Importance of Surgery-Related Outcome in Thoracic Disc Disease

Surgery-related outcome measures indicate the result of a surgical procedure. For the vast majority of surgeons, outcome is loosely defined as the percentage of patients who benefit from an operation compared with the incidence of postoperative complications. Stricter criteria with quantifiable measurements will become increasingly important in defining surgery-related outcomes in the future, as it will be important to be able to compare new techniques with those already established to determine the efficacy of a procedure. Insurance companies and managed care organizations will be scrutinizing outcome data to determine whether a procedure should be performed and who should be doing it.

Having stressed the importance of surgery-related outcomes, there is probably no field as difficult to quantify outcome as thoracic disc surgery. There are several reasons for this. First, the incidence of herniated thoracic discs is very low, accounting for less than 1% of all herniated discs, with a population incidence estimated to be approximately 1 per million. Therefore, published surgical series are limited in the number of patients treated for thoracic disease. Second, the natural history of this disease is not clear, making it difficult to conclude which patients need surgery and which will most benefit from it. For instance, Brown, et al., retrospectively reviewed data obtained in 55 patients with 72 thoracic disc herniations. They found that 15 (27%) of these patients eventually required surgery, especially if they presented with signs of myelopathy. The vast majority of patients, however, did not require surgery and have continued to perform activities of daily living, including vigorous sports activities. There was no correlation between radiographic depiction and the patient’s symptoms. Awwad, et al., have substantiated these findings. In a retrospective review they compared myelography studies obtained in 68 patients harboring asymptomatic herniated thoracic discs with those obtained in five patients harboring symptomatic thoracic herniated discs. They were unable to identify any neuroimaging feature (including size of the herniated disc and degree of spinal cord compression) that could be reliably used to classify a disc as asymptomatic or symptomatic. Third, the operative treatment of thoracic discs has become of increasing interest to a number of spine surgeons who have proposed various surgical approaches to this lesion. These procedures include: 1) posterior approach (transpedicular, transfacet); 2) posterolateral approach (modified costotransversectomy, lateral extracavitary); 3) anterolateral approach (transthoracic); and 4) thoracoscopic approach. Consequently, already small series of thoracic discs are subdivided further based on which surgical approach was used. Fourth, because reports of outcome parameters are often not clearly stated in

KEY WORDS • thoracic spine • intervertebral disc • discectomy • outcome

Abbreviations used in this paper: LOS = length of hospital stay.
The goal of this paper is fourfold: to establish criteria for outcome measurement; review published surgical series of thoracic disc lesions; draw conclusions from the published papers; and make a plea for uniformity in reporting outcome data.

**Measurements of Surgical Outcome in Herniated Thoracic Discs**

Because of the low incidence of herniated thoracic discs, the large number of available surgical procedures, and lack of uniform outcome measures, specific statements about the superiority of one surgical approach over another for thoracic disc disease are very difficult to substantiate. In this paper, the merits of the various procedures reviewed will not be discussed. These procedures are well detailed in the literature. Instead, the author focuses on principles and tools for outcome measurement, making only general statements regarding specific surgical procedures.

From a scientific standpoint, when a surgeon proposes an operation to a patient, he or she is testing the hypothesis that the surgical procedure will benefit the patient more than nonsurgical treatment. Therefore, surgery-related outcome data need to be quantified using strict parameters that may be subsequently validated by statistical analysis. From a clinical standpoint, there are several important questions to answer when determining outcome. 1) Were the patient's presenting signs and symptoms relieved and what was the patient's postoperative neurological status? 2) What was the duration of surgery, estimated blood loss, and LOS? 3) Was the patient satisfied with the procedure? 4) What were the surgery-related complications and were they expected?

To answer these questions, the author reviewed only studies in which a minimum of 10 patients with thoracic disc disease were reported. In papers in which the same cases were discussed in different studies, only data obtained from the latest article or chapter were analyzed. Presenting signs and symptoms vary tremendously among patients with thoracic disc disease. To simplify the quantification of the presentation, the patient's initial signs and symptoms were divided into two categories: pain and myelopathy. Most patients suffered a combination of the two, with only a minority of patients experiencing either pain alone or myelopathy alone. Pain is classified as radiculopathy or as axial loading pain. Radiculopathy usually consists of a radiating band of pain in a dermatomal distribution whereas axial pain is described as a loading or local back pain. Myelopathy is a generalized term encompassing hyperreflexia, sensory loss, motor weakness, and bowel/bladder dysfunction. Although some authors were very specific in describing the type of pain and the degree of myelopathy, patients were classified into either a pain or myelopathy group. Improvement in either pain or myelopathy was noted as positive, even if the patient's response was a partial one.

