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Rehabilitation of Pelvic fracture

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Review：Rehabilitation of Pelvic fracture

Abstract

Rehabilitation protocols for treating pelvic fractures lack uniformity due to variations among patients, injury mechanisms, and fracture types. The incidence of pelvic fragility fractures in the elderly has risen in recent years, prompting discussions on treatment strategies, including conservative approaches. This article aims to conduct a literature review of rehabilitation practices following pelvic fractures reported up to September 2023, to elucidate the current state of the field. We conducted a search on PubMed for literature published prior to September 2023. No systematic selection was applied to articles published thereafter. The search criteria excluded non-English publications, case reports, pediatric fractures, and studies where the primary outcome did not focus on clinical aspects of pelvic fractures. We included a total of 201 papers, narrowing it down to 35 through title and abstract screening. This article described loading protocols, sexual dysfunction, mental dysfunction, surgical techniques and methods of functional assessment. Rehabilitation policies vary, often determined on a case-by-case basis, specifically by individual surgeons or treatment centers. No unified protocols exist at present, but future research will hopefully lead to significant progress.

Keywords: Pelvic fracture, Fragility Fracture of Pelvis, Rehabilitation, Weight bear

レビュー：骨盤骨折後のリハビリテーション

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要旨

＜背景＞

骨盤骨折の治療においては、患者、受傷機序、骨折の種類が多様であるため、統一されたリハビリテーションプロトコルは存在しない。近年、高齢者の骨盤脆弱性骨折が増加しており、保存的治療を含めて治療戦略が議論されている。

＜目的＞

本発表の目的は、2023.9 年までに報告された骨盤骨折後のリハビリテーション

に関する文献レビューを行い、現状を理解することである。

＜方法＞

2023 年 9 月以前の文献の検索には Pubmed を使用した。それ以降に発表された論文については系統的な抽出は行わなかった。タイトル/抄録のスクリーニングで次の項目を除外した。英語でないもの、症例報告、小児骨折、主要転帰が骨盤骨折の臨床成績でない報告。

＜結果＞

201 の論文が対象となり、タイトル/抄録スクリーニングによって最終的に 35 の論文に絞られた。リハビリの方法に関する方針は、施設ごとさらには外科医ごとに決定されていると考えられる。

＜結論＞

骨盤骨折に対するリハビリテーションの現状をレビューした。荷重プロトコール、性機能障害、精神機能障害、手術手技や術後機能の評価方法について述べた。現状では、統一されたプロトコルは存在しないが、いくつかのコンセンサスはあり、今後の研究により大きな進歩が期待される。

Introduction

The incidence of pelvic fragility fractures among elderly individuals has been on the rise in recent years, prompting discussions on treatment strategies, including conservative approaches. Alexander et al. (*1*) highlighted a notable in-hospital mortality rate associated with conservative management of low-energy pelvic fractures in patients aged over 65 years. Their study underscored a relatively elevated in-hospital mortality rate of 3.28%, particularly pronounced among male patients and those of Asian descent. There is a lack of a standardized rehabilitation protocol for pelvic fracture treatment due to the varying demographics of patients, mechanisms of injury, types of fractures, and treatment modalities. Previous literature has, at times, conflated discussions on pelvic ring fractures and acetabular fractures (intra-articular fractures), or has concurrently addressed high-energy fractures in younger patients alongside fragility fractures in older populations. This article aims to conduct a comprehensive literature review of rehabilitation strategies following pelvic fractures reported up to September 2023, aiming to elucidate the current state of the field.

Materials and Methods

A literature search was conducted using PubMed to identify relevant publications up to

September 2023. Articles published after this date were not systematically included. The search query utilized the terms ("pelvic fracture" OR "pelvic injury" OR "pelvic trauma") AND ("rehabilitation" OR "physical therapy" OR "physiotherapy"). Exclusions applied as of September 2023 were: non-English language, case reports, pediatric fractures, and studies where the primary outcome did not focus on clinical outcomes for pelvic fractures. The search flowchart is presented in Figure 1.

