Case report

Pectoralis major tears: comparison of surgical and conservative treatment

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Abstract

***Objectives*—To compare objective measures of strength and subjective functional outcomes in complete distal pectoralis major tears treated either surgically or non-surgically.**

***Methods*—Twenty two pectoralis major tears were included in 21 patients. Ten were surgically repaired and 12 were managed non-surgically. Patients completed a standard questionnaire, and clinical examination and isokinetic dynamometry were carried out.**

***Results*—In patients who had surgical repair, peak torque returned to 99% of that of the uninjured side and work performed returned to 97%. For those managed conservatively, peak torque and work performed returned to only 56% of that of the uninjured side (p = 0.003 for the difference in peak torque, and p = 0.01 for work performed). Findings were independent of the strength of the patient, whether or not the dominant arm was involved, the age of the patient, and the length of time from injury or surgery to testing. Patients were grouped into one of three subjective functional outcome groups, and those who had a surgical repair had a better functional outcome.**

***Conclusions*—Surgical repair results in greater recovery of peak torque and work performed than conservative management of patients with rupture of the pectoralis major.**

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Pectoralis major rupture is a rare injury. Roughly 144 cases have been reported in the world literature.[1] Most authors recommend surgical repair, particularly in athletes, as repair has been associated with better functional results. However, there has been a lack of objective strength testing to support surgical repair as the treatment of choice.

Kretzler and Richardson,[2] in 1989, reported on 19 pectoralis major ruptures, representing the largest series published to date. Sixteen patients had surgical repairs, five of which were tested on a Cybex II isokinetic dynamometer.

Roi *et al*,[3] in 1990, used Cybex testing to evaluate three patients with pectoralis major tears, all of whom were managed conservatively. They found the strength of the injured arm to be comparable to that of the normal arm. However, all were partial tears.

Scott *et al*,[4] in 1992, performed dynamometric assessment of four patients, and undertook late repair in one. They recommend initial conservative treatment. If symptoms persist, dynamometry is considered helpful in the assessment of patients suitable for late repair.

Wolf *et al*,[5] in 1992, reviewed 12 patients with 14 ruptures of the pectoralis major muscle. This represents the previous largest group objectively strength tested. Four of the six unrepaired tears were complete, and, of these, peak torque and work performed at low speed were 74.0% and 60.1% of those of the normal arm respectively. Of the six repaired, four were unilateral, and, of these, peak torque and work performed were 105.8% and 109.0% of those of the normal arm.

We therefore set out to assess in an objective manner the effect of surgical repair in rupture of the pectoralis major muscle. Functional assessment was also undertaken. The study is retrospective, but the almost equal distribution of patients treated surgically and conservatively allows useful comparison of the two treatment methods.

Methods

SUBJECTS

Patients were identified through the public hospital system and practices of orthopaedic surgeons and sports physicians in the Auckland area. Only patients with a complete clinical tear of the pectoralis major muscle were included in the study. We excluded patients with minor tears or muscle belly tears, as these have been shown to do well with conservative management.[6] Twenty four cases of pectoralis major muscle rupture were identified. Informed consent was sought and at this stage two patients declined to be involved in the study. Therefore 22 cases in 21 patients are reviewed. Ten cases were treated surgically and 12 non-surgically. All patients were then assessed by us. A standard questionnaire was administered to evaluate the mechanism of injury, treatment, and the patient's assessment of outcome in terms of pain and function, in both work and sport. The patients were all examined by one of us; muscle

Table 1 Conservatively managed patients

Case No	Age (years)	Injury test (months)	Peak torque (N.m)		Work performed (J)		Dominant arm	Injured arm
			Normal	Injured	Normal	Injured		
1	30	2	52	29	86	53	R	R
2	35	72	93	50	121	67	L	R
3	26	36	108	99	161	154	R	R
4	33	108	115	97	146	106	R	L
5	38	48	155	72	—	—	R	L
6	43	2	95	82	116	101	R	R
7	50	16	64	52	85	60	R	R
8	34	1	98	35	126	26	R	L
9	25	24	97	53	—	—	R	R
10	24	11	114	92	158	122	R	L
11	30	5	119	39	165	45	R	R
12	25	1	111	55	150	5	R	L

contour, range of motion, and clinical strength were assessed. Objective strength testing of both arms was undertaken using the Kin-Com Isokinetic Dynamometer (Chattex Corporation, Chattanooga Group, Hixson, Tennessee, USA).

