

Tertiary prevention strategies for the elbow dislocation

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Abstract. The elbow joint is one of the most complex joints in the human body, playing a crucial role in coordinating movements between the shoulder, forearm, and wrist, with functions including flexion, extension, and rotation. Elbow dislocation is a common yet serious injury, causing significant discomfort and increasing economic burden for patients in their normal work and daily life. With a deepening understanding of the condition, an increasing number of scholars recognize the importance of comprehensive management focused on prevention. This paper, integrating concepts and principles of tertiary prevention from preventive medicine, provides an overview of common causes, diagnostic methods, and preventive measures for this condition. Early diagnosis and intervention are emphasized to offer healthcare workers a theoretical basis for action. Through multi-dimensional, multi-system preventive measures, the occurrence rate of elbow dislocation can be reduced, improving clinical treatment outcomes and enhancing disease prognosis, so that to improve patients' quality of life.

Keywords: Elbow joint, dislocation, tertiary prevention

1. Introduction

The elbow is the second most commonly dislocated major joint in adults, it is usually caused by trauma or sports injury. As one of the most critical and complex joints of the human upper limb, the elbow joint plays an important role in daily activities and sports. However, when the joint is subjected to external forces or twisted, it can lead to dislocation of the elbow joint, which can trigger severe pain, swelling and dysfunction. Elbow dislocation comprising 11% to 28% of all elbow injuries, with an annual incidence rate of 5.21 per 100,000 [1]. Although surgical reduction can be a good treatment for severe elbow dislocation, it has some disadvantages such as large iatrogenic injury, long recovery period and heavy economic burden. Therefore, prevention is important. The best way is to prevent elbow dislocation from happening and getting worse. Tertiary prevention is a concept in the field of public health [2]. Among them, primary prevention, also known as etiological prevention, is a preventive measure taken against the risk factors of the disease, that is, prevention before the disease. The Secondary prevention, also known as preclinical prevention, focuses on early detection, diagnosis and treatment of the disease as far as possible, and is the main measure to prevent the development of the disease. Tertiary prevention, also known as clinical prevention. Mainly to prevent complications and recurrence of the disease. There is no research on the application of tertiary prevention in the prevention of elbow dislocation, so this paper will apply tertiary prevention to study the prevention of elbow dislocation before disease, prevent deterioration and prevent recurrence.

2. Primary prevention of elbow dislocation

Primary prevention, also known as etiological prevention, is a preventive measure taken against the risk factors of the disease, that is, prevention before the disease. Controlling risk factors is the core of prevention and treatment of elbow dislocation. This section will discuss the high-risk groups, high-risk activities and preventive measures of elbow dislocation.

2.1. High-risk population and high-risk activities

2.1.1. High-risk population. High-risk groups for elbow dislocations include younger age groups, particularly those aged from 10 to 19, who are most susceptible to such injuries due to the strong elasticity of their joint capsules and ligaments [3]. Additionally, older women are at increased risk, attributed to decreased estrogen levels, which can lead to osteoporosis, reduced muscle strength, and laxity of joint ligaments. All of which increase the risk of elbow dislocation. Furthermore, individuals with a previous history of dislocation are also at higher risk due to residual ligament injury, hyperlaxity, and poor reduction quality following the initial dislocation [4].

2.1.2. High-risk activities. For men, the highest risk activities for elbow dislocation is soccer, while for women it is gymnastics. The reason for this is the possibility of collisions in soccer, landing with extended arms and feet, and strong contact with an opponent or the ground, all of which increase the risk of elbow dislocation. Gymnasts are prone to serious fractures and dislocations due to elbow hyperextension [4]. Therefore, the high-risk groups discussed above, namely the young group of 10 to 19 years old and the elderly group of women and people with a history of dislocation need to be extra careful about elbow injuries in daily life, work and sports to prevent dislocation. In addition, you need to be extra careful when playing physically confrontational sports such as football, and sports such as gymnastics that often overstretch or twist your arms.

2.2. Preventive measure

2.2.1. Reduce movements that injure the elbow. When performing daily activities or sports activities, improper postures and movements with excessive extension and stress should be avoided to reduce the adverse impact on the elbow joint. During daily activities and sports, if a posture or movement causes pain or discomfort in the elbow, attention should be paid to stop or reduce the posture or movement. In sports, correct movement skills and posture are essential to prevent elbow dislocation, and professional guidance and timely correction of wrong movements should be received when exercising.

2.2.2. Warm up before exercise. Warm-up before exercise is one of the important measures to prevent elbow dislocation. By performing proper warm-up activities, you can increase the flexibility of your muscles and ligaments, improve joint flexibility and stability, and reduce the risk of injury during exercise. It is recommended to fully warm up the body before exercise, especially for the muscle groups around the elbow joint with appropriate stretching and activity.

