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Does the hypopharyngeal cavernous body protect the development of Zenker's diverticulum?

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ABSTRACT

Objective: The aim of this study was to examine the morphology of the cavernous body at the pharyngoesophageal segment.
Methods: In 47 cadavers the submucosal vascular plexus of the pharyngoesophageal segment and the cricopharyngeal muscle were examined.
Results: A vascular plexus which was macroscopically non visible or slightly identified was observed in the majority of the specimens (28 or 59.6%). Fourteen of the cadavers (29.8%) exhibited macroscopically lightly observable blood vessels which were covering a discontinuous area of the hypopharyngeal wall. In the other five specimens (10.6%) the vascular plexus was covering a large part of the dorsal wall of the pharyngoesophageal segment as a compact mass. The grade of dilation of the vascular plexus corresponded to the degree of protrusion of the cricopharyngeal muscle.
Conclusions: In the case of a persistent constricted cricopharyngeal muscle, the dilation of the hypopharyngeal cavernous body may protect from developing a Zenker's diverticulum by reinforcing the Killian's dehiscence.

1. Introduction

The Zenker's diverticulum is a protrusion of the mucosa and submucosa of the hypopharynx through the muscular layer in the area of the Killian's dehiscence. Various theories have been postulated concerning the etiology and pathophysiology of a hypopharyngeal diverticulum. The upper esophageal sphincter (UES) plays a central role in the development of a Zenker's diverticulum and according to a popular theory, an inadequate opening of the UES due to a reduced compliance of the cricopharyngeal muscle leads to abnormal intrabolus pressures, which cause a herniation of the hypopharyngeal wall [1,2]. Among other pathologies the hypopharyngeal pouch has been associated with the presence of extraesophageal reflux. In the case of reflux structural and functional changes of the cricopharyngeal muscle may be induced by the local action of the gastric acid fluid [2–4]. Individual anatomical variations concerning the Killian's dehiscence may be a co-factor for the processes of the wall herniation. A present muscular dehiscence of the dorsal hypopharyngeal wall is essential for the development of a Zenker's diverticulum and a large dehiscence is considered as a predisposing factor [5–7]. In addition to the specific structure of the muscular layer, the composition of the connective tissue contributes to the mechanical weakness of the dorsal hypopharyngeal wall as well. It is reported that at this region of the pharynx the solid pharyngobasilar fascia is replaced by loose connective tissue [8]. An additional component of the dorsal hypopharyngeal wall is a plexus of blood vessels in the submucosal layer, whose existence is closely related to the function of the pharyngoesophageal segment as a sphincter mechanism [9,10]. However, little is known about the vascular plexus in regard to its potential contribution to the mechanical stability of the hypopharyngeal wall.

The aim of this anatomical study was to investigate the macroscopical morphology of the submucosal blood vessel plexus on the pharyngoesophageal segment.

2. Material and methods

A total of 47 human cadavers were examined [32 females, 15 males; mean age 82 years (61–99 years)]. The cadavers were fixed with a 90% ethanol and 10% formalin solution. In each cadaver a series of observations and measurements on the

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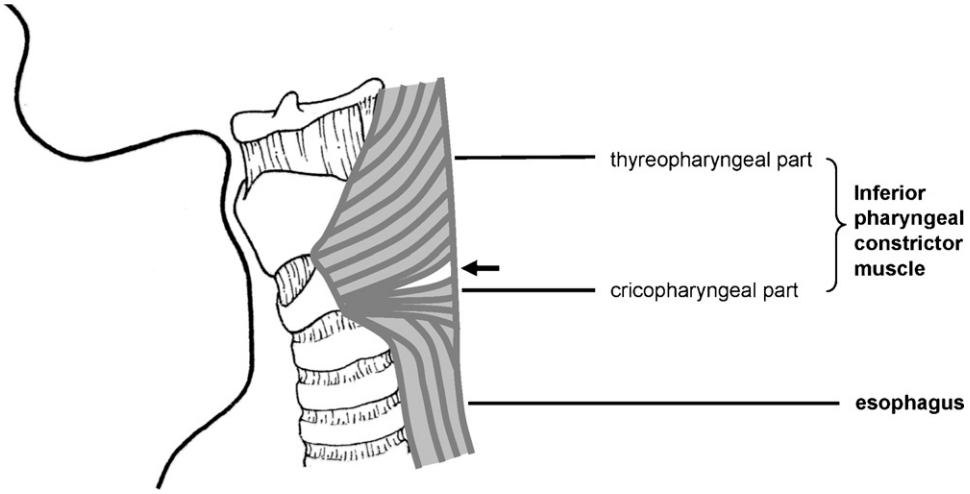

Fig. 1. The pharyngoesophageal segment (lateral view). The arrow shows the Killian's triangle.

pharyngoesophageal segment regarding the hypopharyngeal submucosal vascular plexus and the cricopharyngeal muscle were performed (Figs. 1 and 2).

