ORIGINAL ARTICLE

Dysphagia Incidence after Outpatient Anterior Cervical Surgery Using Instrumentation *versus* No Instrumentation

KR Chin[1], FJR Pencle[2], AV Coombs[3], J Wheeler[3], JA Seale[2]

ABSTRACT

Objective: *Dysphagia is a relatively common occurrence in the postoperative period following anterior cervical surgery, with some indicating rates as high as 79%. In most cases, it remains only a transient phenomenon. The cause has been debated, with most speculating injury to nerves in the swallowing mechanism. The objective of this study was to determine if the presence of instrumentation during anterior cervical surgery in the outpatient setting would affect the incidence, duration and severity of dysphagia.*

Methods: *We did a retrospective review of the medical records of 50 consecutive patients who had undergone single-level instrumented anterior cervical discectomy and fusion. Then we compared that group with our control group of 50 patients who had had simple single-level anterior cervical discectomy without instrumentation or fusion. The patients were evaluated for the presence of dysphagia as well as neck disability index outcome scores.*

Results: *There was no significant difference between the groups in postoperative neck disability index outcomes at the two-year follow-up (*p *= 0.182). Dysphagia occurred only in the instrumented group, with an incidence of 12% (six patients): their symptoms lasted on average three weeks, and all six patients experienced only mild severity on the Bazaz-Yoo scale. There was statistically significant difference between the two groups (*p *= 0.012).*

Conclusion: *There was a greater trend towards postoperative dysphagia in cases with instrumentation (12% of the patients). Dysphagia was transient with mild severity in patients who received instrumentation compared with those who underwent discectomy alone.*

Keywords: Anterior cervical discectomy and fusion, dysphagia, less exposure surgery, outpatient surgery

Incidencia de la disfagia tras la cirugía cervical anterior ambulatoria con instrumentación y sin instrumentación

KR Chin[1], FJR Pencle[2], AV Coombs[3], J Wheeler[3], JA Seale[2]

RESUMEN

Objetivo: *La disfagia es una ocurrencia relativamente común en el período postoperatorio después de la cirugía cervical anterior, con algunas tasas indicadoras tan altas como 79%. En la mayoría de los casos, sigue siendo sólo un fenómeno transitorio. Su causa ha sido discutida,*

From: [1]Charles E Schmidt College of Medicine at Florida Atlantic University, Herbert Wertheim College of Medicine at Florida International University, Less Exposure Surgery Specialists Institute, United States of America, and University of Technology, Jamaica, West Indies, [2]Less Exposure Surgery Specialists Institute, United States of America and [3]Less Exposure Surgery Society, United States of America.

Correspondence: Dr KR Chin, Less Exposure Surgery Specialists Institute, 3816 Hollywood Boulevard, #102, Hollywood, FL 33021, United States of America. Email: kingsleychin@thelessinstitute.com

 DOI: 10.7727/wimj.2016.152

atribuyéndose principalmente a una lesión en los nervios del mecanismo de deglución. El objetivo de este estudio fue determinar si la presencia de la instrumentación durante la cirugía cervical anterior en el contexto ambulatorio afectaría la incidencia, duración y severidad de la disfagia.

Métodos: *Realizamos una revisión retrospectiva de las historias clínicas de 50 pacientes consecutivos que habían tenido discectomía y fusión cervical anterior con instrumentación a un solo nivel. Entonces comparamos ese grupo con nuestro grupo de control de 50 pacientes a quienes se les había practicado una discectomía cervical anterior a un solo nivel simple sin instrumentación o fusión. Los pacientes fueron evaluados con respecto a la presencia de disfagia, así como en relación con las puntuaciones del resultado del índice de la discapacidad cervical.*

Resultados: *No hubo diferencias significativas entre los grupos en cuanto a los resultados del índice de discapacidad cervical postoperatorio en el seguimiento de dos años (*p = *0.182). La disfagia se produjo sólo en los grupos con instrumentación, con una incidencia de 12% (seis pacientes): sus síntomas duraron un promedio de tres semanas, y los seis pacientes experimentaron toda una severidad leve en la escala de Bazaz-Yoo. Hubo una diferencia estadísticamente significativa entre los dos grupos (*p = *0.012).*