Results and Discussion

A total of 201 papers were initially considered eligible, but after screening based on title and abstract, the number was reduced to 35.

These papers can be classified into six main areas: functional outcomes, locomotion and walking ability, loading protocols, sexual dysfunction, surgical techniques, and psychological and spiritual assessments. It was assumed that there would be few reports with a high level of evidence (*2, 3*).

＜1. Functional outcomes＞

Lefaivre et al. (*4*) conducted a systematic review of functional outcome measures following surgery for pelvic ring fractures, revealing a wide variation in reported scores.

The most frequently utilized scoring system was the Short Form 36 (SF-36). Some studies also employed the Majeed, Iowa Pelvic, Hannover Pelvic, and Orlando Pelvic Scores. They concluded that the existing literature is insufficient to meaningfully guide surgeons or patients regarding the functional outcomes of these fractures after fixation. Kokubo et al. (*5*) investigated factors associated with unsatisfactory short- and long-term postoperative outcomes in 82 patients with unstable pelvic ring fractures. Multiple logistic regression analysis indicated that lower limb fracture (odds ratio (OR): 5.64), conservative treatment (OR: 13.690), and nerve injury (OR: 21.392) were determinants of unsatisfactory short-term functional outcomes. Additionally, nerve damage (OR: 66.926) and ring displacement exceeding 20 mm (OR: 33.944) were found to be determinants of long-term functional outcomes. Standardization of assessment systems, particularly for the elderly, is crucial as short-term postoperative outcomes may carry greater significance.

＜2. Locomotion and walking ability>

Kubota et al. (*6*) conducted a comparative study examining gait analysis and muscle strength measurements in 19 patients with pelvic ring fractures, both at 3 and 12 months postoperatively, in comparison with those of age- and sex-matched healthy controls.

Additionally, a similar study was conducted on 19 patients with acetabular fractures (*7*). Their findings revealed a distinctive gait pattern characterized by lower walking velocity, step length, and cadence, which gradually approached normal levels by the 12-month mark in pelvic ring fractures. Notably, complete recovery was observed in peak hip abduction and ankle plantar flexion moments by the 12-month assessment. In contrast, for acetabular fractures, the majority of kinematic and kinetic variables had returned to control levels by three months post-surgery. However, pelvic forward tilt remained diminished, with abductor muscle strength notably compromised, registering at 64.6% at 3 months and 75.4% at 12 months. Physiotherapy targeting posterior pelvic tilt and abductor muscle weakness was deemed more effective in this context. Moreover, Karin et al. (*8*) noted a reduction in physical activity levels, particularly in long-distance walks, among patients aged 60 years or older with hip or pelvic fractures, three months post-discharge. Interestingly, their study revealed that despite efforts to improve physical activity during inpatient rehabilitation, these gains were not sustained upon returning home.

＜3. Loading protocols＞

The inaugural investigation in this domain was the 2019 Systematic Review led by

Rickman et al. (*9*). They noted the absence of randomized trials addressing postoperative weight-bearing protocols following pelvic fracture surgery, with only one out of 122 papers explicitly addressing this concern. Moreover, over half of the studies documenting functional outcomes failed to detail the postoperative protocols, thereby complicating the interpretation of data. The review asserted that an average partial weight-bearing duration of 8–10 weeks was consistently recommended across varied fracture types and injury severities, with longer durations observed for AO/OTA classification type C fractures. The authors emphasized the paucity of direct evidence available to guide surgical intervention, stating, "It is evident that treating surgeons lack substantial guidance." In a subsequent literature review, Murena et al. (*10*) explored early loading in acetabular fractures. They posited that early postoperative loading might facilitate bony fusion, hasten functional recovery, and expedite the resumption of daily activities. However, they found limited clinical evidence supporting early weight-bearing in pelvic fractures, especially acetabular ones. The authors concluded that further studies evaluating fixation techniques and quality are warranted. They suggested that early loading could be beneficial in acetabular and partially unstable pelvic ring fractures among the elderly, citing reports of full loading commencing at 4 weeks postoperatively, provided pain tolerance. Seo et al. (*11*) documented a 22% compliance

rate with loading restrictions among patients aged over 65, while Pfeufer et al. (*12*) reported near impossibility of partial loading in a cohort with an average age of 84 years. Furthermore, insole-based measurements revealed lower loading in Rommens classification type IV compared to type I, even when full loading was permitted.

