Anterior cervical corpectomy and fusion

- Impact of anterior controllable antedisplacement and fusion (ACAF) on cervical lordosis and sagittal alignment in OPLL: A comparative radiographic analysis
- Epithelioid angiosarcoma of the cervical spine: A case report
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- Cervical Pyogenic Spondylitis: A Comprehensive Review of Diagnosis and Treatment Strategy
- Anterior Cervical V-Shaped Osteotomy and Fusion (ACVF) for Retro-Corporeal Decompression Bypassing Anterior Corpus Vertebra: A Technical Note
- Three-Dimensional Printed Anterior Cervical Standalone Combined Cage-Plate-300 Consecutive Medical Implants

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Indications

Anterior cervical corpectomy, is often done for multi-level cervical spinal stenosis with spinal cord compression caused by osteophytes.

Although an autologous bone graft is the gold standard for vertebral replacement after corpectomy, industrial implants have become popular because they result in no donor-site morbidity.

Cervical corpectomy is an uncommon procedure and there are only limited data on the procedure's indications, surgical approaches, and complications. The diagnosis, indications, surgical planning, and complications of cervical corpectomy were therefore surveyed to clarify the treatment strategies used by spinal surgeons in central Europe, with special attention to preoperative planning and decision-making for additional dorsal approaches in multilevel cases.

An online survey with 18 questions on the preoperative, intraoperative, and postoperative management of cervical corpectomies was conducted. The relevant specialist societies in Germany and Austria provided 1137 contacts for surgeons, and the responses were compared with recent literature reports.

In all, 302 surgeons (27 %) completed the survey, with wide variability in the treatment options offered. Most (51 %) perform fewer than five anterior cervical corpectomy and fusion (ACCF) procedures per year; 35 % do 5-20 per year. Anterior cervical discectomy and fusion (ACDF) was preferred by 41 % of the participants to laminoplasty/laminectomy (19 %/16 %) and ACCF (12 %). Most indications for ACCF involved degenerative (27 %), traumatic (17 %), and neoplastic (20 %) conditions. Intraoperative and postoperative complications were mainly associated with hardware failure. One-third of the surgeons tend to use an additional dorsal approach to increase the corpectomy construct's stability for either two-level or three-level corpectomies.

There is no current consensus in central Europe on the treatment of complex cervical disease and

cervical corpectomy. The procedure is still rare, and the need for additional dorsal fixation is unclear. Further studies are needed in order to establish evidence-based standards for patient care [1)].

Technique

see also Anterior cervical discectomy and fusion technique.

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1. Supine position: some use halter traction with this

2. equipment:

a) microscope (not used by all surgeons)

b) C-arm

3. implants: graft (e.g. PEEK, cadaver bone, titanium cage…) and anterior cervical plate (optional, especially on single level ACDF)

The approach is similar to a cervical discectomy (anterior approach), although a larger and more vertical incision in the neck will often be used to allow more extensive exposure. The spine surgeon then performs a discectomy at either end of the vertebral body that will be removed (e.g. C4-C5 and C5-C6 to remove the C5 vertebral body). More than one vertebral body may be removed. The posterior longitudinal ligament is often removed to allow access to the cervical canal and to ensure complete removal of the pressure on the spinal cord and/or nerve roots. The defect must then be reconstructed with an appropriate fusion technique.

The surgery is performed utilizing general anesthesia. A breathing tube (endotracheal tube) is placed and the patient breathes using a ventilator during the surgery. Preoperative intravenous antibiotics are given. Patients are positioned in the supine (lying on the back) position, generally using a standard flat operating table. The surgical region (neck area) is cleansed with a special cleaning solution. Sterile drapes are placed, and the surgical team wears sterile surgical attire such as gowns and gloves to maintain a bacteria-free environment.

A 2-4 centimeter (depending on the number of levels) transverse incision is made in one of the creases of neck, just off the midline. The cervical fascia is gently divided in a natural plane, between the esophagus and carotid sheath (area containing the blood vessels in the neck). Small retractors and an operating microscope are used to allow the surgeon to visualize the anterior (front part) vertebral body and discs. After the retractor is in place, an x-ray is used to confirm that the appropriate spinal level(s) is identified.

A complete corpectomy and discectomy (removal of the cervical vertebral body and disc, including the protruding osteophytes and disc fragments) is typically performed, allowing the spinal cord and nerves to return to their normal size and shape when the compressive lesions are removed. Small dental-type instruments and biting/grasping instruments (such as a pituitary rongeur and kerrison

rongeur) are used to remove the arthritic, hypertrophic (overgrown) bone spurs. All surrounding areas are also checked to ensure no compressive spurs or disc fragments are remaining. The size of the empty disc space is measured; a graft size is chosen so as to restore the normal disc space height and the graft is then gently tapped into the disc space, in between the two vertebral bodies. A small titanium metal plate is frequently placed, affixed to the vertebrae with small screws, to impart immediate stability to the construct and allow for optimal bone healing and fusion. X-rays are then used to confirm appropriate position and alignment of the graft and hardware.

