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Risk factors associated with dysphagia after anterior surgery in treatment for multilevel cervical disorder with kyphosis

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Abstract

This is a retrospective study. Our aim was to investigate the risk factors related to dysphagia following anterior surgery treating the multilevel cervical disorder with kyphosis based on a subgroup of follow-up time. Finally, a total of 81 patients suffering from the multilevel cervical disorder with kyphosis following anterior surgery from July 2018 to June 2020 were included in our study. Patients with dysphagia were defined as the dysphagia group and without dysphagia as the no-dysphagia (NG) group based on a subgroup of follow-up time (1-week, 1-month, 3-month, 6-month, and 1-year after surgery). Clinical outcomes and radiological data were performed to compare between dysphagia group and NG. In our study, the rate of dysphagia was 67.9%, 44.4%, 34.6%, 25.9%, and 14.8% at 1-week, 1-month, 3-month, 6-month, and 1-year after surgery, respectively. Our findings showed that change of Cobb angle of C2–7 was associated with dysphagia within 3-month after surgery. Furthermore, postoperative Cobb angle of C2–7 was linked to dysphagia within 6-month after surgery. Interestingly, a history of smoking and lower preoperative SWAL-QOL score were found to be risk factors related with dysphagia at any follow-up. In the present study, many factors were found to be related to dysphagia within 3-month after surgery. Notably, a history of smoking and lower preoperative SWAL-QOL score were associated with dysphagia at any follow-up. We hope this article can provide a reference for spinal surgeons to predict which patients were susceptible to suffering from dysphagia after anterior surgery in the treatment of multilevel cervical disorder with kyphosis.

Abbreviations: ACCF = anterior cervical corpectomy and fusion, ACDF = anterior cervical discectomy and fusion, BMI = body mass index, JOA = Japanese Orthopedic Association, SWAL-QOL = swallowing quality of life.

Keywords: anterior cervical surgery, dysphagia, kyphosis, multilevel cervical disorder, risk factors.

1. Introduction

Cervical disorders are common clinical diseases and severely influence numerous people, especially the elder.[1,2] As we know, anterior surgeries are widely used in the treatment of cervical diseases such as multilevel cervical disorder with kyphosis[1–3] because they are able to provide sufficient decompression and improve cervical lordosis (Fig. 1). However, dysphagia, a serious and common complication of anterior surgeries, impacts approximately from 1 to 79% morbidity as reported according to previous studies, which has a greater effect on quality of life and psychology of patients.[4,5] Therefore, it is greatly important to identify the risks of dysphagia after anterior surgeries. Bazaz[6] mentioned that female patient, ≥60 years old and multiple surgeries were risk factors for dysphagia. Multilevel cervical spine and upper cervical spine surgeries were the leading factors for dysphagia.[7] An increasing number of articles focus on this topic, as far as we know, yet the risk factors for dysphagia remain controversial. Therefore, the purpose of this study was to explore risk factors of dysphagia based on a subgroup of follow-up time following anterior cervical surgery treating multilevel cervical diseases.

2. Methods

2.1. Search strategy

2.1.1. Patients. Finally, 81 patients receiving anterior cervical surgery from July 2018 to June 2020 at HeBei Medical University were included in our study. We defined patients with dysphagia as the dysphagia group (DG) and without dysphagia as the no-dysphagia group (NG) at follow-up (1-week, 1-month, 3-month, 6-month, and 1-year after surgery). The inclusion criteria for the study were

There is no need to write informed consent forms from patients because this is a retrospective study.

The authors have no conflicts of interest to disclose.

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

The study was approved by the Institutional Review Board of the third hospital of HeBei Medical University before data collection and analysis.

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as follows: (1) study population must be adult patients (>18 years old); (2) patients suffering from the multilevel cervical diseases including cervical spondylotic myelopathy, cervical spondylotic radiculopathy, ossification of posterior longitudinal ligament; (3) patients were diagnosed with dysphagia at follow-up according to Bazaz dysphagia score[6]; (4) patients following anterior cervical surgery including anterior cervical discectomy and fusion, anterior cervical corpectomy and fusion; (5) radiographic evaluation including X-ray imaging at the time of before surgery, 1-week, 1-month, 3-month, 6-month, and 1-year after surgery, preoperative computed tomography (CT), and magnetic resonance imaging of the cervical spine must be performed. Studies were excluded if they (1) were without completed data; (2) patients treated for cervical trauma, tumor, infection, inflammation, or scoliosis; (3) patients with another history of cervical surgery.