For young patients, the most appropriate indication for postoperative management of PF involves a non-weight-bearing period of 6–12 weeks, with early passive mobilization beginning after 15 days. Subsequently, a progressive increase in weight load of approximately 25% per week can be initiated.

While we recognize the widespread use of this protocol, it's important to note that rehabilitation policies may vary on a facility-by-facility basis, and more specifically, on a surgeon-by-surgeon basis.

＜4. Sexual dysfunction＞

In 2014, a prospective study by Katherine et al. (*13*) showed that sexual function and quality of life were significantly reduced one year after a pelvic fracture and that sexual dysfunction was an independent risk factor for reduced quality of life after injury. To the best of our knowledge, this is the first such study. In 2023, the American National Database reported 6174 pelvic fracture patients, including childbirth and sexual

dysfunction. Pelvic fractures have a dramatic impact on the quality of life of women through sexual dysfunction and increase the probability of cesarean sections (*14*). A systematic review of the relationship between pelvic fractures and sexual dysfunction in men and women was conducted in 2021. Florian et al. (*15*) reported that 37% of male patients with pelvic ring fractures developed EDs and that appropriate rehabilitation may prevent a decline in quality of life. Alice et al. (*16*) examined the relationship between pelvic fractures and female sexual dysfunction. Female sexual dysfunction after pelvic fractures ranged from 25% to 62%. There is a need to characterize sexual dysfunction in patients recovering from injury and establish effective treatments through large prospective studies.

＜5. Differences in rehabilitation according to technique＞

Numerous reports have addressed various aspects of this domain. The following are select examples: In 1991, Latenser et al. (*17*) asserted that very early surgical intervention—within eight hours—could potentially decrease hospitalization duration, lower complication and bleeding rates, and enhance survival rates. Nevertheless, ongoing debates persist regarding the optimal timing for surgical intervention. Pradeep et al. (*18*) documented that locking plate fixation for symphyseal disruption proves

efficacious for early loading and boasts a minimal complication rate.

Breann et al. (*19*) reported a higher frequency of fixation failure in vertical shear-type pelvic ring fractures (AO/OTA 61C1) in the group treated with a single transsacral (TS) screw. However, no failures were observed in sacroiliac joint dislocations using similar fixation techniques. In recent years, some reports have described LC1-type fractures according to the Young-Burgess classification. Historically, conservative treatment has been utilized; however, even in a patient population with an average age of 45 years, conservative treatment for unstable fractures has been shown to prolong the time to independent walking and return to work (*20*). Min et al. (*21*) reported that the INFIX technique performed better than conventional cannulated screws (CCS) for anterior fixation of LC1 fractures in elderly patients. There were no differences observed in the length of hospital stay or complications, and early loading was feasible. A TULIP study protocol has been registered to evaluate the advantages and disadvantages of conservative treatment for unstable LC1 fractures (*22*). Oda et al. (*23*) reported favorable outcomes using the ability to reposition on the bed and transfer to a wheelchair, regardless of the fracture type, and the ability to commence gait training within three weeks as criteria for surgical treatment. This study might offer a reasonable treatment strategy, although attention should be given to the potential exacerbation of

fractures.

＜6. Psychological and Spiritual Assessments>

A comprehensive rehabilitation program is essential in the postoperative management of pelvic fractures, and psychological support is equally crucial (*24*). According to a systematic review by Muscatelli et al., which examined 7109 adult patients following pelvic trauma, 32.6% experienced depression, and 26.6% suffered from PTSD (*25*). In a prospective study, McMinn et al. found that PTSD, depression, alcohol dependence, and pain scores showed poor recovery even 12 months after injury (*26*).