Conclusión: *Hubo una mayor tendencia a la disfagia postoperatoria en los casos con instrumentación (12% de los pacientes). La disfagia fue transitoria con severidad leve en los pacientes que recibieron instrumentación, comparada con la de los que experimentaron discectomía solamente.*

Palabras clave: Discectomía y fusión cervical anterior, disfagia cirugía de menos exposición, cirugía ambulatoria

West Indian Med J 2018; 67 (1): 40

INTRODUCTION

Postoperative dysphagia after anterior cervical surgery has long been debated to be the result of a variety of proposed factors. However, many attribute it to injury to the nerves involved in swallowing and to the local soft tissue (1). Further, it has been proposed that beyond tissue injury, patient factors (such as age and gender) and surgical factors (including surgical operative time, level of surgery, duration of oesophageal retraction and anterior instrumentation) may play a greater role (2, 3).

Many prospective studies had been conducted which revealed that this common complaint occurred more frequently than previously believed (4–7). Conclusions on the best practice to limit the incidence of dysphagia are difficult to interpret due to the variability of the results. However, the incidence of dysphagia in the early postoperative period was found to be as high as 79% in the literature (8). Fortunately, as ubiquitous as this postoperative complaint had been, in most cases, it remained only a transient phenomenon, hardly ever becoming a persistent problem for the patients (9).

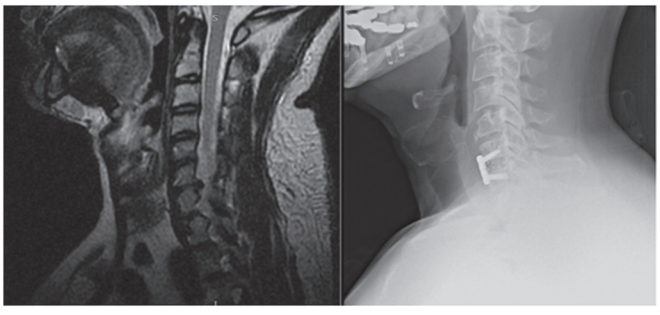
We had performed anterior cervical surgery with and without instrumentation on numerous patients in an ambulatory surgery centre. In our experience, having stringent patient selection protocols with a focus on less invasive operative techniques and instruments was the foundation of successful outpatient surgery. As such, it is difficult to extrapolate the results of prospective studies on the topic of dysphagia conducted in the hospital setting to the outpatient setting, as there is variability in exposure, surgical operative time and reliance on inpatient postoperative observation. Therefore, we determined the incidence, severity and duration of dysphagia after anterior cervical surgery in two similar groups of patients, instrumentation *versus* no instrumentation.

Specifically, we looked at instrumented surgeries using the frequently used Smith-Robinson approach to the anterior cervical spine (10): anterior cervical discectomy and fusion (ACDF). Then, we compared these results with a control group of patients who had only partial discectomies with no instrumentation and annuloplasty. Our hypothesis was that the presence of an anterior cervical plate increased the risk of early postoperative dysphagia. To our knowledge, this is one of the first studies which looked at the incidence and factors related to postoperative dysphagia after anterior

cervical surgery due to instrumentation in the ambulatory setting.