2.1.2. Imaging assessment. The following radiological variables were measured: angle of C2 to C7 (C2–7) was defined as the angle formed by the inferior endplates of C2 and C7 in lateral radiographs. C2–C7 SVA is the distance from the posterosuperior corner of C7 and the vertical line from the center of the C2 body. T1 slope was measured as the angle between a horizontal line and the superior endplate of T1 on the lateral radiograph.

The methods were carried out by the approved guidelines. We compared the data between DG and tNG based on a subgroup of follow-up time. All measurement data were presented as the mean ± SD (standard deviation) when data satisfied the criteria for normality with $P > .05$. When data like age, the Chi-square test was used for data analysis. The Kolmogorov-Smirnoff test was used to verify the normal data distribution. Statistical significance levels were considered to be $P < .05$. We choose backwards conditional selection, and select the factors that a $P < .10$ in univariate analyses in the final multivariate logistic models. The level of significance was set at $P < .05$. All statistical analyses were carried out using SPSS, version 21.0 (SPSS Inc., Chicago, IL).

3. Results

3.1. One week after surgery

At 1-week after surgery, 55 of 81 patients (67.9%) suffered from dysphagia. There was no difference in age, sex, diabetes, body mass index (BMI), disease duration, diagnoses, surgical procedure, pre- and postoperative JOA, number of fusion levels, preoperative Cobb angle of C2–7, change of, pre- and postoperative T1 slope, and pre- and postoperative C2 SVA in 2 groups. However, smoker ($P = .046$), preoperative swallowing quality of life (SWAL-QOL) score ($P = .001$), postoperative Cobb angle of C2–7 ($P = .001$), change of Cobb angle of C2–7 ($P = .001$), and change of C2 SVA ($P = .031$) were found to be risk factors related to dysphagia at 1-week after surgery (Table 1).

3.2. One month after surgery

Thirty-six of 81 patients (44.4%) suffered from dysphagia. There was no difference in age, sex, diabetes, BMI, disease duration, diagnoses, surgical procedure, pre- and postoperative JOA, number of fusion levels, preoperative Cobb angle of C2–7, change of, pre- and postoperative T1 slope and change of, pre- and postoperative C2 SVA in 2 groups. However, smoker ($P = .001$), preoperative SWAL-QOL score ($P = .001$), postoperative Cobb angle of C2–7 ($P = .001$), change of Cobb angle of C2–7 ($P = .001$), and Change of C2 SVA ($P = .038$) were associated with the increased rate of dysphagia at 1-month after surgery (Table 2).

Table 1

Comparison of characteristics between the 2 groups at 1-week after surgery.

Characters	Dysphagia (n = 55)	No dysphagia (n = 26)	*P*
Age(yrs)	55.3 ± 10.6	52.6 ± 9.3	.245
Sex (male/female)	28/27	14/12	.805
Smoker (yes/no)	23/32	5/21	.046
DM	11/44	5/21	.935
BMI (kg/m^2)	24.2 ± 3.1	25.0 ± 3.2	.541
Disease duration (mo)	11.2 ± 3.1	10.8 ± 2.2	.323
Diagnostic categories			
CSM	22	9	.642
CSR	33	17	
Surgical procedure			.675
ACDF	29	15	
ACCF	26	11	
Preoperative JOA	10.1 ± 1.4	10.2 ± 1.8	.623
Postoperative JOA	13.3 ± 2.1	13.2 ± 2.0	.991
Number of fusion levels	3.6 ± 0.8	3.1 ± 0.5	.078
Preoperative SWAL-QOL score	36.8 ± 12.6	58.9 ± 15.6	.001
Preoperative Cobb angle of C2–7 (°)	1.1 ± 2.1	0.8 ± 2.0	.167
Postoperative Cobb angle of C2–7 (°)	15.1 ± 3.6	12.3 ± 2.9	.001
Change of Cobb angle of C2–7 (°)	14.0 ± 3.1	11.5 ± 3.7	.001
Preoperative T1 slope(°)	8.3 ± 1.8	8.2 ± 2.0	.912
Postoperative T1 slope(°)	11.3 ± 2.0	11.5 ± 2.3	.867
Change of T1 slope(°)	3.0 ± 1.8	3.3 ± 3.2	.765
Preoperative C2 SVA (mm)	3.8 ± 1.5	3.3 ± 1.2	.457
Postoperative C2 SVA (mm)	4.7 ± 3.1	5.0 ± 3.0	.746
Change of C2 SVA (mm)	0.9 ± 1.3	1.7 ± 1.4	.031

