Editorial

Current strategies of reduce the rate of dysphagia and dysphonia after anterior cervical spine surgery and role of corticosteroids

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Provenance: This is an invited Editorial commissioned by Section Editor Zhantao Deng, PhD (Department of Orthopedics, Guangdong General Hospital, Guangdong Academy of Medical Sciences, Guangzhou, China).

Comment on: Jenkins TJ, Nair R, Bhatt S, *et al.* The Effect of Local Versus Intravenous Corticosteroids on the Likelihood of Dysphagia and Dysphonia Following Anterior Cervical Discectomy and Fusion: A Single-Blinded, Prospective, Randomized Controlled Trial. J Bone Joint Surg Am 2018;100:1461-72.

Submitted Oct 18, 2018. Accepted for publication Nov 12, 2018.
doi: 10.21037/atm.2018.11.29
View this article at: http://dx.doi.org/10.21037/atm.2018.11.29

Anterior cervical spine surgery via Smith-Robinson approach (include anterior cervical discectomy and fusion, anterior cervical corpectomy and fusion, and anterior cervical disc arthroplasty) is one of the most commonly surgical procedures in treatment of degenerative cervical spine diseases and cervical spine trauma (1-3). The vagus and recurrent laryngeal nerves are not visualized at the surgical procedures, and the distension of the peri-vertebral tissues can't be avoided. Therefore, the dysphagia and dysphonia are two well-known complications after anterior cervical spine surgery (4-7). Although most dysphagia and dysphonia are mild, transient, and usually reversible, the severe and persistent dysphagia or dysphonia is the major complication, will significantly influence the clinical outcomes and increase the medical costs, sometimes induce post-operative airway obstruction.

Current strategies to reduce postoperative dysphagia and dysphonia

Many factors had proved may have related to the dysphagia or dysphonia, such as: gender, age, smoking status, operative time, retraction pressure and time, the numbers of surgical levels, use bone morphogenetic protein (BMP) or recombinant human BMP (rhBMP), use plate, secondary procedure, surgeons' technique factors and psychiatric factors (7-9).

To reduce the dysphagia and dysphonia, the previous surgeons and researchers did lots of jobs. Siska *et al.* (9) used the swallowing-quality of life questionnaire to assess the dysphagia, they found that the smokers had lower scores than the nonsmokers at 3 weeks after surgery, quit smoking before operation may reduce the dysphagia. Chen *et al.* (10) developed a preoperative tracheal/esophageal

traction exercise for patient preformed the anterior cervical spine surgery, they found that second- to fourth-level fusion patients in the tracheal/esophageal traction exercise group had significant better Bazaz scores than the patients in the control group at 3 weeks after operation, suggested that tracheal/esophageal traction exercise can reduce the dysphagia for patients with anterior multiple-level cervical spine fusion.

In the surgical procedure of anterior cervical spine surgery, the retraction pressure may injury the soft tissue and induce the complications of dysphagia and dysphonia (11,12). Ratnaraj *et al.* (13) reported that increased neck retraction time is one risk factor of postoperative dysphagia, meanwhile, to adjust the endotracheal tube cuff pressure at 20 mmHg during the period of neck retraction can reduce the rate of patients with postoperative sore throat. Mendoza-Lattes *et al.* (12) suggested the dynamic retraction intra-operatively may be associated with a lower incidence of postoperative dysphagia. Pattavilakom and Seex (14) designed a novel retractor system (named Seex retractor system), which based on the principle that use the bone fixation to provide the retractor blade with an axis of rotation inside the surgical wound, with advantage of reduce retraction pressure, had trend less rate of postoperative sore throat, dysphagia, and dysphonia.

Moreover, Tian *et al.* (15) found that the dC2–C7 angle (dC2–C7 angle is calculated by formula: dC2–C7 = postoperative C2–C7 angle – preoperative C2–C7 angle) >5 degrees will significantly increase the chance of developing postoperative dysphagia, suggested to avoid the over-enlargement of cervical lordosis in anterior cervical spine surgery.

