Outcomes and Practical Information for Patients Choosing Nonoperative Treatment for Distal Biceps Ruptures

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abstract

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The goal of this study was to evaluate the outcomes of patients selecting nonoperative treatment for distal biceps tendon ruptures to provide information to patients and caregivers to consider in decision making. Five men conservatively treated for distal biceps tendon rupture between November 2002 and December 2006 were compared to 5 age-matched controls treated operatively. Outcomes at 4.5 years included supination strength, range of motion, and American Shoulder and Elbow Surgeons (ASES) score. Two groups of 9 normal volunteers—one young group averaging 30.7 years and 1 older group averaging 48.8 years—served as controls.

In nonoperative patients, elbow supination strength in the injured arm was 4.14 Nm (SD 0.94) and in the uninjured arm was 4.91 Nm (SD 0.65). In operative patients, supination strength was 4.25±1.08 Nm in the operatively repaired arm and 5.74±1.27 Nm in the uninjured arm. Age-matched normal patients had supination strength of 5.78±1.46 Nm in the dominant arm and 5.59±1.32 Nm in the nondominant arm. The ASES score averaged 89.57, with 3 patients reporting pain, compared to a score of 87.5 in the operative patients.

Patients choosing conservative treatment for distal biceps ruptures have residual pain and weakness approximately double that seen between normal dominant and nondominant extremities.

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Distal biceps brachii tendon rupture is a rare injury, comprising an estimated 3% of biceps tendon avulsions, with an incidence 1.2 per 100,000 patients. Although a handful of studies have compared treatment options, few agree on the best course of treatment. While early studies supported the efficacy of nonoperative treatment, favorable results with operative intervention have recently been reported. Improved clinical outcomes following operative repair have been reported in studies comparing operative to conservative treatment. While differences between these groups existed, these studies lacked long-term follow-up.

Although we do not advocate for nonoperative treatment, our patient population includes some who are resistant to operative therapy and opt for the conservative approach. For these patients, we have found a paucity of data to predict their long-term outcome, making it difficult to advise them on the course of treatment best suited to their individual expectations. Furthermore, the clinical significance of a 40% loss of supination and 30% loss of flexion historically cited for conservative treatment is unclear. The purpose of this study was twofold: (1) to evaluate the clinical outcomes for patients with distal biceps ruptures who opted for conservative treatment, and (2) to provide practical information that can be given to patients to help in their decision-making process.

**Materials and Methods**

After obtaining Institutional Review Board approval, we retrospectively reviewed all patients sustaining distal biceps tendon ruptures in a single surgeon’s practice (A.D.M.) between November 2002 and December 2006, resulting in 28 total patients. Exclusion criteria included chronic disease, chronic pain, or revision surgery, resulting in 25 patients who qualified for inclusion in the study. After discussing the risks and benefits of surgery with the surgeon, 6 patients opted for conservative therapy while 19 opted for surgery (Figure 1). All were sent for physical therapy. Nonoperative patients were asked to return for follow-up to assess range of motion (ROM), strength testing using a handheld dynamometer, and subjective evaluation using the elbow survey created and validated by the American Shoulder and Elbow Surgeons (ASES). One of the 6 eligible patients could not be contacted.

Five age-matched operative patients were also contacted and evaluated by identical outcome measures.

**Diagnostic Criteria**

Diagnosis was made by history, clinical evaluation, and radiographs and confirmed by magnetic resonance imaging (MRI).

**Treatment**

All patients diagnosed with distal biceps ruptures, including those who later opted for both operative and nonoperative treatment, were immediately treated with ROM and strengthening exercises and reassessed after 2 to 4 weeks. At that time, if they were able to perform all work and leisure activities, operative fixation was not stressed and they were given the option of operative or nonoperative treatment. Patients opting for operative treatment underwent a double-fixation technique by a single surgeon (A.D.M.) using interference screw and cortical button.

**Functional Strength Testing**

Supination strength was measured using a handheld dynamometer (PowertrackII; JTECH Medical, Salt Lake City, Utah). Reproducibility of the handheld dynamometer was confirmed through 9 trials of bilateral supination strength collected on 9 healthy patients. Intraclass correlation coefficient was used to test reliability. Interrater correlation coefficient (3,1), in which each patient is rated by the same judges who are the judges of interest, was .934 (95% confidence interval [CI], .802-.976). Intrarater correlation coefficients were determined by collecting strength data on the same patients a minimum of 2 hours apart and were .951 (95% CI, .871-.982) and .988 (95% CI, .968-.996) for the 2 raters, reflecting high reliability. We chose a handheld dynamometer because we wanted to test concentric muscle strength, which is more representative of activities of daily living.
Supination torque was evaluated with the elbow at 90° of flexion and 0° of abduction. Patients were positioned against a fixed doorway with the wrist 2 fingerbreadths beyond the boundary of the wall to eliminate external rotation. A lever arm measuring 17 cm was held in neutral position and the patient was asked to supinate with maximum effort against resistance by the investigator holding the hand-held dynamometer. Three sets of 3 repetitions were recorded and averaged on each extremity. Complete ROM (flexion, extension, supination, and pronation) and ASES elbow score evaluating both pain and function were completed at follow-up. Supination strength of both dominant and nondominant arms were tested by hand-held dynamometer on 2 different control groups, 1 comprising 9 young men and women averaging 30.7 years and another comprising 10 middle-aged men averaging 48.8 years who were visiting a physical therapy office either as a patient or as the spouse of a patient. One of the 10 was excluded as an outlier, resulting in 9 participants in each group. None of the patients who were physical therapy patients had recent pathology of the shoulder or arm. The group of young patients also served as the source of data to prove reproducibility.