The wound area is usually washed out with sterile water containing antibiotics. The deep fascial layer and subcutaneous layers are closed with a few strong sutures. The skin can usually be closed using special surgical glue, leaving a minimal scar and requiring no bandage [2].

Complications

The most common complication is intrusion of the implant into the endplate of the adjacent vertebrae [3].

Outcome

The National Surgical Quality Improvement Program database was used to identify 1560 patients who underwent cervical corpectomy in United States Veterans Affairs hospitals from 1997 to 2006. Multivariate analysis was performed to analyze the effects of patient and hospital characteristics on morbidity and mortality rates.

A total of 1560 patients underwent corpectomy, with an overall in-Hospital mortality rate of 1.6%, a complication rate of 18.4%, and a mean length of stay of 6 days. Multivariate analysis identified age older than 80 years (odds ratio [OR], 21.24), history of Type 1 diabetes (OR, 2.36), American Society of Anesthesiologists class greater than 3 (OR, 6.93), and dependent functional status (OR, 3.17) as the most significant preoperative predictors of complications. Three or more corpectomy levels (OR, 2.46) and operative duration longer than 6 hours (OR, 3.45) were also found to be significant predictors of postoperative complications. Patients who underwent 3 or more levels of corpectomy had a return-to-operating room rate of 17.9% and a graft/instrumentation failure rate of 5.4% compared with those who underwent single-level corpectomy, who had rates of 6.2 and 1.87%, respectively. Patients who were returned to the operating room had significantly higher mortality rates (7.0 versus 1.2%) and accounted for 39.9% of the total number of complications. Multivariate analysis identified age, American Society of Anesthesiologists class, history of disseminated cancer, and diabetes as the most significant predictors of mortality. Patients with Type 1 diabetes had 4-fold higher mortality rates compared with patients with no history of diabetes or diet-controlled diabetes.

Type 1 diabetes was established as a strong risk factor for 30-day mortality after cervical corpectomy [4]

Review

Shamji et al., conducted a systematic search in MEDLINE and the Cochrane Collaboration Library for human studies in the English-language literature published through September 2012. They included studies comparing multiple discectomies with single or multiple corpectomy, multiple discectomies with discectomy-corpectomy hybrid, and multiple corpectomies with discectomy-corpectomy hybrid,

comparing effectiveness and safety outcomes of each procedure, and defining the ancillary stabilization techniques used. Exclusion criteria included patients with degenerative disc disease or degenerative joint disease without CSM, single-level CSM, ossified posterior longitudinal ligament (OPLL), spinal tumor, concomitant infection, and ankylozing spondylitis. Case series, case reports, data not reported separately for each comparison group, or studies that consisted of an N less than 10 for either comparison group were excluded. The evidence strength was rated using the GRADE (Grades of Recommendation Assessment, Development, and Evaluation) criteria.

Of the 49 citations identified from the search, 10 studies were initially found suitable for inclusion. Patients undergoing any of the 3 procedures generally experienced improvements in clinical outcomes (neck disability index, Japanese Orthopaedic Association score, and Visual Analogue Scale score for pain) as well as overall sagittal alignment, with minimal perioperative morbidity. There is moderate evidence supporting selection of multiple discectomies compared with corpectomy or discectomy-corpectomy hybrid procedures with regard to superior clinical outcomes and postoperative sagittal alignment. Furthermore, if more extensive operation is needed, there is evidence to support the selection of discectomy-corpectomy hybrid procedures compared with multiple corpectomies if it is technically feasible to accomplish the requisite decompression. The multiple discectomies approach also may have a lower incidence of C5 palsy than corpectomy or discectomy-corpectomy hybrid approaches.

All 3 operative approaches are effective strategies for the anterior surgical management of CSM. When the patient pathoanatomy permits, selection of multiple discectomies is favored compared with corpectomy or discectomy-corpectomy hybrid approaches [5].

Case series

Expandable cages are frequently used to reconstruct the anterior spinal column after a corpectomy. In a retrospective study, Pojskic et al. evaluated the perioperative advantages and disadvantages of corpectomy reconstruction with an expandable cage.

Eighty-six patients (45 male and 41 female patients, medium age of 61.3 years) were treated with an expandable cervical titanium cage for a variety of indications from January 2012 to December 2019 and analyzed retrospectively. The mean follow-up was 30.7 months. Outcome was measured by clinical examination and visual analogue scale (VAS); myelopathy was classified according to the EMS (European Myelopathy Score) and gait disturbances with the Nurick scale. Radiographic analysis comprised measurement of fusion, subsidence and the C2-C7 angle.