3.3. Three months after surgery

Twenty-eight of 81 patients (34.6%) occurred with dysphagia. There was no difference in age, sex, diabetes, BMI, disease duration, diagnoses, surgical procedure, pre- and postoperative JOA, number of fusion levels, preoperative Cobb angle of C2–7, change of, pre- and postoperative T1 slope and change of, pre- and postoperative C2 SVA in 2 groups. However, smoker ($P = .001$), preoperative SWAL-QOL score ($P = .001$), postoperative Cobb angle of C2–7 ($P = .001$), and change of Cobb angle of C2–7 ($P = .001$) were associated with the increased rate of dysphagia at 3-month after surgery (Table 3).

3.4. Six months after surgery

Twenty-one of 81 patients (25.9%) suffered from dysphagia. There was no difference in age, sex, diabetes, BMI, disease duration, diagnoses, surgical procedure, pre- and postoperative JOA, number of fusion levels, change of, and preoperative Cobb angle of C2–7, change of, pre- and postoperative T1 slope and change of, pre- and postoperative C2 SVA in 2 group. However, smoker ($P = .001$), preoperative SWAL-QOL score ($P = .001$), and postoperative Cobb angle of C2–7 ($P = .008$) were associated with the increased rate of dysphagia at 6-month after surgery (Table 4).

3.5. One year after surgery

Twelve of 81 patients (14.8%) suffered from dysphagia. There was no difference in age, sex, diabetes, BMI, disease duration, diagnoses, surgical procedure, pre- and postoperative JOA, number of fusion levels, change of, pre- and postoperative Cobb angle of C2–7, change of, pre- and postoperative T1 slope and change of, pre- and postoperative C2 SVA in 2 groups. However, smoker ($P = .001$) and preoperative SWAL-QOL score ($P = .001$) were associated with the increased rate of dysphagia at 1 year after surgery (Table 5).

Table 2

Comparison of characteristics between the 2 groups at 1-month after surgery.

Characteristics	Dysphagia (n = 36)	No dysphagia (n = 45)	*P*
Age (yrs)	54.1 ± 10.1	53.9 ± 9.0	.540
Sex (male/female)	17/19	25/20	.456
Smoker (yes/no)	20/16	7/38	.001
DM	9/27	7/38	.289
BMI (kg/m^2)	24.4 ± 3.4	24.9 ± 3.6	.725
Disease duration (mo)	11.1 ± 3.1	10.9 ± 2.2	.455
Diagnostic categories			
CSM	14	17	.919
CSR	22	28	
Surgical procedure			.842
ACDF	20	24	
ACCF	16	21	
Preoperative JOA	10.1 ± 1.5	10.2 ± 1.7	.584
Postoperative JOA	13.3 ± 2.1	13.2 ± 2.0	.923
Number of fusion levels	3.5 ± 0.8	3.1 ± 0.6	.125
Preoperative SWAL-QOL score	33.2 ± 13.6	55.9 ± 16.6	.001
Preoperative Cobb angle of C2–7 (°)	1.1 ± 2.0	0.8 ± 2.0	.227
Postoperative Cobb angle of C2–7 (°)	15.3 ± 3.5	12.4 ± 2.9	.001
Change of Cobb angle of C2–7 (°)	14.2 ± 3.1	11.6 ± 3.6	.001
Preoperative T1 slope(°)	8.3 ± 1.8	8.2 ± 1.9	.612
Postoperative T1 slope(°)	11.3 ± 2.0	11.5 ± 2.3	.767
Change of T1 slope(°)	3.0 ± 1.8	3.3 ± 3.2	.513
Preoperative C2 SVA (mm)	3.7 ± 1.3	3.4 ± 1.2	.441
Postoperative C2 SVA (mm)	4.6 ± 3.1	5.0 ± 3.0	.646
Change of C2 SVA (mm)	0.9 ± 1.3	1.7 ± 1.4	.038

Table 3

Comparison of characteristics between the 2 groups at 3-month after surgery.

