

## Horner's Syndrome after Single Level or Two Levels Anterior Cervical Discectomy with Fusion; Clinical Series

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**BACKGROUND:** Horner's syndrome (HS) is a rare postoperative complication after anterior cervical discectomy and fusion (ACDF).

**OBJECTIVE:** This study aims to assess the incidence, patient's demography and surgical approach, outcomes and possible predictive factors for the occurrence of Horner's syndrome following the anterior approach for cervical discectomy.

**METHODS:** A retrospective study of 820 patients who had single or successive two levels ACDF for cervical degenerative disc disease using PolyEtherEtherKetone (PEEK) cages between 2016 and 2019 was conducted. Charts were reviewed to identify patients with postoperative occurrence of Horner's syndrome with a follow up period of 12 months. Outcome for ptosis, being the most important factor, was classified according to margin to reflex distance.

**RESULTS:** Forty patients had postoperative HS following ACDF out of 820 patients (4.8%). Around 67% of the patients with HS had single level discectomy, and the most frequent level was C5-6. The average age of patients with HS was 47 years, 55% were males, 33% were smokers and 20% were diabetics. Radiculopathy was more frequent than myelopathy. When anterior plate fixation system was used the incidence of Horner's syndrome was higher (60%). Improvement or complete resolution occurred in 90% of the cases.

**CONCLUSION:** Using anterior plating system during ACDF increases the risk of Horner's syndrome. In most of the cases, Horner's syndrome is a temporary clinical manifestation that is managed conservatively. Rarely, surgical repair for ptosis might be required.

**KEYWORDS:** Anterior cervical discectomy, Horner's syndrome, Ptosis

### INTRODUCTION

Anterior cervical discectomy and fusion (ACDF) is an increasingly surgical management for cervical degenerative disc disease.<sup>1,2</sup> Smith, Robinson, and Cloward in 1958 introduced such approach which uses the anatomical layers to reach the cervical disc and is considered to be less invasive.<sup>3,4</sup> However, this approach is associated with many complications such as hematoma, esophageal injury, dysphagia, vascular insults, and vocal cord affection, which can be potentially life-threatening sometimes.<sup>5-7</sup> Other less common complications including incidental dural tears, thoracic duct injury, and Horner's syndrome (HS) were observed.<sup>8,9</sup>

Horner's syndrome is described by partial ptosis, pupillary miosis, and facial anhidrosis due to sympathetic fibers injury or traction along the medial aspect of longus colli muscle fibers, which can be violated during the surgical approach.<sup>10-12</sup> Horner's syndrome causes functional loss

as well cosmetic impairments causing unsatisfactory outcome to patients.<sup>13,14</sup>

This study aims to assess the incidence, patient's demography and surgical approach, outcomes and the predictive factors for occurrence of HS following ACDF.

### PATIENTS AND METHODS

A retrospective observational study of 820 patients who had single or successive two levels ACDF for cervical degenerative disc disease using PolyEtherEtherKetone (PEEK) cages with or without plate fixation at Ain Shams University hospitals and its affiliated hospitals between 2016 and 2019 was conducted. All participants signed a written informed consent to enroll in the study. Institutional Review Board at our institute approved the retrospective observational study.

Charts were reviewed to identify patients with postoperative occurrence of Horner's syndrome. Patients were excluded if they had pre-existing ptosis or failed to follow up for 12 months. Charts were reviewed for demographic data, pre-existing medical conditions, operated level(s), surgery duration, radiology imaging, length of hospital stay, time of resolution of symptoms and outcome of Horner's syndrome using margin to

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reflex distance (MRD).<sup>15</sup>

Outcome for ptosis was classified as no improvement if MRD was less than 2 mm, moderate improvement if MRD was between 2-3 mm and resolution if MRD was 4 mm or more. MRD was measured by an ophthalmologist as light reflex was performed, and the distance in mm between the edge of cornea and upper lid margin was recorded.