SUBJECTS AND METHODS

We reviewed the medical records of prospectively collected data of 50 consecutive patients who had undergone single-level instrumented anterior cervical discectomy and fusion [ACDF] (Group 1). Our control included 50 patients who had had simple single-level anterior cervical discectomy (ACD) without instrumentation or fusion (Group 2). Approval by the Institutional Review Board of The George Washington University was obtained for this study as part of a cohort of patients who had cervical spine surgery performed. All the operations were done in an ambulatory surgery centre by a single surgeon who was experienced in performing all three procedures in academic and private hospitals as if in an outpatient setting, prior to commencing in an outpatient setting. The patients were considered for surgery only after failed conservative management for at least six weeks. The exclusion criteria for surgery included acute severe trauma, fractures, malignancy, infection, unstable chronic medical illnesses, prior anterior cervical fusions and a body mass index (BMI) of over 42 (11). The indications for ACDF included symptomatic, spontaneous/degenerative or traumatic herniated cervical nuclei pulposi (Fig. 1). Polyetheretherketone (PEEK) interbody cages, anterior cervical plates and demineralized bone matrix (DBM) were all used to aid with fusion. All the implants and bone substitutes used in Group 1 were of the same design and manufactured by the same company. Group 2 had a similar modified Smith-Robinson approach and localization of the operative level. The indications for ACD included younger patients with minimal disc herniation with or without disc dissection secondary to non-acute trauma without evidence of facet-generated pain and patient preference after all options were discussed. A small annulotomy was made using a beaver blade, and a small straight curette was advanced towards the herniated disc visualized on preoperative magnetic resonance imaging (MRI). A micropituitary ronguer was used to perform a partial discectomy under fluoroscopic guidance. Radiofrequency annuloplasty was then performed at 80°C to seal the window. The posterior longitudinal ligament was not taken down. The closure of the wound was in similar fashion as that in Group 1. A standard postoperative protocol (Appendix) was explained to the patients and their relatives attending to them (12).



A B

Fig. 1: A: sagittal view of a preoperative magnetic resonance imaging (MRI) of a 46-year-old man with multiple herniated discs (most severe at C6–7).
B: a lateral plain radiograph at eight months post-ACDF showing good plate position. The patient was asymptomatic and clinically fused.

The patients were reviewed, and evaluation of postoperative outcomes was based on the presence or absence, severity and duration of dysphagia within the first 24 hours of surgery, then at follow-ups two weeks, six weeks, six months and, finally, two years after surgery. Postoperative dysphagia was defined as any discomfort or difficulty with swallowing which was not historically present prior to surgery. The severity was assessed using the Bazaz-Yoo dysphagia severity scale of mild, moderate and severe [Table 1] (4). We performed additional statistical analyses to determine any association of age, BMI, gender, level of surgery, surgical operative time and neck disability index (NDI) outcome scores with the incidence of dysphagia.

Table 1: Bazaz-Yoo dysphagia severity scale

	Dysphagia severity	
Severity	**Liquid**	**Solid**
None	None	None
Mild	None	Rare
Moderate	None or rare	Occasionally (only with specific food)
Severe	None or rare	Frequent (majority of solids)

Statistical analyses were performed using SPSS V22 (IBM Corporation, New York, United States of America), and comparisons were expressed as counts or means with standard error. Intergroup comparisons were made using *t*-test and Chi-square test. Tests were considered significant if p was < 0.05. Power analysis with a power of 0.8 and alpha of 0.05 was performed based on dysphagia incidence. This demonstrated that an adequate sample size of 12 patients per group was needed to verify statistically significant difference between groups (13, 14).

RESULTS

Of the 50 patients in Group 1 (ACDF), 48% were female, with the group's mean age being 46.3 ± 1.7 years and mean BMI 24.7 ± 2.1 kg/m^2. Of the 50 patients in Group 2 (ACD), 63% were female, with the group's mean age being 38.8 ± 4 years and mean BMI 24.8 ± 0.7 kg/m^2. No statistically significant differences in gender, age and BMI between the groups were found. In Group 1, C5–6 was the most frequently treated level (43%), followed by C6–7 (22.7%). In Group 2, C5–6 was also the most frequently treated level (33.3%), followed by C4–5 (20.8%). Figures 2 and 3 show the frequency of surgical levels operated on in Groups 1 and 2, respectively. The surgical operative time in Group 1 was 58.4 ± 2.8 minutes, as compared to Group 2 which was 43.0 ± 7.5 minutes. This difference of 15 minutes did achieve statistically significant difference ($p = 0.046$). The preoperative mean NDI score for Group 1 decreased from 37.7 ± 1.3 to 28.1 ± 1.0 at the two-year follow-up ($p = 0.131$). In Group 2, the preoperative mean NDI score dropped from 36.0 ± 2.1 to 28.6 ± 2.0 at the two-year follow-up ($p = 0.558$). A statistical comparison of preoperative and postoperative outcomes between Groups 1 and 2 showed no statistically significant difference in the NDI scores ($p = 0.274$, $p = 0.182$, respectively).