Two studies have investigated rehabilitation interventions and their assessment concerning fear of falling (*27, 28*). Kampe et al. presented a unified intervention protocol in their study and implemented it. The protocol comprises six steps: 1) relaxation, 2) engagement in meaningful activities and mobility-oriented goals, 3) addressing fall-related cognition and emotions, coping strategies for high-risk tasks and situations, 4) personalized exercise programs, 5) planning and execution of exercises and activities, and 6) identification of fall risks and hazards. This intervention follows a sequential process spanning two months, involving both telephone interviews and in-person visits. The study reports the outcomes of the intervention. In the field of nursing

science, the significance of comprehensive mental health care has been highlighted, with active participation in social activities deemed crucial (*29*). It is anticipated that numerous future studies will explore this topic from various angles.

Conclusion

The current status of rehabilitation for pelvic fractures was reviewed. Although there were few high-quality reports, some degree of consensus was identified. Early surgery to ensure bony stability may be useful as a way of preventing a decline in ADL, particularly in older patients, who may have difficulty with partial loading. Sexual and mental dysfunction, often seen as a complication, has a significant impact on the patient's quality of life. Physicians treating pelvic fractures need to be aware of total management, and multidisciplinary team care can be an important factor in improving outcomes. Future large-scale studies using uniform standards for surgical technique and functional assessment are essential. Consequently, treatment approaches must evolve to meet contemporary needs. Although standardised protocols are currently lacking, it is hoped that significant advances will be made in the future through extensive, high-quality research.

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Conflict of interest: We have no commercial associations (e.g., consultancies, stock ownership, or equity).

interest, patent/licensing arrangements), which might pose a conflict of interest in connection with the submitted article.

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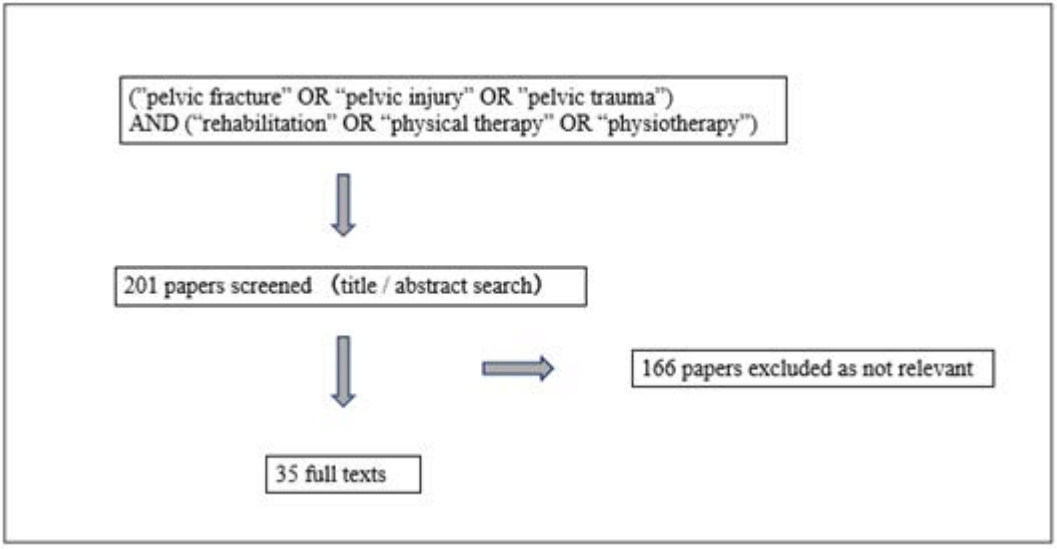
Figure legends

Fig. 1 Document retrieval.


("pelvic fracture" OR "pelvic injury" OR "pelvic trauma")
AND ("rehabilitation" OR "physical therapy" OR "physiotherapy")
201 papers screened (title / abstract search)
166 papers excluded as not relevant
35 full texts