Indications included spinal canal stenosis with myelopathy (46 or 53.5%), metastases (24 or 27.9%), spondylodiscitis (12 or 14%), and fracture (4 or 4.6%). In 39 patients (45.3%), additional dorsal stabilization (360° fusion) was performed. In 13 patients, hardware failure occurred, and in 8 patients, adjacent segment disease occurred. Improvement of pain symptoms, myelopathy, and gait following surgery were statistically significant ($p < 0.05$), with a medium preoperative VAS of 8, a postoperative score of 3.2, and medium EMS scores of 11.3 preoperatively vs. 14.3 postoperatively. Radiographic analysis showed successful fusion in 74 patients (86%). As shown in previous studies, correction of the C2-C7 angle did not correlate with improvement of neurological symptoms.

The results show that expandable titanium cages are a safe and useful tool in anterior cervical corpectomy for providing adequate anterior column support and stability [6].

2006

A total of 31 cases were available for the 10-year follow-up after surgery (86% follow-up rate). Clinical results and radiographic measurements were obtained before surgery, 3 months after surgery, and at follow-up.

There were 3 patients who had deterioration of the Japanese Orthopedic Association score of 1 point because of increasing hand numbness; 1 patient had adjacent disc degeneration, and 1 had pseudarthrosis without additional stenosis on magnetic resonance imaging. Adjacent disc degeneration did not affect the clinical results (P = 0.76).

The long-term follow-up showed stable clinical results for more than 10 years, which depended on the thorough removal of the possible causes of the myelopathy, such as ossification of the posterior longitudinal ligament or a degenerated disc. Adjacent disc degeneration has minimal effects on the long-term clinical results after anterior long fusion [7)].

2004

72 patients who underwent cervical corpectomy between February 1992 and June 2001 were retrospectively investigated.

The indications for this operation were degenerative spondylitic disease (26 cases; 36.1%), trauma (18 cases; 25%), tumour (11 cases; 15.3%), infection (10 cases; 13.9%), and ossification of the posterior longitudinal ligament (7 cases; 9.7%). Thirty-seven patients (51.4%) underwent one-level corpectomy, and 35 (48.6%) underwent two-level corpectomy. Autografts were used in 13 cases (18.1%) and allografts were used in 59 cases (81.9%). Anterior plate-screw fixation was performed in all cases. There were 31 postoperative complications in 15 (20.8%) patients. Twelve of the complications were surgical, 5 were graft-related, 7 were plating-related, and 7 were medical. Solid bony fusion was achieved in 65 (92.9%) of the 70 surviving patients. The mean follow-up time was 23.4 months. An overall favourable outcome was achieved in 88% of cases.

The outcomes in this series indicate that cervical corpectomy is an effective method for treating traumatic lesions, degenerative disease, tumours and infectious processes involving the anterior and middle portions of the cervical spine [8)].

Videos

<html><iframe width="560" height="315" src="https://www.youtube.com/embed/1jZ-YM3_myI" frameborder="0" allowfullscreen></iframe></html>

1)
Hartmann S, Tschugg A, Obernauer J, Neururer S, Petr O, Thomé C. Cervical corpectomies: results of a survey and review of the literature on diagnosis, indications, and surgical technique. Acta Neurochir (Wien). 2016 Oct;158(10):1859-67. doi: 10.1007/s00701-016-2908-z. Epub 2016 Aug 25. PubMed PMID: 27557956.

2)
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3)
Guzik G. Outcomes of Corpectomy in Patients with Metastatic Cancer. Ortop Traumatol Rehabil. 2017 Jan 26;19(1):23-32. doi: 10.5604/15093492.1235275. PubMed PMID: 28436378.
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5)
Shamji MF, Massicotte EM, Traynelis VC, Norvell DC, Hermsmeyer JT, Fehlings MG. Comparison of anterior surgical options for the treatment of multilevel cervical spondylotic myelopathy: a systematic review. Spine (Phila Pa 1976). 2013 Oct 15;38(22 Suppl 1):S195-209. doi: 10.1097/BRS.0b013e3182a7eb27. Review. PubMed PMID: 23962998.
6)
Pojskic M, Saβ B, Nimsky C, Carl B. Application of an Expandable Cage for Reconstruction of the Cervical Spine in a Consecutive Series of Eighty-Six Patients. Medicina (Kaunas). 2020 Nov 25;56(12):E642. doi: 10.3390/medicina56120642. PMID: 33255605.
7)
Ikenaga M, Shikata J, Tanaka C. Long-term results over 10 years of anterior corpectomy and fusion for multilevel cervical myelopathy. Spine (Phila Pa 1976). 2006 Jun 15;31(14):1568-74; discussion 1575. PubMed PMID: 16778689.
8)
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