joint, which can accelerate cartilage wear and precipitate earlier onset of degenerative changes [13]

Demographically, PTA of the hip tends to affect males more than females, likely due to higher exposure to high-energy trauma and participation in physically demanding activities. Additionally, younger patients may live longer with the consequences of trauma, increasing the observed incidence of PTA over time.

Surgical Management: Total Hip Arthroplasty (THA)

Total hip arthroplasty (THA) is the standard surgical option for managing end-stage post-traumatic arthritis (PTA) of the hip, particularly in cases where conservative measures—such as pharmacologic therapy, physical rehabilitation, or intra-articular injections—fail to alleviate symptoms. The primary objectives of THA in these patients include restoring hip function, reducing pain, and enhancing mobility. However, performing THA in the setting of previous trauma or surgery can be significantly more challenging due to anatomical deformities, scarring, and the potential presence of hardware from earlier interventions [14].

Selecting an appropriate surgical approach is a crucial part of preoperative planning and must take into account several patient-specific considerations, such as body structure, previous operative history (e.g., open reduction and internal fixation), soft tissue condition, and any retained implants. The most widely adopted approaches include:

- **Posterior approach** – commonly used and offers excellent visualization of the joint, but may carry a slightly increased risk of postoperative dislocation in certain cases.
- **Direct anterior approach** – a muscle-sparing technique that promotes faster early rehabilitation, though it is technically demanding, particularly in patients with altered anatomy due to trauma.
- **Lateral (anterolateral) approach** – provides strong joint stability and adequate exposure but may compromise abductor muscle function [15–17].

Implant selection must be tailored to individual needs based on factors like age, activity level, bone density, and the presence of bone deformities or loss. For younger and more active patients, ceramic-on-ceramic or ceramic-on-polyethylene implant bearings are often favored due to their reduced wear profiles. In older patients, highly cross-linked polyethylene liners are frequently used to enhance implant longevity while minimizing particle wear. In complex cases—such as those involving acetabular defects, malalignment, or prior reconstructive surgeries—surgeons may need to utilize modular or revision-grade components to achieve proper alignment and implant fixation [18].

Advanced preoperative imaging, particularly computed tomography (CT), is essential for thorough surgical preparation in total hip arthroplasty (THA), especially in patients with post-traumatic arthritis (PTA). CT scans enable surgeons to assess the quality and quantity of acetabular and femoral bone, detect the location of retained surgical hardware, and evaluate structural deformities. These detailed insights support precise planning for implant selection, including the use of custom-made or revision-specific prosthetic components. In cases with substantial bone loss, reconstructive techniques such as impaction bone grafting, the use of metallic augments, or customized 3D-printed implants may be required to restore mechanical alignment and achieve stable fixation [19].

Intraoperatively, technologies like robotic-assisted systems and navigation platforms can significantly improve the accuracy of implant placement and help ensure proper leg length balancing—especially important when normal anatomical landmarks have been altered by previous trauma. Surgeons should also be equipped to handle complex intraoperative tasks such as removal of pre-existing hardware, release of soft tissue contractures, and excision of dense scar tissue. Addressing these issues is crucial to minimizing complications and improving surgical outcomes in PTA cases [5].

Comparative Analysis of Key Studies

O'Driscoll et al. (2023): This systematic review included 29 studies and over 1,200 patients who underwent THA for PTA following acetabular fracture. Mean follow-up was 86 months. Harris Hip Scores improved from 45 to 86. Infection occurred in 3.6% of cases, and the revision rate was 9.7%. Higher complication rates were observed in patients previously treated with ORIF. (20)

Choudhary et al. (2024): This narrative review emphasized the importance of surgical technique and implant selection. The authors noted favorable outcomes in pain and function but cautioned about the elevated risk of complications such as infection and implant loosening. Patient education and expectation management were highlighted as key elements. (5)

