

RESEARCH ARTICLE

Clinical Outcome of Pectoralis Major Repair in Major Trauma Centre: Return to Work and Sports

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Abstract

Objectives: Pectoralis major tear (PMT) is an uncommon yet functionally significant injury with an increasing incidence reported in recent literature. This rise is largely attributed to participation in high-intensity sports, particularly weightlifting and bench pressing. Anabolic steroid use, notably in weightlifters, has also been associated with PMT. Males aged 20–40 years are most affected.

Methods: This retrospective review analyzed prospectively collected data from patients who underwent primary PMT repair between January 2020 and January 2024, with a minimum follow-up of one year. Exclusion criteria included revision repairs, reconstructions, and concomitant glenohumeral tendon or ligament repairs. Patients were assessed at final follow-up for clinical outcomes, return to sport and work, cosmetic and strength satisfaction, physical examination findings, range of motion, and cosmesis using Bak's Criteria.

Results: All patients were male, with a mean age of 30 years at the time of injury. The average time from injury to surgery was 31 days, and mean follow-up was 12 months. Most injuries occurred during bench pressing (15/22; 60%), followed by wrestling (3/22; 15%). Intraoperative findings included complete sternal head tears in 15 patients (68%) and partial sternal tears in 7 (31%). According to Bak's Criteria, outcomes were excellent in 11 patients (50%), good in 9 (37%), and fair in 3 (13%). Cosmetic satisfaction was reported by 20 of 22 patients. Seventeen patients returned to sports at a mean of 18 weeks (range, 7–32 weeks) and returned to work at a mean of 9 weeks (range, 5–22 weeks). Overall outcomes were satisfactory in 18 patients and fair in 4. No anabolic steroid use or complications were reported.

Conclusion: Surgical repair of pectoralis major tears leads to improved patient-reported outcomes, high cosmetic satisfaction, and reliable return to sport and work.

Level of evidence: IV

Keywords: Outcome, Pectoralis major, Repair, Sports, Tear, Work

Introduction

Pectoralis major tear is not a common but functionally important injury, and there is an increase in cases of pectoralis major injury, as shown by recent literature.¹ Reasons for the increase in cases are due to interest in intense sports activities, weightlifting, particularly bench pressing, and in military personnel.^{2,3}

Moreover, the use of anabolic steroids, especially in weightlifters, is also associated with a tear of the tendon.⁴ Males from 20 to 40 years of age are more prone to this

injury.

The pectoralis major muscle is responsible for adduction, flexion, and internal rotation of the humerus. The mode of injury can determine the nature of the injury. Direct trauma causes a tear at the junction of the muscle belly and musculotendinous junction, while indirect trauma leads to tendon avulsion when the muscle is at maximal contraction.⁵ Despite increasing cases, there is a relative infrequency of this condition. It can be missed and misdiagnosed as only a muscle sprain, leading to a delay in

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diagnosis and treatment.⁶ Delayed diagnosis can undermine management as direct repair is not possible, and less favourable outcomes are achieved, resulting in notable decreased strength and inferior function.

The most performed repair techniques include suture anchor fixation, TOS, and cortical bone fixation. In chronic cases where direct repair is not feasible, various autograft and allograft reconstructions are employed.⁷

Specifically, shortening of the musculotendinous unit and scarring potentially increase the risk of neurovascular injury and place an increasing amount of tension on the repair.^{6,8} Functional results can be achieved with conservative treatment; however, surgical repair can only restore the strength of the muscle before the tear.⁸ Therefore, surgical management of the tendon is the recommended method of treatment.

There is limited information in the current orthopaedic literature on the outcome of acute repair of the Pectoralis Major rupture. The recent review highlights that surgical repair has achieved more favourable functional outcomes. The tendon-to-bone surgical technique yields more optimal outcomes, while bone-to-tendon contact favours early healing, thereby yielding more favourable functional outcomes and contributing to promising rates of return to sport and work.⁹

Although the consensus exists for surgical repair, the functional scores and time to return to support and activities remain debatable. A meta-analysis of 18 studies revealed insufficient information on parameters such as return-to-work rates and time to return to work.¹⁰

As orthopaedic surgeons, we are faced with a very young and active patient population with high demands for immediate treatment. Therefore, most patients are willing to undergo early surgical intervention.¹¹ The purpose of our study is to evaluate outcomes of acute primary surgical repair of the Pectoralis major in terms of pain outcomes, ability to do daily life activities without any difficulty, time to return to the level of the sport before injury, cosmetic appearance, and overall satisfaction of the patient. This will also highlight any complications associated with the acute repair of the pectoralis major.

