Anterior cervical discectomy and fusion complications

In multiple studies, overall morbidity rates for ACDF varied from 13.2% to 19.3%. These included in descending order: dysphagia (1.7%-9.5%), postoperative hematoma (0.4%-5.6% (surgery required in 2.4% of 5.6%), with epidural hematoma 0.9%), exacerbation of myelopathy (0.2%-3.3%), symptomatic recurrent laryngeal nerve palsy (0.9%-3.1%), cerebrospinal fluid (CSF) leak (0.5%-1.7%), wound infection (0.1-0.9%-1.6%), increased radiculopathy (1.3%), Horner's syndrome (0.06%-1.1%), respiratory insufficiency (1.1%), esophageal perforation (0.3%-0.9%, with a mortality rate of 0.1%), and instrument failure (0.1%-0.9%). There were just single case reports of an internal jugular vein occlusion and a phrenic nerve injury. Pseudarthrosis occurred in ACDF and was dependant on the number of levels fused; 0-4.3% (1-level), 24% (2-level), 42% (3 level) to 56% (4 levels). The reoperation rate for symptomatic pseudarthrosis was 11.1%. Readmission rates for ACDF ranged from 5.1% (30 days) to 7.7% (90 days postoperatively).

Complications attributed to ACDF included; dysphagia, hematoma, worsening myelopathy, recurrent laryngeal nerve palsy, CSF leaks, wound infection, radiculopathy, Horner's Syndrome, respiratory insufficiency, esophageal perforation, and instrument failure. There were just single case reports of an internal jugular vein thrombosis, and a phrenic nerve injury. As anticipated, pseudarthrosis rates increased with the number of ACDF levels, ranging from 0-4.3% for 1 level up to 56% for 4 level fusions.

ACD is known to be associated with a higher risk either of residual increased neck and shoulder pain or of developing a postoperative kyphotic deformity of the cervical spine; and this, in turn, can lead to the development of degenerative changes at adjacent levels.

A 2-page survey was distributed to attendees at the 2015 Cervical Spine Research Society (CSRS) meeting. Respondents were asked to categorize 18 anterior cervical discectomy and fusion-related adverse events as either: “common and acceptable,” “uncommon and acceptable,” “uncommon and sometimes acceptable,” or “uncommon and unacceptable.” Results were compiled to generate the relative frequency of these responses for each complication. Responses for each complication event were also compared between respondents based on practice location (US vs. non-US), primary specialty (orthopedics vs. neurosurgery) and years in practice.

Of 150 surveys distributed, 115 responses were received (76.7% response rate), with the majority of respondents found to be US-based (71.3%) orthopedic surgeons (82.6%). Wrong level surgery, esophageal injury, retained drain, and spinal cord injury were considered by most to be unacceptable and uncommon complications. Dysphagia and adjacent segment disease occurred most often, but were deemed acceptable complications. Although surgeon experience and primary specialty had little impact on responses, practice location was found to significantly influence responses for 12 of 18 complications, with non-US surgeons found to categorize events more toward the uncommon and unacceptable end of the spectrum as compared with US surgeons.

These results serve to aid communication and transparency within the field of spine surgery, and will help to inform future quality improvement and best practice initiatives.
Vocal cord palsy

see Vocal cord palsy after anterior cervical discectomy.

Cervical adjacent segment disease

Cervical adjacent segment disease

Hoarseness

Hoarseness, approximately in 5%.

Dysphagia

Dysphagia after anterior cervical discectomy

Postoperative hemorrhage

see Postoperative hemorrhage after anterior cervical discectomy and fusion

Cerebrospinal fluid (CSF) leaks

Cerebrospinal fluid (CSF) leaks, although uncommon, may occur and can be a potentially serious complication. Little is known regarding the fusion rate after durotomy in ACDF.

In a single-institution retrospective review, 14 patients who experienced CSF leak after ACDF between 1995 and September 2014 were identified.

The median follow-up was 13.1 months. The diagnoses included spondylosis/degenerative disc disease (n = 10), disc herniation with radiculopathy (n = 3), and kyphotic deformity (n = 1). Of ACDFs, 7 were 1-level, 5 were 2-level, and 2 were 3-level procedures. The posterior longitudinal ligament was intentionally opened in all cases and the microscope was used in 9 cases. Durotomy was discovered intraoperatively in all cases and was generally repaired with a combination of fibrin glue and synthetic dural replacement. Lumbar drainage was used in 5 patients, and 3 patients reported orthostatic headaches, which resolved within 1 month. Two patients reported hoarseness, and 8 patients reported dysphagia; all cases were transient. Follow-up imaging for fusion assessment was available for 12 patients, and a 100% fusion rate was achieved with no postoperative infections.

