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Clinical Study

Evaluation of hip flexion strength following lateral lumbar interbody fusion

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Abstract

BACKGROUND CONTEXT: Lateral interbody fusion (LIF) is a minimally invasive procedure that is designed to achieve a solid interbody fusion while minimizing the damage to the surrounding soft tissue. Although short-term results have been promising, few data have been published to date regarding its risks and complication rate.

PURPOSE: The aim was to evaluate the extent of injury to the psoas muscle after the LIF procedure by measuring hip flexion strength.

STUDY DESIGN: A prospective case series was used in the study.

METHOD: Hip flexion strength was measured using a handheld digital dynamometer while the patient was seated on a chair; the examiner held the device against the patient's attempt to flex the hip. Both sides were measured to compare the operated and nonoperated psoas muscles. Each side was measured three times and the average amount (in pounds) was recorded. Measurements were done before and after surgery on Day 2-3, at 2 weeks, 6 weeks, and at 3 and 6 months.

RESULTS: Thirty-three patients were recruited for this study. Mean preoperative hip flexion strength values were 20.7±3.47 lb and 21.3±4.31 lb for operated and nonoperated legs, respectively, with no significant difference ($p=.85$). With a mean of 11.2±2.24 lb postoperative measurements on Day 2, the operated side showed statistically significant reduction of strength ($p=.0001$). The nonoperated side was also weaker postoperatively, but not significantly (mean=19.12±1.74 lb; $p=.097$). From the first follow-up visit at 2 weeks, the values on the operated leg had returned to baseline values (20.6, $p=.97$) and were not significantly different from preoperative values on either side.

FDA device/drug status: Approved (lateral interbody fusion).

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The disclosure key can be found on the Table of Contents and at www.TheSpineJournalOnline.com.

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DISCUSSION: Hip flexion was weakened immediately after the LIF procedure, which may be attributed to psoas muscle injury during the procedure. However, this damage was temporary, with almost complete return to baseline values by 2 weeks. © 2013 Elsevier Inc. All rights reserved.

Keywords: Minimally invasive spine surgery; Lateral interbody fusion; Hip flexion weakness

Introduction

Minimally invasive spine surgery has gained increasing popularity since the first laparoscopic lumbar discectomy was described by Obenchain in 1991 [1]. The advantages of minimally invasive spine surgery include less tissue trauma during the surgical approach, less postoperative pain, improved cosmesis, shortened recovery time, and quicker return to normal daily living for the patient compared with traditional open approaches of lumbar interbody fusion [2–5].

A novel approach to minimally invasive lumbar fusion, known as lateral interbody fusion (LIF), accesses the spine via a more lateral position through the retroperitoneal fat and psoas muscle. This allows for less invasive access to the spine while still affording direct visualization of the disc. Although the technique of the LIF approach and its short-term results have been promising, limited data have been published to date regarding the long-term risks and complication rate [6–9].

Among the potential risks during LIF are injuries to the psoas muscle, exiting the ventral nerve root, and to the genitofemoral nerve. Although LIF uses an electromyographic monitoring system while transversing the psoas muscle to minimize trauma on the psoas muscle and nerves during surgery, injury to the psoas muscle remains an inherent part of this procedure, caused by the insertion of dilating instruments during discectomy and cage insertion. This may result in postoperative muscle atrophy and unilateral hip flexion weakness. No previous studies have shown whether the procedure causes any damage to the psoas muscle or not. The objective of this study was to evaluate the extent of injury to the psoas muscle after the LIF procedure by measuring hip flexion strength.

Materials and methods

A prospective evaluation of 33 patients undergoing LIF between September 2008 and November 2011 at our institution was performed.

Patient selection

Patients presenting with degenerative scoliosis, spondylolisthesis, or adjacent segment degeneration with progressive axial and radicular leg pains having failed at least 6 months of conservative, traditional nonoperative treatment were considered candidates for the LIF surgery. For our study, these candidates were further selected to include only patients who could complete their postoperative follow-up visits at 2 weeks, 3 months, and 6 months. Patients were informed of all their surgical options during a preoperative consultation. A detailed description of the LIF procedure was provided to patients who were interested in the technique, and informed consent for surgery was obtained for each patient.

Institutional Review Board approval was obtained to conduct the study on the patients undergoing LIF. All candidates were given a detailed description as to what participating in the study entailed, including study procedures, confidentiality, and potential risks. Informed consent was obtained from each patient before the study was conducted.

Clinical outcome

Psoas muscle strength was evaluated by measuring maximal hip flexion strength for 10 seconds on both legs, three times, using a handheld dynamometer (Hoggan Health Industries, West Jordan, UT, USA). Strength was measured in pounds, and the average value of the three measurements was recorded. Both sides were measured to compare the operated and nonoperated psoas muscle strengths. This measurement was performed five times: once during the patient's preoperative visit, once 2 days after the procedure, and once during each of the patient's follow-up visits at 2 weeks, 3 months, and 6 months.

Statistical analysis

The Student *t* test was used to determine if there was a statistically significant difference between the psoas strength on the operated side versus the nonoperated side. Preoperative values were also compared with postoperative values using the Student *t* test.

Results

Thirty-three patients were recruited for this study. The average age of the patients was 77 years (range 51–98 years). There were 20 women and 13 men. All fusions were performed between L2 and L5. Six of the patients were single-level procedures, 17 were two-level procedures, and 10 were three-level procedures. Sixteen patients had degenerative scoliosis, 13 had spondylolisthesis and stenosis, and 4 had adjacent segment degeneration as their primary diagnosis.

Mean preoperative hip flexion strength values were 20.7 ± 3.47 lb and 21.3 ± 4.31 lb for operated and nonoperated legs, respectively, with no significant difference ($p = .85$). With a mean of 11.2 ± 2.24 lb postoperative on

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