Weber et al. (2022): This epidemiological study assessed 170,934 trauma patients and found a 0.8% incidence of hip dislocation. Patients with THDs had longer hospital stays and a higher rate of concomitant injuries. The study stressed the need for early recognition and reduction to prevent PTA. (21)

Complications

Total hip arthroplasty (THA) performed in the context of prior trauma is considerably more challenging and is associated with a higher complication rate compared to THA conducted for primary degenerative joint conditions. Patients with a history of significant hip injuries—especially those who have experienced acetabular fractures or undergone procedures like open reduction and internal fixation (ORIF)—frequently present with complex anatomical distortions, extensive fibrotic tissue, and retained surgical hardware. These elements contribute to increased technical demands during surgery and elevate the likelihood of intraoperative difficulties [22]. Several complications are more prevalent in the post-traumatic THA population. Prosthetic joint infection, for instance, affects approximately 3–4% of these cases, likely due to previous surgical exposure and compromised soft tissue envelopes. Implant loosening and aseptic failure are also more commonly encountered and may necessitate earlier-than-expected revision surgeries. Heterotopic ossification, or the abnormal formation of bone in surrounding soft tissues, can result in restricted joint motion and postoperative stiffness. In some cases, sciatic nerve palsy may occur, often due to traction or scar encasement around the nerve during dissection [23].

Another major concern is **malpositioning of implant components**, which is more likely when the native bony landmarks are disrupted by trauma. This misalignment can lead to joint instability, dislocation, and uneven wear of prosthetic materials. Furthermore, extensive **acetabular bone loss**, whether due to initial injury or prior surgeries, may require advanced reconstructive methods. These may involve the use of bone grafts, metal augments, or custom-designed revision implants to restore proper joint biomechanics and ensure stable fixation. In summary, achieving favorable outcomes in post-traumatic THA depends heavily on meticulous preoperative planning, the application of advanced surgical techniques, and, in many cases, the use of modular or customized implant systems to address complex anatomical variations [24].

Functional Outcomes and Patient Satisfaction

Although total hip arthroplasty (THA) in the setting of post-traumatic arthritis (PTA) presents considerable technical challenges, outcomes are generally positive when the procedure is executed successfully. Most patients report significant alleviation of pain, restoration of joint mobility, and enhanced functional capacity. These benefits often result in a substantial improvement in overall quality of life, enabling individuals to resume daily activities that were previously hindered by joint stiffness and discomfort.

Functional improvements are typically measured using validated assessment tools such as the Harris Hip Score (HHS). Research consistently demonstrates that PTA patients undergoing THA experience marked improvements, with scores increasing from a baseline of approximately 40–50 to 80 or above following surgery. Similarly, instruments like the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and other patient-reported outcome measures (PROMs) reflect substantial reductions in pain and improvements in physical performance [25]. Despite these encouraging outcomes, the recovery process for PTA patients is often longer and more complicated than for those undergoing primary THA. Contributing factors may include previous surgeries such as ORIF, the presence of scar tissue, altered joint mechanics, and other medical comorbidities. As a result, rehabilitation frequently requires a more personalized plan, involving extended physical therapy and ongoing clinical supervision.

Patient satisfaction after THA for PTA is closely tied to effective preoperative preparation. Transparent communication regarding surgical risks, expected outcomes, and realistic goals plays a vital role. Patients who are thoroughly informed about their condition and what the surgical journey entails are more likely to report high levels of satisfaction. Additionally, the application of modern implant technologies, refined surgical techniques, and coordinated care from a multidisciplinary team can further contribute to improved patient experiences and clinical outcomes [26].

Recommendations for Clinical Practice

Effective management of post-traumatic arthritis (PTA) of the hip requires a multidisciplinary and evidence-based approach, beginning at the time of initial injury and continuing through surgical intervention and rehabilitation. The following clinical recommendations aim to optimize patient outcomes and minimize the long-term impact of PTA:

Immediate and accurate management of the initial trauma: Prompt reduction of hip dislocations—preferably within the first six hours—is vital to minimize the risk of avascular necrosis and long-term joint damage. Proper identification, alignment, and stabilization of acetabular fractures, ideally guided by CT imaging, are critical to reestablish joint congruity and help prevent the onset of post-traumatic arthritis.

