

DEFINING THE ROLE OF VIDEO ASSISTED THORACOSCOPIC APPROACH IN TREATMENT OF SPINAL DEFORMITY: ANTERIOR RELEASE

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INTRODUCTION

Video-assisted thoracoscopic (VAT) spinal surgery has become a popular approach to the anterior thoracic spine. VAT spinal surgery has benefits over the traditional open thoracotomy approach in that the scar is less unsightly, there is less postoperative morbidity, and there is better visualization at the ends of the fusion. VAT spinal surgery is performed either in the lateral position with single lung ventilation via a double lumen endotracheal intubation or prone with single lumen endotracheal technique. The single lumen technique is particularly useful in the child less than thirty kilograms, as single lung ventilation is difficult in the small child. Access from the T-2 to L1 vertebral body and disc can be obtained with retraction of the relevant structures.

The indications for VAT spinal surgery are similar to the indications for open surgery and include:

1. Anterior spinal release
2. Anterior spinal fusion
3. Anterior spinal decompression
4. Internal thoracoplasty
5. Anterior spinal growth arrest

The open thoracotomy technique is still preferred in the presence of excessive thoracic lordosis, pleural adhesions from infection or prior thoracotomy, or respiratory function that cannot be adequately supported during endoscopic approach. The ability of the surgeon to achieve success with the VAT technique for each indication is in evolution.

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HOW IS THE RIGIDITY OF THE SPINAL DEFORMITY DETERMINED?

Anterior release, as a means for increasing correction for posterior spinal instrumentation and arthrodesis, is been advocated when rigid deformity is encountered. Classically, a deformity that fails to correct to less than 50 degrees by side-bending radiographs has been an indication for anterior spinal release. The rationale for achieving greater correction is that a straighter spine has less deformity, which in turn results in a higher rate of union.

The rigidity of a spinal deformity is determined by radiographic examinations. Standing radiographs are compared to views in a corrected position. The corrected positional views used at various times are:

1. Side-bending
2. Prone push
3. Fulcrum bending
4. Traction

Side-bending films may be supine or standing. With active side-bending films, the patient is instructed to bend toward the right and left while a radiograph is obtained in each maximal position. The amount of correction can be expressed as a percentage of the standing radiographic deformity or as an absolute number. A passive bending radiograph can be obtained when the patient cannot participate actively. Such a circumstance arises when a patient is under anesthesia, or if the patient is unable to comply with instructions. The side-bending radiograph is most useful in idiopathic scoliosis, and it is an important part of the King and Lenke classification systems for idiopathic scoliosis.

The prone push test is a useful maneuver to assess the effect of correction of the lumbar deformity on the residual thoracic deformity. Manual pressure is applied to the patient in the prone position while the thoracic spinal asymmetry is assessed. A large residual thoracic deformity would encourage the surgeon to incorporate both the thoracic and lumbar curves in the correction of a double major deformity.

Side-lying fulcrum-bending radiograph has been shown to give a larger correction than active lateral bends. The improved correction with fulcrum-bending may be a better predictor of surgical outcome as achieved with use of third generation spinal instrumentation.

For patients with neuromuscular scoliosis, a traction film provides better prediction of postoperative results. Longitudinal

traction is applied with the patient in the supine position, and the correction is captured on a radiograph. The position of the spinal deformity with traction is analogous to traction on a Risser of frame or the distraction obtained with spinal instrumentation. Traction force is most corrective for curves greater than 50 degrees, whereas translational forces are most corrective for curves less than 50 degrees.

HOW EFFECTIVE IS THE VAT ANTERIOR RELEASE?

The amount of correction gained by an anterior release may be related to the extent of soft tissue contracture. Even a large deformity with significant correction on pre-operative corrective radiographs may be safely handled with posterior instrumented spinal fusion. A rigid deformity will require release of the soft tissue contracture prior to the insertion of the spinal instrumentation. Feiertag et al. performed a biomechanical study on cadaveric spines, demonstrating that the amount of spinal mobility achieved by the anterior release is related to the amount of disc excision. The study found that the standard "complete" discectomy to the level of posterior longitudinal ligament did not improve spinal mobility in their model of a non-scoliotic cadaveric spine. They noted that the addition of rib head excision to the standard discectomy produced significantly improved spinal mobility spine. The extent of soft tissue contracture in the scoliotic spine has not been previously studied.

In a pilot study of spinal flexibility in adolescent idiopathic scoliosis, we found that VAT anterior spinal surgery did improve spinal mobility. Patients with idiopathic scoliosis were retrospectively reviewed to determine the effectiveness of VAT anterior release in improving spinal mobility. The fulcrum bend test, under anesthesia, was applied to the patients prior to and after VAT anterior spinal release. Cobb measurements were obtained. A comparison of the pre-operative and post-operative values was made. VAT anterior release involved excision of the anterior longitudinal ligament, the annulus, and the nucleus pulposus on the convexity of the rigid portion of the curve. The post-operative correction exceeded the pre-operative correction by an average of 10 degrees as measured on the fulcrum bend tests. The ultimate correction of each curve is determined after the posterior instrumentation, an event that is influenced by the anterior release.

SUMMARY

VAT anterior spinal surgery is useful in the treatment of spinal deformity. We have invoked the VAT approach to reduce the peri-operative morbidity associated with a thoracotomy. The anterior spinal release of the anterior longitudinal ligament, annulus, and nucleus pulposus can be effectively achieved with the VAT approach to improve the spinal mobility by 10 degrees, as measured by corrective radiographs. In order to achieve a greater amount of correction, a more extensive anterior release, including adjacent rib head excision and posterior longitudinal ligament release, may be needed.

Reference

1. Feiertag MA, Horton WC, Norman JT, *et al.* The effect of different surgical releases on thoracic spinal motion: A cadaveric study. *Spine* 1995 Jul 15;20(14):1604-11.