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Tracheotomy revisited: results of a cross-sectional pilot study

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ABSTRACT

Background: Tracheotomy is one of the oldest surgeries performed to bypass the obstructed airway to save life in emergency. The aim of present study was to assess the status of this traditional surgery in present clinical settings of technical advancement with special reference to the controversial issue like, is horizontal incision a better choice over the traditional vertical incision?

Methods: Retrospective study of 67 cases of surgical tracheotomy done from April 2017 to March 2018 and photographic assessment of the scar site in the patients who had undergone tracheotomy in the past at least more than a year before the commencement of the study period i.e. before 2015.

Results: Prolonged ventilator support is the commonest indication for surgical tracheotomy comprising more than 55% of cases in present study followed by traumatic obstruction (19%) and neoplastic obstruction (18%) of upper airway. Although horizontal skin incision is increasingly being used but vertical incision remains incision of choice in emergency settings.

Conclusions: The inflammatory conditions are no longer prime indicators for surgical tracheotomy. Horizontal skin incision has no significant advantage over vertical incision, which is still preferred in emergency settings.

Keywords: Tracheotomy, Tracheostomy, Technique, Incision, Scar

INTRODUCTION

Tracheotomy is a procedure to create a trachea-cutaneous fistula / tracheostomy to bypass the upper airway and the surgery holds its position as life saving procedure in critically ill patients with compromised respiration. The term tracheotomy and tracheostomy is mostly used interchangeably.

Historical references of a procedure like tracheotomy can be traced to 3600 B.C Egyptian clay tablets 2000 B.C. Rig Veda the holy scripture of hindi medicine and 1550 B.C Ebers Papyrus an encyclopedia of medical knowledge that ancient Egyptians possessed. Asclepius, Hippocrates and Galen each refer to tracheotomy in their

ancient writings and finally at the beginning of 20th century Chevalier Jackson (1865-1958) set principles for surgical technique of tracheotomy and tracheostomy care.^{1,2}

Up to early decades' of 20th century tracheotomy was a procedure that was done in emergency settings providing alternative airway to breath in patient whose upper airway was obstructed and keeping in view that the brain cannot survive anoxia for more than 5-minutes the time taken to complete the procedure was of utmost importance. The traditional technique as described by chevalier involves 1-2 cm vertical skin incision in alignment with the 2nd tracheal ring downwards and dissection is restricted to the midline with retraction of the strap muscles and tracheal rings identified, the

isthmus of thyroid may need retraction or dissection, the tracheal lumen can be confirmed by suction of bubbles into the saline filled syringe and trachea opened and tracheostomy tube introduced.^{3,4}

With advances in technology especially in field of anesthesia the procedure could be performed in more controlled settings and people started favoring horizontal incision for the procedure as it falls along the natural neck creases and deemed to be cosmetically better but at the same time vertical incision stays in the target area and hence a dilemma for operating surgeon as to with which incision to start.^{5,6}

METHODS

The study was conducted in the ENT department of SMHS Hospital, of Government Medical College Srinagar. Data of all the patients who have undergone surgical tracheotomy in the year starting from April 2017 to 31st March 2018 was analyzed. This being a retrospective analysis of data the operating surgeons where not aware of the study and there was permission from the departmental ethical committee.

The inclusion criteria being, all the patients referred to department of ENT for surgical tracheotomy i.e. patients where the parent department had decided for tracheostomy for further management of the patient. These patients were mostly from surgical, medical or pediatric intensive care units where the decision is taken by parent department and ENT department is requested for the procedure.

All patients who directly report to the department of ENT in respiratory distress due to upper airway obstruction where emergency endotracheal intubation is not possible due to technical difficulty like neoplastic mass acting as obstruction or trauma to neck and maxillofacial region where active bleeding and multiple fractures make endotracheal intubation impossible.

The exclusion criteria being lack of consent for the procedure and also in emergency cases where airway could be secured with non-invasive techniques like endotracheal intubation etc.

Routine investigations were available in all elective tracheotomy cases while as in emergency cases the procedure as such took the priority over the investigations especially in cases with warfare injury and severe maxillofacial trauma and in many such cases all routine investigations were not available at the time of procedure

Microsoft excel work sheet 2013 and Maxstat lite free version 2018 was used to analyze the data.

RESULTS

Table 1: Age and sex distribution (n=67).