The patients were positioned according to the standard protocol outlined in the *Kin-Com 500H muscle testing and training system manual*. Subjects were tested supine. Torque was recorded as the subjects moved their upper limb from 160° shoulder abduction and 30° horizontal flexion. The elbows were extended and the direction of motion was across the body, towards the contralateral hip. The arc of motion was 140° and the angular velocity was 120°/second. There was a period of warm up and familiarisation followed by three one repetition maximum effort attempts. The best effort was analysed.

STATISTICAL ANALYSIS

A generalised linear model was used to investigate the differences in work performed and peak torque in the injured arms between surgically and non-surgically treated patients. The peak torque or work performed for the uninjured arm, age of the patient at the time of injury, the time from injury or surgery to testing, and whether the injured arm was dominant were included in the model. The patient who had bilateral repairs was excluded from the model.

Results

The study included 22 pectoralis major tears in 21 patients. Of these, 12 were unrepaired, and 10 had been surgically repaired. All patients were men of mean age 30.9 years (range 24–50). Table 1 gives the details of the conservatively managed patients, and table 2 those for the patients treated surgically.

MECHANISM OF INJURY

Twelve of the 22 injuries were sustained while participating in rugby union or rugby league, and five of these were repaired. A further four were caused by bench pressing free weights, three of which were repaired. Three were sustained while water skiing, two were related to livestock handling, and one was the result of a fall downstairs.

PEAK TORQUE

There was full information for 20 patients and they were included in the analysis. The mean peak torque for the repaired patients was 93.2 N.m compared with 55.9 N.m in the unrepaired group ($p = 0.007$). This represents a 66.7% greater peak torque in the repaired arms. These differences were present after controlling for dominance, strength of the other arm, age, and the time from injury or surgery to testing.

The ratio of peak torque in the injured arm to that in the uninjured arm was then calculated using a generalised linear model, which controlled for dominance, age, and time since injury or surgery. The mean ratio of injured to non-injured arm torque for the repaired group was 0.99, compared with 0.56 for those treated conservatively ($p = 0.003$, fig 1). In other words, for those in the surgical group, the injured arm regained an average of 99% of the strength of the uninjured arm, as measured by peak torque. Those in the non-surgical group regained only 56%.

The repaired group was further analysed to investigate whether delay between injury and

Table 2 Surgically repaired patients

Case	Age (years)	Time (months)		Peak torque (N.m)		Work performed (J)		Dominant arm	Injured arm
		Injury to surgery	Surgery to test	Normal	Involved	Normal	Involved		
13	28	0.50	6	94	79	118	110	R	R
14	34	1.25	5	86	69	128	96	R	R
15a	30	0.50	13	—	107	—	162	R	R
15b	32	0.50	5	—	109	—	145	R	L
16	26	3.00	8	78	82	119	107	L	R
17	27	0.33	2	111	89	159	151	R	R
18	25	1.00	8	89	98	94	136	R	R
19	30	7.00	48	75	99	119	144	R	L
20	27	0.25	50	130	125	186	179	R	R
21	27	0.10	5	119	105	161	147	R	R

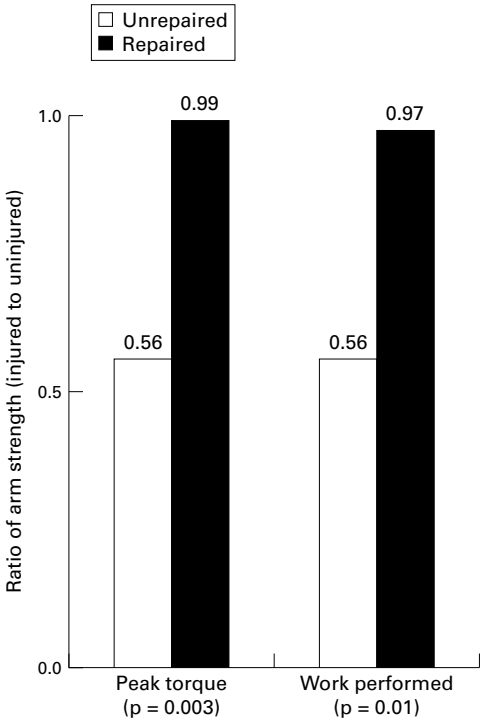

Figure 1 Comparison of the strength of the injured arm with that of the uninjured arm, for peak torque and work performed.

surgery had an effect on the peak torque. This was not found to be a significant factor.

WORK

There was full information for 18 patients and they were included in the analysis. The mean work performed in the repaired patients was 124.0 J compared with 74.7 J in the unrepaired group ($p = 0.02$). This represents a 65.8% greater amount of work performed in the repaired arms. These differences were present after controlling for dominance, strength of the other arm, age, and the time from injury or surgery to testing.