Appropriately timed total hip arthroplasty (THA): Elective THA should be deferred until the acute phase of injury has resolved. This includes complete fracture healing, resolution of soft tissue inflammation, and recovery of joint stability. Undertaking surgery during active inflammation or incomplete healing increases the risk of infection, implant-related complications, and technical failure [27].

Detailed preoperative evaluation: Advanced imaging techniques—such as high-resolution CT scans and 3D reconstructions—are essential for assessing bone quality, identifying deformities, and detecting any retained implants. This planning phase helps guide the choice of prosthetic components, the need for bone grafts or augments, and corrections of leg length discrepancies or alignment issues.

Preparation for intraoperative complexities: Surgeons managing PTA cases should be skilled in complex hip reconstructions, particularly in patients with a history of ORIF. These surgeries often present challenges like dense scar tissue, altered joint anatomy, diminished bone stock, and existing hardware. Operating rooms should be equipped with a variety of implant options, revision tools, and bone graft materials to accommodate these scenarios.

Strict infection prevention measures: The risk of prosthetic joint infection is significantly higher in post-traumatic cases due to prior surgical interventions and soft tissue compromise. Preventive strategies should include meticulous surgical technique, thorough infection screening, targeted antibiotic prophylaxis, and strict adherence to sterile protocols. High-risk patients may also benefit from extended antimicrobial regimens and intensified postoperative monitoring [28].

Comprehensive patient education and expectation management: Preoperative consultations must address the potential risks—such as stiffness, nerve injury, infection, and possible revision surgery. It's equally important to inform patients of the longer and potentially more challenging recovery process, including the possibility of limited joint mobility. Setting realistic expectations improves postoperative satisfaction and promotes adherence to rehabilitation programs.

Structured postoperative rehabilitation and monitoring: A well-designed rehabilitation plan should begin early to enhance joint motion, strengthen periarticular muscles, and improve gait mechanics. Routine follow-up visits, incorporating clinical assessments and imaging, are essential for tracking implant performance, detecting early signs of complications, and implementing timely interventions [29].

Future Directions

While total hip arthroplasty (THA) in the setting of post-traumatic arthritis (PTA) has evolved significantly, there remain important opportunities for improvement in patient outcomes, surgical precision, and implant longevity. Future advancements in clinical research, surgical technology, and materials science are expected to address current limitations and enhance the effectiveness of hip reconstruction in these complex cases.

Emphasis on high-quality clinical research: A significant limitation in the current literature is the absence of large-scale, multicenter, prospective studies with extended follow-up. Much of the existing evidence is derived from retrospective analyses or single-institution experiences. Future investigations should aim to evaluate implant longevity, patient-reported outcomes (PROMs), complication rates, and quality of life across broader patient populations. Such robust data are crucial for identifying risk factors associated with poor surgical outcomes and establishing evidence-based clinical protocols.

Adoption of patient-specific implant technologies: Conventional implants may not adequately address the anatomical variations seen in patients with prior trauma or reconstructive surgeries. Advances in 3D printing and high-resolution imaging have paved the way for the creation of implants that are customized to a patient's unique bone geometry and biomechanical needs. These personalized solutions offer the potential for superior fit, improved joint stability, and reduced surgical duration—particularly valuable in complex cases involving severe bone deformities or loss.

Expansion of robotic and computer-assisted surgical techniques: The integration of robotics and computer navigation into orthopedic procedures is rapidly advancing. These systems enhance the precision of implant placement, improve restoration of limb alignment, and support management of altered anatomical structures. In PTA cases, where conventional anatomical landmarks may be unreliable, such technologies can significantly reduce errors in component orientation and minimize complications like leg length discrepancy or implant malposition.