**Approximation of Supination Needed for Activities of Daily Living**

To provide a real-life comparison for the strength deficit, the supination strength required to perform activities of daily living was approximated. A standard torque wrench with a constant lever arm was used to test activities of daily living by firmly affixing the wrench to various objects and completing the task of interest (Figure 2).

**RESULTS**

Of 25 eligible patients sustaining distal biceps ruptures between November 2002 and December 2006, six (24%) opted for conservative therapy. Of these, 1 was unable to be contacted and was lost to follow-up, resulting in 5 patients (83%) available for evaluation performed by an independent observer.

All conservatively managed patients returning for follow-up were right-handed men with an average age of 60.2±9.52 years who sustained a distal biceps tendon rupture. Two of the 5 had injuries to their dominant arm, while the other 3 were the nondominant arm. All 5 patients had complete ruptures and all were a result of heavy lifting (Table 1). Average time from injury to follow-up was 48.2 months (range, 24-71 months). Patients were employed as an accountant, a priest, a fire chief, a teacher, and a tile-layer. All returned to work within 7 days. Reasons for choosing nonoperative treatment included poor timing, minimal physical requirements, and operative anxiety. Radiographs at the time of injury were all negative for bony pathology. Five patients undergoing operative treatment had an average age of 48.26±7.79 years. Four were right-handed and 1 was left-handed. Two patients had injuries to their dominant arm, while 3 had injuries to their nondominant arm. Average time to surgery was 3.43±3 months. Surgery was performed acutely in 3 patients, at 3 months for 1 patient with a delay in presentation, and at 11 months for 1 patient with a chronic tear.

All nonoperative patients had 0° to 130° of flexion-extension and −90° to 90° of supination-pronation. Strength of elbow supination by hand-held dynamometer in the injured arm was 4.14±0.94 Nm and in the uninjured arm was 4.91±0.65 Nm. This resulted in a 0.77 Nm deficit or 15.6% deficit compared to the uninjured arm. In the operative group, flexion-extension was 0.5° to 128° and supination-pronation was −90° to 90° (Figure 3). Supination strength was 4.25±1.08 Nm in the operatively repaired arm and 5.74±1.27 Nm in the uninjured arm, resulting in a 1.49 Nm deficit in the injured arm or 25.9% deficit (Figure 4).

Supination strength in 9 young healthy patients aged 30.8±4.52 years was 7.36±2.22 Nm in the dominant arm and 6.97±2.45 Nm in the nondominant arm, resulting in 0.39 Nm or 5.3% difference. In a control group of 10 men averaging 48.8±6.70 years, supination strength was 5.78±1.46 Nm in the dominant arm and 5.59±1.32 Nm in the nondominant arm, resulting in 3.3% difference (Figure 5).
In the nonoperative patients, at an average of 4.5 years from injury, the mean ASES elbow score was 89.6 of 100, compared to 87.5 in the operative patients (Figure 6). Reported pain in nonoperative patients was 2/10 and 4/10 during heavy lifting for 2 patients and 2/10 during repetitive movement for 1 patient. A third patient had 3/10 pain at rest, 5/10 pain with lifting, and 7/10 pain with repetitive movement, although he described this as fatigue rather than frank pain. Two patients reported no pain. Function disability was described by only 1 patient, who reported difficulty with heavy lifting and toileting. Reports in operative patients included mild paresthesias in 2, fatigue with lifting, pain with lifting, and cosmesis.

**DISCUSSION**

In our experience in evaluating and discussing treatment options with patients who have sustained distal biceps ruptures, some patients are opposed to surgery for various reasons. However, for these patients, it has been difficult to accurately provide information about expected outcomes. Our purpose in evaluating the patients was to answer the questions: (1) How do patients who choose nonoperative treatment do after physical therapy? (2) How do patients who choose nonoperative treatment compare to those who choose surgery? and (3) how do normal patients compare?

**How Do Patients Who Choose Nonoperative Treatment Do After Physical Therapy?**

All returned to work within 7 days of injury. Our data show a residual 15% deficit remains after physical therapy. Clinically, they are pleased with their results, averaging an ASES score of 89. The ASES is divided into 50 points for pain and 50 points for function, with higher numbers indicating better outcomes. Three of our patients scored 50 for pain. Two patients who scored 47 and 39, respectively, described pain with heavy lifting, and 4 had pain with repetitive movements.

