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REVIEW

The role of steroid administration in the management of dysphagia in anterior cervical procedures

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Abstract Dysphagia is a common postoperative symptom for patients undergoing anterior cervical spine procedures. The purpose of this study is to present the current literature regarding the effect of steroid administration in dysphagia after anterior cervical spine procedures. We performed a literature search in the PubMed database, using the following terms: "dysphagia," "ACDF," "cervical," "surgery," "anterior," "spine," "steroids," "treatment," and "complications." We included in our review any study correlating postoperative dysphagia and steroid administration in anterior cervical spine surgery. Studies, which did not evaluate, pre- and postoperatively, dysphagia with a specific clinical or laboratory methodology were excluded from our literature review. Five studies were included in our results. All were randomized, prospective studies, with one being double blinded. Steroid administration protocol was different in every study. In two studies, dexamethasone was used. Methylprednisolone was administrated in three studies. In four studies, steroids were applied intravenously, while in one study, locally in the retropharyngeal space. Short-term dysphagia and prevertebral soft tissue edema were diminished by steroid administration, according to the results of two studies. In one study, prevertebral soft tissue edema was not affected by the steroid usage. Furthermore, short-term osseous fusion rate was impaired by the steroid administration, according to the findings of one study. The usage of steroids in patients undergoing anterior cervical spine procedures remains controversial. Multicenter, large-scale, randomized, prospective studies applying the same protocol of steroid administration and universal outcome criteria should be performed for extracting statistically powerful and clinically meaningful results.

Keywords Anterior · Cervical spine · Dysphagia · Soft tissue edema · Steroids

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Introduction

Dysphagia is generally defined as difficulty in swallowing occurring in patients with anterior surgeries of the neck involving either the cervical spine or organs located in this anatomical region, as the larynx or the thyroid gland [23, 27, 37–39, 42, 45]. Also, it could be present as a complication after a vigorous intubation [7, 36]. Dysphagia can pre-exist of any surgical intervention, when a pathologically enlarged structure of the anterior surface of the spine (osteophyte) or anterior neck masses are present [13, 14, 47]. Systematic diseases such as diffuse idiopathic spine hyperostosis (DISH) could cause dysphagia, due to direct compression of the esophagus [8, 30]. Postoperative dysphagia could have a specific etiological factor, such as a subcutaneous hematoma, muscular or mucosal injury, hypocalcemia, nerve injury, mechanical compression caused by any implanted instrumentation, or it may well be multifactorial [1, 6, 11, 12, 21–23, 35]. Additionally, chronic dysphagia after anterior cervical injury could be linked to pre-existing psychiatric factors [20]. Dysphagia appears either solely, or along with dysphonia,

and/or airway compromise, depending on the underlying etiology [9–12].

Classification, diagnosis, and management of dysphagia vary significantly in the literature. Depending on the time of occurrence, dysphagia can be divided into early and late forms [48]. In addition, dysphagia can be short-term or long-term, depending on the duration of the symptoms [11, 26, 28, 32]. Based on the severity of swallowing difficulties, dysphagia is divided into mild, moderate, and severe forms, as evaluated by specific clinical scales, such as the Bazaz grading scale, the M.D. Anderson dysphagia index (MDADI), the Dysphagia Short Questionnaire (DSQ), the Functional Outcome Swallowing Scale (FOSS), the Swallowing-Quality of Life (SWAL-QOL) survey, and the Swallowing Impairment Score (SIS) [7, 28, 32, 42, 43]. In addition to the previously described, numerous clinical dysphagia scales, there are several laboratory tests, which may objectively evaluate dysphagia. Serial video-fluoroscopic swallowing study, fiber-optic endoscopic evaluation of swallowing, video recording of swallowing movements, and standardized modified barium swallowing study have all been employed in the evaluation of dysphagia [2, 4, 13, 18, 29].