Innovation in implant materials and design: Ongoing research into novel biomaterials is essential to extend implant longevity and mitigate complications such as wear, loosening, and osteolysis. Current solutions, including highly cross-linked polyethylene, ceramic-on-ceramic bearings, and non-metallic alternatives, already demonstrate reduced wear rates. Looking ahead, innovations may include bioactive coatings that promote bone integration, antimicrobial surfaces to prevent infections, and smart implants capable of sensing mechanical stress or early signs of loosening.

Emergence of biologic and regenerative interventions: Although still in early stages, regenerative strategies such as stem cell therapy, growth factor application, and scaffold-based cartilage repair hold promise for delaying or potentially avoiding the need for THA in certain post-traumatic cases. In the future, combining these biologic therapies with surgical techniques could provide a more comprehensive approach to joint preservation and long-term function.

Improved postoperative monitoring and patient support: The use of digital health tools including telehealth platforms, wearable rehabilitation monitors, and AI-driven predictive algorithms—can enhance postoperative care. These technologies enable continuous tracking of recovery progress, allow early detection of complications, and support remote, personalized follow-up care that may improve long-term outcomes.

CONCLUSION

Post-traumatic arthritis (PTA) of the hip commonly follows high-energy injuries like dislocations and acetabular fractures, often affecting younger, active individuals. Total hip arthroplasty (THA) is the primary treatment for advanced PTA, offering significant pain relief and functional improvement. However, THA in this setting is technically complex and carries a higher risk of complications due to prior trauma, distorted anatomy, and surgical history.

Key factors influencing outcomes include timely injury management, thorough preoperative planning, experienced surgical technique, and patient education. Emerging technologies—such as 3D-printed implants and robotic-assisted surgery—show promise in improving precision and long-term success. A multidisciplinary approach and ongoing research are essential to optimize care and outcomes for this challenging patient population.

REFERENCES:

1. Karateev, A. E., Chernikova, A. A., & Makarov, S. (2023). Post-traumatic osteoarthritis: epidemiology, pathogenesis, clinical picture, approaches to pharmacotherapy. Sovremennaâ Revmatologiâ, 17(1), 108–116. https://doi.org/10.14412/1996-7012-2023-1-108-116
2. Dilley, J. E., Bello, M. A., Roman, N., McKinley, T., & Sankar, U. (2023). Post-traumatic osteoarthritis: A review of pathogenic mechanisms and novel targets for mitigation. *Bone Reports*, *18*, 101658. https://doi.org/10.1016/j.bonr.2023.101658
3. Bennett, K. J., Cornett, E. M., & Hasoon, J. (2023). *Osteoarthritic Hip Pain* (pp. 164–172). Cambridge University Press. https://doi.org/10.1017/9781108979849.022
4. Lu, M., & Phillips, D. (2019). Total Hip Arthroplasty for Posttraumatic Conditions. *Journal of The American Academy of Orthopaedic Surgeons*, *27*(8), 275–285. https://doi.org/10.5435/JAAOS-D-17-00775
5. Choudhary, A., Pisulkar, G., Taywade, S., Awasthi, A., & Salwan, A. (2024). A Comprehensive Review of Total Hip Arthroplasty Outcomes in Post-traumatic Hip Arthritis: Insights and Perspectives. *Cureus*. https://doi.org/10.7759/cureus.56350
6. Milenković, S., Mitkovic, M., & Mitkovic, M. (2020). Avascular necrosis of the femoral head after traumatic posterior hip dislocation with and without acetabular fracture. *European Journal of Trauma and Emergency Surgery*, 1–7. https://doi.org/10.1007/S00068-020-01495-X

