Clinical Anatomy of the Vocal Cord

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Abstract:
Larynx is a multifunctional organ. Laryngeal cavity is divided into the supra-glottic, glottic and sub-glottic cavity by vestibular fold (False vocal cords) and vocal folds (True vocal cords). Various conditions are responsible for vocal cord paralysis; commonest one is recurrent laryngeal nerve injury during neck surgeries. Possible complications should be kept in mind by surgeons and anesthetists. In this paper we have discussed various conditions causing vocal cord paralysis.

Key Words: Larynx, Vocal cords, Recurrent laryngeal nerve, Paralysis.

Introduction:
Laryngeal primordia appears at approximately 33 days of gestation. At this stage auditus becomes ‘T’ shaped by the growth of epiglottis in anterior direction while arytenoid cartilages grow in the lateral direction. The adult larynx is about 5 cm in length in males and shorter in females. Longer length in males is due to larger growth after puberty. Larynx descends from the level of C5 vertebra at the age of 2 years to C6 – C7 in adult position. During this descend the relationship between the internal and external parts of the larynx is maintained. The position of true vocal cords remains midway between the thyroid notch and lower border of thyroid cartilage. The narrowest part of larynx in children is subglottic region and rima glottidis in adults (O’Neill et al, 1998).

The inlet of the larynx is set obliquely facing backwards (Fig.1). The inlet bounded anteriorly by the upper border of the epiglottis. The aryepiglottic fold containing aryepiglottic muscles and corniculate and cuneiform cartilages. The inlet is related laterally on each side to the piriform recess of the laryngopharynx. The cavity of the larynx is divided into the supraglottic, glottic and sub-glottic cavity, by two pairs of horizontal folds, the vestibular and vocal folds as shown in figure 2. Vestibular folds are also termed as false vocal cords and vocal folds are termed as true vocal cords. Each vocal fold consists of central part formed by muscle, intermediate part formed by conus elasticus consisting of layers of collagen and elastic tissue which in turn is covered by epithelium and superficial layer of lamina propria (Reinke’s space) as shown in figure 3 (Cummings et al, 2005).

Discussion:
Various pathological conditions are responsible for vocal cord paralysis. The most common cause of the vocal cord paralysis is recurrent laryngeal nerve injury (Fernandes & Mesqunlta, 1997; Shindo et al, 2005). Most of the recurrent laryngeal nerve injuries occur during neck and mediastinal surgeries. Neoplasms, tracheal intubation, blunt trauma, inflammation and some idiopathic condition are other common causes. Although, rarely direct infiltration of recurrent laryngeal nerve by laryngeal tumors causes vocal cord paralysis (Million, 1992). Skalicky et al (2007) stressed about the protection of the nervous laryngeus recurrens from iatrogenic damage. Many central nervous system disorders and various congenital abnormalities may cause vocal cord paralysis viz. transient ischaemic

Vocal cord paralysis may be unilateral or bilateral. Unilateral vocal cord paralysis is more common than the bilateral. Etiology of the unilateral and bilateral vocal cord paralysis is almost the same but with a varying percentage (Benninger et al, 1994; Hillel et al, 1999). Unilateral paralysis is seen in almost 75% of cases (Terris et al, 1992). In unilateral vocal cord palsies, left sided palsies (in 56% cases) are more common than the right because of the longer course and extension of the recurrent laryngeal nerve in the mediastinum (Jacob et al, 1987). Nerurkar et al (2006) in a series of 85 patients with unilateral paralysis of vocal cords observed left sided palsy in 68 patients and right sided in 17 patients. In 90% of cases of unilateral vocal cord paralysis, there is an involvement of recurrent laryngeal nerve (Terris et al, 1992).

Chen et al (2007) studied 291 patients, out of which 259 patients presented with unilateral vocal cord paralysis and 32 with bilateral vocal cord paralysis. These were attributed to surgical in 40.2%, neoplastic in 29.9%, idiopathic in 10.7%, traumatic in 8%, central in 3.8%, radiation induced in 3.4%, inflammatory in 2%, cardiovascular in 1.7% and other causes in 0.3% cases. Hulscher et al (1999) in his retrospective study of 241 patients who underwent transhiatal oesphagogastrectomy observed thirty-one patients with recurrent laryngeal nerve paralysis out of which 3 had bilateral and 28 with unilateral palsies.

Yoskovitch & Kantor (2001) reported a unique case of unilateral vocal cord paralysis due to degenerative cervical spine disease resulting in extrinsic compression of recurrent laryngeal nerve. Bilateral vocal cord paralysis was observed following anterior cervical discectomy and fusion. (Hachwa & Halim, 2006; Manski et al, 1998).

Witt (2003) observed a case of sarcoidosis with cranial polyneuritis with bilateral paratracheal and mediastinal adenopathy resulting in bilateral vocal cord paralysis. Aydin et al (2002) observed a case of bilateral vocal cord paralysis caused by cervical spinal osteophytes compressing the recurrent laryngeal nerve. Bilateral vocal cord immobility can be life threatening for some patients. Weksler et al (2001) reported an unusual bilateral vocal cord paralysis following preoperative bupivacaine infiltration for pain control of tonsil surgery. Knowledge of such uncommon complications should be kept in mind by anaesthetists and surgeons.

Sometimes weakness or a paradoxical motion of vocal cords may mimic paralysis (Hillel et al, 1999). In such cases of paradoxical motion, vocal folds approximate together during inspiration, instead of opening normally. Therefore, it is essential to consider paradoxical movements as a differential diagnosis of bilateral vocal cord paralysis.

In 0.3% to 1% cases an unusual ‘non-recurrent’ laryngeal nerve may arise from the vagus nerve, usually on right side. This may get injured during surgery or due to laryngeal pathology leading to paralytic condition of vocal cords (Stranding, 2005).

Growth on vocal cords varies from simple benign nodule to malignant growth in the form of polyps (Fig. 4), which may lead to dysfunction of the vocal cords. This infiltration may be direct or indirect from metastasis. A well recognised form of papillary carcinoma of thyroid directly infiltrating the larynx was reported by Mcaffrey et al (1994). Varghese et al (2003) reported an unusual metastasis of papillary carcinoma indirectly affecting vocal folds. Many researchers reported vocal cord dysfunction as a consequence of the laryngeal tuberculosis mimicking carcinoma larynx (Hunter et al, 1981; Bull, 1966). Glottic tumors will not show the signs of spread of metastasis to adjacent lymph nodes at presentation because glottis is very poorly endowed with lymphatic vessels (Stranding, 2005).

![Fig. IV: Photograph showing vocal cord polyp as seen by direct laryngoscopy. [By courtesy of Dr. Devendra Mahore, Professor of ENT, Govt. Medical College, Nagpur.]

Conclusion:

Paralysis of the vocal fold is most common laryngeal pathology. A detailed clinical history and meticulous examination on head and neck is necessary to evaluate vocal cord paralysis. It is essential that anaesthesiologists and surgeons should be well versed with the topographic anatomy of the larynx and all possible complications should be kept in mind before surgeries.

Bibliography:


