Reconstructive Procedures after Oesophageal Resection

An Essay

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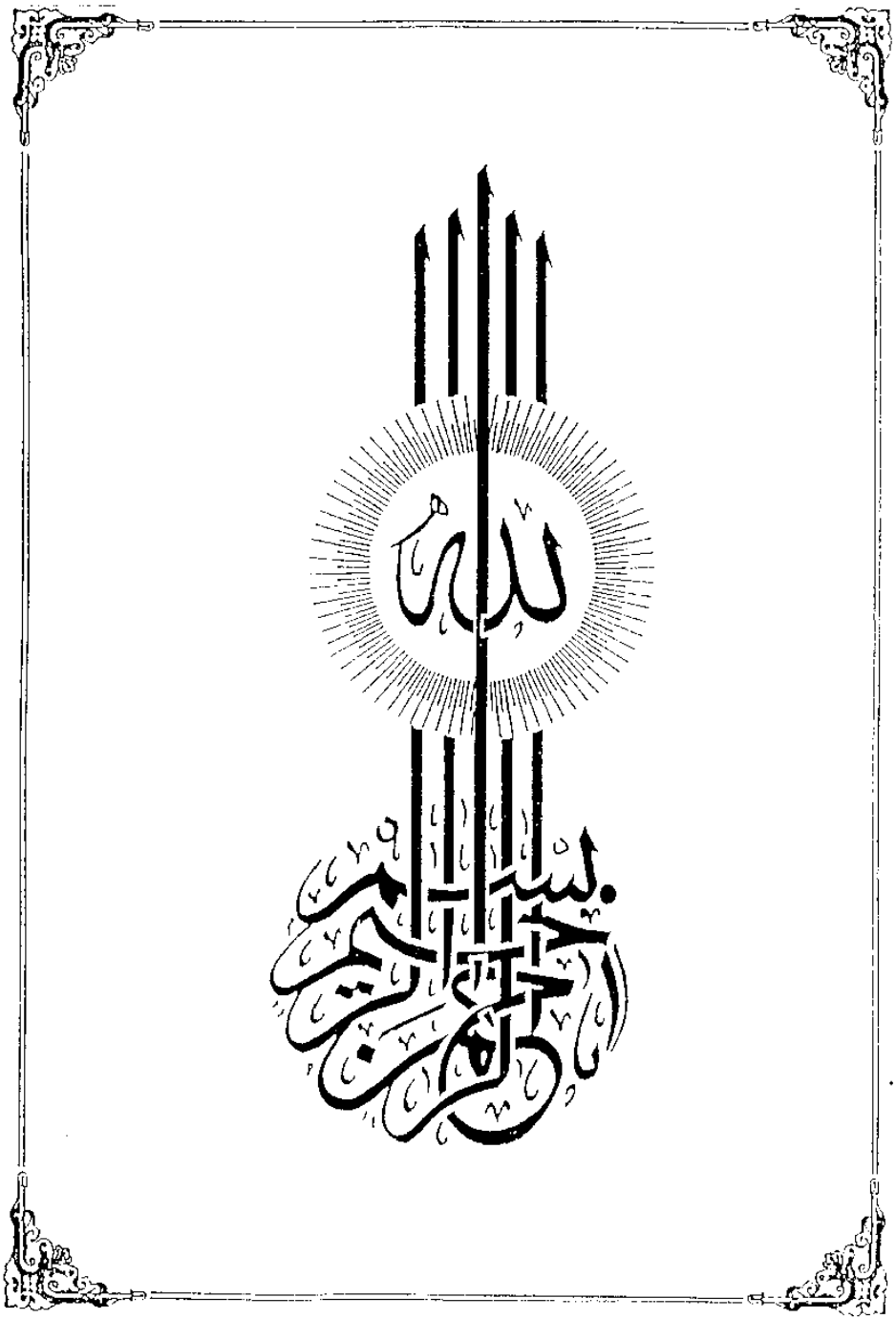

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INTRODUCTION

There is no universal agreement on the best technical method for visceral replacement of the oesophagus.