To gauge the complexity and extent of the procedure, it is extremely important to know the duration of surgery, estimated blood loss, and LOS. Unfortunately, these parameters are rarely noted in most papers. Although these parameters are directly related to the experience and skill of the reporting surgeon, they do provide an indirect measure of the complexity of the operation. Patient satisfaction with outcome is a parameter that will be increasingly used in the future. In most of the papers reviewed the authors did not directly measure patient outcome. Instead, they used various outcome measures based on their estimation of relief of symptoms and patient satisfaction. One example is the following outcome system used by Otani, et al., and Currier, et al.: 1) excellent (asymptomatic; full activity). 2) good (slight leg pain).
Outcomes in thoracic disc surgery

**TABLE 2**

<table>
<thead>
<tr>
<th>Author &amp; Year</th>
<th>Approach</th>
<th>Duration of Surgery</th>
<th>LOS</th>
<th>Patient Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benjamin, 1983</td>
<td>transthoracic</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Sekhar &amp; Jannetta, 1983</td>
<td>laminectomy, posterolateral, transthoracic, transpedicular</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Lesoin, et al., 1986</td>
<td>transthoracic, costotransversectomy, transpedicular</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Bohman &amp; Zdeblick, 1988</td>
<td>transthoracic, costotransversectomy</td>
<td>NR</td>
<td>NR</td>
<td>53% excellent, 32% good, 5% fair, 11% poor</td>
</tr>
<tr>
<td>Otani, et al., 1988</td>
<td>extrapleural thoracotomy</td>
<td>2.5 hrs (av), blood loss 380 ml</td>
<td>NR</td>
<td>44% excellent, 35% good, 22% fair</td>
</tr>
<tr>
<td>Young, et al., 1989</td>
<td>costotransversectomy</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>El-Kalliny, et al., 1991</td>
<td>costotransversectomy, transpedicular, transthoracic</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>LeRoux, et al., 1993</td>
<td>transpedicular</td>
<td>NR</td>
<td>NR</td>
<td>68% excellent, 16% good, 16% fair</td>
</tr>
<tr>
<td>Simpson, et al., 1993</td>
<td>transpedicular, modified costotransversectomy</td>
<td>4.9 hrs, blood loss 100–800 ml, (av 360 ml)</td>
<td>3–13 days (mean 6.8 days)</td>
<td>32% excellent, 32% good, 5% fair, 5% poor*</td>
</tr>
<tr>
<td>Currier, et al., 1994</td>
<td>transthoracic, fusion</td>
<td>NR</td>
<td>NR</td>
<td>75% w/ &quot;significant improvement in remission of pain &amp; neurologic recovery&quot;</td>
</tr>
<tr>
<td>Delfini, et al., 1996</td>
<td>lateral extracavitary</td>
<td>NR</td>
<td>NR</td>
<td>71% satisfactory, 18% unchanged, 11% worse</td>
</tr>
<tr>
<td>Regan, 1996</td>
<td>thoracoscopic</td>
<td>174 mins, blood loss 449 ml</td>
<td>4 days</td>
<td>58% excellent, 25% good, 17% fair</td>
</tr>
<tr>
<td>Korovessis, et al., 1997</td>
<td>transthoracic</td>
<td>blood loss 200 ml</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Stillerman, et al., 1998</td>
<td>lat extracavitary, transfacet transpedicular</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Billsky &amp; Patterson, 1999</td>
<td>lat extracavitary</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Sebring, et al., 1999</td>
<td>lat extracavitary</td>
<td>11 days (earlier in series) down to 5 days</td>
<td>NR</td>
<td>NR</td>
</tr>
</tbody>
</table>

* Five patients were excluded because of prior laminectomy or preexisting multiple sclerosis.

spasticity or weakness, return to work), 3) fair (mild to moderate leg spasticity or weakness, return to part-time work), 4) poor (no improvement), and 5) failed (worse than before surgery). This outcome classification system is beneficial to the surgeon in that it takes into account both relief of presenting signs and symptoms and the patient’s postoperative functional status.

