Proceedings of the 5th International Conference on Modern Medicine and Global Health
DOI: 10.54254/2753-8818/2027.39259

Risk Factor, Diagnosis and Preventive Measures for Shoulder Rotator Cuff Injury

Haoyuan He[1,*], Xiaoke Wang[2]

[1]*Department of Medical Technology, Tianjin University of Traditional Chinese Medicine, Tianjin, China*
[2]*Department of Physical Education, Liaoning Technical University, Fuxin, China*
**Corresponding Author. Email: hhy050604@outlook.com*

Abstract. Shoulder rotator cuff injury is one of the key topics in the field of sports medicine and orthopedics today. Researchers mainly focus on the treatment of shoulder rotator cuff injury, and there is still a lack of unified arrangement on how to prevent it. Therefore, this article aims to analyze the high-risk factors, such as age factors, occupational factors and exercise factors, for the purpose of preventing shoulder rotator cuff injury; at the same time, it combing diagnostic evaluation methods, including clinical symptoms, self-test experiments and imaging examinations; through exercise training and physical therapy assistance, it finally establishes the diagnosis of risk factors for shoulder rotator cuff injury. The standardized process of preventive measures. This article can provide multi-dimensional reference for the prevention of shoulder rotator cuff injury, but there are still problems that have not been solved. For example, the difference in the preventive effect of the joint implementation of multiple preventive measures compared with a single measure is not yet clear. Future research should focus on the direction of joint prevention and carry out high-quality research to optimize the prevention strategy.

Keywords: Shoulder rotator cuff injury, high-risk factors, diagnosis assessment, prevention, physical agents

1. Introduction

First of all, the shoulder rotator cuff is a "sleeve-like" tissue composed of tendons from the supraspinatus muscle, infraspinatus muscle, subscapularis muscle and teres minor muscle, and the shoulder rotator cuff injury is one of the main causes of shoulder joint activity and dysfunction, including tendonitis, partial tear and full-layer tear. The symptoms after injury are manifested as nocturnal pain, limited mobility and muscle. The decline in strength seriously affects the quality of life of patients. Studies have shown that shoulder rotator cuff injury has become the third most common musculoskeletal disease, accounting for about 17-41% of all shoulder joint diseases [1]. In addition, the Chinese Shoulder rotator cuff Injury Diagnosis and Treatment Guide 2025 Edition points out that shoulder rotator cuff injury is especially common in people over 50 years old (the incidence rate is about 15-30%), and it can be as high as 40% in people over 70 years old [2].

© 2026 The Authors. This is an open access article distributed under the terms of the Creative Commons Attribution License 4.0 (https://creativecommons.org/licenses/by/4.0/).

DOI: 10.54254/2753-8818/2027.39259

Relevant studies point out that professional athletes, repetitive shoulder activities and middle-aged and elderly people are high-risk groups [3]. Therefore, early prevention is particularly important. Mastering preventive measures in advance can not only reduce the incidence but also reduce pain and dysfunction. By carrying out risk assessment for high-risk groups, reasonably controlling shoulder load and strengthening shoulder rotator cuff muscle group training, the occurrence of shoulder rotator cuff injury can be effectively reduced.

At present, the treatment of shoulder rotator cuff injury is mainly divided into non-surgical treatment and surgical treatment. Non-surgical treatment mainly includes physical therapy, exercise therapy, traditional Chinese medicine treatment and drug treatment; surgical treatment mainly includes arthroscopic treatment. The former is suitable for clinically small-scale and non-acute shoulder rotator cuff injury, and the latter is suitable for patients with large-scale and acute shoulder rotator cuff injury. The problem is that the non-surgical treatment method mainly focuses on relieving symptoms, such as pain, limited mobility and decreased muscle strength, but cannot repair structural damage, and the trauma of surgical treatment is large, and the risk of symptoms is high. The prevention of shoulder rotator cuff injury in this article begins with the analysis of high-risk factors, such as age, sports and occupational factors; then diagnosis and evaluation, such as clinical symptoms, self-test experiments and imaging examinations; and finally, specific preventive measures, including exercise therapy and physical aid therapy. Nowadays, there is still a shortage of literature on how to prevent shoulder rotator cuff injuries, and there is a lack of a relatively specific prevention process. Therefore, this paper mainly studies the design of a relatively effective and easy-to-implement prevention plan from the aspects of risk factors, diagnostic evaluation and preventive measures of shoulder rotator cuff injury, to provide theoretical reference for people who are not sick or already sick.

