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Review Article

Dysphagia after anterior cervical spine surgery: a systematic review of potential preventative measures

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Abstract

BACKGROUND CONTEXT: Anterior cervical spine surgery is one of the most common spinal procedures performed around the world, but dysphagia is a frequent postoperative complication. Many factors have been associated with an increased risk of swallowing difficulties, including multilevel surgery, revision surgery, and female gender.

PURPOSE: The objective of this study was to review and define potential preventative measures that can decrease the incidence of dysphagia after anterior cervical spine surgery.

STUDY DESIGN: This was a systematic literature review.

METHODS: A systematic review in the Medline database was performed. Articles related to dysphagia after anterior cervical spine surgery and potential preventative measures were included.

RESULTS: Twenty articles met all inclusion and exclusion criteria. These articles reported several potential preventative measures to avoid postoperative dysphagia. Preoperative measures include performing tracheal exercises before the surgical procedure. Intraoperative measures can be summarized as avoiding a prolonged operative time and the use of recombinant human bone morphogenetic protein in routine anterior cervical spine surgery, using small and smoother cervical plates, using anchored spacers instead of plates, application of steroid before wound closure, performing arthroplasty instead of anterior cervical fusion for one-level disease, decreasing tracheal cuff pressure during medial retraction, using specific retractors, and changing the dissection plan.

CONCLUSIONS: Current literature supports several preventative measures that may decrease the incidence of postoperative dysphagia. Although the evidence is limited and weak, most of these measures did not appear to increase other complications and can be easily incorporated into a surgical practice, especially in patients who are at high risk for postoperative dysphagia.

Keywords: Dysphagia; Anterior cervical surgery; Preventative measures; Complications; Swallowing; Anterior cervical approach

Introduction

Anterior cervical spine surgery (ACSS) is a common procedure performed to treat many spine conditions, such as trauma and degenerative spinal disease. Many studies have reported that one of the most common complications after ACSS is dysphagia [1–3]. The reported incidence of dysphagia is widely variable and is likely due to the

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heterogeneity of the existing literature. However, an incidence of up to 71% has been reported in well-designed prospective studies that assess the dysphagia rate after surgery [4]. Several risk factors have been associated with an increase in postoperative dysphagia incidence, including multilevel surgery, revision procedures, female gender, older age, and involvement of C4–C5 and C5–C6 levels [5,6]. The objective of this study was to review potential measures that could be used to decrease the incidence and intensity of postoperative dysphagia after ACSS.

Material and methods

A systematic review of the literature using the Medline database (National Library of Medicine), without time restriction, was performed. The following search strategy was used: (“deglutition disorders”[MeSH Terms] OR (“deglutition”[All Fields] AND “disorders”[All Fields]) OR “deglutition disorders”[All Fields] OR “dysphagia”[All Fields]) AND anterior[All Fields] AND (“neck”[MeSH Terms] OR “neck”[All Fields] OR “cervical”[All Fields]) AND (“surgery”[Subheading] OR “surgery”[All Fields] OR “surgical procedures, operative”[MeSH Terms] OR (“surgical”[All Fields] AND “procedures”[All Fields] AND “operative”[All Fields]) OR “operative surgical procedures”[All Fields] OR “surgery”[All Fields] OR “general surgery”[MeSH Terms] OR (“general”[All Fields] AND “surgery”[All Fields]) OR “general surgery”[All Fields]).

The search produced a total of 451 published articles. Abstracts were reviewed and included if dysphagia was a reported patient outcome measure and if the study investigated perioperative measures to reduce dysphagia after ACSS. Only articles written in English language (or translated text) were included. Exclusion criteria included case reports, literature reviews, and cadaveric or experimental studies in animals. Twenty-one articles were eligible after abstract screening and were fully reviewed. Of those, 20 articles were included based on the purpose of our review and our inclusion criteria. The articles selected were then classified according to evidence-based medicine criteria proposed by Wright et al. [7].

Results

The 20 articles that met all inclusion and exclusion criteria are summarized in Table 1, and the preventative measures proposed are described in Table 2. The following articles are described in the following:

Preoperative measures

Tracheal/esophageal traction exercise preoperative treatment

Chen et al. [8] proposed a preoperative exercise to improve the compliance of the trachea and the esophagus before ACSS. Chen et al. labeled the exercise as tracheal/esophageal traction exercise (TTE), which consisted of maneuvers that softly and gradually pushed off the thyroid cartilage at least 1 cm across the anterior midline of the neck. The TTE was performed twice per day, 15 counts each time, for 3 days, starting 4 days before the surgery. A total of 52 patients underwent TTE and 50 patients were the control group. The dysphagia was assessed using the Bazaz dysphagia score. One week postoperatively, the Bazaz dysphagia scores for patients with two- to four-level fusions in the TTE group were significantly better than those in the control group ($p=.000$ for the second- and third-level fusions and $p=.013$ for the fourth-level fusion). The same was observed at 3 weeks postoperatively, the two- to four-level fusion patients in the TTE group had better Bazaz scores than those in the control group ($p=.000$ for the second- and third-level fusions and $p=.004$ for the fourth-level fusion; Level II of Evidence).

Intraoperative measures

Avoiding a prolonged operative time

Rihn et al. [4] performed a prospective study to determine the incidence and severity of postoperative dysphagia after anterior cervical discectomy and fusion (ACDF). Thirty-eight patients who underwent one- or two-level ACDF were followed and compared with a control group of 56 patients who underwent posterior lumbar decompression. They observed a correlation between operative time and the severity of dysphagia after 12 weeks ($p=.04$; Level II of Evidence).

Bone morphogenetic proteins

Bone morphogenetic proteins (BMPs) have previously been shown to increase complications after ACSS. Bone morphogenetic proteins are characterized by osteoinductive properties, which make them a useful adjuvant in arthrodesis procedures to enhance bone fusion. They are commercially available in two forms: recombinant human BMP-2 (rhBMP-2) and BMP7 [9]. In our study, four articles relating the use of BMP and dysphagia after cervical spine procedures were found.

Tumialán et al. [10] reported the results of a retrospective review of 200 patients who underwent single or multilevel ACDF with titanium plate fixation and polyetheretherketone spacers filled with recombinant rhBMP-2 impregnated in a Type I collagen sponge to achieve fusion. After a mean of 16.7 months of follow-up (ranging from 8 to 36 months), good to excellent results were reported in 85% of the cases based on Odom criteria, with fusion obtained in 100% of patients. However, 14 patients (7%) had significant clinical dysphagia and four (2%) required reoperation for hematoma or seroma after surgery (Level IV of Evidence).

Buttermann [11] performed a prospective nonrandomized study of 66 patients who underwent a one- to three-level ACDF with iliac-crest bone autograft (36 patients) compared with a group of patients using BMP and allograft (30 patients). Although clinical and radiologic outcomes were similar between the groups, 15 patients (50%)