Age group	No of pt.	Male	Female
0-1 year	3	2	1
1-10	1	0	1
11-20	4	3	1
21-30	11	7	4
31-40	9	5	4
41-50	7	4	3
51-60	12	7	5
61-70	13	6	7
71-80	5	2	3
81-90	2	0	2
Total	67	36 (54%)	31 (46%)

There is apparently a bimodal peak as far as age distribution is concerned with most of the patients falling in the 3rd and 7th decade of life. There is slightly more male preponderance probably because conditions like laryngeal neoplasm and trauma which are prime diseases needing emergency tracheotomy are more common in males than females.

Table 2: Clinical setting at the time of procedure (n=67).

Setting	No. of patients (%)	Male (%)	Female (%)	Vertical incision (%)	Horizontal incision (%)
Emergency	28 (42)	16 (57)	12 (43)	21 (75)	7 (25)
Elective	39 (58)	20 (51)	19 (49)	12 (31)	27 (69)
Total	67	36 (54)	31 (46)	33 (49)	34 (51)

Table 3: Distribution as per conditions requiring tracheotomy.

Condition (n=67)	No of patients (%)	Male	Female
Congenital airway anomaly	2 (3.12)	1	1
Neoplastic	12 (17.91)	7	5
Traumatic	13 (19.40)	8	5
Inflammatory	2 (3.12)	1	1
ICU calls for ventilator support	37 (55.22)	19	18
others	1 (1.49)	0	1
Total	67	36	31

Table 4: Type of scar in patients who had undergone tracheotomy in past (i.e. before April 2016) using horizontal skin incision and duration of intubation (n=10).

Scar	No of patients	Duration of tracheostomy tube
Linear inconspicuous	1	5days
Circular	7	More than 2 weeks (Figure 3, Figure 4)
Thickened irregular	2	1-2 weeks (Figure 5)

The incidence of emergency tracheotomy is slightly more in male patients and what is more significant is that 75% of emergency tracheotomies were done using vertical incision. And horizontal incision is preferred more in elective settings. Average surgical time with vertical incision was 6.60 minutes and with horizontal incision was 9.73minutes.

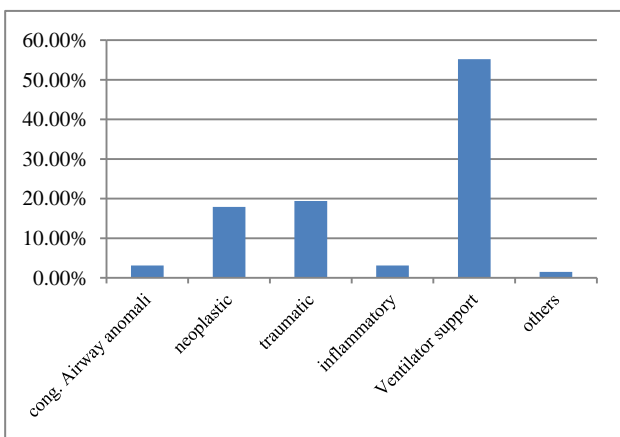


Figure 1: Percentage distribution of indications for tracheostomy.

Prolonged ventilator support is the commonest condition needing tracheotomy followed by traumatic conditions (road traffic accidents and violence and warfare injuries) and Neoplastic obstruction of upper airway (Table 3 and Figure 1).



Figure 2: Stoma track 72 hours after tracheotomy (horizontal incision).

The final outcome of the local scar is apparently greatly influenced by the duration that the tracheostomy-tube

stays in place and cosmetically satisfactory results of horizontal incision are appreciable only when the tube is removed within few days, otherwise a 1cm vertical scar is unavoidable even when the horizontal incision is used and chi-square test p value of <0.045 negates the hypothesis that horizontal incision always gives a cosmetically better scar but further long term studies with large number of participants are needed to further confirm the results as for the time being the present pilot study points towards that approaches for tracheotomy using horizontal incision takes longer surgical time and may not necessarily yield the expected linear scar in the skin crease and the traditional vertical incision holds its place as approach of choice in emergency and difficult situations.



Figure 3: Tracheostomy scar in a 12 year boy who underwent elective tracheotomy at the age of 7 years (horizontal incision).



Figure 4: Scar after percutaneous dilatational tracheotomy.



Figure 5: Scar of horizontal incision of tracheotomy compared to horizontal incision for vertical partial laryngectomy.