The administration of steroids for the treatment of dysphagia remains controversial [6, 40]. Although there are a few studies indicating a potential role of steroids in the management of dysphagia and dyspnea after anterior cervical spine surgery, there is lack of strong evidence in the literature, supporting the efficacy of steroid administration. Moreover, the existent studies used highly variable steroid schemes and dosologies, making thus the extraction of any meaningful conclusions extremely difficult. The purpose of our current study is to meticulously evaluate the existent literature regarding the usage of steroids in the treatment of postoperative dysphagia and assess the actual efficacy of this treatment methodology.

Material and methods

We performed a medical literature search in the PubMed database with the following terms, in all possible combinations: “dysphagia,” “ACDF,” “cervical,” “surgery,” “anterior,” “spine,” “steroids,” “treatment” and “complications”. Our study was limited from January 2000 to October 2015, and only full articles in English were considered. The references of the retrieved articles were carefully reviewed for any additional pertinent references.

We included any retrospective or prospective clinical study focusing in the management of dysphagia with the use of steroids. Every study, analyzing the presence of dysphagia after an anterior cervical spine approach for a benign lesion, as well as the effectiveness of steroid use in its treatment, was included in our current search. In all included studies, dysphagia was estimated with a specific subjective or objective scaling system, before and after the surgical intervention.

Results

Five studies met our inclusion criteria (Table 1). All the retrieved studies were controlled, randomized, prospective clinical trials [19, 24, 31, 34, 44], while one of them was a double-blinded study [19]. More specifically, Jeyamohan et al., in a prospective randomized double-blinded controlled study, recorded the effect of intravenously (iv.) administrated dexamethasone in patients undergoing multilevel (≥2 levels) anterior cervical discectomy and fusion (ACDF), during the immediate postoperative period for the first 24 h [19]. A right-sided Smith-Robinson approach was used in all their cases. Retraction was applied by employing a Thompson Farley self-retained retractor. According to their protocol, dexamethasone was administrated intraoperatively in a dose of 0.2 mg/kg, followed by four postoperative iv. doses of 0.06 mg/kg, every 5 h for the first 24 h. Pregnancy, chronic preoperative steroid use, coma, incapacitation, allergy to dexamethasone or other related drugs, and age below 18 years were their exclusion criteria. They recorded the patients’ demographics, their smoking habits, the reason for surgical intervention, the observed osseous fusion (as this was estimated by a cervical spine computed tomography), the length of hospital stay, and their patients’ functional outcome scores evaluated by the modified Japanese Orthopedic Association (JOA), the Neck Disability Index (NDI), and the Visual Analog Scale (VAS). The authors performed a long-term follow up at 1, 3, 6, and 24 months after surgery. Any swallowing difficulties were determined by employing the Functional Outcome Swallowing Scale (FOSS). According to their findings, intravenous administrated dexamethasone reduced significantly any swallowing dysfunction, as well as the length of hospital stay, in a statistically significant fashion. However, it did not affect pain, patient’s function outcome, or long-term swallowing function. They also found that dexamethasone negatively affected the observed fusion rate at the first six postoperative months, an effect which gradually disappeared during their follow-up [19].

Likewise, Lee et al., in their prospective randomized study, administrated triamcinolone and morcellized collagen sponge to the retropharyngeal space of their patients undergoing single- or two-level ACDF [24]. They excluded from their study patients with revision surgery, corpectomy, trauma, infection, tumor, and metabolic diseases. They performed a standard right-sided Smith-Robinson approach, while they provided no information regarding the type of retractor they were using. Swallowing difficulties were evaluated with the VAS scale at 24 and 48 h, and then at 2 weeks postoperatively. The studied parameters were postoperative drainage,

Table 1 Summarized data of previously published studies assessing the effect of steroids in postoperative dysphagia