2.2.3. Accentuation training. Through targeted training of the muscle groups around the elbow, muscle strength and stability can be increased to reduce the risk of elbow injury. Common elbow exercises include strengthening the flexor, extensor and pronator muscles. As well as improving overall body stability through balance training and core stability training to prevent elbow dislocation caused by falls.

2.2.4. Use of protective gear. When performing high-risk sports or activities, it is recommended to wear appropriate protective gear, such as elbow pads. A protective gear can provide additional protection and support to the joints and muscles, reducing the risk of elbow injury. Choosing the right protective gear and ensuring that it is worn correctly can give full play to the protective effect of the protective gear and reduce the risk of elbow dislocation.

In summary, comprehensive preventive measures can be taken to prevent elbow dislocation, including reduce movements that injure the elbow, warming up before exercise, strengthening muscle training and using appropriate protective gear.

3. Secondary prevention of elbow dislocation

Secondary prevention is also called preclinical prevention. The early detection, diagnosis, and treatment of elbow dislocation are the primary measures to prevent the worsening of the condition during the onset of elbow dislocation. This section will discuss the diagnosis and treatment of elbow dislocation.

3.1. Diagnosis

To accurately diagnose elbow dislocation, healthcare professionals employ various methods and techniques. This section will delve into the diagnostic process, including the examination, imaging tests, and other assessments that aid in determining the extent of elbow dislocation and any associated injuries.

3.1.1. Physical Examination. During the diagnostic phase of elbow dislocation, physical examination is always the first step. Experienced medical professionals can gain a basic understanding of the extent of elbow joint injury solely through physical examination. This method is rapid and cost-effective. During the physical examination, a healthcare provider will carefully assess the affected elbow to determine the type and severity of the dislocation. The medical professional will observe the elbow for symptoms like visible deformity, swelling, discoloration, and tenderness. They will also evaluate the range of motion in the joint and check for any associated fractures or ligament damage. The patient's medical history and the circumstances surrounding the injury will be taken into account during this evaluation. However, in many cases, a physical examination alone cannot accurately diagnose more complex injuries and dislocations, so further diagnosis by other means is required.

3.1.2. X-rays. X-ray is a common and important means of diagnosis of elbow dislocation, and when the physical examination cannot be accurately diagnosed, X-ray is an effective method of further examination, it provides detailed images of the bones and joint alignment. It can reveal any dislocation in the elbow joint. But X-rays have limitations. In the diagnosis of elbow dislocation, we also need to know the condition of muscles and ligaments near the elbow in many cases, and X-ray can only show the image of the bone but cannot provide the image of soft tissues such as muscles and ligaments, so sometimes X-ray can not understand the injury caused by elbow dislocation in detail.

3.1.3. CT Scans. CT scans use a combination of X-rays and computer technology to create cross-sectional images of the bones and soft tissues, this makes up for the lack of X-rays showing soft tissue. This imaging technique is particularly useful when assessing complex elbow dislocations, as it allows for a more comprehensive evaluation of the joint, including the evaluation of fractures in multiple planes. CT scans can help guide treatment decisions and provide valuable information for surgical planning. But The X-ray radiation dose of CT scans is much higher than that of traditional X-ray examinations, often tens to hundreds of times higher. And CT scans typically obtain cross-sectional images, which often cannot display the overall structure of organs and lesions. The application of CT three-dimensional display technology can overcome this limitation, but it increases post-processing time. While CT scans provide detailed cross-sectional images, they may not always provide the same level of resolution as other imaging modalities, such as MRI, especially for soft tissues.

3.1.4. MRI. Magnetic resonance imaging (MRI) may be utilized when there is suspicion of soft tissue damage, such as ligament or tendon tears. Unlike X-rays or CT scans, MRIs use a strong magnetic field and radio waves to create detailed images of the soft tissues in the body. These images can help identify any tears or disruptions in the ligaments, tendons, and other structures around the elbow joint. MRIs are especially beneficial in cases where the physical examination and X-rays do not provide a complete picture of the injury or when surgical intervention is being considered. However, MRI scanning requires

patients to remain still in a confined space for an extended period, which may be challenging for some patients such as children and individuals with claustrophobia. Additionally, MRI cannot be used for patients with metallic implants inside their bodies.

