



## The outcome of surgical management of chronic pectoralis major ruptures in weightlifters

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Pectoralis major repair is increasing in frequency due to the uptake of weight training. Chronic tendon injuries tend not to have as favourable outcomes. We report our outcome of chronic pectoralis major ruptures following surgical repair.

Retrospective analysis of 8 patients who were weightlifters, treated for primary pectoralis major repair by one surgeon. Surgical repair was direct via suture anchors and one additionally required fascia lata graft due to tendon retraction. Outcome was assessed by comparing strength to the contralateral pectoralis muscle and the Oxford Shoulder Score.

All patients were male with mean age of 36 years. Mean delay to surgery was 25.6 months. Mean follow-up was 19.6 months and mean Oxford Shoulder Score was 43.7. Six out of eight patients had full strength compared to the contralateral side. Complications included visible skin tethering not associated with weakness, stiffness associated with weakness and a seroma at fascia lata donor site.

This is the largest documented study of Chronic Pectoralis Major repair showing excellent outcomes with repair, even if delayed.

**Keywords:**

### INTRODUCTION

Pectoralis major ruptures are growing in frequency due to the increase in weight training and other demanding sporting activities (7). Its initial description was by Patissier in 1822(10) but the

overwhelming majority of cases have been reported within the last 20 years. Chronic ruptures have been defined as being more than six weeks since the time of injury. Repairs are usually delayed secondary to a delay in diagnosis, presentation and investigation. Here we report our outcome of chronic pectoralis major repair.

### METHODS AND MATERIALS

A retrospective cohort analysis was performed for eight patients, who were weightlifters, diagnosed with chronic pectoralis major tendon rupture and underwent primary pectoralis major tendon repair by the senior author between February 2011 and July 2013. Patient details including age, occupation, mechanism of injury, hand dominance, number of months of delay to surgery and number of months

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to follow-up were recorded. At review patients were examined for strength, range of motion, cosmesis and overall satisfaction. The measurements were taken by the senior author ; a subjective assessment was made compared to the contralateral side of injury. For assessing strength, the arm on the operated side was adducted against resistance and then compared to the other side. It was graded full strength, minor weakness, moderate weakness or weak.

Objective functional outcomes were recorded in the form an Oxford Shoulder score (OSS) with patients completing a questionnaire at their latest follow-up. The OSS is a 12 item patient reported outcome tool designed to assess surgical interventions in shoulder surgery and assess the impact on patients' quality of life. Studies have demonstrated the validity and reliability of this tool for assessing the outcome of shoulder surgery and therefore it can be used as an indicator of recovery and general improvement in quality of life following surgery (6). The score ranges from 0-48 with the lower the score the lower the quality of life and greater the disability experienced by the patient.

This study was of reviewing chronic ruptures, therefore 'time of rupture' (acute versus chronic) was not used to classify the injury. The injury was classified intra-operatively using the injury

pattern classification of contusion/ sprain, partial or complete rupture and anatomical location (14).

All patients underwent surgical repair by the senior author. A deltopectoral approach was used in all cases. The ruptured tendon end was identified, refreshed and repaired with G2 Mitek suture anchors to achieve fixation in the humerus, restoring normal anatomy. One patient who had no visible tendon after a delay to surgery of 96 months required fascia lata graft reconstruction taken, from the ipsilateral side. The graft was harvested in the normal manner.

## RESULTS

All patients in this study were male, aged between 25 to 45 years with a mean age of 36.6 years (*see Table I*). The mean delay to surgery was 25.6 months (range 4 to 96 months). Postoperatively, mean follow-up was 19.6 months (range 4 to 34 months). Patient reported functional outcomes demonstrated a mean OSS of 43.7 (range 31 to 48) with five patients achieving maximum or almost maximum scores. This mean OSS of 43.7 represents an excellent functional outcome.

Clinical assessment of strength revealed, 6 out of the 8 patients had full strength, 1 patient had mild weakness and 1 patient had moderate weakness. Furthermore, 5 out of the 8 patients had no obvious

Table I. — Summary of results

	Age	Anabolic steroids	Delay to surgery (months)	Muscle wasting	Surgical technique	Surgical findings	Follow-up (months)	Follow-up OSS	Strength (compared to contralateral side)	Outcome	Complications
	44	No	14	Severe	Suture anchor	Sternal head avulsion, intact clavicular head	25	48	Full	Excellent	
	27	Yes	8	Moderate	Suture anchor	Partial rupture of both heads	10	48	Full	Excellent	Skin tethering
	42	No	6	Mild	Suture anchor	Complete rupture of both heads	34	47	Full	Excellent	
	45	No	7	Mild	Suture anchor	Complete rupture of both heads	28	42	Full	Excellent	
	26	Yes	1.5	Nil	Suture anchor	Complete rupture of both heads	26	48	Full	Excellent	
	25	No	14	Severe	Suture anchor	Complete rupture of both heads	24	42	Mild weakness	Good	
	44	No	4	Mild	Suture anchor	Complete sternal head and partial clavicular head	6	31	Moderate weakness	Good	Mild pain, stiffness
	40	No	96	Severe	Fascia lata graft, Suture anchor	Complete rupture of both heads	4	48	Full	Excellent	Seroma which resolved
MEAN	36.6		25.6				19.6	43.7			

complications either reported by the patient or on review. Of the remaining 3 patients, one patient had visible skin tethering but no discernible weakness. One patient complained of mild pain and stiffness, as well as having moderate weakness which reflected in his lower OSS.