Author	Type of study	Patients	Surgery	Exclusion criteria	Steroids protocol	Clinical scales for dysphagia	Parameters studied	Effect
Jeyamohan SB et al. [19]	Prospective, randomized, double-blinded, controlled	112	Underwent multilevel (≥2 motion segments) anterior cervical spine surgery	Age <18 years, pregnancy chronic pre-op steroid use, coma or incapacitation, unable to provide consent, Allergy to dexamethasone or related drugs	Intravenous dexamethasone or saline every 6 h for the first 24 h.	FOSS scale follow-up was performed at 1, 3, 6, 12, and 24 months	Demographics, smoking history, JOA-NDI-VAS scores, indications for surgery	Significantly improved swallowing function and airway edema and shortened length of stay/delays fusion
Lee SH et al. [24]	Prospective, randomized	50	ACDF involving one or two segments	≥3 segments, revision surgery, corpectomy, trauma, infection, tumor, metabolic diseases	Triamcinolone 40 mg and morcellized collagen sponge to retropharyngeal space.	VAS odynophagia 1, 2 days postop, and 2 weeks postop	Postoperative drainage, odynophagia, fusion, NDI, PSTE	Positive for the reduce of odynophagia and PSTE
Nam TW et al. [31]	Prospective randomized	62	One-level ACDF for cervical radiculopathy	≥2-level ACDF, myelopathic disease, cervical trauma, corpectomy, traffic accidents, and workers' compensation	Dexamethasone intravenously: 0, 24, and 48 h postop. Group 1, 10/5/5 mg; group 2, 20/10/10 mg; group 3, normal saline.	VAS for dysphagia and for dyspnea follow-up: daily for 5 days after the procedure	Gender, smoking habits, operative duration, fusion level, and degree of PSTE	Not effective in reducing postoperative prevertebral soft tissue density or VAS for dysphagia.
Pedram M et al. [34]	Prospective randomized	236	Anterior cervical surgery	No reference	Methylprednisolone at 0, 12, and 24 h postop	Fiberoptic ENT examination preop and 24–36 h postop	Age, height, weight, operative duration, intubation duration, number of operated levels	Positive impact in dysphagia
Song KJ et al. [44]	Prospective randomized	40	≥3 levels ACDF	Trauma or any other situation that could cause soft-tissue swelling. gastrointestinal (GI) problems, Diabetes mellitus (DM), history of received steroids	Methylprednisolone intravenously (iv) every 6 h for the first 24 h.	Bazaz scale daily until discharge (about 5 days)	Age, sex, smoking, tissue swelling, dysphagia history, operation time, hospitalization	Short-term effective in relieving dysphagia and decreasing the PSTE

ACDF anterior cervical spine and fusion, *FOSS* Functional Outcome Swallowing Scale, *JOA* Japanese Orthopedic Association score, *NDI* Neck Disability Index, *VAS* Visual Analog Scale

odynophagia, fusion, prevertebral soft tissue swelling, and functional outcome expressed by the NDI score. The observed odynophagia measured by the VAS scale was significantly better in the steroid group patients compared to the control group. This difference was statistically significant in their cohort. They also found that prevertebral soft tissue swelling was significantly lower in the steroid group patients. They concluded that the retropharyngeal regional administration of steroids was proved to be beneficial in their study [24].

Also, Pedram et al. performed a prospective randomized study assessing the role of methylprednisolone in anterior cervical spine surgery [34]. They recorded the patients' age, height, and weight, the duration of the surgical procedure, the duration of intubation, as well as the number of the operated levels, in an effort to evaluate and identify any possible risk factors for pharyngo-laryngeal dysfunction. Right-sided surgical approaches were used in all their cases. The dose of the administered methylprednisolone was 1 mg/kg at 0, 12, and 24 h postoperatively. Evaluation of their patients was preoperatively performed by a direct laryngoscopic, fiberoptic examination, and also 24 to 36 h postoperatively. The authors concluded that dysphagia and all other pharyngo-laryngeal complications were significantly lower among patients receiving steroids [34].