Statistical analysis was performed using the statistical package for social sciences (SPSS) software, (version 23.0, Chicago, IL, USS). The multiple logistic regression was done to perform the analysis. Statistical significance (p-value) was set at a probability value less than 0.05.

## RESULTS

Our study included 40 patients who developed HS following ACDF out of 820 patients (4.8%). We identified that 67% of the patients with HS had single level discectomy and the most frequent level was C5-6 (p-value = 0.06). Patient characteristics, clinical presentations, operative data, and complications are shown in

**Table 1.** The average age of patients with HS was 47 years, 55% of the cases were males (p-value = 0.34), 33% were smokers and 20% had diabetes. Radiculopathy was more frequent than myelopathy. The mean procedure time was 90 minutes. Regarding the side of surgical approach; the right side was performed in 77.5% of the patients with HS (p-value = 0.052), while in 18% of the cases the side of HS mismatched the side of the approach. When anterior plate fixation system was used, the incidence of HS was higher (p-value = 0.028). Associated complications included recurrent laryngeal nerve injury in 7.5%, weakness in 5%, and both hematoma and cage dislodgement in 2.5%. The average length of hospital stay was 2 days (**Table 1**).

Complete resolution occurred in 10% of the patients within a mean of 6 weeks (range: 4-12 weeks). Patients who had partial improvement till 12 months after surgery represented 80% (**Figs. 1,2**). The average time for beginning of improvement was 4.3 weeks. No improvement was identified in 4 patients till 12 months of follow up. Two patients had surgical repair after 12 and 14 months (**Table 2**).



**Fig 1: Horner syndrome of left eye. (A) Assessment of anisocoria in dark (B) Assessment of anisocoria in light.**



**Fig 2: Partial ptosis after 2 months postoperatively.**

**Table 1: Patient demographics, clinical presentations, operative data and complications**

Characteristic	Value
<b>Patient demographics</b>	
Age	47 (27-73) years
Males	22 (55%)
Smokers	13 (33%)
Diabetes mellitus	8 (20%)
<b>Presenting symptoms</b>	
Myelopathy	35%
Radiculopathy	65%
<b>Operative data</b>	
<b>Number of level(s) operated upon</b>	
Single level	67%
Two levels	33%
<b>Level operated upon</b>	
C3/4	15%
C4/5	33%
C5/6	53%
C6/7	33%
With plate fixation	60%
Without plate fixation	40%
<b>Side</b>	
Right side surgical approach	77.5%
Right side Horner affection	75%
Different side of Horner than approach	18%
<b>Duration of surgery</b>	90 (60 - 180) minutes
<b>Associated complications</b>	
Weakness	5%
Hoarseness of voice	7.5%
Hematoma	2.5%
Cage dislodgement	2.5%
<b>Length of hospital stay</b>	2 (1 - 3) days

**Table 2: Patient outcome of the 40 patients with HS according to margin to reflex distance**

Outcome	Value
No improvement (MRD less than 2 mm)	10%
Partial (MRD 2-3 mm)	80%
Complete (MRD 4 mm)	10%
Time to improvement	4.3 (2-10) weeks
Complete improvement	6 (4-12) weeks
Need for blepharoptosis repair	5%

MRD: Margin to reflex distance.

## DISCUSSION

Horner's syndrome is an uncommon complication after anterior cervical discectomy and fusion, but with more utilization of this approach, this complication is observed more frequent.<sup>11,13,14</sup> Horner's syndrome is caused by central, preganglionic and postganglionic causes. Preganglionic injury to the sympathetic fibers to the orbit and its adnexa might result from injury to sympathetic plexus that occurs during surgical approach to the cervical disc with dissections that expose the lateral edge of vertebral body, uncovertebral joint, and foramen transversarium.<sup>10,14,16,17</sup> The frequency of HS after ACDF is variable in different series ranging between 0.02% and 4%.<sup>18</sup> In a large multicenter clinical series including 8887 patients, the reported incidence of HS was 0.06%.<sup>14</sup> In our current study the incidence was higher (4.8%) this is likely due to the bias often seen in large studies or underdiagnosis and reporting of mild degrees of HS, however the incidence is still relatively high.