One patient who underwent a fascia lata graft reconstruction developed a seroma at the graft site, however, there were no complications reported at the repair site and the seroma spontaneously resolved. It was noted that 2 patients out of the 8 used anabolic steroids. A total of 7 patients had muscle wasting noted at the time of surgery.

Overall, 6 of the patients had 'excellent' outcomes (which we defined as having an OSS of >40 and having no weakness) and 2 patients had 'good' outcomes (defined as an OSS >30 or having mild - moderate weakness).

## DISCUSSION

Ruptures can be classified on the injury pattern type (contusion/sprain, partial, complete) or on the anatomical location (muscle origin, muscle belly, musculotendinous junction, tendinous insertion) (14). A more recent comprehensive classification

Table II. — Reported surgical procedures for chronic pectoralis major tendon tears (modified from Zachilli et al) compared with our results

Study	Graft type	Surgical technique	Tear location	Delay to surgery (months)	Patients	Surgical Result classification*
Zacchilli et al 2013(15)	Achilles allograft	Suture anchors	Tendinous insertion	22.2	3	1 excellent 2 good
de Castro Pochini et al 2010(5)	Hamstring autograft	Screw/washer	Tendinous insertion	>3	2	1 excellent 1 good
Schachter et al 2006(11)	Hamstring autograft	Bone tunnels	Prior repair	3	1	1 excellent
Zafra et al 2005(16)	Bone-patella tendon autograft	Screw/washer	Musculotendinous junction	11	2	1 good 1 fair
Sikka et al 2005(13)	Fascia lata allograft	Suture anchors	Tendinous insertion	60	1	good or excellent
Joseph et al 2003(9)	Achilles allograft	Suture anchors	Tendinous insertion	2	1	good
Alho 1994(2)	Pectoralis fascial release	Bone tunnels	Tendinous insertion	3	1	good or excellent
<b>Summary</b>			<b>8 insertion 2 MT Junction 1 prior repair</b>	<b>14.8</b>	<b>11</b>	<b>3 excellent 2 good/excellent 5 good 1 fair</b>
Our study	Direct repair and 1 fascia lata graft	Suture Anchors	Tendinous insertion	25.6	8	6 Excellent 2 Good

\* Based on the classification system used by Bak et al. (4).

system considers the extent (width and thickness), location and timing (acute or chronic) of injury(7). Our cohort of patients had either complete or partial ruptures of either head or both heads of the pectoralis major tendon. Interestingly, there was no impact of the extent or location of the rupture on patient outcomes although this may be a reflection of the small patient cohort size.

Management options include conservative treatment or surgical repair. A meta-analysis of the literature demonstrated significantly better results of surgical treatment with 88% of surgical patients reporting excellent or good results compared to 27% of patients treated conservatively (4). Furthermore, a retrospective study comparing surgical treatment to conservative treatment showed that surgical patients regained an average of 99% of the peak torque of their uninjured arm compared to conservative patients who regained 56% of strength(8).

Several authors have shown that surgical repair performed acutely attains superior results compared to delayed surgical repair, which in turn has better outcomes than conservative treatment with regard to pain, strength and cosmesis (1,4,12). We have defined acute surgical repair being within 6 weeks since the time of injury based on the senior author's experience. However, acute surgical repair has been defined inconsistently in the literature varying between 2 weeks to 8 weeks from injury.

There have been several methods described to repair the pectoralis major. The methods differ in their exact technique, however, the majority use drill holes (with or without troughs), sutures and/or bone anchors to achieve repair. Chronic tears have been repaired using the same techniques as acute repairs. There has been one case report detailing a successful surgical repair of an avulsed sternal head 13 years after initial injury using a trough and drill hole technique (3). However, in some cases, direct surgical repair was not possible due to tendon retraction and involution. There have been cases describing graft reconstruction with Achilles tendon, bone-patellar tendon, fascia lata and hamstring. Fixation in these cases was achieved using suture anchors, bone tunnels or using screws with washers (2,5,9,11,13,15,16) (Table II).

Our retrospective analysis of patients undergoing delayed primary surgical repair to chronically ruptured pectoralis major tendon revealed encouraging and relatively successful outcomes in all patients. This study reflects similar results reported in the literature. One patient complained of ongoing mild pain and moderate weakness, but reported a significant improvement from his preoperative state.

Our case series had a total of 8 patients who had a mean delay to surgery of 25.6 months. To our knowledge, this represents a relatively large sized study with a longer mean delay to surgery compared to the published literature. One of our patients underwent a repair using fascia lata graft reconstruction 8 years after initial injury. This represents the longest delay to surgical repair using graft reconstruction than was previously reported. There have been published reports of longer delays to surgery, up to 13 years in one case (3), however the author notes that the avulsed sternal head was adherent to the intact clavicular head preventing retraction and therefore avoided the use of graft reconstruction.

The use of anabolic steroids did not appear to have an adverse outcome after repair. There was an obvious correlation between the delay in surgery and muscle wasting noted intra-operatively. It would appear that around 6 months the muscle becomes only mildly wasted, beyond this it then becomes moderate then severe by 14 months. The patient who had moderate weakness was on the upper age range, this may have had a bearing on his ability to heal and rehabilitate. Therefore, the greater the age the more guarded the outcome.

We acknowledge the limitations of our study, the primary one being that the OSS is not a truly validated outcome measure for pectoralis major repair and that there is no objective dynamometry in our results. Bearing these limitations in mind this study adds to the relatively small evidence base of successfully repairing a chronically ruptured pectoralis major tendon, even when the delay to surgery has been prolonged.

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