Dysphagia occurred only in Group 1 (instrumented) with an incidence of 12% (six patients): their symptoms lasted on average 3 ± 0.6 weeks, recovery was within two to five weeks (Table 2), and severity was mild in all six patients. None of the patients in Group 2 complained of dysphagia. None of our patients complained of dysphonia in either group. There was statistically significant difference between the two groups regarding dysphagia incidence ($p = 0.012$). Table 3 summarizes the association of dysphagia with age, BMI, gender and level of surgery with the reported incidence of dysphagia in Group 1. During the study period of 2011–14, we had no re-operations or any major complications reported.

Table 2: Summary of incidence of postoperative dysphagia

Dysphagia severity	First 24 hours	Two weeks	Five weeks*	Six months	Two years
Mild	6	6	1	0	0
Moderate/Severe	0	0	0	0	0

* Patients were seen at six weeks after surgery, but one patient noted dysphagia one week prior to the visit.

Table 3: Summary of association between various patient parameters and the presence or absence of dysphagia in Group 1 (instrumented)

	Dysphagia	No dysphagia	*p*-value
Total number of patients	6	44	–
Mean age (years)	45	46.7	0.75
Mean body mass index (kg/m^2)	30	24	0.36
Surgical operative time (minutes)	90	58	0.880
Associated gender	50% male	52.7 % male	0.9
	50% female	42.3 % female	
Associated level of surgery	C3–4: 17%	C3–4: 18.42%	–
	C4–5: 17%	C4–5: 13.15%	–
	C5–6: 33%	C5–6: 44.73%	–
	C6–7: 33%	C6–7: 21.05%	–
		C7–T1: 2.63%	–

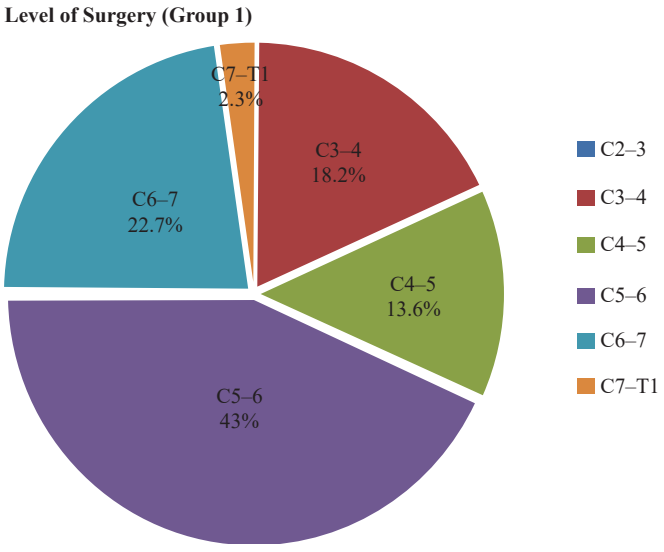


Fig. 2: The frequency of surgical levels operated on in Group 1.

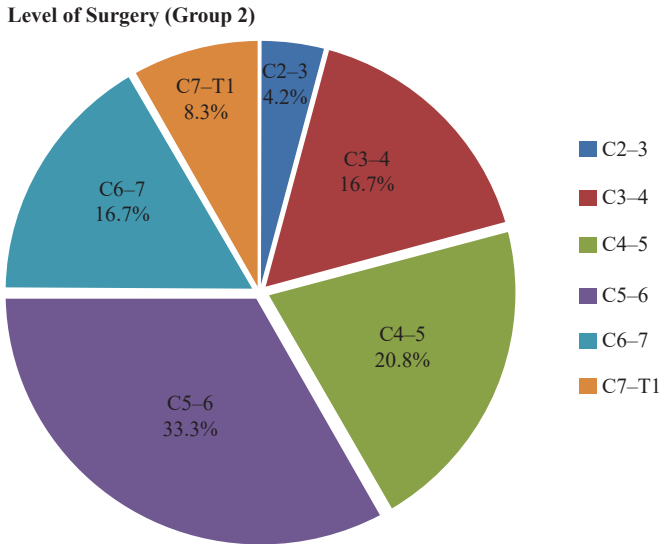


Fig. 3: The frequency of surgical levels operated on in Group 2.

DISCUSSION

Patient education about the incidence, duration and severity of potential dysphagia has become a standard part of the consent procedure prior to anterior cervical surgery (4, 15, 16). The results of several retrospective and prospective studies on the topic of postoperative dysphagia after anterior cervical surgery indicated that spine surgeons should expect at least 50% of their patients to have complaints of at least mild and transient swallowing discomfort after these procedures (8, 17, 18). The majority of these patients' symptoms tended to resolve by the sixth-month follow-up. Though rare, reports of dysphagia up to 12 months postoperatively, particularly in young female patients, had been published (4, 7). We sought to determine the incidence, duration and severity of postoperative dysphagia after anterior cervical surgery in the ambulatory surgery setting and whether the phenomenon was related to the presence of instrumentation.

There was a paucity of data which addressed these questions in the rapidly growing outpatient spine surgery arena, where preoperative patient selection and education, as well as intraoperative techniques and instruments, were designed to minimize tissue trauma, lessen operative and thus tissue retraction time, blood loss and complications.

In this retrospective series, Group 1 (instrumented anterior cervical surgery) revealed an incidence of dysphagia of 12%, a mean duration of three weeks and an overall mild severity. There was no associated dysphonia noted by our patients. For the non-instrumented control group (Group 2), none of our patients had dysphagia. Although there was a higher incidence in the instrumented group, all cases of dysphagia were transient, short in duration and mild in severity.

Several prospective and retrospective studies had assessed dysphagia after ACDF (14, 18–20). A prospective study by Rihn *et al* which assessed the incidence of dysphagia after ACDF compared with the control group noted that at two weeks after surgery, 71% of the patients complained of dysphagia, but it was reduced to 8% at 12 weeks after surgery (14). This demonstrated that dysphagia was transient in a majority of patients (14). Papavero *et al* also noted an incidence of dysphagia as high as 49.3% (18). A retrospective review by Zeng *et al* of 186 patients noted an incidence rate of 26.9% (20). These differences could be attributed to the type of study where retrospective reviews may not have collected all the data points.

Video fluoroscopic swallow evaluation (VSE) is considered the gold standard for assessing dysfunctional swallowing and has been used to investigate postoperative dysphagia following anterior cervical surgery. Frempong-Boadu *et al* found that 48% of the patients who had VSE preoperatively were found to have preexisting dysfunction in the swallowing mechanism; however, there were no preoperative complaints by any of these patients (19). Our choice of the Bazaz-Yoo dysphagia questionnaire was not only because it was the most widely used tool, but also because it provided direct patient-reported feedback that was clinically relevant for assessing the patient's severity of dysphagia (4).

We reported no biases but noted limitations of the study. These include its retrospective nature, a single-surgeon centre and no video fluoroscopic evaluation. Our preliminary results showed that in this study, postoperative dysphagia occurred with similar patterns and trends of the hospital reported outcomes, with instrumented procedures showing a significant increase in dysphagia incidence compared with non-instrumented surgery. We acknowledge that the use of an anterior cervical procedure with no instrumentation as a control group may potentially confound our results due to oesophageal retraction, neck dissection, endotracheal intubation and selection criteria for surgery. It was difficult to analyse and control the extent of retraction to achieve adequate exposure. However, we noted that the same operative techniques and retractor system were used in both groups. The selection criteria variable was not specifically analysed as the type of surgery performed was based on the pathology. The severity of disease preoperatively and its relation to dysphagia had not been shown in the literature. The main variable as a cause of dysphagia between the groups was the use of instrumentation. Although oesophageal retraction had been intuitively considered to be a risk factor for postoperative dysphagia, correlational analyses were inconclusive on whether it was a causative factor (18).