3.1.5. Arthroscopy. When X-ray examinations, CT scans, and MRI fail to accurately diagnose elbow dislocation, arthroscopic surgery can be employed. Arthroscopy is a minimally invasive diagnostic procedure that can be used to visualize the inside of the elbow joint. During this procedure, a small camera called an arthroscope is inserted through tiny incisions in the skin. Arthroscopy transmits real-time images of the joint to the detector, providing more intuitive and detailed information, assisting healthcare professionals in assessing internal structural damage of the elbow joint [5]. It can help identify any loose fragments, assess ligament integrity, and determine if additional surgical intervention is necessary. However, despite being minimally invasive, arthroscopic surgery still causes some degree of trauma. Like any surgical procedure, arthroscopic surgery carries inherent risks such as infection, nerve or blood vessel damage, and persistent pain or stiffness. Additionally, arthroscopic surgery is costly.

3.1.6. Other Assessments. Apart from the above-mentioned imaging tests, healthcare professionals may conduct additional assessments to evaluate nerve function, blood flow, and overall joint stability. Nerve conduction studies or electromyography can be performed to assess any nerve damage or compression. Doppler ultrasound or angiography may be ordered to evaluate blood vessel status in case of suspected complications. These additional assessments provide a comprehensive evaluation of the elbow joint and surrounding structures, aiding in a more accurate diagnosis.

In conclusion, the diagnosis of elbow dislocation involves a combination of physical examination, X-rays, CT scans, MRI, arthroscopy, and other assessments as deemed necessary. This multi-faceted approach ensures a thorough evaluation of the affected joint, allowing healthcare professionals to determine the extent of the dislocation, identify any associated injuries, and devise an appropriate treatment plan. Timely and accurate diagnosis is essential to facilitate effective management and optimize the outcomes for patients with elbow dislocation.

3.2. Treatment

Elbow dislocation is a serious injury that requires immediate treatment. Following a series of diagnostic measures, once diagnosed, initiating the correct treatment early can greatly assist in restoring function and alleviating pain. The choice of treatment depends on the severity of the dislocation and any accompanying injuries. This section will discuss various treatment options for elbow dislocation.

3.2.1. Closed Reduction. The first treatment method for elbow dislocation is typically closed reduction. This non-surgical technique involves manipulating the bones back into their normal position without making an incision. Muscle relaxation is necessary during the elbow reduction process. To minimize patient discomfort, closed reduction typically needs to be performed under anesthesia or sedation. An intra-articular lidocaine injection may be used to assist in reduction and may reduce the need for sedation or general anesthesia. Fluoroscopic imaging can be used to guide the reduction and to assess stability after the reduction.[1] The integrity of the lateral periosteal hinge and elbow capsule is the anatomic basis of a successful closed reduction [6]. Once successfully reduced, splints, casts, or braces will be used to immobilize the elbow, promoting healing and preventing re-injury. The immobilization period may vary based on the individual case, ranging from a few weeks to several months. During this time, the patient is advised to avoid any activities that could potentially re-injure or further damage the joint. Another study has shown that after closed reduction followed by short-term splinting and early motion therapy, the outcomes are good and can be maintained in the long term [7]. Compared to immobilization in a cast, early functional treatment yields superior clinical outcomes. However, the long-term results of proper early movement and immobilization in a cast are comparable, with early movement enabling patients to return to work sooner [8].

3.2.2. Surgery. In some cases, closed reduction may not be successful, or there may be other complex situations and complications, such as fractures, ligament tears, and nerve injuries. The proportion of complex elbow dislocations accompanied by fractures is approximately 26% [9]. In these situations, surgical intervention is necessary. Surgical approaches can vary depending on the specific condition of the elbow joint. One common surgical procedure is open reduction, wherein an incision is made to directly access the joint. The surgeon then carefully repositions the bones and repairs any associated injuries. The joint may be stabilized using screws, plates, wires, or other fixation devices. Alternatively, in cases where there are severe fractures or extensive soft tissue damage, the surgeon may opt for a reconstructive procedure such as ligament repair or replacement [1]. This type of surgery aims to restore stability and functionality to the joint, often involving the use of grafts or synthetic materials. Following surgery, a period of immobilization is typically required to allow for proper healing. Physical therapy and rehabilitation exercises will be prescribed to help regain range of motion, strength, and flexibility in the elbow. A retrospective, single-center study was conducted on 44 athletes aged 16 to 65 with a history of elbow dislocation (injury occurred at least 2 years prior, with 29 patients undergoing surgical treatment). The patients were followed up for at least 2 years (mean 7.6 years). The results showed that nearly all patients resumed some form of sports activity, but only 81.8% of them achieved a full recovery to their pre-injury level. The average time to return to sports was 21.7 weeks. There was no significant difference in the time to return to sports between surgical and non-surgical treatments, with similar outcomes observed [10].