Materials and Methods

This retrospective study was initially registered as a Quality Improvement project in the Audit department with Registration no 21663 at Queen Elizabeth Hospital, Birmingham. All the data were collected between January 2022 and December 2024 from the hospital database, theatre data sheets, and the Clinical Portal of the Hospital systems.

Ethical Considerations: The project was conducted as a Quality Improvement effort to review and enhance the outcomes of surgical repair of pectoralis major tendon ruptures within our organization. Every method and therapy documented in this set of cases adhered to standard medical practice, with no unusual or experimental approaches employed. This project was reviewed and approved by the Queen Elizabeth Hospital Birmingham Audit and QI Department, under reference number 21663.

This retrospective and Prospective review identified 20 patients who underwent pectoralis major muscle repair by fellowship-trained shoulder & elbow surgeons using the

Arthrex Suture button technique in three different hospitals within our trust.

All operative repairs were performed at the three hospitals that are part of University Hospital Birmingham, including three different hospitals in Birmingham City. Data on age, sex, mechanism of injury, rupture location and type, time since injury, preoperative cosmetic appearance, preoperative examination, diagnostic studies, operative technique, involved side, and primary follow-up were obtained from hospital records.

No mentions of anabolic steroids were recorded or investigated in this study.

Surgical Technique

The procedure uses regional anaesthesia with general anaesthesia for comfort. The patient sits in an upright supported position. Standard sterile preparation protects the arm and chest.

A short incision along the front fold of the armpit exposes the damaged tendon. Soft tissues open with controlled separation until the surgeon finds the retracted end of the tendon. Surrounding adhesions release to reduce tension. Care is taken near nerves on the inner side of the field.

The upper arm bone is exposed. The attachment site receives light surface preparation to improve healing. Strong sutures secure the tendon end. Arthrex button implants provide fixation into the humerus. Multiple fixation points spread load and create a stable footprint for healing. The tendon is seated against bone and the buttons are engaged to hold the repair in place.

The wound is washed. Shoulder motion is checked by lifting and rotating the arm to confirm stability without stress on the repair. The incision closes in layers and a dressing covers the site. The arm rests in a sling after surgery.

Rehabilitation

A sling supports the arm to reduce strain. A physical therapist guides early motion. The first phase focuses on arm comfort and simple stretching with help from the therapist. Shoulder motion stays limited to protect the repaired tendon.

Once healing looks stable, supervised exercises start. The focus is steady progress without pain. Patients perform controlled movements for lifting the arm forward, moving it to the side, and rotating inward. Activity increases only when symptoms stay low.

Strength work starts later. Light resistance builds shoulder control and power. Training volume rises in small steps. Full resistance work returns when strength, range of motion, and comfort reach safe levels. The goal is return to daily tasks first, then sports if desired.

Resistance training begins at 6 to 12 weeks postoperatively.^{12,13}

Clinical assessment was evaluated by a range of motion (ROM), cosmesis, and return to activity. The outcome of the treatment at follow-up was graded as excellent, good, fair, or poor, according to Bak's criteria [Table 1].

A retrospective and prospective review identified 22 patients who underwent PMM repair by fellowship-trained shoulder & elbow surgeons at our institute between 2020 and 2024.

Injury and surgical data were reviewed for all 22 patients.

All patients were assessed a minimum of one year postoperatively for clinical outcomes, Return to sports, Cosmetic and strength satisfaction, and physical exam (ROM & cosmesis).

To summarise the data, descriptive statistics were used for patient demographics, care timings, and the outcomes of each patient. The means, ranges, and interquartile

ranges (IQRs) were reported for the continuous variables, including age, time to magnetic resonance imaging (MRI), time to surgery, follow-up period, and time to recovery. Data for categorical variables, such as injury mechanisms, findings during surgery, and Bak criteria, were presented as frequencies and percentages.

Table 1. Bak's Criteria

	Excellent	Good	Fair	Poor
Pain	Free	Free	With activity	Persistent
Range of Motion	Full	Slight Decrease	Slight Decrease	Restricted
Cosmesis	No complaints	Minor	Minor	Unsatisfactory
Return to Activity	Full function	Slight impairment	Impaired	Complications
Strength	<10% Isokinetic loss	<20% Isokinetic loss	>20% Isokinetic loss	>20% Isokinetic loss

Results

All patients were men with an average age of 30 years (Range, 28-51; IQR, 11.5) at the time of injury. The average time from injury to get an MRI scan was 12 days (Range 1-35 days and IQR 22 days), to surgical repair was 31 days (range 5-81 days and IQR 38 days), and the average follow-up was 12 months (range 2-18 months and IQR 8 months)

[Figures 1 and 2]. Most patients suffered an injury while bench pressing (15/22; 60%) or wrestling (3/20; 15%). The most common intraoperative findings were partial sternal tears (7/22; 31%), followed by complete sternal tears (15/22; 68%).

