Surgical Management of Latissimus Dorsi Rupture in a Steer Wrestler

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Injuries are common in professional rodeo, and in a 5 year epidemiologic study, Butterwick et al[1] reported ligament and tendon ruptures as 25% of all serious rodeo injuries. The latissimus dorsi muscle performs the function of extending, adducting, and internally rotating the shoulder. It originates from the spinous processes and supraspinous ligaments of all lower thoracic, lumbar, and sacral vertebrae; the lumbar fascia; the posterior third iliac crest; the last 4 ribs, and inferior angle of scapula. Its tendon inserts on the floor of the bicipital groove of the humerus.

Rupture of the latissimus dorsi tendon has only rarely been reported in the literature. Nonoperative management of the latissimus dorsi rupture was reported by Butterwick et al,[2] who described a latissimus dorsi rupture in a professional steer wrestler. Although the patient did well in the short term, no long-term results were available, because the patient died of other causes a year after his injury. Spinner et al[3] described an atraumatic latissimus dorsi rupture in a 38-year-old golfer that was treated nonoperatively. No strength data were reported.

Surgical repair of the latissimus dorsi tendon has been reported, with good functional results but no objective strength testing.[4,5] Strength testing has been reported after surgical repair of a traumatic rupture of the latissimus dorsi tendon in a 38-year-old water skier.[6] Isokinetic strength testing in all directions at 60 and 180 degrees per second at 10 months postsurgery showed that strength of the operated limb returned to strength equal to or greater that that of the unoperated limb. Burks et al[7] described a 33-year-old police officer who ruptured his latissimus dorsi tendon, with subsequent surgical repair at 4 weeks after the injury. Results describe good function, with manual muscle strength testing of 4+/5. The current case study reports on the operative treatment of an acute latissimus dorsi tendon rupture, with objective strength outcome measures at 1 year postoperatively.

CASE REPORT

A 27-year-old steer wrestler with no history of shoulder problems was injured at a professional rodeo event. When wrestling a steer the cowboy came off his horse, falling down onto the steer with the affected arm around the steer's neck, creating a hyper-abduction force to his shoulder. He felt an immediate pop and pain in the posterior aspect of his shoulder. He was assessed on site by the Canadian Pro Rodeo Sport Medicine Team. He reported pain in the posterior axillary wall. Examination of the shoulder demonstrated a palpable defect that was made more obvious by adduction and internal rotation of the shoulder against resistance (Figure 1). Bruising over the posterior aspect of his arm developed throughout the next 2 days. A clinical diagnosis was made of a complete rupture of the latissimus dorsi tendon, and he was sent to an orthopaedic surgeon (L.A.H.) for definitive treatment 1 week after the original injury.

Preoperative imaging included radiographs of the right humerus, whose results were normal, and magnetic resonance imaging (MRI). The MRI was performed on a 1.5-T unit (Magnetom Sonata; Siemens Medical Solutions, Munich, Germany) using a torso phased-array coil. At the MRI evaluation, there was a paucity of literature to guide the imaging analysis, and therefore a multiplanar examination using a combination of axial T1-weighted images (for anatomy), axial fat-suppressed T1-weighted and T2(*) gradient echo images (for hemorrhage), and fluid-sensitive coronal short τ inversion recovery and axial fat-suppressed T2-weighted images (for localizing soft-tissue and osseous oedema) was performed.[3]

The MRI examination confirmed a complete tear at the humeral insertion of the right latissimus dorsi tendon (Figures 2 and 3). The tendon was retracted approximately 6.5 cm inferiorly and demonstrated diffuse thickening and increased T2 signal consistent with intrasubstance edema or tendinosis. A large hematoma was identified, surrounding the retracted tendon.