7. Letournel, E. (2019). Acetabulum Fractures: Classification and Management. *Journal of Orthopaedic Trauma*, *33*(2). https://doi.org/10.1097/BOT.0000000000001424
8. Afifah, E., Mozef, T., Sandra, F., Arumwardana, S., Rihibiha, D. D., Nufus, H., Rizal, R., Amalia, A., Bachtiar, I., Murti, H., & Widowati, W. (2019). Induction of Matrix Metalloproteinases in Chondrocytes by Interleukin IL-1β as an Osteoarthritis Model. *Journal of Mathematical and Fundamental Sciences*, *51*(2), 103–111. https://doi.org/10.5614/J.MATH.FUND.SCI.2019.51.2.1
9. Dwivedi, G. D., Flaman, L., Alaybeyoglu, B., Struglics, A., Frank, E. H., Chubinskya, S., Trippel, S. B., Rosen, V., Cirit, M., & Grodzinsky, A. J. (2022). Inflammatory cytokines and mechanical injury induce post-traumatic osteoarthritis-like changes in a human cartilage-bone-synovium microphysiological system. *Arthritis Research & Therapy*, *24*(1). https://doi.org/10.1186/s13075-022-02881-z
10. Kenanidis, E., Lampridis, V., Vlastos, I., Tsiridis, E., Bićanić, G., Sulje, Z., Delimar, D., Delimar, D., Deleanu, B., Meding, J. B., Keating, E. M., & Sueyoshi, T. (2018). *Posttraumatic Hip Osteoarthritis* (pp. 257–280). Springer, Cham. https://doi.org/10.1007/978-3-319-64177-5_8
11. Sen, R. K., Tripathy, S. K., Goyal, T., Aggarwal, S., Kashyap, S., Purudappa, P. P., & Chandrappa, M. H. (2021). Complications and Functional Outcome of Femoral Head Fracture-Dislocation In Delayed and Neglected Cases. *Indian Journal of Orthopaedics*, *55*(3), 595–605. https://doi.org/10.1007/S43465-020-00309-X
12. Konarski, W., Poboży, T., Śliwczyński, A., Kotela, I., Krakowiak, J., Hordowicz, M., & Kotela, A. (2022). Avascular Necrosis of Femoral Head—Overview and Current State of the Art. *International Journal of Environmental Research and Public Health*, *19*(12), 7348. https://doi.org/10.3390/ijerph19127348
13. Rothrauff, B. B., Fox, M. A., Murray, R. S., Winkler, P. W., & Musahl, V. (2022). *Biomechanics of Instability and Its Relationship to OA*. https://doi.org/10.1007/978-3-030-79485-9_8
14. Rahm, S., & Zingg, P. O. (2018). Indications for joint replacement : Total hip arthroplasty. *Zeitschrift Fur Rheumatologie*, *77*(1), 55–65. https://doi.org/10.1007/S00393-017-0408-Z
15. Iyer, K. M. (2021). *Posterior approach to the Hip Joint*. *8*(2), 024–028. https://doi.org/10.17352/2455-5487.000089
16. Ang, J. J. M., Onggo, J. R., & Ambikaipalan, A. (2023). *Comparing direct anterior approach versus posterior approach or lateral approach in total hip arthroplasty: a systematic review and meta-analysis.* https://doi.org/10.1007/s00590-023-03528-8
17. Putananon, C., Tuchinda, H., Arirachakaran, A., Wongsak, S., Narinsorasak, T., & Kongtharvonskul, J. (2018). Comparison of direct anterior, lateral, posterior and posterior-2 approaches in total hip arthroplasty: network meta-analysis. *European Journal of Orthopaedic Surgery and Traumatology*, *28*(2), 255–267. https://doi.org/10.1007/S00590-017-2046-1
18. Wu, T., Jiang, Y., Shi, W., Wang, Y., & Li, T. (2024). Comparative postoperative prognosis of ceramic-on-ceramic and ceramic-on-polyethylene for total hip arthroplasty: an updated systematic review and meta-analysis. *PeerJ*, *12*, e18139. https://doi.org/10.7717/peerj.18139
