Angiographic Study of the Superior Laryngeal Artery

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Summary: The study goals were to demonstrate the superior laryngeal artery in detail with angiograms and to understand its vasculature three-dimensionally. Three fresh cadavers were totally injected with lead oxide-gelatin mixture. The larynx with the surrounding tissue was resected and radiographed stereoscopically with soft X-ray system. We get informed consent from a person in question and the bereaved family. The superior laryngeal artery was divided into the ascending and descending branches. The ascending branch supplied the epiglottis chiefly from the ventral surface, and anastomosed with branches of the lingual artery. The descending branch supplied the vestibular and vocal folds, muscles of the larynx and mucosa over the muscles, and anastomosed with distal branches of the superior thyroid artery. Stereographic angiograms and macroscopic observation enabled us to understand vasculature of the superior laryngeal artery.

Introduction

Anatomy of the superior laryngeal artery has been well performed in previous studies and has been well known to be a dominant nutrient artery of the larynx. However, they were macroscopic anatomy or observation of specimens partially injected with ink or latex and detailed angiographic anatomy in three-dimensions was not seemed to be performed. In the study, in order to define blood supply by the superior laryngeal artery and to understand its three-dimensional pathway visibly, we investigated anatomy of the superior laryngeal artery angiographically with fresh cadavers which were totally injected with radiopaque.

Materials and Methods

In three fresh cadavers, the femoral and common carotid arteries were exposed and they were cannulated with 14 Fr catheters. The lead oxide-gelatin mixture was injected into the arteries, until the skin color changed into orange. The skin was incised in the midline of the neck and the superior and inferior thyroid and lingual arteries were identified, and then they were ligated. After that, the root of tongue, hyoid bone, pharynx, larynx, trachea, thyroid gland, and esophagus were dissected en mass. Macroscopic dissection was performed, and then stereographic angiograms were taken with soft X-ray equipment.

Results

The superior laryngeal artery derived from the superior thyroid artery. After the superior laryngeal artery pierced the thyrohyoid ligament, it bifurcated into ascending and descending branches (Fig. 1). The ascending branch ran upward tortuously until the level of the pharyngoepiglottic fold and became a few vessels. These vessels distributed in the ventral surface of the upper half of the epiglottic cartilage and formed a vascular network (Figs. 2 and 3). Some vessels from the vascular network reached the dorsal surface of the epiglottis getting over its margin or piercing the cartilage. Some branches of the lingual artery participated in forming the vascular network through the vallecula and other branches anastomosed with the ascending branch under the pharyngoepiglottic fold (See Figs. 2 and 3). On the ascending way, branches to the lower half of the epiglottis cartilage were given off.
Inferior vessels among the branches reached the dorsal surface getting over the lateral margin of the cartilage. Superior vessels entered the ventral surface of the cartilage and ran just over the lower half of the cartilage. The superior vessels gave off branches nutrifying fat tissue behind the cartilage and piercing the cartilage (See Figs. 2 and 3). In a specimen, a branch of the lingual artery became large and supplied blood to the upper half of the epiglottis cartilage in stead of the ascending branch of the superior laryngeal artery (Fig. 4).

The descending branch divided into anterior and posterior branches after giving off a branch to the vestibular fold and a branch to mucosa and muscles of at the aryepiglottic fold. The anterior branch descended over...
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the anterior portion of the thyroepiglottic and thyroarytenoid muscles behind the thyroid cartilage, supplying mucosa over the muscles and vocal fold, and distally anastomosed with lateral branches of the cricothyroid arcade which existed on the cricothyroid ligament and was formed by anastomoses of distal branches of the superior thyroid artery (Fig. 5). The posterior branch with a relatively large diameter descended over the posterior portion of the thyroepiglottic, thyroarytenoid and lateral crico-arytenoid muscles, and supplied the muscles and mucosa over the muscles (Fig. 6). Median branches of the cricothyroid arcade pierced the cricothyroid ligament, and supplied mucosa below the vocal fold (See Fig. 5 and Fig. 7). On the descending way, branches to the arytenoid muscles were given off.

Fig. 3.  (A) Macroscopic observation of the ventral surface of the epiglottis. Connective tissue behind the lower half of the cartilage was removed. (B) Macroscopic observation of the dorsal surface of the epiglottis. Mucosa on the cartilage was partially resected.

Fig. 4.  Stereographic angiograms of the epiglottis. A case that a branch of the lingual artery (white arrows) supplied the upper half of the epiglottis. Black arrows are the superior laryngeal artery. A dotted line is margin of the epiglottis. An intimate vasculature of the epiglottis can be observed three-dimensionally.
Fig. 5. Stereographic angiograms of the A-P view of the specimen excluding the thyroid cartilage (A) and the lateral view of the specimen with the thyroid cartilage (B). The descending branch (Dbr) of the superior laryngeal artery (SLA) was divided into anterior (A1, A2 and A3) and posterior (P1 and P2) branches. The anterior branch descended over the anterior portion of the thyroepiglottic and thyroarytenoid muscles behind the thyroid cartilage, supplying mucosa over the muscles and vocal fold. Its distal branches (A3) anastomosed with lateral branches of the cricothyroid arcade (arrows). Abr: ascending branch. STA: superior thyroid artery.

Fig. 6. Macroscopic observation of the distal vessels of the posterior branch of the descending branch. Superior arrow (P1) was a branch of the descending branch, which supplied posterior cricoarytenoid muscle and the posterior side of the transverse and oblique arytenoid muscles and mucosa over the muscles. Inferior arrow (P2) was a branch of the posterior branch, which supplied the aryepiglottic muscle and the posterior side of the thyroepiglottic muscle and mucosa over the muscles. Cut: cuneiform tubercle. Cot: corniculate tubercle.
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Discussion

In previous studies, anatomical study of the superior laryngeal artery has been well investigated, but their demonstrations seemed to be poor in quality. Stereo-angiographic angiograms in our previous studies enabled us to see vasculature of arteries and veins in three-dimensions, and it was useful for plastic surgeons. Although the number of cadavers in the study was only three, the demonstrated angiograms and macroscopic specimens were very clear. Our demonstration was found to be coincided with a typical pattern in their studies. In this study, especially, it was found that the epiglottis had an intimate vascular network from the superior laryngeal or lingual arteries and its vasculature could be seen both angiographically and stereoscopically. We expected that an important information of the anatomy of the superior laryngeal artery was given to surgeons in the filed of laryngology.

References