Given the paucity of literature with regard to this injury, the patient participated in a long discussion about operative and non-operative options. The patient requested surgical repair of the tendon. Ten days after the injury, the patient underwent general anesthesia and endotracheal intubation. He was placed in a left-side-down lateral position, tilted slightly forward. A 4 cm posterior axillary incision was used similar to that used anteriorly for a pectoralis major tendon repair. Immediately on incision of the subcutaneous tissue, a large hematoma consistent with the MRI findings was evacuated from the axillary space. Palpation medially in the cavity allowed for easy detection of the end of the latissimus dorsi tendon. It was drawn out of the wound and secured with stay sutures. The tract to the intertubercular groove was palpated by internally and externally

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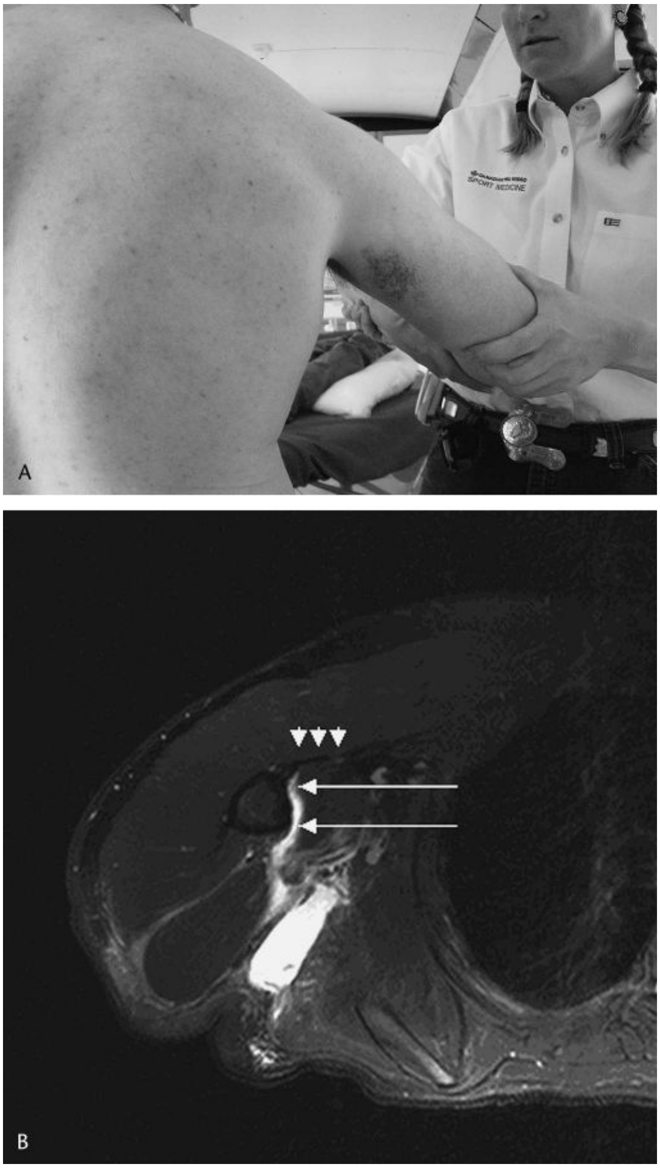

FIGURE 1. A, Bruising and defect in posterior axillary fold of the injured athlete. B, Axial fat-suppressed T2-weighted image of the right humerus and hemithorax. Note the linear high signal fluid extending along the medial margin of the proximal humerus to the expected insertion site of the latissimus dorsi tendon along the medial margin of the intertubercular groove (long white arrows). The normal-appearing, low-signal-intensity pectoralis major tendon can be followed to its insertion on the lateral margin of the intertubercular groove (white arrowheads).

rotating the shoulder. The insertion point of the latissimus dorsi was cleared of soft tissue and then debrided to bleeding bone. The tendon end was repaired to bone under no tension by using sliding whipstitch 2 G2 Mitek anchors (DePuy Mitek Inc, Raynham, MA).

Postoperatively, the patient was placed in a sling for 4 weeks. He was allowed to perform passive and active assisted range of motion in all planes. No active range of motion was allowed. At 4 weeks, the sling was discontinued and progressive active range of motion was initiated. Strengthening exercises in all directions were allowed at 6 weeks.