Similarly, Song et al. performed a prospective controlled study regarding the impact of steroid use in patients undergoing multilevel (≥3 levels) ACDF procedures [44]. The exclusion criteria in their study were trauma cases, the presence of a condition, which could cause soft tissue swelling, gastrointestinal problems, diabetes mellitus, and preoperative steroid use. The authors used a left-sided Smith-Robinson approach, while they provided no information regarding the type of the used retraction system. They administered iv. 250 mg methylprednisolone at the end of the procedure, and then every 6 hours for the first 24 h postoperatively. The studied parameters were the patients' age, their gender, their smoking habits, the duration of the procedure, the presence of any prevertebral soft tissue swelling, dysphagia, and the length of hospital stay. Dysphagia was documented with the use of the Bazaz dysphagia scale. The authors concluded that steroid administration was effective in short-term relief of dysphagia symptoms and significantly diminished the postoperative soft tissue swelling [44].

Contrariwise, Nam et al., in their study concerning the effectiveness of steroids in single-level ACDF, administrated iv. dexamethasone at 0, 24, and 48 h postoperatively [31]. They excluded from their study patients that needed two or more level ACDF, patients with myelopathy, trauma, or patients undergoing cervical corpectomy. They divided their patients into three groups: one group had 10 mg/5 mg/5 mg dexamethasone doses, another group had 20 mg/10 mg/10 mg, and the third group had placebo doses of normal saline. The studied parameters were the patients' gender, their smoking habits, the duration of the surgical procedure, the number of the fusion levels, and the degree of the postoperative prevertebral soft tissue swelling. The employed surgical approach was a left-sided Smith-Robinson technique. The type of the used retractor system was unspecified. Dysphagia was documented with the employment of the VAS score, immediately after surgery, and then daily for five postoperative days. The authors concluded that steroid administration was not effective in reducing the postoperative prevertebral soft tissue swelling, or the VAS dysphagia score. However, they reported that steroids diminished the postoperative dyspnea in their patients, and this effect was independent of the administered steroid dosology [31].

Discussion

A review of the existing literature demonstrates that the reported postoperative dysphagia in anterior cervical spine surgery ranges between 1 and 79 % [1]. Its incidence is high at the immediate postoperative period, and gradually drops to 12–14 %, approximately 1 year after surgery [6]. Several etiological factors have been associated with the development of postoperative dysphagia after anterior cervical procedures. These are mainly the presence of prevertebral soft tissue swelling, any excessive esophageal retraction, and the implantation of cervical spinal instrumentation [5, 15–17, 21, 22, 33]. Furthermore, female gender, patient's older age, the presence of rhBMP-2, revision surgery, multilevel surgery, and prolonged procedures have been associated with increased incidence of postoperative dysphagia [3, 23, 37, 41, 46]. In addition, the role of steroid in avoiding or decreasing the development and the severity of any postoperative dysphagia has remained controversial.

Our current review of the pertinent literature characteristically demonstrates that the design (type of surgical procedure, dosology, and form of the administered steroids, outcome measurement, and duration of follow up) of each study was different, thus making the comparison of these studies almost impossible. The employed surgical approach was right-sided Smith-Robinson in three studies [19, 24, 34], while a left-sided approach was utilized in the other two studies [31, 44]. The type of the used retraction, which may greatly affect the amount of the mechanical compression of the adjacent soft tissues and particularly the esophagus, was unfortunately specified in only one study [19]. Wide variation also occurred in the extent of the studied surgical procedures. Two studies analyzed the impact of steroids in multilevel approaches [19, 44], while two other in single- or two-level ACDFs [24, 31]. In addition, one study assessed the role of steroids in a wide spectrum of anterior cervical approaches including cases for metastatic disease [34], while the other studies included solely degenerative cases.

Significant variation occurred in the form of steroids but also in the employed doses and the route of administration. Two studies analyzed the role of dexamethasone [19, 31], while methylprednisolone was used in the other three studies [24, 34, 44]. In the vast majority of the reviewed studies, steroids were intravenously administered [19, 31, 34, 44]. However, regional application of steroids was employed in another study [24]. Steroids were administrated intravenously within the first 24 postoperative hours in three studies [19, 34, 44]. In another study, intravenously administrated dexamethasone was used for 48 h postoperatively [31].

