How to decannulate tracheostomised severe head trauma patients: A comparison of gradual vs abrupt technique

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ABSTRACT

Tracheostomy is a common surgical procedure performed in patients with severe head injury to facilitate prolonged airway and ventilatory support. Decannulation is the procedure of removing the tracheostomy tube either gradually by downsizing the tube or abruptly in a single sitting. This prospective study was done to evaluate gradual vs abrupt techniques for successful decannulation in tracheostomised severe head trauma patients in Post Graduate Institute of Medical Education and Research (PGIMER), a central government tertiary centre in Chandigarh, India. A total of 118 patients, recruited over one and half years duration were arbitrarily divided into 2 groups: Gradual and Abrupt. Particulars were taken. Time since tracheostomy, timing of decannulation, Glasgow Coma Scale, amount of secretions, breath holding time, CXR and STN radiographs and cough reflex were all assessed. Follow up was done at one month to classify those who were re-tracheostomised or re-intubated as decannulation failures. Sixty-eight patients were decannulated gradually and 50 abruptly. Of the various factors assessed, only cough reflex, number of suctioning required per day, X-ray STN and use of antibiotics for more than 7 days were found to be statistically significant. One hundred and fourteen patients, 67 out of 68 in the GD group and 47 out of 50 in the AD group, had successful outcome. The study showed that success or failure of decannulation is independent of mode of decannulation.

Keywords: Decannulation (Gradual/Abrupt), Head Trauma, tracheostomy.

INTRODUCTION

Tracheostomy is the commonest surgical procedure performed on critically ill patients.[1] Tracheostomy is described as the creation of a stoma at the skin surface which leads into the trachea. Tracheostomy may be temporary, which can again be either elective or emergency, or permanent. A temporary tracheostomy may be rendered "permanent"; however it differs from a permanent one in that there is still a communication between the pharynx and the lower airway via the larynx. Indications of tracheostomy include upper airway obstruction, removal of secretions, prolonged ventilation and as part of other surgical procedures. Various techniques include cricothyroidotomy/ minitracheostomy, percutaneous tracheostomy and open surgical tracheostomy.[2]

"Decannulation" is the process of removing a tracheostomy tube. When the initial indications for tracheostomy are resolved, decannulation is performed. Decannulation is a universal goal of otolaryngologists; however, not every patient with a tracheostomy can be decannulated. Before decannulation, the entire airway should be evaluated to determine its functioning, so as to support respiratory needs. Various evaluation methods have been used, mainly centering on clinical judgment, endoscopy, and radiography. The routine protocol for decannulation is to plug the tracheostomy tube for 24 to 48 hours. If the patient tolerates corking, the tube is removed and the patient is carefully observed. In addition, endoscopic and radiographic examinations can identify anatomic abnormalities preventing decannulation.[3]

Patients with severe head injury often have coma as a sequelae of their injury. It is often necessary to provide a long term artificial airway. In most cases, intubation is followed by tracheotomy.[4] According to several sources, 10–43% of patients hospitalized because of a major brain trauma require tracheostomy. The number of tracheostomies increases to 50–70% with the low Glasgow Coma Scale (<8).[5-7] Richard *et al*[8] recommends tracheostomy in all the cases with the score of 7 and below in GCS confirmed on the 7th day after the trauma. Simultaneously, tracheotomy is recommended in the literature because of reduced Intensive Care Unit stay, shortens duration of mechanical ventilation and reduces hospitalization costs.[9-11] Although tracheostomy is probably the most common surgical procedure performed on critically ill patients, it is unknown when a tracheostomy tube can be safely removed.

This study is intended to evaluate gradual versus (vs) abrupt techniques for successful decannulation in tracheostomised severe head trauma patients in Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh, India.

METHODOLOGY

This prospective study was conducted in the Department of Otolaryngology and Head & Neck surgery in association with the Department of Neurosurgery at PGIMER, Chandigarh. All patients of severe head trauma (GCS<8) presenting to ENT and Neurosurgery departments undergoing decannulation after tracheostomy between the age of 12 to 60 yrs, from June 2010 till December 2011 were included in the study (total of 118 patients). Those with injury to chest, aerodigestive tract, spine , neck and faciomaxillary region and those with known cardiac, lung parenchyma and spinal deformities were excluded.

Decision to decannulate was taken by either the treating clinician (neurosurgeon or otolaryngologist). Any patient who required reinsertion of an artificial airway within a period of 1 month of decannulation was termed as decannulation failure. Removal of tracheostomy tube by gradually downsizing the tube followed by strapping over the tube and finally strapping over stoma was defined as gradual decannulation whereas removal of tracheostomy tube directly without downsizing and strapping over stoma was defined as abrupt decannulation.