Characteristics	Dysphagia (n = 28)	No dysphagia (n = 53)	*P*
Age (yrs)	54.2 ± 10.4	53.8 ± 9.2	.484
Sex (male/female)	15/13	27/26	.822
Smoker (yes/no)	18/10	9/44	.001
DM	6/22	10/43	.783
BMI (kg/m^2)	24.4 ± 3.2	24.9 ± 3.8	.625
Disease duration (mo)	11.0 ± 3.0	10.9 ± 2.3	.665
Diagnostic categories			
CSM	10	21	.731
CSR	18	32	
Surgical procedure			.401
ACDF	17	27	
ACCF	11	26	
Preoperative JOA	10.1 ± 1.5	10.2 ± 1.7	.521
Postoperative JOA	13.3 ± 2.0	13.2 ± 2.0	.823
Number of fusion levels	3.6 ± 0.9	3.0 ± 0.7	.109
Preoperative SWAL-QOL score	33.0 ± 13.4	55.7 ± 16.8	.001
Preoperative Cobb angle of C2–7 (°)	1.1 ± 2.0	0.8 ± 2.0	.205
Postoperative Cobb angle of C2–7 (°)	15.2 ± 3.4	12.5 ± 3.0	.001
Change of Cobb angle of C2–7 (°)	14.1 ± 3.0	11.7 ± 3.5	.001
Preoperative T1 slope(°)	8.3 ± 1.8	8.2 ± 1.9	.542
Postoperative T1 slope(°)	11.4 ± 2.0	11.4 ± 2.3	.923
Change of T1 slope(°)	3.1 ± 2.0	3.2 ± 3.1	.756
Preoperative C2 SVA (mm)	3.6 ± 1.3	3.5 ± 1.3	.441
Postoperative C2 SVA (mm)	4.7 ± 3.0	4.9 ± 3.0	.646
Change of C2 SVA (mm)	1.1 ± 1.4	1.4 ± 1.5	.058

3.6. Multivariate analysis

Smoker, preoperative SWAL-QOL score, postoperative Cobb angle of C2–7 and change of Cobb angle of C2–7 were identified as the risk factors of dysphagia within 3-month after surgery.

Table 4

Comparison of characteristics between the 2 groups at 6-month after surgery.

Characteristics	Dysphagia (n = 21)	No dysphagia (n = 60)	*P*
Age (yrs)	54.1 ± 10.2	53.9 ± 9.3	.423
Sex (male/female)	10/11	32/28	.652
Smoker (yes/no)	14/7	13/47	.001
DM	5/16	11/49	.751
BMI (kg/m^2)	24.5 ± 3.1	24.8 ± 3.6	.875
Disease duration (mo)	11.0 ± 3.0	10.9 ± 2.3	.612
Diagnostic categories			
CSM	8	23	.985
CSR	13	37	
Surgical procedure			.836
ACDF	11	33	
ACCF	10	27	
Preoperative JOA	10.1 ± 1.5	10.2 ± 1.6	.556
Postoperative JOA	13.3 ± 2.0	13.2 ± 2.0	.721
Number of fusion levels	3.5 ± 0.9	3.1 ± 0.7	.297
Preoperative SWAL-QOL score	30.0 ± 14.1	54.9 ± 17.0	.001
Preoperative Cobb angle of C2–7 (°)	1.1 ± 2.0	0.8 ± 2.0	.311
Postoperative Cobb angle of C2–7 (°)	14.6 ± 3.2	13.1 ± 3.2	.008
Change of Cobb angle of C2–7 (°)	13.5 ± 3.0	12.3 ± 3.5	.061
Preoperative T1 slope(°)	8.3 ± 1.7	8.2 ± 1.8	.663
Postoperative T1 slope(°)	11.3 ± 2.1	11.4 ± 2.2	.871
Change of T1 slope(°)	3.0 ± 2.0	3.2 ± 3.0	.451
Preoperative C2 SVA (mm)	3.6 ± 1.3	3.5 ± 1.3	.470
Postoperative C2 SVA (mm)	4.7 ± 3.0	4.8 ± 2.9	.803
Change of C2 SVA (mm)	1.1 ± 1.4	1.3 ± 1.6	.181

Table 5

Comparison of characteristics between the 2 groups at 1 year after surgery.