There had been evidence to suggest that the presence of an endotracheal tube during surgery did not significantly impact the incidence of postoperative dysphagia (17). While evidence existed which identified C5–6 as the most frequently encountered cervical level associated with postoperative dysphagia, our results were not conclusive enough to address this question. This was likely due to the patient population in this study.

This study showed that surgical operative time, although clinically different, was not statistically significant, demonstrating that the variable of surgical operative time as a risk factor for dysphagia was the same in both groups and negligible. Overall, the trend

was towards instrumented procedures showing a greater incidence of dysphagia.

We would like to highlight from our experience some general clinical pearls for outpatient anterior cervical surgery to minimize the risk of dysphagia. These include maintaining a consistent operating team and limiting the extent of tissue dissection and trauma. The surgical team should try to keep surgical operative time (21) and retraction time (22) to a minimum and avoid unnecessary multilevel surgery (23) by operating on the worst level.

AUTHORS' NOTE

We did not seek or receive any funding from the National Institutes of Health, Wellcome Trust, Howard Hughes Medical Institute or others for this work. KR Chin is a shareholder in and receives other benefits from SpineFrontier Inc. None of the other authors (FJRP, AVC, JW or JAS) has any potential conflicts of interest to declare for this work.

REFERENCES

1. Rieger A, Brunne B, Hass I, Brummer G, Spies C, Striebel HW et al. Laryngo-pharyngeal complaints following laryngeal mask airway and endotracheal intubation. J Clin Anesth 1997; **9:** 42–7.
2. Kalb S, Reis MT, Cowperthwaite MC, Fox DJ, Lefevre R, Theodore N et al. Dysphagia after anterior cervical spine surgery: incidence and risk factors. World Neurosurg 2012; **77:** 183–7.
3. Singh K, Marquez-Lara A, Nandyala SV, Patel AA, Fineberg SJ. Incidence and risk factors for dysphagia after anterior cervical fusion. Spine (Phila Pa 1976) 2013; **38:** 1820–5.
4. Bazaz R, Lee MJ, Yoo JU. Incidence of dysphagia after anterior cervical spine surgery: a prospective study. Spine (Phila Pa 1976) 2002; **27:** 2453–8.
5. Edwards CC, 2nd, Karpitskaya Y, Cha C, Heller JG, Lauryssen C, Yoon ST et al. Accurate identification of adverse outcomes after cervical spine surgery. J Bone Joint Surg Am 2004; **86:** 251–6.
6. Martin RE, Neary MA, Diamant NE. Dysphagia following anterior cervical spine surgery. Dysphagia 1997; **12:** 2–8; discussion 9–10.
7. Yue WM, Brodner W, Highland TR. Persistent swallowing and voice problems after anterior cervical discectomy and fusion with allograft and plating: a 5- to 11-year follow-up study. Eur Spine J 2005; **14:** 677–82.
8. Anderson KK, Arnold PM. Oropharyngeal dysphagia after anterior cervical spine surgery: a review. Global Spine J 2013; **3:** 273–86.
9. Stewart M, Johnston RA, Stewart I, Wilson JA. Swallowing performance following anterior cervical spine surgery. Br J Neurosurg 1995; **9:** 605–9.
10. Smith GW, Robinson RA. The treatment of certain cervical-spine disorders by anterior removal of the intervertebral disc and interbody fusion. J Bone Joint Surg Am 1958; **40:** 607–24.
11. Chin KR, Pencle FJR, Coombs AV, Packer CF, Hothem EA, Seale JA. Eligibility of outpatient spine surgery candidates in a single private practice. Clin Spine Surg 2017; **30:** E1352–8.
12. Chin KR, Coombs AV, Seale JA. Feasibility and patient-reported outcomes after outpatient single-level instrumented posterior lumbar interbody fusion in a surgery center: preliminary results in 16 patients. Spine (Phila Pa 1976) 2015; **40:** E36–42.