All of our patients had surgery for subaxial cervical levels either single or two levels, which is matching other large series in the literature. Around 53% of our patients with HS had surgery involving C5/6 level. Similarly, Traynelis and his colleagues reported that the incidence was higher when operating on midcervical levels (C5 and C6).<sup>14</sup> In addition, Lubelski et al. reported that C5,6 was the most commonly affected level (64% of the cases).<sup>18</sup> This could be explained by the anatomical path of sympathetic fibers and trunk, which run inside the longus colli, in average of 11.6 mm from the medial border at C6, when compared to the mean of 20 mm at upper levels.<sup>19-22</sup> In an anatomic study of 28 adult cadavers by Ebraheim et al., they observed that longus colli muscles progressively run laterally from C3 to C6, while the sympathetic trunk runs medially.<sup>19</sup>

Hence, at these levels, minimal usage of electrocautery should be considered along the lateral border of the vertebral body and through longus colli.<sup>23,24</sup> Knowing such anatomy of longus colli fibers and the sympathetic trunk relation, subperiosteal dissection and fixing the retractors beneath the medial edge of longus colli are advised to decrease occurrence of HS.<sup>11,25</sup> In addition, avoidance of forceful and longer duration of retraction, and transient release of the retractors, can decrease the risk of HS and laryngeal palsy.<sup>26-30</sup> Such findings can explain why there was a higher incidence of HS when plate fixation system was used in our current study (60% of total cases), as more extensive exposure and traction was needed.<sup>13,14</sup>

In our current series, right side HS (75%) was more common than left side. In 77% of the patients the right side approach was performed, while in 18% of the cases HS mismatched the side of the approach for ACDF. On the contrary, Lubelski et al. in their series reported that the majority of HS cases were on the left side.<sup>18</sup> This might reflect the anatomic risk that predispose to HS. The right sided corridor is being more accessible

for right handed surgeons, while the left sided corridor theoretically decreases the risk of injury to the recurrent laryngeal nerve.<sup>9,12,19</sup>

The reported resolution rate of HS after ACDF in the literature, ranges between 80%-100%.<sup>1,9,13,14,18,31-34</sup> In the current study, HS occurred immediately postoperative, and through 1 year 10% of patients had complete recovery, 80% had partial recovery of the ptosis while 10% had no improvement. Margin to reflex distance was used to assess the blepharoptosis degree as it is the main cosmetic concern with the limitation of the upper field of vision.<sup>15</sup> The average time to the appearance of improvement was 4.3 weeks and the average time for complete resolution was 6 weeks. The ptosis can be corrected by surgical procedure, with good cosmetic and functional outcomes.<sup>34</sup> Only 4 cases (10%) showed no improvement, 2 cases (5%) underwent surgical repair for ptosis after more than one year while the other 2 patients did not find the ptosis to be a cosmetic burden. The outcome of HS resolution depends on the type of damage; if the damage was caused by retraction there is often a spontaneous improvement and complete recovery but if there was a complete sectioning of the sympathetic fibers, HS will not improve.<sup>13,14,17</sup>

## CONCLUSION

The incidence of Horner's syndrome following ACDF increases with surgery at C5-6 level. Using the anterior plating system increases the risk of Horner's syndrome. In most of the cases, Horner's syndrome is a temporary clinical manifestation that is managed conservatively, with improvement or complete resolution occurring in the majority of the patients. Rarely, surgical repair for ptosis might be required.

### List of abbreviations

ACDF: Anterior cervical discectomy and fusion.  
 HS: Horner's syndrome.  
 MRD: Margin to reflex distance.  
 PEEK: Polyetheretherketone.  
 SPSS: Statistical package for social sciences.

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