Characters	Dysphagia (n = 12)	No dysphagia (n = 69)	*P*
Age (yrs)	54.3 ± 10.0	53.8 ± 9.6	.307
Sex (male/female)	6/6	36/33	.889
Smoker (yes/no)	9/3	18/51	.001
DM	3/9	13/56	.621
BMI (kg/m^2)	24.6 ± 3.0	24.7 ± 3.7	.899
Disease duration (mo)	11.0 ± 3.0	10.9 ± 2.3	.633
Diagnostic categories			
CSM	4	27	.760
CSR	8	42	
Surgical procedure			.762
ACDF	7	37	
ACCF	5	32	
Preoperative JOA	10.1 ± 1.7	10.2 ± 1.4	.351
Postoperative JOA	13.2 ± 2.2	13.2 ± 2.0	.629
Number of fusion levels	3.4 ± 1.0	3.2 ± 0.8	.405
Preoperative SWAL-QOL score	35.7 ± 15.0	57.0 ± 19.1	.001
Preoperative Cobb angle of C2–7 (°)	1.1 ± 2.1	0.8 ± 2.0	.255
Postoperative Cobb angle of C2–7 (°)	14.0 ± 3.0	13.5 ± 3.3	.051
Change of Cobb angle of C2–7 (°)	12.9 ± 2.8	12.7 ± 3.3	.661
Preoperative T1 slope(°)	8.3 ± 1.8	8.2 ± 1.1	.756
Postoperative T1 slope(°)	11.3 ± 2.1	11.4 ± 2.1	.571
Change of T1 slope(°)	3.0 ± 2.0	3.2 ± 3.0	.522
Preoperative C2 SVA (mm)	3.6 ± 1.2	3.5 ± 1.3	.650
Postoperative C2 SVA (mm)	4.7 ± 3.0	4.8 ± 3.0	.786
Change of C2 SVA (mm)	1.1 ± 1.4	1.3 ± 1.6	.215

At 6-month follow-up, smoker, preoperative SWAL-QOL score, and postoperative Cobb angle of C2–7 were independent risks of dysphagia. However, only smoker and preoperative SWAL-QOL score were found to be risks of dysphagia at 1-year follow-up (Table 6).

Table 6

Multivariate analysis of dysphagia based on follow-up time.

Characters	*P*	OR	95% CI	
			lower	Upper
1-week follow-up				
Smoker	.020	1.237	1.056	1.478
Preoperative SWAL-QOL score	.011	1.593	1.301	1.674
Postoperative Cobb angle of C2–7 (°)	.032	1.204	1.072	1.451
Change of Cobb angle of C2–7 (°)	.001	1.776	1.342	2.154
1-month follow-up				
Smoker	.032	1.364	1.098	1.556
Preoperative SWAL-QOL score	.018	1.605	1.276	1.876
Postoperative Cobb angle of C2–7 (°)	.020	1.453	1.172	1.721
Change of Cobb angle of C2–7 (°)	.001	1.802	1.412	2.206
3-month follow-up				
Smoker	.019	1.231	1.008	1.453
Preoperative SWAL-QOL score	.017	1.305	1.126	1.576
Postoperative Cobb angle of C2–7 (°)	.020	1.243	1.040	1.401
Change of Cobb angle of C2–7 (°)	.033	1.202	1.016	1.414
6-month follow-up				
Smoker	.008	1.445	1.214	1.697
Preoperative SWAL-QOL score	.012	1.401	1.113	1.778
Postoperative Cobb angle of C2–7 (°)	.014	1.331	1.126	1.543
1-year follow-up				
Smoker	.012	1.347	1.134	1.532
Preoperative SWAL-QOL score	.006	1.754	1.375	2.163

SWAL-QOL = swallowing quality of life.