Lastly, although surgery-related complications are related to the surgeon’s experience and the procedure performed, it is extremely important to describe all complications. Consider that laminectomy was the operation of choice for patients with thoracic disc disease; when evidence began to mount that neurological worsening was a laminectomy-related complication, the procedure ceased to be used in the treatment of thoracic disc lesions. In addition, complications unusual for one procedure may be considered standard for another procedure. For example, a chest tube is used in operations performed via a transthoracic approach; however, a pleural tear requiring a chest tube would be considered a complication had the surgery been performed via a lateral extracavitary approach.

To simplify the classification system, complications were divided into neurological or systemic, the former indicating worsening of neurological status or the spine, the latter relating to physical injuries such as vascular injury, pleural tears, or infections.

**FINDINGS**

**Improvement in Signs and Symptoms After Thoracic Discectomies**

Table 1 lists the published series on thoracic discectomies in which there were a minimum of 10 cases. Care was taken to ensure that no cases of laminectomy were included. For instance, in the study reported by Lesoin, et al., patients who underwent laminectomy were not included in the present author’s analysis. Of these three patients, two became worse after their surgery. Because 129 patients underwent laminectomy in the series reported by Arce and Dohrmann, this large series was not included in the author’s analysis. In the future, more detailed documentation regarding grading of the pain and myelopathy may also be useful. Myelopathy may be graded using standard scales such as the Frankel classification system for assessing motor strength, evidence of urinary incontinence, or bowel constipation, and
sensory level. Pain may be more specifically noted to be radicular or axial in nature.

**Duration of Surgery, LOS, and Patient Satisfaction**

Table 2 lists the duration of surgery and LOS as well as patient satisfaction. In most cases, duration of surgery and LOS are not recorded. Regan provided the most thorough data on these outcome measures; he compared two factors, the duration of surgery and LOS, in patients who underwent thoracoscopy with those in patients who underwent conventional open surgery. In the latter series, thoracoscopic discectomy resulted in considerable reductions in both operative time and blood loss compared with open surgery. Moreover, satisfaction was quite higher in patients in whom thoracoscopy was performed. New developments in techniques for treating thoracic disc lesions need to be published, and lesions and data on duration of surgery, LOS, and patient satisfaction need to be compared, as in the study by Regan. Although these data are useful as an indirect measurement of the case complexity, duration of surgery and LOS will remain indicators of a surgeon’s skill and choices.

**Complications of Thoracic Discectomy**

Table 3 lists the complications for thoracic discectomies. Most of the systemic-related complications were infection or pulmonary injury secondary to the procedure. Neurological complications were very rare. The vast majority of patients with thoracic disc lesions did not experience worsened status postoperatively; this is keenly apparent now that laminectomies are not performed. Although the incidence of complications is low, these series were published by surgeons experienced in the surgical treatment of the thoracic spine and thoracic discs in particular. A surgeon who is inexperienced in this field should consider referring these patients to more experienced surgeons. Overall it is important to be able to anticipate the specific approach- and surgery-related complications so that they can be dealt with in an expeditious manner. Recognition of the individual surgeon’s limitations is important in decreasing the number of potential complications.

**CONCLUSIONS**

Quantification of surgical outcome is crucial in the treatment of thoracic disc disease. I have reviewed surgical series with more than 10 patients treated for thoracic disc disease in the postlaminectomy era. Outcome measurement was quantified in terms of alleviation of presenting signs and symptoms; duration of surgery, estimated blood loss, and LOS; patient satisfaction with procedure; and surgical complications. In general, the procedures currently performed for thoracic discs (transthoracic, lateral extracavitary, transpedicular, endoscopic) were found to be effective in eliminating complications. However, duration of surgery, estimated blood loss, LOS, and patient satisfaction were often not reported. A plea is made for greater uniformity in documenting outcome for thoracic disc disease.

**References**

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Address reprint requests to: Thomas C. Chen, M.D., Ph.D., 1200 North State Street #5046, Los Angeles, California 90033. email: tchen68670@aol.com.