13. Carneiro AV. Estimating sample size in clinical studies: basic methodological principles. Rev Port Cardiol 2003; **22:** 1513–21.
14. Rihn JA, Kane J, Albert TJ, Vaccaro AR, Hilibrand AS. What is the incidence and severity of dysphagia after anterior cervical surgery? Clin Orthop Relat Res 2011; **469:** 658–65.
15. Riley LH 3rd, Vaccaro AR, Dettori JR, Hashimoto R. Postoperative dysphagia in anterior cervical spine surgery. Spine (Phila Pa 1976) 2010; **35 (9 Suppl):** S76–85.
16. Chaw E, Shem K, Castillo K, Wong SL, Chang J. Dysphagia and associated respiratory considerations in cervical spinal cord injury. Top Spinal Cord Inj Rehabil 2012; **18:** 291–9.
17. Smith-Hammond CA, New KC, Pietrobon R, Curtis DJ, Scharver CH, Turner DA. Prospective analysis of incidence and risk factors of dysphagia in spine surgery patients: comparison of anterior cervical, posterior cervical, and lumbar procedures. Spine (Phila Pa 1976) 2004; **29:** 1441–6.
18. Papavero L, Heese O, Klotz-Regener V, Buchalla R, Schroder F, Westphal M. The impact of esophagus retraction on early dysphagia after anterior cervical surgery: does a correlation exist? Spine (Phila Pa 1976) 2007; **32:** 1089–93.
19. Frempong-Boadu A, Houten JK, Osborn B, Opulencia J, Kells L, Guida DD et al. Swallowing and speech dysfunction in patients undergoing anterior cervical discectomy and fusion: a prospective, objective preoperative and postoperative assessment. J Spinal Disord Tech 2002; **15:** 362–8.
20. Zeng JH, Zhong ZM, Chen JT. Early dysphagia complicating anterior cervical spine surgery: incidence and risk factors. Arch Orthop Trauma Surg 2013; **133:** 1067–71.
21. Joaquim AF, Murar J, Savage JW, Patel AA. Dysphagia after anterior cervical spine surgery: a systematic review of potential preventative measures. Spine J 2014; **14:** 2246–60.
22. Han IH, Lee SH, Lee JM, Kim HS, Nam KH, Duetzmann S et al. Does a medial retraction blade transmit direct pressure to pharyngeal/esophageal wall during anterior cervical surgery? Spine (Phila Pa 1976) 2015; **40:** E18–22.
23. Wu B, Song F, Zhu S. Reasons of dysphagia after operation of anterior cervical decompression and fusion. Clin Spine Surg 2017; **30:** E554–9.

APPENDIX

A standard postoperative protocol

Postoperative protocol given prior to discharge from ambulatory surgery center

1. Most incisions are closed with subcuticular sutures that will dissolve on their own.
2. Cover area to avoid getting incision wet for 2–3 days.
3. While showering avoid allowing water to hit incision directly, apply water resistant bandage.
4. Cover the incision with dry sterile gauze dressing daily and cover with paper tape, until advised at 1st postoperative appointment.
5. Call if concerned with wound. Pain, reddened, increased drainage.
6. Steri-strips fall off in 10–12 days.
7. Monitor temperature daily. Fever greater than 101.5F, please call.
8. Pain is expected after surgery. If pain is not relieved by pain medications or getting progressively worse, call office to let us know. Weakness and tingling in

extremities can be part of healing process especially after surgery.

Medications: Patients may take over-the-counter (OTC) laxatives and stool softeners for constipation. Follow the administration instructions on the product package.
Stool softeners such as: Colace, Pericolace, Surkfak, Senokot-S
Laxatives such as: Milk of Magnesia, Dulcolax, Senokot, and Herbal teas
Suppositories such as: Dulcolax and Glycerin

IF THERE ARE ANY ISSUES DO NOT HESITATE TO CALL
Dr (): xxx-xxx-xxxx