4. Discussion

Dysphagia is a common postoperative complication of anterior cervical surgery in the treatment of cervical diseases. Bazaz[6] performed a prospective study including 249 patients and reported the rate of postoperative dysphagia was 50.2%, 32.2%, 17.8%, and 12.5% at 1, 2, 6, and 12 months, respectively. A growing number of studies paid attention to the risk factors of postoperative dysphagia and demonstrated that age, female patients, smoking, multilevel fused level, rhBMP use, operative time, type of surgical procedure, surgical level, revision surgery, as well as comorbidities such as diabetes and hypertension, and severe neck pain were related to the increased risk of postoperative dysphagia.[4,5] Accumulating evidence focused on postoperative dysphagia after anterior cervical surgeries, yet the risk factors associated with postoperative dysphagia remain poorly understood. To our knowledge, little research have investigated the risk factors of postoperative dysphagia after anterior cervical surgery treating the multilevel cervical disorder with kyphosis based on a subgroup of follow-up time.

Thus, we perform a retrospective study to evaluate the risk factors associated with postoperative dysphagia based on a subgroup of follow-up time. Our findings showed that a history of smoking, lower preoperative SWAL-QOL score, postoperative Cobb angle of C2–7 and change of Cobb angle of C2–7 were associated with dysphagia within 3-month after surgery. Furthermore, a history of smoking, lower preoperative SWAL-QOL score, and postoperative Cobb angle of C2–7 was linked to dysphagia within 6 months after surgery. Notably, a history of smoking and lower preoperative SWAL-QOL score were found to be risk factors related to dysphagia at any follow-up.

In the present study, 67.9%, 44.4%, 34.6%, 25.9%, and 14.8% 1-week, 1-month, 3-month, 6-month, and 1-year after surgery, respectively. As Figure 2 shows, the number of patients with postoperative dysphagia significantly decrease along with follow-up time, but the descent gradually slowed down. Nevertheless, we did not observe an obviously stable tendency within 1-year follow-up due to our relatively short follow-up. We need a longer follow-up to assess when the rate of postoperative dysphagia tend to stabilize.

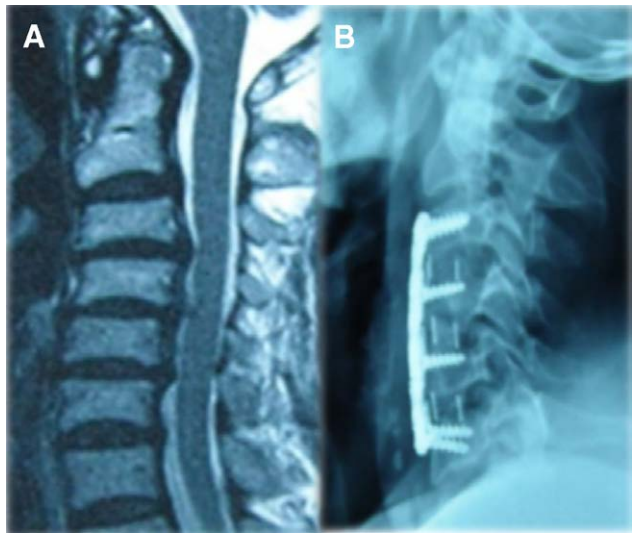

Figure 1. (A) Magnetic resonance imaging showed multilevel cervical disorder with kyphosis. (B) X-ray showed recovery of cervical lordosis after anterior cervical surgery.

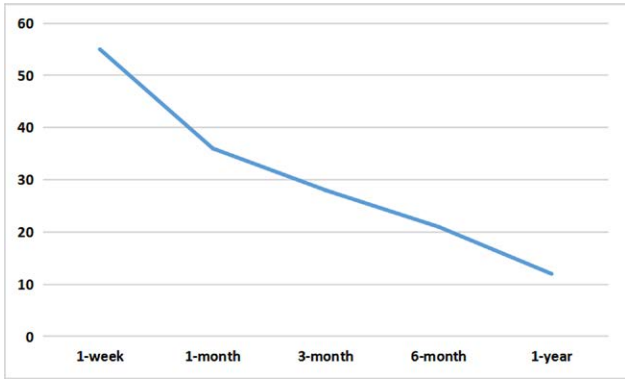

Figure 2. Relation between rate of dysphagia and follow-up time.