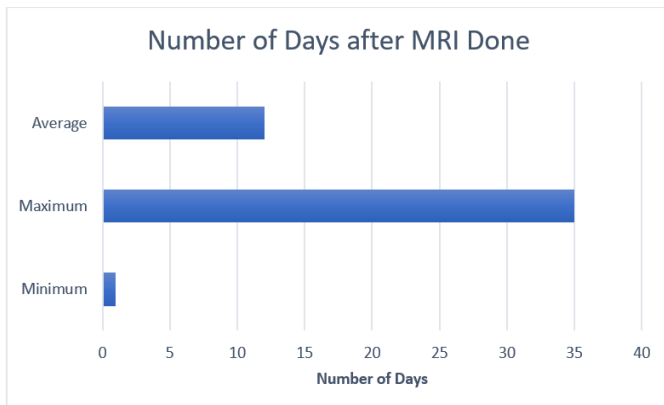


Figure 1. Number of Days after MRI Done

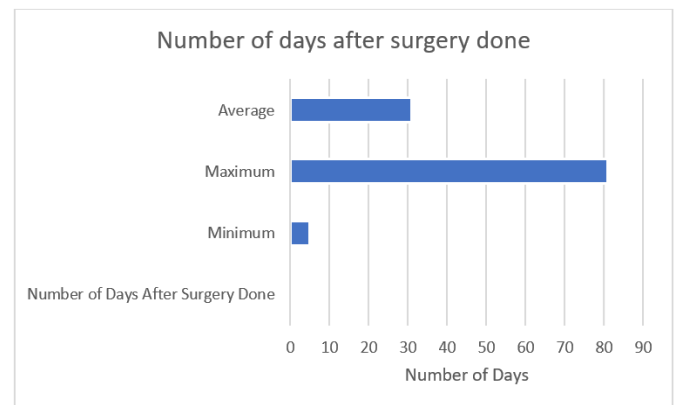


Figure 2. Number of Days after Surgery Done

According to the Bak criteria, overall results were excellent in 11 patients (50%), good in 9 (37%), while three patients (13%) had a fair result [Table 1].

Cosmetic satisfaction was achieved in 20 out of 22 patients. Seventeen patients returned to sports, with an average of 18 weeks (range, 7-32 weeks; IQR, 12.5 weeks), and returned to work at an average of 9 weeks (range, 5-22 weeks; IQR, 8.5 weeks) [Figures 3 and 4]. Antibiotics were administered to all patients, and tranexamic acid (TXA) was

given to 9 out of 22 patients at the surgeons' discretion, as some surgeons strongly believe that TXA substantially decreases the risk of bleeding, while others are not convinced in soft tissue surgeries. Outcomes were satisfactory for 18 patients and fair for 4, with no reported steroid use or complications.