In attempting to correlate the loss of strength with functional loss, we approximated supination strength necessary for various activities of daily living. Loosening a bolt, opening a jar, turning an average doorknob, and pouring coffee from a pot all required $4 \text{ Nm}$. None of our patients approached these values in their strength, leading us to the conclusion that nonoperatively treated patients were easily able to perform these tasks.

**How Do Patients Who Choose Nonoperative Treatment Compare to Those Who Choose Surgery?**

Preliminary data collected on 5 operative patients reveal an average supination force of $4.25 \pm 1.06 \text{ Nm}$ in the operative arm (Table 2). Comparing this to the 4.14 Nm in the affected nonoperative group, there is only a 3% loss of supination strength. Furthermore, ASES scores averaged 86, lower than those for nonoperative patients. Range of motion was equivalent to the uninjured arm in all conservatively treated patients, while there were some deficits in flexion and pronation in the operatively treated group.

**How Do Normal Patients Compare?**

We observed that young patients had supination strength of $5.78 \pm 1.46 \text{ Nm}$ in the dominant arm and $5.59 \pm 1.32 \text{ Nm}$ in the nondominant arm. In an older control group more demographically similar to the study group, the difference between

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*Abbreviations: ASES, American Shoulder and Elbow Surgeons; I, injured; L, left; R, right; U, uninjured.*
the dominant and nondominant normal arms was slightly less than that seen in the younger group. Therefore, the difference between extremities in healthy patients was 3.3% to 5% vs the 15% reported in our study group. Morrey20 reported a 5% to 10% expected deficit between dominant and nondominant arms. Therefore, the loss of function following nonoperative treatment in our patients is only slightly different than that found between dominant and nondominant arms in a normal, healthy individual.

In 1985, Morrey et al13 compared results of operative reattachment with conservative treatment in 10 patients, finding an average loss of 40% of supination strength and 30% loss of flexion strength in the conservative group, whereas immediate reattachment restored normal strength in 1 year. Morrey et al13 reported subjective reports of weakness and fatigue in nonoperative patients requiring forceful supination.

Similarly, the 1985 study of Baker and Bierwagen5 comparing operative distal biceps repair with the Boyd and Anderson 2-incision approach to conservative treatment showed loss of function in the nonoperative group. Strength and endurance in flexion and supination were decreased compared to both the noninjured side and to the operative patients. Nonoperative patients had a 27% weakness of supination and a 47% loss of endurance in the injured side compared with the noninjured side, as opposed to a 13% increase in strength and 32% increased in endurance in the operative patients. Flexion strength was 21% less in the injured arm in nonoperative patients, and endurance was also 21% less compared to the noninjured side, compared with a 9% increase in both parameters in the operative group. Again, patients reported an inability to use a screwdriver and weakness with a baseball bat.

In both studies, nonoperative patients were treated by immobilization for 3 weeks following injury and progressive movement and strength exercises as tol-

![Figure 3](image3.png)  
**Figure 3:** Range of motion of the affected arm in nonoperative and operative patients after treatment.

![Figure 4](image4.png)  
**Figure 4:** Peak torque comparison between operatively and nonoperatively treated patients.

![Figure 5](image5.png)  
**Figure 5:** Peak torque comparison of patients treated nonoperatively and normal patients.

![Figure 6](image6.png)  
**Figure 6:** Average ASES results for 5 nonoperatively treated patients.
erated. Our protocol included immediate physical therapy aimed at ROM and strength. Another difference is the length of follow-up. Both of these studies averaged a follow-up of 2 years, while ours averaged 4.5 years following injury. This extra time may have resulted in the greater improvement seen in our group.

Our study design included a significant component of selection bias by allowing patients to decide whether to undergo operative vs nonoperative treatment. This could potentially alter the results if those patients who opted for conservative treatment were less severely injured at onset or had a less demanding lifestyle where a deficit would be less apparent. Also, our study did not evaluate the population of patients who were forced into nonoperative treatment, such as those with a late diagnosis or inappropriate management. Finally, our operative group had a variety of presentations, with 1 patient presenting with a chronic tear.

CONCLUSION

The purpose of this study was not to advocate conservative management of distal biceps tendon ruptures but to offer practical information to patients who choose it. Distal biceps ruptures treated either operatively or nonoperatively were associated with pain and weakness approximately double that seen between a normal dominant and nondominant extremity. This weakness appeared to be most pronounced in endurance. Additionally, patients were able to do most activities of daily living without difficulty and were satisfied with their outcomes. These patients likely differed from those evaluated in past studies because these patients were engaged in immediate ROM and strengthening once pain resolved and because of the longer follow-up.

REFERENCES


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Operative Patient Demographics

Table 2

Abbreviations: ASES, American Shoulder and Elbow Surgeons; I, injured; L, left; R, right; U, uninjured.