Strength testing was performed on both the injured and uninjured arms before the surgical procedure and at 1 year postoperatively. Strength testing was performed on a Cybex dynamometer (Cybex International, Medway, MA) and included the following measurements, contraction types, and angular velocities: internal and external shoulder rotation (isokinetic concentric, 60 and 180 degrees/second), shoulder flexion and extension (isometric at 30 degrees of flexion), and shoulder abduction and adduction (isometric, 30 degrees of abduction). Strength deficit was defined as strength of the uninjured arm minus the strength of the injured arm and reported as a percentage difference between arms.

Strength deficit results for flexion, extension, abduction, and adduction are presented in Table 1. The largest strength deficit preoperatively was observed for shoulder extension (77%), which reduced considerably at 1 year postoperatively (24%). Preoperative strength deficits were also observed for flexion (21%), adduction (13%), and abduction (14%).

Table 2 presents the external and internal rotational strength deficit data. There were no considerable preoperative strength deficits detected for internal (−12% and −16% for 60 and 180 degrees/second, respectively) or external rotation (−10% and 4% for 60 and 180 degrees/second, respectively). The greatest improvement in postoperative strength was observed in external rotational strength of the injured arm when tested at an angular velocity of 180 degrees/second (4% to −32%). Strength gains were made for both limbs for all movements compared with their preoperative values. In addition, the postoperative shoulder extension values for the injured arm were higher than the preoperative values for the uninjured arm.

DISCUSSION

This report describes the surgical repair of an acute latissimus dorsi tendon rupture in a professional athlete with isokinetic strength testing at 1 year postoperatively. The most significant deficit in strength with an acute latissimus dorsi tendon rupture is observed in shoulder extension, which suggests that although the motions performed by the latissimus dorsi include adduction and internal rotation, extension remains its primary role. The results of this case report support the theory that acute rupture of the latissimus dorsi does cause significant strength deficits, as suggested by Livesey et al.[4] These deficits can be reduced with surgical repair of the

TABLE 1. Strength Deficits for Flexion, Extension, Abduction, and Adduction of the Uninjured and Injured Limb Preoperatively and at 1 Year Postoperatively

	Uninjured Left Shoulder (Ft/lb)	Injured Right Shoulder (Ft/lb)	Strength Deficit (Uninjured – Injured/100), %
Flexion preoperative	67	55	21
Flexion 1 y postoperative	70	73	4 (Strength gain)
Extension 1 y postoperative	91	73	24
Abduction preoperative	62	54	14
Abduction 1 y postoperative	61	65	−6 (Strength gain)
Adduction preoperative	94	83	13
Adduction 1 y postoperative	116	111	4

TABLE 2. Strength Deficits for Internal and External Rotation of the Uninjured and Injured Arm Preoperatively and at 1 Year Postoperatively

		Uninjured Left Shoulder (Ft/lb)	Injured Right Shoulder (Ft/lb)	Strength Deficit (Uninjured – Injured/100), %
Internal rotation 60°/s	Preoperative	36	41	−12 (Strength gain)
	1 y postoperative	51	48	6
Internal rotation 180°/s	Preoperative	26	31	−16 (Strength gain)
	1 y postoperative	46	42	9
External rotation 60°/s	Preoperative	27	30	−10 (Strength gain)
	1 y postoperative	30	37	−18 (Strength gain)
External rotation 180°/s	Preoperative	21	22	4
	1 y postoperative	23	34	−32 (Strength gain)

tendon. Although a 24% shoulder extension side-to-side strength deficit remained at 1 year, the postoperative strength of the injured side was higher than that of the uninjured side during the preoperative testing, which suggests that the nonoperative limb increased in strength as a result of the rehabilitation process. The operative limb regained preoperative levels of strength as compared to the other side, complementing the results of Lim et al.[6] These results support good functional outcome after surgical repair of an acute traumatic latissimus dorsi tendon rupture. Unfortunately, no results of nonoperative treatment are available for comparison.

The improvement of strength in both limbs during the rehabilitation process brings up the question of whether preexisting strength deficits predispose athletes to injury.

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