ACDFs with CSF leak had a 100% fusion rate in this series, with generally excellent clinical outcomes, although it is difficult to conclude definitively that there is no effect on fusion rates because of the small sample size. However, given the relative rarity of this complication, this study provides important data in the clinical literature regarding outcomes after CSF leak in ACDFs.

Pharyngoesophageal perforation

see Esophageal perforation.
Spinal subdural hematoma

A spinal subdural hematoma is a rare clinical entity with considerable consequences without prompt diagnosis and treatment. Throughout the literature, there are limited accounts of spinal subdural hematoma formation following spinal surgery. This report is the first to describe the formation of a spinal subdural hematoma in the thoracic spine following surgery at the cervical level. A 53-year-old woman developed significant paraparesis several hours after anterior cervical discectomy and fusion of C5-6. Expeditious return to operating room for anterior cervical revision decompression was performed, and the epidural hematoma was evacuated without difficulty. Postoperative imaging demonstrated a subdural hematoma confined to the thoracic level, and the patient was returned to the operating room for a third surgical procedure. Decompression of T1-3, with evacuation of the subdural hematoma was performed. Postprocedure, the patient's sensory and motor deficits were restored, and, with rehabilitation, the patient gained functional mobility. Spinal subdural hematomas should be considered as a rare but potential complication of cervical disectomy and fusion. With early diagnosis and treatment, favorable outcomes may be achieved.

Carotid artery compression

Legatt et al., report herein a case of anterior cervical discectomy and fusion (ACDF) surgery in which findings on somatosensory evoked potential (SSEP) monitoring led to the correction of carotid artery compression in a patient with a vascularly isolated hemisphere (no significant collateral blood vessels to the carotid artery territory). The amplitude of the cortical SSEP component to left ulnar nerve stimulation progressively decreased in multiple runs, but there were no changes in the cervicomedullary SSEP component to the same stimulus. When the lateral (right-sided) retractor was removed, the cortical SSEP component returned to baseline. The retraction was then intermittently relaxed during the rest of the operation, and the patient suffered no neurological morbidity. Magnetic resonance angiography demonstrated a vascularly isolated right hemisphere. During anterior cervical spine surgery, carotid artery compression by the retractor can cause hemispheric ischemia and infarction in patients with inadequate collateral circulation. The primary purpose of SSEP monitoring during ACDF surgery is to detect compromise of the dorsal column somatosensory pathways within the cervical spinal cord, but intraoperative SSEP monitoring can also detect hemispheric ischemia. Concurrent recording of cervicomedullary SSEPs can help differentiate cortical SSEP changes due to hemispheric ischemia from those due to compromise of the dorsal column pathways. If there are adverse changes in the cortical SSEPs but no changes in the cervicomedullary SSEPs, the possibility of hemispheric ischemia due to carotid artery compression by the retractor should be considered.

Heterotopic Ossification

Heterotopic ossification (HO) has been reported following total hip, knee, cervical arthroplasty, and lumbar arthroplasty, as well as following posterolateral lumbar fusion using recombinant human morphogenetic protein 2 (rhBMP-2). Data regarding HO following anterior cervical disectomy and fusion (ACDF) with rhBMP-2 are sparse. A subanalysis was done of the prospective, multicenter, investigational device exemption trial that compared rhBMP-2 on an absorbable collagen sponge (ACS) versus allograft in ACDF for patients with symptomatic single-level cervical degenerative disc disease.