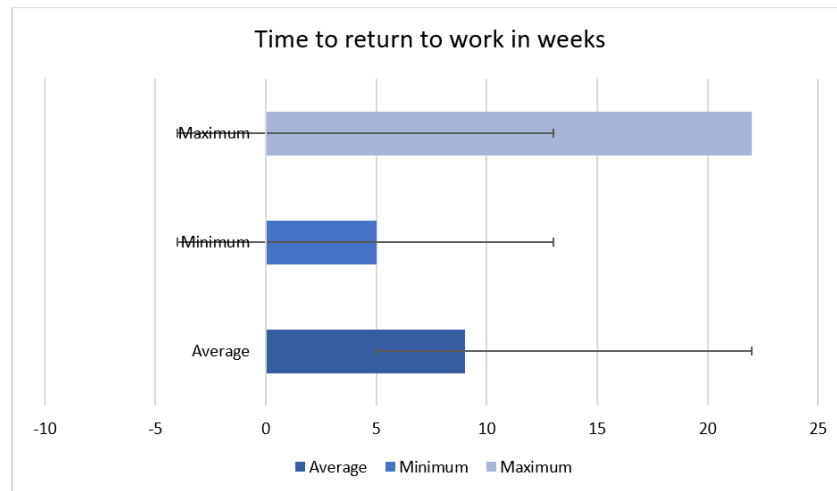


Figure 3. Time to Return to Work in Weeks

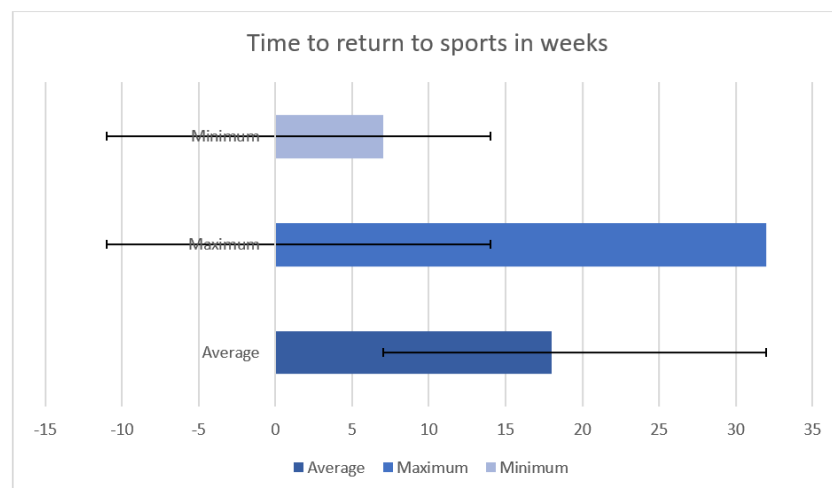


Figure 4. Time to return to sports in weeks

Discussion

Few studies have been conducted on the outcomes of pectoralis major tendon repair. The results are satisfactory in young people and bodybuilders. Our study confirmed that approximately 77% of patients were able to start sports after a mean of 18 weeks. In contrast, 91% of patients return to their pre-injury level of function. We used the endobutton technique in all cases, and a few studies suggest that Unicortical endobutton fixation can provide an alternative fixation strategy for acute pectoralis major tears in young, active, high-demand individuals.¹¹ One study suggests that anabolic steroids may contribute to the injury.¹⁴ The studies suggest that the outcome of repair is satisfactory, and we can predict a high possibility of returning to work after repair and a moderate likelihood of returning to preinjury level.^{15,16}

Certain complications were noted in various papers. The most common complications are re-ruptures and wound infection. About 40% required redo surgery, and outcomes were good based on seven studies.¹⁷⁻²³ Whereas in our study, the most common complication was shoulder joint stiffness, which was improved with physiotherapy.

Many publications endorse the outcome that surgical repair has better results than conservative management in young patients and athletes.^{1,9,15} But there are certain objections, as two studies concluded no difference between operative and non-operative management.⁹ After a close look, it was found that these two studies did not measure peak torque and work. Therefore, these outcomes may be underestimated.

Previous studies have shown that outcomes are better

when surgery is performed acutely rather than late.^{4,9,17,19} However, statistically, it doesn't show much difference. Therefore, it is concluded that acute repairs are better, but chronic repairs may also yield good results. So, it does not mean that chronic repair should not be performed. Most of the cases in our study showed promising results when repaired acutely.

The findings from this study join other existing literature by presenting data from patients who were treated surgically early after their pectoralis major tendon ruptures. Several studies have discussed the results of procedures but often report them differently or study the outcomes of only small groups of athletes. Our results align with previous reports, which indicate that early repair yields better outcomes for both function and appearance. On the other hand, we emphasise the importance of early MRI use, support a standard surgical procedure, and examine the timing for athletes to return to their sport in detail, which is often overlooked in earlier research. Based on these data, we recommend referring and intervening early for active patients.

This study has certain restrictions. Its retrospective format produces bias because the records may be incomplete or inaccurate. Because the sample is so small, the research's findings may not be as useful or reliable as hoped. Comparing outcomes to those experienced when patients are not operated on or when surgery is delayed is not possible because there is no control group. Patients in the study were treated at four locations within one trust, so some people with pectoralis major injuries might not be represented. People's satisfaction was studied using the Bak criteria and personal cosmetic opinions, which are not always sensitive or objective. The time between patients' treatments and their follow-up exams could affect the accuracy of the results. Again, information about steroid use was not collected as standard, so it was difficult to link tendon injuries to the drugs. Surgeries were performed by expert orthopaedic surgeons at a single large hospital, which may impact outcomes in other areas of medicine.

Conclusion

Based on Bak's criteria, most patients who undergo repairs of their pectoralis major tears show either excellent or good outcomes. Following treatment, most patients achieved satisfactory functional and cosmetic outcomes, returning to sports in an average period of 18 weeks. Evidence shows that early surgical procedures remain

effective because they help restore power and functionality, primarily for individuals who remain physically active.

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