Pharyngeal Tilt Angle - Predictor of the Incidence of Dysphagia after Occipitothoracic Fusion

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Introduction: Craniocervical malalignment after occipitothoracic fusion (OTF) is one of a trigger of dysphagia. However, the critical value of dangerous craniocervical alignment has not been indicated and also, there has been no logical explanation for the etiology yet. The objective of this study is to seek the critical point of the craniocervical alignment to avoid the dysphagia after OTF.

Methods: A total of 31 patients (26 female, 5 male; mean age 68.4 years) underwent OTF since 2005, and were followed for at least one year. We defined following two parameters on the lateral cervical radiogram after surgery and at follow-up: 1; Pharyngeal tilt angle (PTA) as the angle between the McGregor’s line and the line that links the center of C2 pedicle and the center of vertebral body at the apex of cervical sagittal curvature. 2; Anteroposterior diameter of oropharyngeal airway space (dPS) measured just cranial to epiglottis. PTA reflects anterior protrusion of mid-cervical spine, smaller PTA indicates greater anterior protrusion of mid-cervical spine. Additionally, O-C2 angle was also measured. The relationship of these parameters and their influence to the incidence of dysphagia were analyzed.

Results: Six of 31 cases (19.4%) exhibited postoperative dysphagia during follow-up period. Each optimal cut-off points were determined by receiver operating characteristic (ROC) curves using Youden index: 77 degrees for PTA, 10mm for dPS, and one degree for O-C2 angle. ROC curves also showed that PTA and dPS had moderate accuracy for the predictor of the dysphagia after OTF with the area under the curve (AUC) of 0.76 and 0.86 respectively, whereas O-C2 angle had moderate to low accuracy with AUC of 0.70 (Figure 1). The incidence of dysphagia after OTF was significantly higher in the cases with less than 77 degree of PTA (45.5%) than the cases with 77 or more degree (5.0%) (P=0.006) and higher in the cases with less than 10mm of dPS (57.1%) than the case with 10mm or larger (8.3%) (P=0.016), whereas no significant difference was observed between the cases with less than one degrees of O-C2 angle (33.3%) and the cases with one or more degrees (10.5%) (P=0.117). In addition, the strong linear correlation was observed between PTA and dPS (R=0.693, P<0.001) (Figure 2).
**Conclusion:** Our results demonstrated a strong relationship between the value of dPS or PTA and the incidence of dysphagia. These results indicated that dysphagia after OTF is caused by narrowing of oropharyngeal space due to direct compression from anteriorly protruded mid-cervical spine. Although dPS was revealed to be the best indicator of postoperative dysphagia with the highest AUC value, it is not suitable for intra-operative indicator because dPS cannot be measured during surgery. On the other hand, PTA is easy to measure radiologically during surgery and has a high AUC value. Moreover, since PTA has strong relationship to dPS and the incidence of dysphagia after OTF, PTA works as a practical intra-operative indicator of postoperative dysphagia. In conclusion, PTA should be adjusted to 77 degree or more during OTF.

**Figure 1: ROC curves**

**Figure 2: Correlation between PTA and dPS**

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