Based on the methodology of previous anatomical studies [11,12] and after macroscopical investigation of the specimens we noted if the cricopharyngeal muscle was showing a smooth continuity with the rest of the pharyngoesophageal wall and therefore a flat surface in the frontal plane (Type A) or if it was forming a recess on the muscular wall resulting in a protrusion into the pharyngeal lumen (Type B). A third category (C) was defined for the cases where the recess was pronounced to such a degree that the diameter of the pharyngoesophageal tube at this point was smaller as the two thirds of the diameter of the adjacent esophagus.

Subsequently the cricopharyngeal part of the inferior pharyngeal constrictor muscle was isolated and folded up from the submucosal bed, so that the submucosal tissue became free.

On several specimens the submucosal vessels on the dorsal hypopharyngeal wall were seen macroscopically. According to the degree of vascular dilation, three types of the submucosal vein plexus were defined (Fig. 3). The structure was classified subtype I when blood vessels were not visible at all macroscopically or they were slightly dilated within some few isolated areas of the dorsal wall of the hypopharynx. Cases were classified subtype II when the submucosal blood vessels were macroscopically lightly observable and were covering a discontinuous area of the hypopharyngeal wall. If the vascular plexus showed a dilation that covered a large part of the dorsal wall of the pharyngoesophageal segment as a compact mass the case was classified subtype III.

For accurate measurements, all the cadavers were dissected in exactly the same method by the author. The dissection of the structures of the pharyngoesophageal transition was performed under a binocular loupe. The statistical analysis was carried out using the SPSS 15.0 software for Windows®. Data in the text are presented as mean ± standard deviation. Because of the small number of samples ($n = 47$) non parametrical statistical tests were used.

3. Results

A smooth pharyngoesophageal transition without a recess of the cricopharyngeal muscle (Type A) was found in 32 specimens (68.1%, 10 males and 22 females). Nine cadavers (19.1%, three males and six females) showed a moderate cricopharyngeal recess (Type B), whereas in six specimens (12.8%, two males and four females) the protrusion was classified as Type C. The incidence of the cricopharyngeal recess showed no statistically significant gender specific differences.

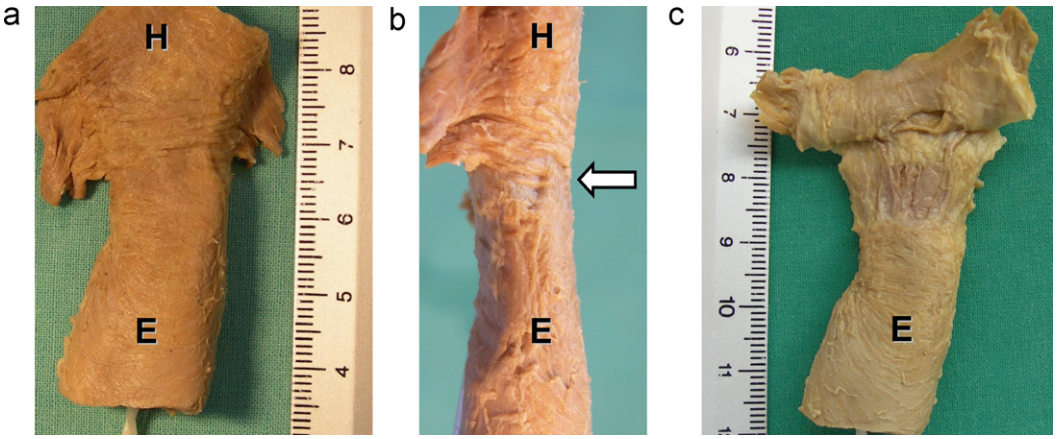

Fig. 2. Examination method of the pharyngoesophageal segment (female, 88 years): (a) dorsal view of the pharyngoesophageal transition, (b) lateral view in order to observe the variability of the form of the cricopharyngeal muscle (arrow) compared with the rest of the muscular wall of the pharynx and esophagus, (c) dorsal view after the inferior pharyngeal constrictor muscle was detached in order to examine the submucosal vascular plexus. E: esophagus, H: hypopharynx.