Percutaneous Dilatational Tracheostomy versus Surgical Tracheostomy in Critically ill patients

Thesis submitted for fulfillment of the MD degree in anesthesia

By: Sharif Samy Fahmy Mohamed
M.B.B.ch., M.Sc.
Faculty of medicine, Cairo University

Supervised by:
Prof.Dr. Hanan Mahmoud Kamal, MD.
Professor of anesthesia, Cairo University

Prof.Dr. Mohamed Walid Ahmed Fouad Awad MD.
Professor of anesthesia, Cairo University

Dr.Ahmad Zaghlool MD.
Lecturer of anesthesia, Cairo University
Principle supervisor

Prof.Dr. Hanan Mahmoud Kamal MD.
Professor of anesthesia
Cairo University

Faculty of medicine, Cairo University
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List of Abbreviations

PDT: Percutaneous Dilatational tracheostomy
ST: Surgical tracheostomy
BB: Beta blockers
X: median
ANOVA: Analysis of Variance
CNS: Central nervous system
CVS: Cardiovascular system
Fig.: Figure
Tab.: Table
ECG: ElectroCardioGraphy
SD: Standard of Deviation

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Figure 14: Ciaglia Blue Dolphin® Balloon Percutaneous Tracheostomy Introducer.

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Abstract

Background: it is claimed that the rate of complications with percutaneous dilatational tracheostomy is less than the rate of complications in open surgical tracheostomy. The literature did not closely observe this rate of complications in the first 48 hours after procedure.

Methods: 20 tracheostomy cases were selected 10 percutaneous and 10 open surgical. The study was done in a retrospective manner.

Results: one complication occurred in the percutaneous group "pneumothorax", three complications occurred in the open surgical tracheostomy group "pneumothorax, posterior tracheal wall perforation, subcutaneous emphysema".

Conclusion: Percutaneous dilatational tracheostomy caused less complication rate compared to open surgical tracheostomy in first 48 hours.

Keywords: percutaneous. Open surgical. Tracheostomy. Pneumothorax.

1. Review of Literature

A.Neck anatomy:

Anterior Triangle of the Neck

The anterior triangle of the neck is formed by the anterior border of the sternocleidomastoid muscle, inferior border of the mandible, and midline of the neck (Fig.1). It is further subdivided by the superior belly of the omohyoid muscle and the anterior and posterior bellies of the digastric muscle into the submandibular, submental, carotid, and muscular triangles. These arbitrary subdivisions of the anterior triangle of the neck help compartmentalize and assist in localization of important anatomical structures.

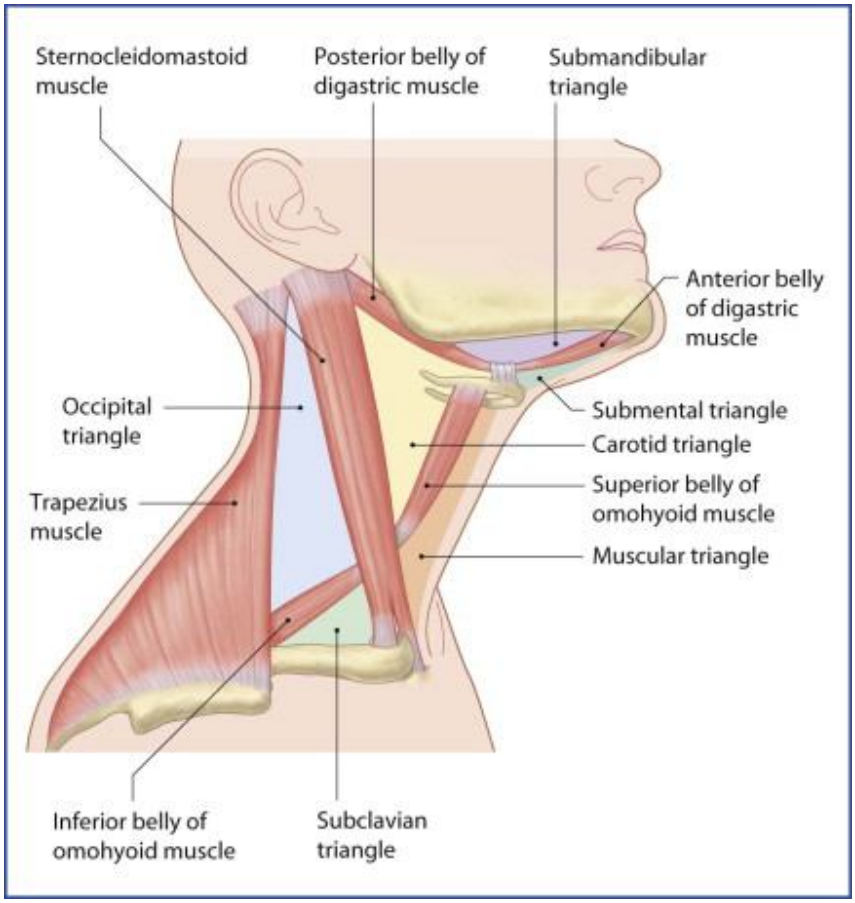

FIGURE 1:The anterior triangle of the neck and its descriptive subdivisions.