2. Risk factors

A comprehensive analysis of the risk factors affecting the shoulder rotator cuff injury is conducive to the reasonable formulation of targeted preventive measures, to "take the right medicine". This section mainly elaborates on the three aspects of age, occupation and sports. Age is a common risk factor for shoulder rotator cuff injury. The middle-aged and elderly group is the main group of shoulder rotator cuff injury. Studies have shown that the incidence and severity of shoulder rotator cuff injury increase with age (a total of 928 people aged 64-87 were selected. The results showed that the median age of normal shoulder patients was 70 years old, and the median age of some tears was 73 years old. Full thickness tear. The median age of the split is 74 years old) [4]. The main reason is that with age, the shoulder rotator cuff tendon wears out day by day, and the cell repair ability weakens, making the damage difficult to repair. Therefore, for middle-aged and elderly people, we should pay attention to the prevention of shoulder rotator cuff injury, gradually strengthen the exercise training of the shoulder rotator cuff muscle group, and pay attention to avoid sudden excessive weight. Occupational factors are also risk factors that cannot be ignored for shoulder rotator cuff injury. For working groups who use shoulder joints for a long time, such as automobile manufacturing workers, they are prone to shoulder rotator cuff injury (the incidence rate is as high as 87.7%) [5]. The reason is that such occupations often require repeated shoulder extension, forward flexion or fixed posture operations, which leads to excessive burden on the shoulder joint and repeated postures are easy to cause continuous compression and damage to the shoulder rotator cuff tendon, thus increasing the risk of shoulder rotator cuff injury. Sports factors are also an important cause of shoulder rotator cuff injury. Shoulder problems are very common in

DOI: 10.54254/2753-8818/2027.39259

sports, such as handball and swimming. The reason is that these sports often overuse the shoulder. Handball requires frequent over-throwing and sudden stop and steering. Swimming involves many repeated paddling movements, which are easy to cause friction and squeezing of the shoulder rotator cuff tendon with the surrounding tissue. If the training load is too heavy, the warm-up is insufficient, and the technical movement is wrong, it will further increase the risk of injury. In summary, in the early stage of prevention, a comprehensive analysis of the risk factors of shoulder rotator cuff injury can make follow-up preventive measures more targeted, thus reducing the incidence and severity.

3. Structure diagnosis and evaluation

Diagnostic evaluation is a relatively important part of preventive measures, and follow-up programs need to be carried out according to the results of diagnostic evaluation. The main processes of diagnostic evaluation in this article are clinical symptom observation, self-test experimental verification and imaging examination confirmation.

3.1. Clinical symptoms

The clinical symptoms of shoulder rotator cuff injury mainly include limited movement, decreased muscle strength and pain, which can be preliminarily judged by these symptoms in the high-incide group. The part of the pain is the anterior outer side of the shoulder joint, which can radiate to the deltoid muscle stop point or the outer side of the upper arm. It is manifested as intermittent shoulder joint pain, and the symptoms are aggravated during rest and at night, especially the pain induced in the lying position on the affected side and the top movement is a typical feature; the decline in muscle strength is reflected in the asymmetry of bilateral muscle strength, the resistance of the affected side is reduced, and some The patient's main complaint is "shoulder weakness", which is manifested as difficulty in starting the abductor, forward flexion or external rotation; the limited movement is reflected in the limited active lifting of the shoulder joint, while the passive lifting is relatively normal.

3.2. Self-test experiment

The self-test experiment has the advantages of being able to complete independently, high convenience, comparison of the affected side of the healthy side and dynamism, but attention should be paid to the risk of inducing secondary injury in the experiment. This section mainly focuses on the pain arc experiment, the falling arm experiment and the falling experiment. First, the pain arc experiment requires the shoulder joint to actively extend to 60° to 120°. If there is shoulder pain currently, and the pain is reduced when the extension is >120° and <60°, then the experiment is positive, indicating that there is muscle damage or tendonitis on the shoulder. The experiment alone may not be accurate enough; the falling arm experiment requires the shoulder joint actively outreach 90°, and then slowly lowers the upper limb. If there is pain or sudden fall due to weakness in the process of lowering, the experiment is positive, indicating that there is damage to the upper muscle. Finally, the sitting position of the falling experiment. The shoulder joint is actively outward 90° at the scapula plane, the elbow is bent 90°, and the forearm is neutral. Then the shoulder joint rotates outward as much as possible and maintains this posture. If the shoulder joint is unable to maintain the maximum outward rotation, and the hand falls from above to the shoulder inward rotation, the experiment is positive, indicating that there is muscle damage under the hill. Injured.