The ratio of work performed in the injured arm to work performed in the uninjured arm was then calculated using a generalised linear model which controlled for dominance, age, and time since injury or surgery. The mean ratio of work performed by the injured arm to that performed by the uninjured arm for the repaired group was 0.97, compared with 0.56 for those treated conservatively ($p = 0.01$, fig 1). In other words, for those in the surgical group, the injured arm regained an average of 97% of the strength of the uninjured arm, as measured by work performed. Those in the non-surgical group regained only 56%.

The repaired group was further analysed to investigate whether delay between injury and surgery had an effect on work performed. This was not found to be a significant factor.

SUBJECTIVE FINDINGS

The subjective results from patient interviews and clinical examination allowed classification of patients into one of three outcome groups: group I, patients had no clinical loss of power, full pain-free range of motion, and normal function at work and in sport; group II, patients had loss of power and/or ongoing pain and/or some restriction of range of motion but were able to return to work and/or sport; group III, patients had clinical loss of power, restriction of movement or ongoing pain, any of which led to an inability to return to work or sport.

Of those repaired, six were in group I, three were in group II, and none were in group III. Of those unrepaired, there was only one in group I, seven in group II, and four in group III (fig 2). All patients regained a full range of shoulder motion.

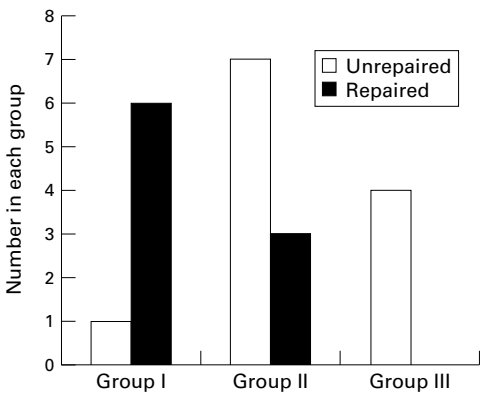

Figure 2 Subjective functional outcome groups.

Discussion

Wolfe *et al*,[5] in 1992, evaluated 12 patients with 14 tears of the pectoralis major. Cybex testing was undertaken on both repaired and unrepaired groups. Four of the six unrepaired patients were diagnosed as having complete tears and, of these, peak torque and work performed at low speed (60°/second) were 74.0% and 60.1% of the normal arm respectively. Repair was recommended for patients with acute complete tears who require use of their upper extremity in high strength activities or sports. They were also able to repair two chronic muscle ruptures.

After dynamometric assessment of four patients with pectoralis major ruptures, Scott *et al*[4] recommended initial conservative management for pectoralis major rupture. These authors concluded that, if pain or weakness

Figure 3 Patient presenting late with rupture of the right pectoralis major. The diagnosis is apparent from the obvious clinical signs: loss of the anterior axillary fold and bunching of the pectoralis major muscle on the chest wall.