Likewise, an impressive variation characterizes the utilized outcome criteria, and the length of the follow-up in the reviewed studies. Thus, three series studied the effect of steroids usage on the amount of prevertebral soft tissue swelling along with dysphagia [24, 31, 44]. Swallowing difficulties were estimated in one series only by employing an objective laboratory method (fiberoptic examination) [34], while in the other four studies more subjective and less accurate clinical scales were used, such as the VAS dysphagia score, the FOSS scale, and the Bazaz dysphagia scale. Similarly, the follow-up varied significantly among the reviewed series. Three studies assessed dysphagia in the immediate (≤5 days) postoperative period [31, 34, 44]. The follow-up in one study reached the first two postoperative weeks [24], while only in one series, there was long-term (24 months) follow-up [19]. Two of the reviewed studies demonstrated that steroid administration significantly reduced dysphagia [34, 44]. Jeyamohan et al. also found that steroid administration significantly reduced postoperative dysphagia at 1 month after surgery [19]. However, the effect of steroids could not be established in the long-term follow-up of their patients [19].

A significant advantage related to the steroid administration in the reviewed studies was the reduction in the length of hospital stay, which was reported by two studies [19, 44]. Prevertebral soft tissue swelling reduced significantly with steroid administration in two studies [24, 44]. However, another study failed to demonstrate such effect [31]. Pain and function outcome was not affected in a significant way in one of the reviewed studies [19]. Interestingly, Nam et al. concluded that steroid administration was beneficial in reducing postoperative dyspnea but not dysphagia in their patients [31].

In regard to the occurrence of any steroid-associated complications, such as increased infection rate, there were no reports in the reviewed series for increased morbidity in their patients. It has to be pointed out, however, that retropharyngeal application of steroids has been associated with increased risk of esophageal perforation, especially among patients with esophageal wall deficiency or decreased esophageal motility [25]. Moreover, in one of the reviewed series, lower fusion rates were observed at the first postoperative 6 months [19]. However, this effect faded over time, with no difference in the observed osseous fusion rate at the 2-year evaluation of these patients.

In conclusion, the reviewed studies provided valuable information regarding the potential role of steroid use in anterior cervical spine surgery. Although these studies were prospective and well-designed, their significant variations allow the extraction of no meaningful conclusions, regarding the actual role of steroid administration in avoiding or decreasing the incidence and the severity of postoperative dysphagia. The designing and the performance of large-scale, multicenter, prospective clinical trials, with clearly defined methodology and widely accepted outcome criteria and long-term follow-up, are necessary for defining the potential role of steroid administration in anterior cervical procedures.

Compliance with ethical standard

Conflicts of interest The authors declare that they have no conflict of interest.

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Comments

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The authors chose five prospective RCTs evaluating postoperative dysphagia after administration of steroids. Four out of the five studies showed improvement in postop dysphagia. The only study that did not show significant difference was the study that included only one-level ACDFs. On the other hand, one RCT that was a double-blinded study with 112 patients who underwent >2-level ACDFs (by Jeyamohan et al.) showed significant improvement in postoperative dysphagia. This article's level of evidence was even higher than other the four studies due to the double-blinded design. The other three studies that included multilevel ACDFs also showed better outcomes in treatment group. The authors should have explained their conclusion that "the usage of steroids in patients undergoing ACDF remains controversial" given the evidence they review. Perioperative steroids (especially intravenous steroids dexamethasone or methylprednisone) help with postsurgical dysphagia to some extent. These studies were all prospective RCTs, and authors acknowledge repeatedly that all studies were well designed. And yet, the primary conclusion that the authors repeat is that it remains controversial.

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This is an intriguing manuscript on the effect of steroids for dysphagia after anterior cervical procedures. Even if the topic is of particular relevance in the daily practice, only few articles were published in the literature. This interesting meta-analysis prompts cervical spine surgeons to think about a possible prospective multicenter study for a final statistical evaluation.