The anterior cervical spine plate is also accused the reason of dysphagia. Lee *et al.* (16) compared two different designed plates (the Atlantis plate and Zephir plate, both of them from the Medtronic Danek company, but the Atlantis plate has thicker and wider than the Zephir plate), the results shown that permanent rate of dysphagia is 13.6% for the Atlantis plate group and 3.58% for the Zephir plate group, suggested the smaller and smoother profile plate can reduce the incidence of postoperative dysphagia. Recently, several kinds of zero-profile anchored spacer have designed and developed, Liu *et al.* (17) compared 28 patients treated by zero-profile anchored spacer and 32 patients treated by traditional cage-plate system, with the mean follow-up time of 23.8±6.6 months (range, 12–36 months), the rate of dysphagia in zero-profile anchored spacer is 1/28 (3.6%) and 1/28 (3.6%) at 3 months after operation and final follow up, respectively, significantly less than the cage-plate group of 8/32 (25%) and 7/32 (21.9%) at 3 months after operation and final follow up, respectively. The zero-profile anchored spacer may the alternative technique to reduce to postoperative dysphagia.

The anterior multi-level cervical spine surgery or secondary procedure are independently risk factors for postoperative dysphagia and dysphonia, Mehra *et al.* (18) followed up 129 patients that performed multilevel procedure (high-cervical above C4 and low-cervical below C6) and/or revision, total of 35 (27%) patients had postoperative voice complaint, and 62 (48%) patients had swallowing complaint, after 1 year postoperatively, 28% and 9% patients still had the persist voice complaint and voice complaint. Wu *et al.* (19) conducted a logistic regression model also found that the multilevel cervical spine surgery patients had high risk of postoperative dysphagia. In study of Danto *et al.* (20), the patients performed anterior cervical spine surgery ≥4 levels had about 4-fold increased risk (with odds ratio =4; 95% CI: 1.1–13.8) of developing dysphagia and/or dysphonia than the single level patients. The surgical levels and whether it is a revision surgery are depended on the patients' diseases, therefore, for these patients, may be to consider altering the posterior approach.

The role and effect of corticosteroids

Besides above current strategies, the administration of corticosteroid is one of the most important ways to reduce the postoperative dysphagia and dysphonia in anterior cervical spine surgery.

Recently, the Jenkins *et al.* (21) conducted a single-blinded, prospective randomized controlled trial to compare local or intravenous corticosteroids *vs.* placebo on the likelihood of dysphagia and dysphonia following anterior cervical discectomy and fusion. Total of 75 patients were randomized assigned into three different groups of control (placebo without steroid, N=21), IV (intravenous) steroid (IV 10 mg dexamethasone at the time of closure, N=25), and local steroid (local 40 mg triamcinolone, N=29). The surgery is performed with the standard Smith-Robinson technique, using an interbody spacer and cervical plate in all cases. The study is blinded to patients, but not to the surgeons and surveyors. Bazaz classification and EAT-10 (Eating Assessment Tool-10) was used as primary outcome to evaluate the dysphagia, VHI-10 (Voice Handicap Index-10) was used as primary outcome to evaluate the dysphonia. Secondary outcomes include the visual analog

scale for neck pain, neck disability index, surgical site infection, pseudarthrosis, and reoperation.

In study of Jenkins *et al.* (21), both IV and local steroid groups had significantly less severe dysphagia and neck pain than the control group. Additionally, the patients in local steroid group showed better outcomes of dysphagia and neck pain than these in IV steroid group.

Previously, there also had several studies focus on the effect of IV or local steroid on postoperative anterior cervical spine surgery. Jeyamohan *et al.* (22) conducted a randomized controlled trial include 112 patients, 56 of them received intravenous 0.2 mg/kg dexamethasone intraoperatively, followed by 4 doses of 0.06 mg/kg dexamethasone (every 6 hours for the first 24 hours) postoperatively, other 56 patients received equivalent volume of saline as control group, they also found that the IV steroid group had significantly less rate of postoperative severity of dysphagia. The result of IV steroid reduce the severe dysphagia was also supported by study of Song *et al.* (23). Additionally, Song *et al.* (23) reported that the IV steroid groups had lower prevertebral soft-tissue swelling, but whether the dysphagia related to the prevertebral soft-tissue swelling is still unclear.