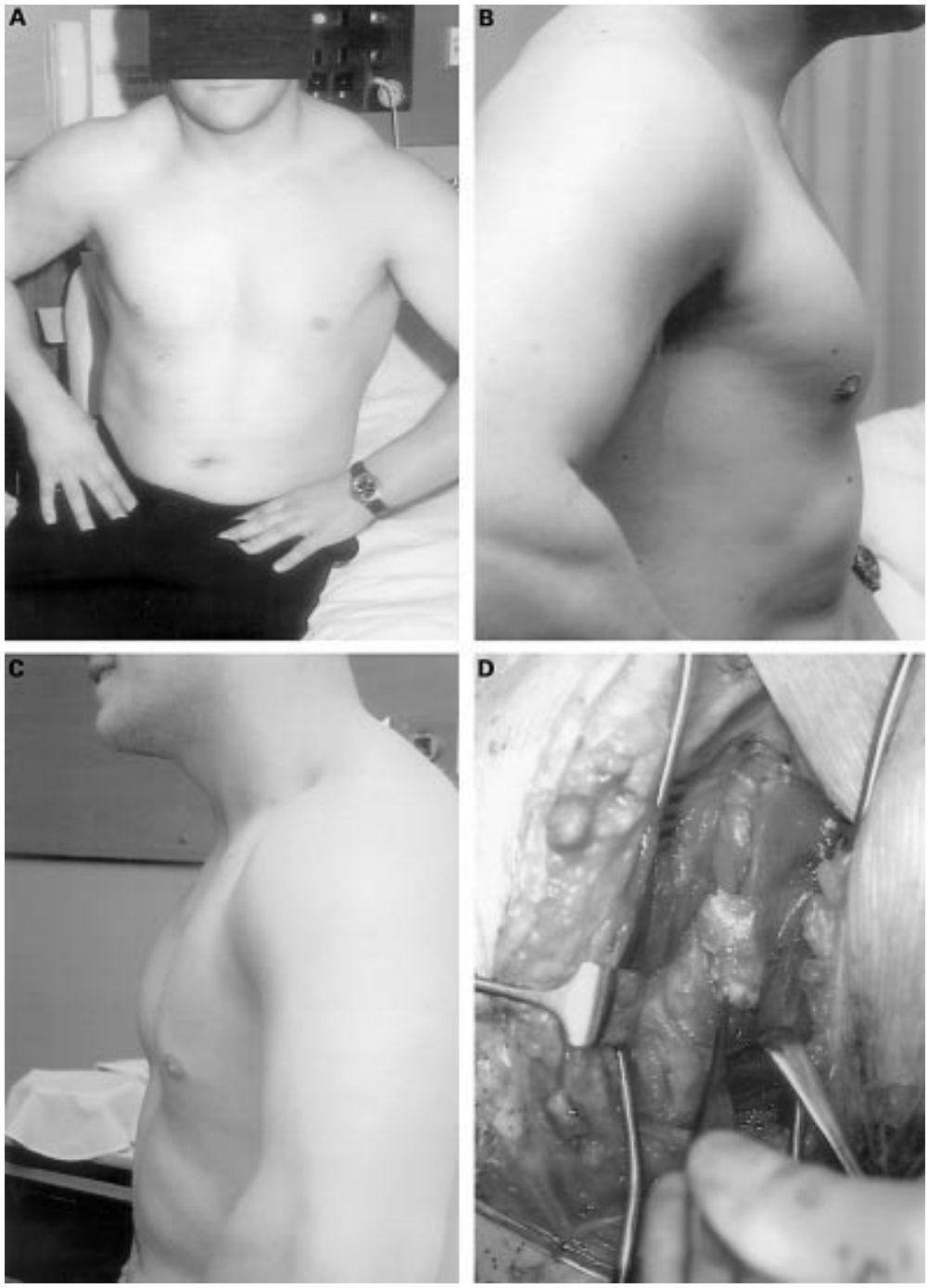

Figure 4 Diagnosis of acute rupture. (A) Acute rupture of the pectoralis major with ecchymosis over the biceps region. (B) Haematoma over the affected right pectoralis major produces appreciable swelling. (C) Normal left side for comparison. (D) Exploration confirms a complete avulsion of the pectoralis major tendon from the bone. (Photos courtesy of Mr T Lynskey.)

persists, dynamometry is helpful in the assessment and selection of patients suitable for late repair. In our experience, although the time between injury and surgery had no statistically significant effect on peak torque or work performed, we have found that delay makes the surgery technically more difficult. In a review of the literature, Jones and Matthews[7] concluded that, once diagnosed, exploration and repair within one week gives the best functional results. There is no doubt that early diagnosis and repair is ideal. However, in our series of patients, six of those who were unrepaired (50%) were diagnosed late or misdiagnosed initially. This is consistent with rates reported elsewhere,[7] and highlights the importance of awareness of this injury. The diagnostic symptoms and signs (figs 3 and 4) have been well described by Scott *et al*.[4]

In this study, 22 pectoralis major tears in 21 patients, 10 of which had been surgically repaired, were strength tested. For those surgically repaired, there was significantly greater peak torque ($p = 0.007$) and work performed ($p = 0.02$) than for those treated conservatively.

These findings were also reflected in the subjective reports of the patients. The poorest result in the repaired group was seen in a patient with a musculotendinous junction rupture, who appeared clinically to have disrupted part of his repair. Only one patient who was not repaired returned to full function. However, all patients, whether surgically treated or not, regained a full range of shoulder motion.

In the past, sports related injuries of the pectoralis major muscle have been predominantly associated with weight lifting.[7] Of the sports related injuries in the present series, most occurred during rugby or rugby league games (12), and only four were related to bench press.

CONCLUSION

Objective strength testing shows that surgical repair of a clinical tear of the pectoralis major results in greater recovery of peak torque and work performed than conservative management. This finding is independent of the strength of the patient, whether or not the dominant arm is involved, the age of the patient, and the length of time from the injury or surgery to testing. We therefore conclude that, in a patient with the clinical diagnosis of rupture of the pectoralis major, surgical repair will give the best results in terms of regaining strength and functional outcome.

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Take home message

Surgical repair results in 41–43% greater recovery of work performed and peak torque than conservative management of patients with pectoralis major rupture. This is an important issue when discussing management options with a strength or power athlete with this injury.