3.2.3. Bracing, Cast and Splinting. Whether closed reduction or surgical reduction, fixation of the elbow joint is generally required after reduction to provide support and stability during the healing process. The process often uses casts, braces and splints. These devices help maintain the correct alignment of the bones and protect the joint from further injury. Bracing and splinting may be used in conjunction with other treatments, such as physical therapy, to optimize recovery. The specific type of brace or splint used will depend on the severity of the dislocation and the individual patient's needs. Custom-made braces can provide a personalized fit and better control of joint movement. It is essential to follow healthcare professional guidance on when and how long to wear the casts, brace or splint.

3.2.4. Physical Therapy and Rehabilitation. Following either closed reduction or surgical treatment, physical therapy plays a crucial role in the recovery process. Early intervention with physical therapy can help prevent stiffness, improve strength, and restore normal function of the elbow joint. Physical therapy typically begins with gentle range-of-motion exercises to gradually increase mobility in the joint. As the healing progresses, strengthening exercises are introduced to rebuild the muscles surrounding the elbow. The therapist may also incorporate manual techniques, such as joint mobilization or soft tissue massage, to aid in the recovery process. Throughout the rehabilitation process, patients are advised to follow a prescribed exercise program. Compliance with therapy recommendations and guidelines is essential to achieve optimal recovery and prevent long-term complications.

4. Tertiary prevention of elbow dislocation(rehabilitation and prevention of recurrence after elbow dislocation)

Tertiary prevention, also known as clinical prevention, targets individuals already suffering from elbow dislocation, aiming to minimize the damage caused by the disease and prevent its recurrence.

Recovering from an elbow dislocation can be a challenging process. The aim of rehabilitation is to restore the normal range of motion, strength, and function of the elbow joint. This section will discuss the various aspects of rehabilitation and the steps involved in the recovery process.

Range of motion exercises play a crucial role in preventing stiffness and maintaining flexibility. It is important to start these exercises under the guidance of a qualified healthcare professional.

Passive range of motion exercises involves using external forces to move the elbow joint without activating the muscles around it. These exercises could include gentle flexion and extension of the elbow, as well as pronation and supination of the forearm [11]. Gradually, as pain and swelling decrease, active

range of motion exercises can be introduced. These exercises involve actively contracting the muscles to move the joint through its range of motion.

4.1. Strengthening exercises

As the range of motion improves, strengthening exercises become an integral part of the rehabilitation process. Strengthening exercises help to restore the muscle power and stability around the elbow joint. Strengthening exercises may initially focus on the muscles of the forearm, such as wrist flexors and extensors, as they play a crucial role in elbow stability.

Exercises such as wrist curls, wrist extensions, and grip strengthening exercises can gradually be incorporated into the rehabilitation program. As the patient progresses, more advanced exercises targeting the muscles around the shoulder and upper arm, such as bicep curls and tricep extensions, can be added.

4.2. Prevention of recurrent elbow dislocation

The high-risk population for elbow dislocation includes individuals with a history of elbow dislocation because it often results in decreased stability of the elbow joint [4]. Therefore, prevention of recurrent dislocations is especially crucial after an initial dislocation.

Prevention of recurrent elbow dislocation shares many similarities with the prevention strategies discussed earlier, including minimizing actions that may injure the elbow, warming up before activities, strengthening exercises, and using protective gear. Additionally, regular check-ups and follow-up appointments after treatment for elbow dislocation are particularly important. The risk for redislocation has been described to be slightly lower in those undergoing early mobilization (1.3%) than in those undergoing short-term immobilization (2%), further confirming the superiority of early mobilization-based treatment [12].

5. Conclusion

In September 2015, the General Office of the State Council issued guidance on promoting the construction of a hierarchical medical system. The guidance explicitly emphasized the need to significantly enhance the capacity of primary healthcare services, implement a hierarchical diagnosis and treatment model featuring primary-level initial diagnosis, two-way referral, treatment differentiation between acute and chronic conditions, and coordinated linkages between different levels of healthcare institutions. With the continuous development and progress of society, and the significant improvement in people's living standards, factors such as the booming automotive and construction industries have led to a gradual increase in the incidence of fractures. Among them, elbow dislocation is a common yet serious injury, which predominantly affects the young and middle-aged population, causing inconvenience and pain in their daily lives and work, necessitating active prevention. Prevention is the most economical and effective health strategy.

This paper explores the three-level prevention of elbow dislocation and finds that timely prevention and intervention can effectively control the incidence, exacerbation, and recurrence rates of elbow dislocation to a certain extent. However, there is currently a lack of specific research on the correlation between the prevention of elbow dislocation and its outcomes. Future efforts should focus on developing interventions from multiple perspectives and validating them in multi-center, large-sample populations to further improve the management and prevention of elbow dislocation.

Simultaneously, reducing the incidence and recurrence of elbow dislocation requires joint efforts from various parties, including increasing the dissemination of prevention knowledge and health education, as well as promoting targeted screening for the entire population.

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