Comparison And Analysis of Treatment Strategies for Radius Fractures: Internal Fixation Surgery Versus External Plaster Fixation Treatment

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Abstract. One of the most frequent forms of fractures is the radius fracture. This kind of fracture would have a significant negative impact on people's lives. There has been ongoing debate regarding the treatment options for radius fractures. This article conducts a comparative analysis of two treatment approaches for radius fractures: internal fixation surgery and non-surgical external plaster fixation treatment. This article provides a comprehensive elucidation and analysis of the principles, actual treatment outcomes, and various factors associated with these two treatment approaches. It separately outlines the treatment principles and real-world results for each of the two treatment methods, concluding with a summary and comparison. When viewed from a singular perspective, both treatment approaches demonstrate reasonable and excellent treatment outcomes. However, when these two approaches are compared, this article finds that surgical internal fixation typically outperforms non-surgical cast external fixation in a broader range of evaluations.

Keywords: Radius fracture; internal fixation; plaster; surgery.

1. Introduction

Wrist fractures are among the most prevalent types of fractures, often occurring due to falls or high-intensity physical activities. These fractures typically involve the wrist bones, including the carpal, radius, and ulna bones, exerting a significant impact on an individual's daily life. Different types of fractures necessitate tailored treatment strategies. For severe, complex, or fractures located in critical anatomical regions of the wrist, surgical intervention has emerged as a pivotal means of restoring bone structure and function.

Over years of research, the technique for handling acute radius fractures is now more advanced. However, there still exist some issues regarding the manner in which radius fractures are addressed, such as the requirement for individualized care, including the development of individualized treatment plans based on patient characteristics, and the necessity for long-term follow-up assessments to gauge treatment efficacy, as well as considerations for quality of life during recovery, among other factors.

To minimize the adverse impact of radius fractures, appropriate treatment is imperative. An overview of treatment options for radius fractures holds substantial clinical and academic significance. This study seeks to provide rational decision-making choices, thereby driving further research and enhancing public awareness regarding the treatment of radius fractures.

This paper aims to explore and compare treatment modalities for radius fractures: non-surgical treatment, involving cast immobilization, and surgical treatment, specifically internal fixation surgery. This article will offer detailed insights into the principles, indications, treatment outcomes, advantages, and limitations of these two approaches. Through a comprehensive analysis of existing research and clinical practice, this paper endeavors to furnish readers with a comprehensive understanding, aiding them in comprehending the pivotal roles of non-surgical and surgical treatments in radius fracture management. By delving deep into these methods, this paper aspires to provide clinical practitioners and patients with more precise treatment options, thereby achieving enhanced rehabilitation outcomes.

2. Internal Fixation

Despite the fact that the evolution of these devices has been rather slow, internal fixation has emerged as a cornerstone of surgical specialties [1]. The primary objective of this surgical procedure is to stabilize and maintain the correct alignment of fractured bone segments by affixing specialized metallic instruments at the fracture site, thereby promoting fracture healing. Following the completion of the internal fixation surgery, the surgical incision is closed using sutures or other wound closure techniques to ensure proper wound healing postoperatively. Research indicates that internal distraction plating on the radiocarpal is an effective tool for comminuted distal radius fractures. This technique allows for the recovery of fracture inclination and width, making it particularly valuable for high-risk patients prone to fracture collapse and loss of reduction, furthermore, patients with multiple injuries can gain from early forearm loading exercises [2].

2.1. Principle

The principle behind internal fixation surgery is to realign the fractured bone segments to their correct positions, thereby restoring the normal anatomical structure of the bone. This step is crucial for ensuring fracture healing and functional recovery. It also provides stability to the fracture site. By introducing metallic instruments such as metal plates, screws, nails, or metal wires at the fracture site, these instruments securely fix the fracture segments together. This stability helps prevent displacement of the fracture segments, thereby facilitating fracture healing. This surgical technique aims to precisely reposition the fractured bone segments, creating an environment conducive to the body's natural healing processes. The introduction of these specialized metallic devices plays a pivotal role in stabilizing the fractured bone, allowing for a controlled and favorable healing response. At the same time, internal fixation allows the wound cut to be smaller than other treatments [3].

2.2. Outcome and Effect

Internal fixation surgery is typically employed for severe or complex distal radius fractures to ensure proper healing and restoration of wrist and hand function, such as open fractures and comminuted fractures. However, in some cases, internal fixation surgery may not be warranted. For instance, in the case of relatively simple and stable distal radius fractures, physicians may opt for conservative treatment methods like cast immobilization instead of surgical intervention.