19. Mancino, F., Fontalis, A., Magan, A. A., Plastow, R. G. E., & Haddad, F. S. (2024). The Value of Computed Tomography Scan in Three-dimensional Planning and Intraoperative Navigation in Primary Total Hip Arthroplasty. *Hip and Pelvis*, *36*, 26–36. https://doi.org/10.5371/hp.2024.36.1.26
20. O'Driscoll CS, Davey MS, Hughes AJ, O'Byrne JM, Leonard M, O'Daly BJ. Total hip arthroplasty in the setting of post-traumatic arthritis following acetabular fracture: a systematic review. Arthroplasty Today. 2023 Feb 1;19:101078.
21. Weber CD, Lefering R, Sellei RM, Horst K, Migliorini F, Hildebrand F, TraumaRegister Dgu. Traumatic hip dislocations in major trauma patients: epidemiology, injury mechanisms, and concomitant injuries. Journal of clinical medicine. 2022 Jan 18;11(3):472.
22. Busch, A., Busch, A., Stöckle, U., Schreiner, A. J., Zwaart, P. de, Schäffler, A., & Ochs, B. G. (2020). Total hip arthroplasty following acetabular fracture: a clinical and radiographic outcome analysis of 67 patients. *Archives of Orthopaedic and Trauma Surgery*, *140*(3), 331–341. https://doi.org/10.1007/S00402-019-03272-X
23. Li, H., Zheng, Q., Niu, E., Xu, J., Chai, W., Xu, C., Fu, J., Hao, L., Chen, J., & Zhang, G. (2024). Increased risk of periprosthetic joint infection after traumatic injury in joint revision patients. *Arthroplasty*, 6. https://doi.org/10.1186/s42836-024-00235-5
24. Sanghavi, S., Paprosky, W. G., & Sheth, N. P. (2024). Evaluation and Management of Acetabular Bone Loss in Revision Total Hip Arthroplasty: A 10-year Update. *Journal of The American Academy of Orthopaedic Surgeons*. https://doi.org/10.5435/jaaos-d-23-00645
25. Leiss, F., Götz, J., Maderbacher, G., Meyer, M., Reinhard, J., Zeman, F., Grifka, J., & Greimel, F. (2021). Excellent Functional Outcome and Quality of Life after Primary Cementless Total Hip Arthroplasty (THA) Using an Enhanced Recovery Setup. *Journal of Clinical Medicine*, *10*(4), 621. https://doi.org/10.3390/JCM10040621
26. Di Martino, A., Keating, C., Butsick, M. J., Platano, D., Berti, L., Hunter, L. N., & Faldini, C. (2024). Enhancing recovery: surgical techniques and rehabilitation strategies after direct anterior hip arthroplasty. *Journal of Orthopaedics and Traumatology*, *25*(1). https://doi.org/10.1186/s10195-024-00786-y
27. Moed, B. R., Kregor, P. J., Reilly, M. C., & Stover, M. D. (2017). Acetabular Fractures: A Problem-Oriented Approach. *Journal of Bone and Joint Surgery, American Volume*, *66*, 3–24. https://pubmed.ncbi.nlm.nih.gov/28594485/
28. Sood, C., & Kumar, S. (2023). *Allograft Prosthetic Reconstruction in Revision Total Hip Arthroplasty* (pp. 789–809). https://doi.org/10.1007/978-981-99-5517-6_61
29. Henry, L. E., Aneizi, A., Nadarajah, V., Sajak, P. M. J., Stevens, K. N., Zhan, M., Gilotra, M. N., Packer, J. D., & Henn, R. F. (2020). Preoperative expectations and early postoperative met expectations of extremity orthopaedic surgery. *Journal of Clinical Orthopedics and Trauma*, *11*. https://doi.org/10.1016/J.JCOT.2020.06.027