In terms of cervical sagittal parameters, Okano[8] collected retrospective data of 291 patients to identify the perioperative risk factors for dysphagia and suggested that preoperative C2–7 angle was not related to high morbidity, which was consistent with our result. However, Okano did not study on effect of postoperative C2–7 or correction of C2–7 on postoperative dysphagia. Tian[9] considered cervical sagittal parameters as factors and concluded that change of C2–7 angle playing an important role in the development of dysphagia in patients with or without kyphosis. Furthermore, Tian[9] demonstrated that once the C2–C7 angle was >5°, the chance of developing postoperative dysphagia was significantly greater. Chen[10] also evaluated risk factors for the development of dysphagia following same-day combined anterior-posterior cervical spine surgeries and indicated increment surgical correction of C2–7 with an increasing rate of postoperative dysphagia. We partially agreed with previous conclusions[9,10] due to the difference in the character of the study population, which may lead to a slight discrepancy. In the present study, we only focused on patients with multilevel cervical disorder with kyphosis and proved that postoperative and change of C2–7 angle significantly impact dysphagia within 6 months, but not at 1-year follow-up. We believed that postoperative and change of C2–7 angle were the leading driver in the development of postoperative dysphagia in special patients with kyphosis at short-term follow-up. Surely, patients were not being adapted to status against esophagus caused by cervical lordosis

and plate after anterior cervical surgery, whereas patients gradually adjust to the status that against esophagus. The mention above may perfectly account for our results. Park[11] believed that most patients were able to tolerate this increase in C2–7 SVA, while we also partially agree with Park' consequence. In our study, change of C2 SVA was discovered to be associated with postoperative dysphagia within 1 month. After 1-month after surgery, patients may adapt to the correction of C2 SVA.

The SWAL-QOL questionnaire is a widely used to measure degree of dysphagia[12,13] and lower scores indicated more frequent symptoms of dysphagia because some questions are less suitable for spinal surgical study.[8] Therefore, we adopted a 14-item questionnaire to assess symptoms frequently associated with dysphagia.[14] Vaishnav[15] first evaluated the relationship between SWAL-QOL score and dysphagia and suggested that preoperative SWAL-QOL score was a predictive factor of dysphagia in single-level ACDF. Park[11] also found that preoperative dysphagia was associated with poor postoperative functional swallow outcome by FOSS score. We obtained similar results with previous study.[11,15] Our findings demonstrated that lower preoperative SWAL-QOL score was an independent risk of postoperative dysphagia at any follow-up in univariate and multivariate analysis, which was particularly relevant clinically because it was beneficial for spine surgeon to preoperatively distinguish those who were susceptible to postoperative dysphagia. Additionally, we are able to offer adequate preoperative preparation to minimize the degree of postoperative dysphagia.

Increasing studies have shown detrimental effects of smoking on clinical outcomes of surgical treatment for spinal disorders. Riley[4] found that smoking was an independent predictor of postoperative dysphagia after anterior cervical surgery. Joaquim[5] had a similar result. In this study, the data indicated that at any follow-up, a history of smoking was positively related to postoperative dysphagia after anterior surgery. One plausible explanation for this result is the deleterious effects of smoking on delaying the detumescence of surrounding tissues.

There were several limitations in this study. First, this is a retrospective study from a single center. We will conduct a prospective multicenter study in the future. Second, the small sample size of patients with postoperative dysphagia, especially at final follow-up, may induce potential biases. A larger number of patients with postoperative dysphagia should be included in the further study. Third, 1-year follow-up time is relatively short, a longer follow-up may be more significant. Fourth, we did not analyze the degree of postoperative dysphagia based on Bazaz dysphagia score[6] because of the small sample.

In conclusion, many factors including patients with a history of smoking, lower preoperative SWAL-QOL score, postoperative Cobb angle of C2–7, change of Cobb angle of C2–7, and C2–7 SVA were related to postoperative dysphagia during 3-month after surgery. Furthermore, patients with a history of smoking and lower preoperative SWAL-QOL score were found to be risk factors for postoperative dysphagia after anterior cervical surgeries at any follow-up. According to the present study, we can clearly see which characters of patients is the more likely to have postoperative dysphagia after anterior cervical surgery in the treatment of multilevel cervical degenerative diseases. We hope this article can provide a reference for spinal surgeons when face with multilevel cervical degenerative diseases. Meanwhile, it is helpful for future study on postoperative dysphagia. Further large-scale, well-designed studies are urgently needed.

Author contributions

YJL was responsible for study concept, design, data extraction, data analysis, and writing the article. YJL was responsible for data extraction, screened the abstracts and reviewed the article. FW were responsible for study concept, design, and data analysis. YS was responsible for study concept, design, data analysis, and writing the article.

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