In 1954 *Mahoney and Sherman* published their classic paper on total esophagoplasty using colon with the comment that "the problem of reconstruction of the oesophagus following resection has remained a major difficulty since *Torek* in 1913 reported the first successful resection of the thoracic oesophagus". In 1969 *May and Samson* in a collective review of oesophageal reconstruction and replacement, stated, "when one considers the many protocols being used; and the varying types of visceral reconstruction being used, one realizes the complexity of the problem and the reason that one cann't say - as yet - which is best method." ***(Wilkins, 1991)***

Nevertheless, there is now increasing consensus that except when it is partially or totally absent owing to prior surgical removal, the stomach provides the best substitute for the oesophagus, when the stomach is not utilizable, segments of colon or jejunum provide alternate possibilities for oesophageal replacement. The earliest methods of replacement (i.e. antethoracic skin tube reconstruction) are no longer necessary and should be avoided because of the complexity of their construction, cosmotic unsightliness and patient dissatisfaction, and a high likelihood of subsequent stricture formation. When in extreme circumstances such reconstruction is deemed necessary, the plastic surgeon must be consulted. Prosthetic replacements of the oesophagus have never been successful.

The general thoracic surgical clinician must be thoroughly familiar not only in the technical knowledge of the utilization of various visceral oesophageal

substitutes but also in the appropiate judgment of selecting of which replacement is best under specific circumstances. Accordingly, this essay is intended to provide the details of the basis for selecting a particular organ for creation of a replacement "oesophagus"

AIM OF THE WORK

The aim of this essay is to review the whole subject of and special emphasis will be made on the different substitutes and its availablity in Egyptian patients.

Anatomy of the oesophagus

ANATOMY OF THE OESOPHAGUS

The oesophagus is a muscular tube approximately 25cm. long extending from the pharynx to the stomach. It begins in the neck at the level of the cricoid cartilage, opposite the sixth cervical vertebra, where it is in continuity with the pharynx, and passes through the diaphragmatic hiatus at the level of the tenth thoracic vertebra. ***(Duranceau et al., 1987)***

Upper and lower vertebral levels are variable and depend upon the position of the body, the flexion or extension of the head and the motility of the oesophagus itself. According to *Terracol & Sweet (1958)* the tubercle of the cricoid cartilage is the single constant landmark of the upper oesophageal opening. An imaginary horizontal line along the inferior border of the tubercle separates the pharynx above from the oesophagus below. ***(Skandalakis, et al., 1988)***

Length of the Oesophagus:

The oesophagus is about 25cm. in length extending from the pharynx above to the stomach below. The length varies with age, sex, and habits of the individual, In living patients, the most useful reference point is the upper incisors which are about 15cm above the pharyngooesophageal junction. Two or three centimetres must be added if the external nares are used. ***(Skandalakis et al., 1988)***

In normal adults, the distance from the inferior alveolar ridge to the gastrooesophageal junction varies between 38 and 43cm. Approximate measurements, which are useful in relating the site of oesophageal lesion to

anatomic landmarks during oesophagoscopy and in planning resectional procedures, are shown in the table below:

Table (1) Approximate measurements of the oesophagus in relation to anatomic landmarks.

upper incisor to	1yr	6 yrs.	14 yrs.	Adult
cricopharyngeus	9 cm	11cm	14cm	16cm
aortic arch	14cm	16cm	21cm	23cm
left bronchus	15cm	18cm	24cm	27cm
Diaph. hiatus	18cm	24cm	33cm	38cm
cardia	19cm	25cm	34cm	40cm
Gast. great curvature	27cm	33cm	43cm	53cm

(Snyder, 1992)

Constrictions of the Oesophagus:

The oesophagus has three distinct areas of naturally occurring anatomic narrowing; the **cervical constriction** occurs at the level of the cricopharyngeus sphincter, the narrowest point of the gastrointestinal tract, typically measuring 14mm. in diameter, 15cm. from the incisor teeth. **The bronchoaortic constriction** (15 to 17mm.) is located at the level of the fourth thoracic vertebra behind the tracheal bifurcation where the left main stem bronchus and aortic arch cross the oesophagus; 25cm. from the incisor teeth. ***(Orringer; 1991)***