However, for the effect of local steroid, Haws *et al.* (24) conducted another single-blind prospective randomized controlled trial include 104 patients, 55 patients in local steroid group received 40 mg Depo-Medrol retroesophageally, other 49 patients in control group received same volume saline, the results showed that no additional benefit was provided by local steroid. Therefore, the effect of local steroid on reduce the rate of postoperative dysphagia is still debate.

Complications and nonunion are the other major concerns of local steroid. Lee *et al.* (25) reported two delayed esophageal perforation cases who underwent anterior cervical spine surgery and retropharyngeal local steroid use. In study of Jenkins *et al.* (21), although without complications of surgical infection and esophageal injuries were observed, both two patients with nonunion are belong to the local steroid group, none of patients with nonunion in two other groups. Give to the lower incidence of nonunion and other complication, the limited number of included patients still can't provide powder enough analysis to permit a significant difference. In fact, the IV steroid patients in study of Jeyamohan *et al.* (22) had significantly lower fusion rate than the control group at 6 months after operation (39.5% *vs.* 60%, respectively), but this difference was disappeared at 12 and 24 months after operation. Further larger sample studies are necessary to investigate the issues of fusion rate and complications.

In summary, the study of Jenkins *et al.* (21) is a well-designed clinical trial, provides novel knowledge of the effect of IV and local steroid use to prevent the postoperative dysphagia and dysphonia. The results of this study also may change the clinical practice of spine surgeons. However, consider still without the evidence from multi-center larger sample clinical trial, the potential of catastrophic complications of esophageal perforation, and nonunion that may need secondary surgery, the routinely local steroid should be used with caution.

Acknowledgements

Funding: This work was supported by the Wenzhou Municipal Science and Technology Bureau (Y20170389), Wenzhou leading talent innovative project (RX2016004), National Natural Science Foundation of China (81501933), Zhejiang Provincial Natural Science Foundation of China (LY14H060008), China Postdoctoral Science Foundation (2018M630450), Zhejiang Provincial Medical Technology Foundation of China (2018KY129). The funders had no role in the design, execution, and writing up of the study.

Footnote

Conflicts of interest: The authors have no conflicts of interest to declare.

References

1. Zadegan SA, Abedi A, Jazayeri SB, et al. Clinical Application of Ceramics in Anterior Cervical Discectomy and Fusion: A Review and Update. Global Spine J 2017;7:343-9.
2. Baker JF, Gomez J, Shenoy K, et al. A radiographic follow-up study of stand-alone-cage and graft-plate constructs for single-level anterior cervical discectomy and fusion. J Spine Surg 2017;3:596-600.
3. Wu AM, Xu H, Mullinix KP, et al. Minimum 4-year outcomes of cervical total disc arthroplasty versus fusion: a meta-analysis based on prospective randomized controlled trials. Medicine (Baltimore) 2015;94:e665.
4. Joaquim AF, Murar J, Savage JW, et al. Dysphagia after anterior cervical spine surgery: a systematic review of potential preventative measures. Spine J 2014;14:2246-60.
5. Cho SK, Lu Y, Lee DH. Dysphagia following anterior