To assess differences in types of HO observed in the treatment groups and effects of HO on functional and efficacy outcomes, clinical outcomes from previous disc replacement studies were compared between patients who received rhBMP-2/ACS versus allograft. Rate, location, grade, and size of ossifications were assessed preoperatively and at 24 months, and correlated with clinical outcomes.
RESULTS Heterotopic ossification was primarily anterior in both groups. Preoperatively in both groups, and including osteophytes in the target regions, HO rates were high at 40.9% and 36.9% for the rhBMP-2/ACS and allograft groups, respectively (p = 0.350). At 24 months, the rate of HO in the rhBMP-2/ACS group was higher than in the allograft group (78.6% vs 59.2%, respectively; p < 0.001). At 24 months, the rate of superior-anterior adjacent-level Park Grade 3 HO was 4.2% in both groups, whereas the rate of Park Grade 2 HO was 19.0% in the rhBMP-2/ACS group compared with 9.8% in the allograft group. At 24 months, the rate of inferior-anterior adjacent-level Park Grade 2/3 HO was 11.9% in the rhBMP-2/ACS group compared with 5.9% in the allograft group. At 24 months, HO rates at the target implant level were similar (p = 0.963). At 24 months, the mean length and anteroposterior diameter of HO were significantly greater in the rhBMP-2/ACS group compared with the allograft group (p = 0.033 and 0.012, respectively). Regarding clinical correlation, at 24 months in both groups, Park Grade 3 HO at superior adjacent-level disc spaces significantly reduced range of motion, more so in the rhBMP-2/ACS group. At 24 months, HO negatively affected Neck Disability Index scores (excluding neck/arm pain scores), neurological status, and overall success in patients in the rhBMP-2/ACS group, but not in patients in the allograft group.

Implantation of rhBMP-2/ACS at 1.5 mg/ml with polyetheretherketone spacer and titanium plate is effective in inducing fusion and improving pain and function in patients undergoing ACDF for symptomatic single-level cervical degenerative disc disease. At 24 months, the rate and dimensions (length and anteroposterior diameter) of HO were higher in the rhBMP-2/ACS group. At 24 months, range of motion was reduced, with Park Grade 3 HO in both treatment groups. The impact of Park Grades 2 and 3 HO on Neck Disability Index success, neurological status, and overall success was not consistent among the treatment groups. The study data may offer a deeper understanding of HO after ACDF and may pave the way for improved device designs.

Subsidence

There is evidence documenting relatively frequent complications in stand-alone cage assisted ACDF, such as cage subsidence and cervical kyphosis.

Subsidence irrespective of the measurement technique or definition does not appear to have an impact on successful fusion and/or clinical outcomes. A validated definition and standard measurement technique for subsidence is needed to determine the actual incidence of subsidence and its impact on radiographic and clinical outcomes.

The results of a observational study were in accordance with those of the published randomized controlled trials (RCTs), suggesting substantial pain reduction both after anterior cervical interbody fusion (AIF) and Cervical total disc replacement, with slightly greater benefit after arthroplasty. The analysis of atypical patients suggested that, in patients outside the spectrum of clinical trials, both surgical interventions appeared to work to a similar extent to that shown for the cohort in the matched study. Also, in the longer-term perspective, both therapies resulted in similar benefits to the patients.

Anterior cervical pseudarthrosis

Anterior cervical pseudarthrosis.
Case series

Analysis of 1000 consecutive patients undergoing Anterior cervical discectomy and fusion (ACDF) in an outpatient setting demonstrated surgical complications occur at a low rate (<1%) and can be appropriately diagnosed and managed in 4-hour ASC PACU window. Comparison with inpatient ACDF surgery cohort demonstrated similar results, highlighting that ACDF can be safely performed in an outpatient ambulatory surgery setting without compromising surgical safety. To decrease cost of care, surgeons can safely consider performing 1- and 2-level ACDF in an ASC environment.

A retrospective case series of 37 patients, paying special attention to immediate complications related to the use of mechanical retraction of soft tissue (dysphagia, dysphonia, esophageal lesions and local hematoma); and a comparative analysis of the outcomes after changes in the retraction method.

All selected cases had a positive neurological symptom response in relation to neuropathic pain. Dysphagia and dysphonia were found during the first 72 h in 94.1% of the cases in which automatic mechanical retraction was used for more than one hour during the surgical procedure. A radical change was noted in the reduction of the symptoms after the use of only manual protective blades without automatic mechanical retraction: 5.1% dysphagia and 0% dysphonia in the immediate postoperative period, P = 0.001.

Soft tissue damage due to the use of automatic retractors in MACDF is not minor and leads to general discomfort in the patient in spite of good neurological results. These problems most often occur when automatic retractors are used continuously for more than 1 hour, as well as when they are used in multiple levels. Dysphagia, dysphonia and local pain decreased with the use of transient manual blades for retraction, and with intermittent release following minimally invasive principles.

6) Morpeth JF, Williams MF. Vocal fold paralysis after anterior cervical discectomy and fusion.