Anatomically there are two separate constrictions; the *aortic* at the level of T4 with diameter of 1.9x2.3cm; and the *bronchial* at the level of T5 with diameters of 1.7x2.3cm. ***(Skandalakis et al., 1988)***

The **diaphragmatic constriction** (16 to 19mm.) occurs where the oesophagus traverses the diaphragm; 40cm from the incisor teeth. The oesophagus between these three areas of constriction has a wider caliber and is termed the *superior and inferior dilatation*, respectively. The normal adult thoracic oesophagus has a maximal diameter of approximately 2.5cm. on barium swallow examination. ***(Orringer; 1991)***

Minor constrictions are occasinally seen in the oesophagus: A retrosternal constriction may lie between the pharyngo-oesophageal and the aortic constrictions; A cardiac constriction may lie behind the pericardium and is produced if right atrial enlargment is present, as in mitral stenosis; and a supradiaphragmatic constriction may be produced by a tortuous, arteriosclerotic aorta. ***(Skandalakis et al., 1988)***

The constrictions are important to the surgeon because they entrap foreign bodies, are most subject to chemical burn, and are the principal sites of malignant tumours of the oesophagus. ***(Pearl, 1992)***

Curves of the Oesophagus

The oesophagus is a midline structure but has three gentle curves. Starting in the neck, the oesophagus is in the midline or slightly to the left. It deviates slightly to the left as passes behind the primary bronchus. Below the bifurcation of the trachea, the oesophagus curves to the right of the midline. It returns to the midline and curves again to the left behind the pericardium descending to enter the hiatus of the diaphragm. In term of vertebral levels; the oesophagus is to the left in the midline at Ti, to the right at T6, and to the left again at T10. ***(Skandalakis et al., 1988)***

These curves are of surgical importance that lesions of the cervical and upper thoracic oesophagus are best approached surgically through a left cervical incision or right posterolateral thoracotomy in the fourth or fifth intercostal space. Lesions of the middle or lower oesophagus are traditionally approached through the right chest, although limited resection of the distal oesophagus can be done through the left chest. In operations requiring exposure of the intra-abdominal portion of the oesophagus through the chest, a left thoracotomy at the eighth intercostal space is performed. ***(Pearl, 1992)***

Topography and Relations

The oesophagus is arbitrarily divided into four segments: pharyngo-oesophageal, cervical, thoracic, and abdominal. ***(Orringer, 1991)***

The pharyngo-oesophageal junction:

The length between the laryngopharynx and the cervical oesophagus is the **"pharyngoesophageal segment"** The pharyngeal musculature includes the superior, middle, and inferior constrictors, as well as the stylopharyngeous muscles. The cricopharyngeus muscle or upper oesophageal sphincter, is the most inferior portion of the inferior pharyngeal constrictor and is clearly identifiable by the transverse direction of its fibers. The transition between the oblique fibers of the thyropharyngeus muscle and the transverse fibers of cricopharyngeus muscle create a point of potential weakness in the pharyngo esophageal segment. ***(Orringer, 1991)***

Posteriorly, there are two areas of weakness above and below the cricopharyngeus muscle (fig. 1). ***The first*** is between the inferior pharyngeal constrictor and the cricopharyngeus muscle. ***The second*** is below the