DOI: 10.54254/2753-8818/2027.39259

3.3. Imaging examination

The imaging examination results are relatively accurate, and the situation of the shoulder rotator cuff can be analyzed more comprehensively, but the disadvantage is that the cost of preventive diagnosis is high. The main imaging examination of shoulder rotator cuff injury in this article is magnetic resonance imaging (MRI), ultrasound examination and X-ray examination. First, MRI examination. Some studies show that MRI examination is slightly more effective than ultrasound examination (MRI and ultrasound examination were carried out for 153 patients with positive shoulder rotator cuff injury respectively. The sensitivity of MRI diagnosis of shoulder rotator cuff injury is 98.11%, and the specificity is 84.62%; the sensitivity of muscle and bone ultrasound diagnosis of shoulder rotator cuff injury The degree is 96.86%, and the specificity is 76.92%;) [6]. Moreover, the advantage of MRI is that it can determine the area of tendon damage and the severity of the injury. It can be used to evaluate the thickness of the shoulder peak angle, the beak shoulder ligament, the shoulder-humeral distance, the beak shoulder ligament bone mass and the degree of fat infiltration of the shoulder rotator cuff injury. However, the disadvantage is that it cannot clearly show the changes in the subtle structure of the movable joint capsule. Secondly, ultrasound examination is carried out. Ultrasound examination is also of certain value for the diagnosis of shoulder rotator cuff injury. Studies have shown that ultrasound examination is moderately consistent with the diagnosis results of shoulder arthroscopy, which is the gold standard (among 82 patients suspected of shoulder rotator cuff injury, 73 cases of shoulder rotator cuff injury were confirmed by arthroscopy. There were 67 positive cases and 15 negative cases in ultrasound diagnosis. The specificity of ultrasound diagnosis of shoulder rotator cuff injury was 88.89%, and the accuracy rate was 90.24%) [7]. The advantage of ultrasound examination is that it can dynamically observe the structure and activity status of the shoulder rotator cuff. Positive patients can see the disappearance of the shoulder rotator cuff or the disappearance of the shoulder rotator cuff, the interruption of the shoulder rotator cuff continuity, the local abnormal echo of the bone surface, the roughness of the bone, and the increase in the amount of fluid accumulation of the deltoid muscle-scapular crest sac through ultrasound examination, which is manifested as anechoic or hypoechoic. Finally, through X-ray flat film, the patient's shoulder crest morphology and shoulder joint bone structure can be comprehensively analyzed. Judging the shoulder rotator cuff injury according to the deformity of the humerus major nodule and the characteristics of the humerus. The reading can see the configuration of the shoulder crest, the formation of the bone under the shoulder crest, the destruction and absorption changes of the shoulder joint or the humerus large nodule, as well as the deformation of the humerus, the shortening of the distance between the shoulder crest and the humerus, etc. are all important features of the shoulder rotator cuff damage. However, it is recommended to use X-ray flat film in combination with MRI. The detection rate of joint diagnosis of shoulder rotator cuff injury is higher than that of X-ray and MRI diagnosis, and the missed diagnosis rate is lower than that of X-ray and MRI diagnosis ($P>0.05$) (in 146 patients, the sensitivity and specificity of X-ray diagnosis of shoulder rotator cuff injury were 65.8% and 41.7% respectively., the sensitivity and specificity of MRI diagnosis of shoulder rotator cuff injury were 78.1% and 66.7% respectively, and the sensitivity and specificity of joint group diagnosis of shoulder rotator cuff injury were 93.8% and 83.3% respectively) [8].

4. Preventive measures

After diagnosis and evaluation, if the result is negative, shoulder rotator cuff injury can be prevented through exercise training and physical therapy. If the result is positive, you can also refer to this

DOI: 10.54254/2753-8818/2027.39259

article for training.