DISCUSSION

Tracheotomy is a surgery which has established itself as a life saving procedure and may be one of the first surgeries needed in situations of trauma especially injuries encountered in warfare conditions. Over the period of time the surgical procedure has become a part and parcel of intensive care unit protocols and in these comparatively controlled settings the surgery can be done without time constraints and newer methods like percutaneous dilatational tracheotomy (PDT) with ultrasound or fibro-optic bronchoscopic guidance makes the procedure easier, but open surgical approach under vision holds its ground especially in difficult cases. This life saving procedure comes with its set of complications especially bleeding, patient exhaustion if the airway is not established in time in a patient in distress. The post operative tracheotomy care is mandatory as accidental dislodgement or occlusion of tube can have catastrophic outcome. With passage of time the indication of this age old surgery has only widening and there being no absolute contraindication for the procedure.⁷

There is no significant gender based variation in the distribution of the procedure and almost 58% of tracheotomies are done in controlled elective settings and remaining 42% in emergency settings. However the incidence of emergency tracheotomies is more in males (57%) than females (43%). It is probably because the incidence of trauma and upper airway malignancies is more in males than females here (Table 1 and 2).

The commonest indication for tracheotomy nowadays are ICU calls for patients on ventilator support (55%) followed by trauma (19%) and upper airway obstruction due to neoplastic diseases (17%). In the pediatric age group it is the patients in the first year of life with congenital airway anomalies that need tracheotomy as the inflammatory diseases of airway are no longer main pathologies behind the procedure, although the largest single indication for tracheotomy in children in the early half of twentieth century use to be inflammatory

conditions like laryngotracheobronchitis, diphtheria and acute epiglottitis (Table 3 and Figure 1).⁸

Traditionally the surgical tracheotomy was defined with the vertical incision when the surgery used to be done in emergency settings of obstructed airway with patient in distress and the time taken to secure the airway had direct impact on the survival outcome. Vertical incision falls perpendicular to the lines of langerhans and hence the skin flaps have tendency to fall apart rather than approach each other and further dissection stays in the relatively avascular midline and no separate retraction is needed for skin flaps as it gets retracted along with the muscle retractors as dissection proceeds. And only logical debate put forward for horizontal skin incision being that it is cosmetically better and hence an element of dilemma as is obvious from other studies regarding this procedure.

While Song prefers vertical skin incision to start the procedure and use horizontal incision on trachea, Nassif and Zielinski in his study uses horizontal skin incision and vertical incision on the trachea.^{9,10} Smith and Saunders in their study on animal model try to clarify that horizontal incision had no superiority over the vertical incision as far as healing is concerned.¹¹ and situation is further cleared from the study of Mitchel and Eisele who besides introducing a technical modification of tracheotomy punch to further speeding up the procedure in cases of urgent tracheotomy use vertical skin incision to start the procedure.¹² The present study proves that while the horizontal incision is as popular as the vertical incision but 75% cases of emergency tracheotomy in the present study where started with vertical incision making it most preferred incision in the emergency settings and also when the procedure is to be done in a compromised patient position (Table 2).

In the present study only 10 patients who had undergone tracheotomy in the past more than one year back using horizontal skin incision reported for the scar assessment and only 2 (20%) had linear inconspicuous scar as compared to 8 (80%) who had 1 cm×1 cm irregular/circular scar (Table 4) Further evidence that horizontal incision does not always fulfill the expectation with which it is used and at the same time increasing the surgical time.

The possible explanation for the scar being irregular or circular rather than being linear can be that within few days of tracheotomy a scar tissue lined track establishes a fish-mouth like tracheocutaneous opening (Figure 2) and with each passing day the local inflammation partly due to mechanical irritation due to tube and chemical irritation due to secretions from trachea thickens the scar tissue around this tracheal stoma so at the time of closure even though the skin edges can be approximated by primary suture the underlying scar tissue remodeling affects the long term local scar appearance (Figure 3 and 4).

Even in patients who had undergone neck surgery using two separate horizontal skin crease incisions the one for main surgery and the another for tracheotomy, the scar of tracheotomy site was not as linear as the one closed soon after the surgery by the primary closure (Figure 5). The cosmetically appreciable scar in two patients had tube in place for less than a week indirect evidence that duration of the time stoma stays patent plays a role in the long term outcome of the scar. Keeping in view that vertical incision has a natural tendency to fall apart and make overall dissection easier for a surgery performed with an intention of creating a stoma rather than closure the choice of incision only remains individual with vertical incision having definite advantages of its own. And further long term comparative studies are needed to establish the claim of horizontal incision in skin crease always gives cosmetically better results.

CONCLUSION

The inflammatory conditions are no longer prime indicators for surgical tracheotomy. Horizontal skin incision has no significant advantage over vertical incision which is still preferred in emergency settings.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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