cervical spinal surgery: a systematic review. Bone Joint J 2013;95-B:868-73.
6. Tasiou A, Giannis T, Brotis AG, et al. Anterior cervical spine surgery-associated complications in a retrospective case-control study. J Spine Surg 2017;3:444-59.
7. Singh K, Marquez-Lara A, Nandyala SV, et al. Incidence and risk factors for dysphagia after anterior cervical fusion. Spine (Phila Pa 1976) 2013;38:1820-5.
8. Kalb S, Reis MT, Cowperthwaite MC, et al. Dysphagia after anterior cervical spine surgery: incidence and risk factors. World Neurosurg 2012;77:183-7.
9. Siska PA, Ponnappan RK, Hohl JB, et al. Dysphagia after anterior cervical spine surgery: a prospective study using the swallowing-quality of life questionnaire and analysis of patient comorbidities. Spine (Phila Pa 1976) 2011;36:1387-91.
10. Chen Z, Wei X, Li F, et al. Tracheal traction exercise reduces the occurrence of postoperative dysphagia after anterior cervical spine surgery. Spine (Phila Pa 1976) 2012;37:1292-6.
11. Heese O, Fritzsche E, Heiland M, et al. Intraoperative measurement of pharynx/esophagus retraction during anterior cervical surgery. Part II: perfusion. Eur Spine J 2006;15:1839-43.
12. Mendoza-Lattes S, Clifford K, Bartelt R, et al. Dysphagia following anterior cervical arthrodesis is associated with continuous, strong retraction of the esophagus. J Bone Joint Surg Am 2008;90:256-63.
13. Ratnaraj J, Todorov A, McHugh T, et al. Effects of decreasing endotracheal tube cuff pressures during neck retraction for anterior cervical spine surgery. J Neurosurg 2002;97:176-9.
14. Pattavilakom A, Seex KA. Results of a prospective randomized study comparing a novel retractor with a Caspar retractor in anterior cervical surgery. Neurosurgery 2011;69:ons156-60; discussion ons60.
15. Tian W, Yu J. The Role of C2-C7 Angle in the Development of Dysphagia After Anterior and Posterior Cervical Spine Surgery. Clin Spine Surg 2017;30:E1306-14.
16. Lee MJ, Bazaz R, Furey CG, et al. Influence of anterior cervical plate design on Dysphagia: a 2-year prospective longitudinal follow-up study. J Spinal Disord Tech 2005;18:406-9.
17. Liu Y, Wang H, Li X, et al. Comparison of a zero-profile anchored spacer (ROI-C) and the polyetheretherketone (PEEK) cages with an anterior plate in anterior cervical discectomy and fusion for multilevel cervical spondylotic myelopathy. Eur Spine J 2016;25:1881-90.
18. Mehra S, Heineman TE, Cammisa FP Jr, et al. Factors predictive of voice and swallowing outcomes after anterior approaches to the cervical spine. Otolaryngol Head Neck Surg 2014;150:259-65.
19. Wu B, Song F, Zhu S. Reasons of Dysphagia After Operation of Anterior Cervical Decompression and Fusion. Clin Spine Surg 2017;30:E554-9.
20. Danto J, DiCapua J, Nardi D, et al. Multiple cervical levels: increased risk of dysphagia and dysphonia during anterior cervical discectomy. J Neurosurg Anesthesiol 2012;24:350-5.
21. Jenkins TJ, Nair R, Bhatt S, et al. The Effect of Local Versus Intravenous Corticosteroids on the Likelihood of Dysphagia and Dysphonia Following Anterior Cervical Discectomy and Fusion: A Single-Blinded, Prospective, Randomized Controlled Trial. J Bone Joint Surg Am 2018;100:1461-72.
22. Jeyamohan SB, Kenning TJ, Petronis KA, et al. Effect of steroid use in anterior cervical discectomy and fusion: a randomized controlled trial. J Neurosurg Spine 2015;23:137-43.
23. Song KJ, Lee SK, Ko JH, et al. The clinical efficacy of short-term steroid treatment in multilevel anterior cervical arthrodesis. Spine J 2014;14:2954-8.
24. Haws BE, Khechen B, Narain AS, et al. Impact of local steroid application on dysphagia following an anterior cervical discectomy and fusion: results of a prospective, randomized single-blind trial. J Neurosurg Spine 2018;29:10-7.
25. Lee SH, Mesfin A, Riew KD. Delayed esophageal perforation after anterior cervical fusion and retropharyngeal steroid use: a report of two cases. Spine J 2015;15:e75-80.

Cite this article as: Chen D, Shao MM, Wang XY, Li YM, Wu AM. Current strategies of reduce the rate of dysphagia and dysphonia after anterior cervical spine surgery and role of corticosteroids. Ann Transl Med 2018;6(Suppl 2):S99. doi: 10.21037/atm.2018.11.29