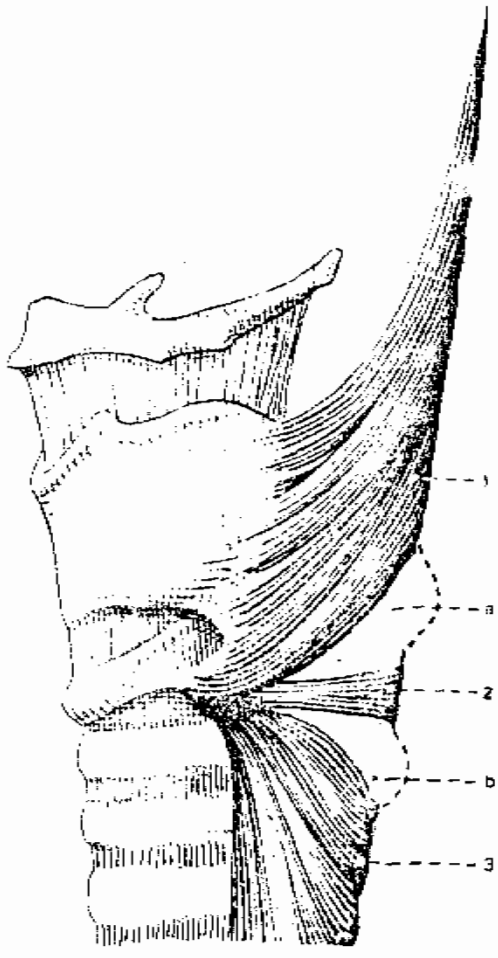

Fig. (1) The lateral aspect of the pharyngo-oesophageal junction showing a. upper weak area, b. lower weak area, 1. oblique fibers of inferior constrictor muscle, 2. cricopharyngeous muscle, 3. muscularis of the oesophagus.

cricopharyngeus muscle in the v-shaped area (of lamier) where the posterior midline is devoid of longitudinal muscle. These are common sites of oesophageal perforation during rigid oesophagoscopy and are the sites of origin of Zenker's diverticulum. ***(Pearl, 1992)***

There are two anatomical entities at this point which contribute to narrowing of the oesophageal lumen. These are internally the **hypopharyngeal** fold and externally the **cricopharyngeus muscle.** Instrumental perforation, lodging of foreign bodies, spasm and neoplasms tend to occur at this location, also, in this area the first or upper cervical oesophageal constriction occurs opposite the cricoid cartilage. ***(Skandalakis et al., 1988).***

The Cervical oesophagus:

The cervical oesophagus is approximately 5-6cm. long and extends from C6 to T1, or from the cricoid cartilage and cricopharyngeal muscle to the thoracic inlet at the level of sternoclavicular joints. The carotid tubercle (of Chassaignae) which is the palpable anterior tuberosity of the transverse process of C6 is a good anatomical landmark. ***(Skandalais et al., 1988).***

Although the cervical oesophagus is a midline structure positioned posteriorly to the trachea, it tends to course more to the left of the trachea and is therefore more readily approached cervically through a left neck incision. ***(Orringer 1991).***

Anteriorly:

The cervical oesophagus is covered by the larynx and trachea. ***Rosenberg in 1982*** stated that the first 3cm of the oesophhagus lies behind the larynx. The mouth of the oesophagus, the so-called cricopharyngeal pinchcock, occupies the

first 1-2cm. ***(Skandalakis et al., 1988).*** It is attached by loose connective tissue to the membranous wall of the trachea. ***(Duranceau et al., 1987)***

Anterolaterally:

Four anatomical entities related to the oesophageal wall on each side, from the periphery inwards: *the carotid sheath, the inferior thyroid artery, the lobe of the thyroid gland and the recurrent laryngeal nerve.* The thoracic duct ascends for a short distance along the left side of the oesophagus, this reaches its highest point at the level of C7, about 3-4cm above the clavicle. It then descends to end at the junction of the left subclavian and internal jugular veins.. ***(Skandalakis et al., 1988)***

Posteriorly:

The cervical oesophagus lies just anterior to the prevertebral fascia and can normally be separated from its loose fibrous posterior attachments by blunt finger dissection of the prevertebral space. ***(Orringer, 1991)***

The pretracheal space in front of the trachea is not related directly to the oesophagus. It is related clinically however, since perforations of the anterior oesophageal wall may open into the pretracheal space and therefore the mediastinum producing a serious or even fatal mediastinitis. ***(Skandalakis et al., 1988)*** In general, the vertical fascial compartments of the neck are continuous with the facial spaces of the mediastinum. Perforation of the anterior wall of the cervical oesophagus can result in serious infection that begins in the pretracheal space and spread to the anterior mediastinum. Most perforations of the cervical oesophagus occur posteriorly or laterally and can cause severe inflammation of the posterior mediastinum because of the paucity of tissue barriers in this region. ***(Pearl, 1992)***