Internal fixation surgery has shown positive treatment outcomes in the management of distal radius fractures, including shortened healing time, functional recovery, reduced risk of complications, and improved quality of life [2, 4, 5]. This surgical approach can enhance the overall quality of life for patients by promoting quicker recovery, functional restoration, and a lower likelihood of complications. Internal fixation surgery, such as the use of fixed-angle screws and volar plates, is appropriate for older patients. This occurrence is especially pronounced among female patients with distal radius fractures, where 85% of female patients have low bone mineral density which is BMD, and 51% suffer osteoporosis [4]. Whereas biological internal fixation provides superior outcomes, it is only applicable while there is live bone. [5]. Traditional internal fixation surgery typically allows for prolonged protection and internal remodeling in cases of severely aged blood supply or bone necrosis at the fracture site. When conditions such as blood supply are favorable, biological internal fixation can be a more prudent approach, aiding in shortened healing times and improved overall medical quality. In addition to retaining the advantages of external fixation, internal fixation surgery permits long-term treatment. The judicious use of internal fixation surgery can significantly reduce healing time [5].

Internal fixation surgery could also have a high healing quality. Internal fixation offers improved restoration of forearm supination and volar tilt. Research involving a total of 750 patients has underscored these advantages. revealing that Volar plates which are secure yielded greatly improved results as stated by the patient versus external fixation [6]. Furthermore, internal fixation demonstrated notably superior results in terms of forearm supination recovery and volar tilt

restoration [6]. The application of fixed-angle steel plates for stabilizing distal radius fractures with unstable dorsal displacement has demonstrated the provision of adequate stability while minimizing the loss of reduction. Data on 114 patients with an age range of 17 to 79 years and a minimum monitoring time frame of 12 months are provided. There were almost 90% outcomes are excellent and good. At the last check-in, grip strength had reached 70% on the unharmed side. Most medical clients reported low residual wrist pain, the DASH (Arm, shoulder, and hand impairments) score had an average of 13 points (ranging from 0 to 39 points). this surgery was successfully achieved in all patients. Notably, there was a mean loss of 3.4 degrees in palmar tilt (ranging from 0 to 8 degrees), and 0.4 degrees in radial inclination (ranging from 0 to 2 degrees), with an ulnar variance of 1.2 mm (going from zero to six millimeters). Complication rates were 27% overall, affecting 31 out of the 114 patients [7].

However, internal fixation surgery for medical care of fractures of the distal radius also comes with drawbacks. Placing the palmar plate too distally can negatively affect the system for flexor tendons, screws may the extensor compartment, and in comminuted fractures, distal screws may traverse the subchondral bone and puncture the radiocarpal joint. Thus, unsteady fractures of the distal radius cannot be adequately addressed using single-plate technology and methodology [7].

3. Plaster Fixation

Gypsum external fixation is also one of the treatment options for fractures. It is a relatively simple and common approach to fracture management. This method involves immobilizing the fractured bone segments in the correct position to facilitate healing. Gypsum treatment typically requires maintenance throughout the entire healing period, during which patients are required to severely restrict the use of the injured area.

3.1. Principle

The principle of plaster treatment is based on the fundamental physiological principles of fracture rehabilitation, aiming to provide stability and support to the fractured site, thereby promoting fracture healing. Plaster is a rigid external material that is wrapped around the injured limb or the site of the fracture. Its primary function is to supply the necessary stability and support to the fractured area. By limiting the movement of the injured site, plaster can prevent further displacement or misalignment of the fracture segments. Plaster treatment restricts the mobility of the fractured area, reducing the risk of additional injury and providing an environment conducive to healing. This immobilization is essential for the restoration of bone integrity. Throughout the healing process, the plaster cast maintains the alignment of the fractured bones, ensuring that they heal in their correct anatomical position. In summary, plaster treatment, through its stabilizing and supportive properties, plays a crucial role in facilitating fracture healing. It creates an environment that minimizes movement at the fracture site, reducing the risk of further damage and contributing to the recovery of bone integrity. This approach, although relatively straightforward, remains an effective treatment choice for various types and degrees of fractures.

3.2. Outcome and Effect

Regarding the effectiveness and outcomes of plaster immobilization treatment, this traditionally conservative approach exhibits a relatively lower DASH score compared to surgical treatments, demonstrating its advantages [8].

The simplicity and effectiveness of the plaster cast treatment make it a suitable choice. According to experimental data from the treatment of 74 cases (77 sides) of unstable distal radius fractures using three different methods: manual reduction with plaster external fixation, fixing from the outside with a fixator, and open reduction with internal fixation of a plate, there were a total of 41 cases treated with plaster. The results were assessed based on wrist joint function evaluation using the Sarmiento criteria. In the plaster cast external fixation group, the excellent and good rate was 88.6% [9].

The plaster cast treatment approach also provides good stability for distal radius fractures. An experiment involving 103 patients with fractures of the distal radius who all underwent plaster cast treatment was conducted. The post-cast removal radiographic outcomes were categorized as acceptable or unacceptable using the Lidstrom scoring system. Subsequently, the Pearson Chi-Square test, likelihood test, and Kendall correlation analysis were applied to assess the radiographic outcomes for different Cooney types. The results showed an acceptance rate of nearly 70%. This experiment demonstrates that conservative treatment can yield favorable outcomes for most distal radius fractures, especially for Cooney types 1, 2, and 3. Therefore, the preferred treatment option should involve manual reduction followed by plaster external fixation [10].

Based on a foundation of plaster-based treatment, along with manual reduction techniques and the application of pharmaceutical agents, this therapeutic regimen demonstrates its efficacy in managing complex cases of radius fractures. A follow-up study was conducted involving 12 patients over a period of 6 months to 1 year, during which all patients exhibited a complete restoration of normal wrist appearance. The assessment of therapeutic outcomes was categorized as Excellent: Complete elimination of wrist pain and symptoms, restoration of normal functionality, and radiographic evidence of a well-aligned reduction. Good: Occasional wrist pain with mild restriction of joint function, along with evidence of a well-aligned reduction on X-rays. Poor: Persistent wrist pain during movement, significant impairment of joint function, impacting daily life and work, with X-ray evidence of fracture displacement and signs of osteoarthritis.

It is worth noting that during subsequent follow-ups, the success rate of this treatment protocol reached an impressive 91.7% [11].

4. Outcome Comparison

The treatment of fractures can typically be categorized into two common approaches: internal fixation surgery and external fixation non-surgical treatment, with a significant distinction being that the former involves a surgical procedure, while the latter does not.

When each of these methods is applied separately, they often yield excellent treatment outcomes, and differences may emerge in certain treatment assessments. However, when comparing these two treatment approaches simultaneously, this study has found that internal fixation surgery tends to exhibit more convincing treatment results in overall aspects compared to plaster cast treatment.

Research has shown that among 92 patients with radius fractures, both internal fixation surgery and external plaster fixation treatment were applied. Analyzing from the perspective of DASH (Arm, shoulder, and hand impairments) scores, it was evident that the internal fixation treatment category had significantly lower scores contrary to an organization utilizing external plaster fixation. This suggests that the former achieved better results in terms of functional recovery and symptom relief. Furthermore, at all intervals afterward, internal fixation surgery consistently demonstrated superior treatment outcomes compared to external plaster fixation [12]. Therefore, it can be concluded that when patients are faced with the choice between internal fixation surgery and external plaster fixation, opting for internal fixation surgery often proves to be the better choice. In another set of experiments, the authors further delineated the differences and advantages between internal fixation surgery and external plaster fixation treatment in radius fractures by assessing various indicators such as the wrist joint's active range of motion, discomfort, arbitrary assessment, Gartland and Werley scores, Batra radiological scores. The group receiving surgical therapy included 16 men and 32 women, ranging in age from 22 years old to 76 years old. The conservative treatment group included 10 men and 27 women, aged 42 to 79 years with an average age of 51.12 years. The final treatment outcomes revealed that for surgically indicated problematic distal radius fractures, surgical treatment outperformed manual reduction and external plaster fixation in various outcome measures [13].

5. Conclusion

Different experiments and research data have demonstrated that both internal fixation surgery and external plaster fixation treatment have their respective advantages and drawbacks. When comparing the two, this article found that in terms of treatment effectiveness, internal fixation surgery generally outperforms external plaster fixation across various aspects. However, external plaster fixation remains an excellent treatment modality as some studies have shown its effectiveness, particularly in managing complex radius fractures where internal fixation surgery may be less effective. Therefore, when considering different treatment options, internal fixation is often a preferred choice, but the potential benefits of external plaster fixation for certain fracture types should not be overlooked.

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