4.1. Sports training

It is necessary to complete warm-up preparation activities before sports training, which can reduce the risk of injury during exercise. After the exercise training, you need to do relaxation training, which can relieve the bloating and pain caused by exercise. First, warm-up preparation activities are carried out in order to fully move the shoulder joints and activate the shoulder joints and surrounding muscles; then carry out exercise training, mainly for activation exercises, strength exercises, stability exercises and functional exercises of the shoulder rotator cuff muscle group. For people who often exercise, the use of preventive exercise training can effectively reduce the injury rate [9]. Some studies have also found that interventions to enhance the sense of ontology for volleyball players are very important for preventing shoulder rotator cuff injury and restoring the function of sports rehabilitation [10]. Through warm-up, exercises to improve shoulder, elbow, wrist and finger strength and balance, as well as advanced exercises for core stability and muscle control. It is necessary to keep warm during the training process. People with a history of shoulder disease should stay away from the humid environment. People without a history of shoulder disease should stop exercising immediately if they have a sense of discomfort during or after exercise. In addition to these trainings, it is also necessary to pay attention to the need to maintain a good posture and adjust movement habits at ordinary times and try to avoid repeated bending of the upper limbs in life or work to show strength or stay in the above position for a long time; finally, do relaxation training. If there is discomfort and pain in the shoulder after training, you should apply ice for 10-15 minutes. Clock, and then stretch and relax the muscles around the shoulders, mainly including the deltoid muscles, biceps, triceps, external rotational muscle group, latissimus dorsi and oblique muscle, etc. Studies have shown that stretching the back of the shoulder every day can reduce the incidence of injuries of high school baseball pitchers [11]. Pay attention to avoid excessive stretching.

4.2. Physical factor-assisted prevention

In the auxiliary prevention of shoulder rotator cuff injury, the application of physical therapy is premised that high-risk people have mild symptoms, but no shoulder rotator cuff injury is confirmed. Currently, physical therapy is not an independent preventive measure, but an auxiliary measure of exercise training. With the therapeutic effect of physical factor therapy, it creates favorable conditions for training to relieve pain, reduce inflammation and improve joint activity. Physical factors This article mainly introduces shock waves, ultrasound and infrared light. Extracorporeal shock waves are non-invasive and highly safe, which can relieve pain, improve the function of the shoulder joint and increase the mobility of the shoulder joint. The mechanism of action is that the shock wave transmits sound waves through the skin to the lesion area, thereby reducing the load and relieving pain by promoting the regeneration of tendons and soft tissues, inhibiting the transmission of pain signals, and reducing local inflammation [12]. The mechanism of ultrasound is different from that of shock wave. The former uses high-frequency sound waves to penetrate human tissues, producing thermal effects and micro massage effects, thereby promoting soft tissue healing and pain relief by increasing local tissue temperature, enhancing blood circulation and accelerating tissue regeneration [13]. The thermal effect of ultrasound helps to relax soft tissues, which is more suitable for people with muscle tension or limited mobility. Traditional infrared rays can easily cause skin temperature to rise, and the penetration depth usually does not exceed 1 cm under the skin. The water filtration infrared-A treatment system further developed based on the

DOI: 10.54254/2753-8818/2027.39259

infrared principle can filter out the light that is easy to cause skin thermal effects and retain high-energy light waves that patients can tolerate and have therapeutic value [14]. To relieve pain, improve function and improve quality of life. Physical factor therapy mainly plays a role in symptom relief in the auxiliary prevention of shoulder rotator cuff injury and can be combined with exercise training to improve the preventive effect of high-risk people. However, most of the existing evidence comes from the treatment research of confirmed patients, and caution is still required for unconfirmed high-risk groups.

5. Conclusion

Through the systematic study of shoulder rotator cuff injury, this article integrates a relatively complete process for the diagnosis and prevention of shoulder rotator cuff injury for high-risk groups. The process includes the analysis of high-risk factors, diagnostic evaluation and preventive measures, hoping to improve the diagnosis and prevention ability of vulnerable people, realize the shift from passive treatment to active prevention, and improve the awareness of rehabilitation treatment. However, there are some limitations in this article. First, it is mainly based on literature integration and lacks targeted clinical trials. Secondly, the difference in the effect of combined prevention and single preventive measures is not yet clear, and there is no direct evidence of the combined effect of different intervention combinations. In summary, in the prevention of shoulder rotator cuff injury, more large-scale, high-quality and long follow-up clinical studies should be carried out in the future to explore the best joint plan and clarify the population, to further improve the shoulder rotator cuff injury prevention system.

Author contribution

All the authors contributed equally, and their names were listed in alphabetical order.