The anterior triangle contains the platysma muscle, which is a thin, sheet-like muscle within the superficial cervical fascia that spreads out over the neck and shoulders. Also located superficially are the cervical branches of the facial nerve [VII], cutaneous nerves from the cervical plexus, and superficial veins. Airway structures can be palpated in the midline:

hyoid bone—vertebral level CIII

thyroid cartilage—vertebral level CIV-CV

cricoid cartilage—vertebral level CVI

tracheal rings—vertebral level CVI to TIV/TV

At the inferior border of the anterior triangle of the neck is the jugular notch (vertebral level TII/TIII).

Bony support for the anterior triangle of the neck comes from the seven cervical vertebrae, the base of the skull, bones of the upper thorax, and the pectoral girdle. An additional point of bony support is the hyoid bone, which is suspended below the mandible by the suprahyoid and infrahyoid muscles. The hyoid bone has a pair of greater horns extending posteriorly from the body of the hyoid bone that gives it a three-dimensional "U" shape. The lesser horns project superiorly and are additional points of muscle attachment.

Muscles

The sternocleidomastoid muscle divides the neck into anterior and posterior triangles. It originates from the sternum and clavicle, ascends to insert onto the mastoid process of the skull, and rotates and flexes the head. It is innervated by the accessory nerve [XI] and the anterior rami of spinal nerves C2 and C3.

The infrahyoid muscles (the sternohyoid, sternothyroid, thyrohyoid, and omohyoid muscles) are deep to the platysma, cutaneous nerves, and superficial veins. These muscles attach to the structures after which they are named and, as a group, contract to depress the hyoid bone and larynx, except for the thyrohyoid muscle, which elevates the larynx (Table 1).

TABLE 1

Muscles of the Anterior Triangle of the Neck

Muscle	Origin	Insertion	Innervation	Action	Blood Supply
Platysma	Fascia and skin over upper part of deltoid and pectoralis major muscles	Lower border of mandible and muscles of lips	Cervical branch of facial nerve [VII]	Anterior part depresses mandible, draws down lower lip, and angles mouth down on each side	Submental branch of facial artery, suprasternal branch of suprascapular artery (thyrocervical trunk)
Sternocleidomastoid	Sternum and medial third of clavicle	Mastoid process of temporal bone and superior nuchal line	Accessory nerve [XI], spinal root	Acting alone, it bends the head to the same side as the muscle and rotates it so that the face is turned to the opposite	Posterior auricular, superior thyroid, occipital, suprascapular arteries

				side. The two muscles, acting together, flex the neck; if neck is kept extended by postvertebral muscles, sternocleidomastoid muscles act together to raise sternum and assist forced inspiration	
Trapezius (cervical part)	Medial part of superior nuchal line, external occipital protuberance, ligamentum nuchae, and spine of CVII	Lateral third of clavicle, acromion, and spine of scapula	Accessory nerve [XI], spinal root	Elevates tip of shoulder, draws scapula medially, and braces shoulder backward	Transverse cervical and suprascapular arteries
Digastric—anterior belly	Digastric fossa, medial aspect of mandible near	Intermediate tendon	Nerve to mylohyoid—inferior alveolar branch	Both bellies act together to raise hyoid bone during swallowing. Acting with	Branches of submental artery

	symphysis		of mandibular nerve [V_3]	infrahyoid strap muscles, they fix the hyoid bone, thereby providing support for tongue movement	
Digastric—posterior belly	Digastric notch, medial to mastoid process	Intermediate tendon	Facial nerve [VII]	Muscular branches of posterior auricular and occipital arteries	
Stylohyoid (infrahyoid muscles)	Styloid process of temporal bone	Hyoid bone splits to embrace intermediate tendon of digastric muscles	Facial nerve [VII]	Pulls hyoid bone upward and backward during swallowing	Muscular branches of facial and occipital arteries
Omohyoid—superior belly	Body and horn of hyoid bone	Intermediate tendon	Ansa cervicalis (C1 to C3)	These muscles depress the larynx and hyoid bone after being elevated by the pharynx during swallowing and speech; they can also do the following:	Suprahyoid branch of lingual artery
Omohyoid—inferior belly	Lateral and superior border of scapula	Intermediate tendon	Ansa cervicalis (C1 to C3)		Superior thyroid artery
Sternohyoid	Posterior aspect of	Body of hyoid bone	Ansa cervicalis (C1 to		Hyoid branches of

	manubrium of sternum and medial end of clavicle		C3)	1- Depress hyoid bone, or when acting with suprahyoid muscles, furnish a stable base for the tongue 2- Elevate larynx in first phase of swallowing 3- Depress larynx during second phase of swallowing	superior thyroid and lingual arteries
Sternothyroid	Posterior aspect of manubrium of sternum and first costal cartilage	Oblique line on thyroid cartilage	Ansa cervicalis (C1 to C3)		Cricothyroid branch of superior thyroid artery
Thyrohyoid	Oblique line of thyroid cartilage	Lower aspect of g. horn of hyoid bone	C1	Infrahyoid branch of superior thyroid artery	

Nerves

The infrahyoid muscles are innervated by the cervical plexus, which is a network of nerves formed by the anterior rami (nerve roots) of the first four cervical spinal nerves (Fig.2). The cervical plexus lies on the middle scalene muscle just posterior to the carotid sheath (a fascial structure that encloses the internal jugular veins, carotid arteries, vagus nerves [X], and part of the ansa cervicalis). The great auricular, lesser occipital, transverse cervical, and supraclavicular nerves originate from the cervical plexus and innervate the skin of the