References

[1] Longo, U. G., Risi Ambrogioni, L., Berton, A., et al. (2020). Physical therapy and precision rehabilitation in shoulder rotator cuff disease. *International Orthopaedics, 44*(5), 893–903. https://doi.org/10.1007/s00264-020-04511-2

[2] Chinese rotator cuff guidelines 2025 edition. (2025). *Baidu Wenku*. https://wenku.baidu.com/view/04d4fe435cfafab069dc5022aaea998fcc2240a6.html

[3] Chinese rotator cuff guidelines 2026 edition. (2026). *Baidu Wenku*. https://wenku.baidu.com/view/e219007df3ec4afe04a1b0717fd5360cbb1a8d5e.html

[4] Hannah, H., Charlotte, G., K. N. A., et al. (2022). Prevalence of rotator cuff tendon tears and symptoms in a Chingford general population cohort, and the resultant impact on UK health services: A cross-sectional observational study. *BMJ Open, 12*(9), Article e059175. https://doi.org/10.1136/bmjopen-2021-059175

[5] Beatriz, C. D. R., Joaquín, B. A., J. I. B., et al. (2020). Occupational risk factors for shoulder chronic tendinous pathology in the Spanish automotive manufacturing sector: A case-control study. *BMC Musculoskeletal Disorders, 21*(1), Article 818. https://doi.org/10.1186/s12891-020-03801-5

[6] Jiang, R., & Ma, J. M. (2026). Clinical value of musculoskeletal ultrasound combined with MRI in the diagnosis of shoulder rotator cuff injury. *Imaging Research and Medical Application, 10*(13), 132–134, 137. (In Chinese). https://doi.org/10.20267/j.issn.2096-3807.2026.13.038

[7] Xie, G. C., & Liu, S. H. (2024). Ultrasound diagnosis and prognosis prediction of shoulder rotator cuff injury. *Journal of Clinical Ultrasound in Medicine, 26*(10), 833–839. (In Chinese). https://doi.org/10.16245/j.cnki.issn1008-6978.2024.10.009

[8] He, Z. F., Jiao, F. H., Bai, Y. N., et al. (2024). Application of combined X-ray and MRI diagnosis in shoulder rotator cuff injury: A study on the supraspinatus outlet view. *Journal of Xi'an Jiaotong University (Medical Sciences), 45*(6), 1027–1031. (In Chinese).

DOI: 10.54254/2753-8818/2027.39259

[9] Martin, A., Martin, H., Markus, W., et al. (2022). The effect of shoulder and knee exercise programmes on the risk of shoulder and knee injuries in adolescent elite handball players: A three-armed cluster randomised controlled trial. *Sports Medicine - Open, 8*(1), Article 91. https://doi.org/10.1186/s40798-022-00478-z

[10] Mostafa, Z., Saeed, E., & Mahdi, H. (2021). The effect of a shoulder injury prevention programme on proprioception and dynamic stability of young volleyball players: A randomized controlled trial. *BMC Sports Science, Medicine and Rehabilitation, 13*(1), Article 71. https://doi.org/10.1186/s13102-021-00300-5

[11] Hitoshi, S., Atsushi, Y., Daisuke, S., et al. (2017). Shoulder stretching intervention reduces the incidence of shoulder and elbow injuries in high school baseball players: A time-to-event analysis. *Scientific Reports, 7*, Article 45304. https://doi.org/10.1038/srep45304

[12] Xiali, X., Qingfa, S., Xinwei, Y., et al. (2024). Correction: Effect of extracorporeal shockwave therapy for rotator cuff tendinopathy: A systematic review and meta-analysis. *BMC Musculoskeletal Disorders, 25*(1), Article 507. https://doi.org/10.1186/s12891-024-07611-x

[13] Wen, M., Hu, X., & Bao, G. (2025). Scapular dyskinesis-based exercise therapy versus multimodal physical therapy for subacromial impingement syndrome in young overhead athletes with scapular dyskinesis: A randomized controlled trial. *BMC Sports Science, Medicine and Rehabilitation, 17*(1), Article 204. https://doi.org/10.1186/s13102-025-01254-8

[14] Xie, E. K., Luo, J., Li, Y. Y., et al. (2016). Effects of water-filtered infrared-A irradiation combined with comprehensive exercise training on pain and joint function in patients with shoulder rotator cuff injury. *Chinese Journal of Sports Medicine, 35*(5), 481–483, 489. https://doi.org/10.16038/j.1000-6710.2016.05.013 (In Chinese)