The study population was arbitrarily divided into two groups: Gradual and Abrupt. Data of all the patients included in the study were taken regarding their name, age, sex, address, CR number and telephone number. Time since tracheostomy and timing of decannulation was noted. The Glasgow Coma Scale (GCS) of the patients, amount of secretions (number of times suctioning is required) and the breath holding time were assessed. A note of pre-decannulation investigations like chest and soft tissue neck radiographs were made. Whether the patient was able to phonate and swallow solids and liquids, at the time of decannulation, were assessed. The size of the tracheostomy tube and cough reflex of the patients were assessed as well.

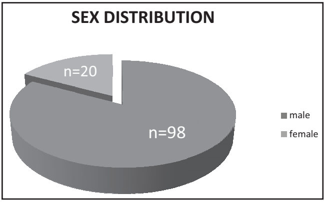

Fig. 1. Sex distribution of the study population

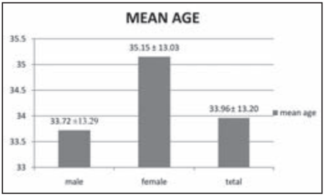

Fig. 2. Age Distribution of the study population

All these details were filled in a proforma for statistical analysis.

FOLLOW UP PROTOCOL:

All the patients who had undergone decannulation were followed up at the end of one month regarding their status. Questions were asked regarding the condition of stoma, ability to swallow foods, breathing difficulties if any, any difficulties in phonation and the cough reflexes. Those who had been re-tracheostomised or re-intubated within this time were classified as decannulation failures.

RESULTS

A total of 118 patients (98 males and 20 females) were recruited for the prospective study over a period of one and half years (from June 2010 till December 2011) (Fig.1). Our patients had mean age of 33.96 ± 13.20 (mean ± 1S.D.) years (Fig.2). The various factors affecting the process of decannulation in the study group and their distribution were assessed (Fig.3).

Eighty three of 118 patients (70.3%) were conscious. Of the 83 conscious patients 48 (57.8%) were decannulated gradually and 35(42.2%) underwent abrupt decannulation (AD). Out of the 35 unconscious patients 20 (57.1%)

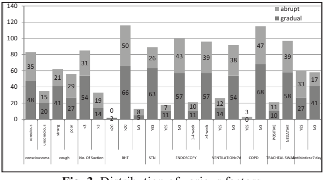

Fig. 3. Distribution of various factors affecting the decannulation process

were decannulated gradually and 15 (42.9%) underwent AD. Applying chi-square test, the clinical bias for consciousness is statistically not significant for decannulation.

Sixty two of 118 patients (52.5%) had strong cough reflex at the time of decannulation. Of the 62 patients with strong cough reflex 41 (66.1%) were decannulated gradually and 21 (33.9%) underwent AD. Applying chi-square tests, the clinician bias for good cough reflex is statistically significant.

Eighty five of 118 patients (72%) required suctioning less than 3 times a day. While distributing these patients into gradual and abrupt group, the clinical decision was statistically biased towards suction requirement less than 3 times while decannulating.

One hundred and sixteen of 118 patients (98.3%) had BHT more than 20 seconds. One hundred and five of 118 patients (89%) underwent CXR before decannulation.

Eighty nine of 118 patients (75.4%) underwent STN X-rays before decannulation. Of these STN X-rays, 63 (70.8%) belonged to the gradual decannulation (GD) subgroup while 26 (29.2%) underwent AD. Applying chi-square analysis, the results were highly significant suggesting significant bias towards STN in GD subgroup.

Only eighteen of 118 patients (15.3%) underwent endoscopic assessment before decannulation. The clinical decision of getting endoscopic assessment prior to decannulation was found to be statistically insignificant.

Ninety six of 118 patients (81.4%) had duration of tracheostomy more than 4 weeks, 21 (17.8%) had between 1 to 4 weeks while only one patient (0.8%) had less than 1 week of tracheostomy prior to decannulation. Chi-square analysis showed no statistical significance in clinician's bias towards longer duration of tracheostomy.

Ninety two of 118 patients (78%) did not require ventilation for more than 7 days prior to decannulation while 26 (22%) did require. Chi-square analysis showed no statistically significant impact of ventilation over clinical decision of decannulation.

Three of 118 (2.5%) patients had COPD at the time of decannulation. Ninety seven of 118 patients (82.2%) had negative tracheal swab for any microorganisms. Both these factors were found to be statistically non-influencing.

Sixty of 118 patients (50.8%) had received antibiotics for more than 7 days prior to their decannulation while 58 (49.2%) had not. Among the antibiotic receiving 60 patients, 27 (45%) underwent GD while 33 (55%) underwent AD. Applying chi-square test the clinical decision of choosing AD for patients who have been under antibiotic cover proves to be statistically significant.

Comparison of various factors affecting decannulation along with their p values is tabulated in Table-1.

One hundred and fourteen of 118 patients (96.6%) who underwent decannulation had a successful outcome after a 1 month follow up while 4 (3.4%) had failure. 67 out of 68 patients (98.5%) in the GD group and 47 out of 50 patients (94%) in the AD group had a successful outcome.

DISCUSSION

A total of 118 patients were included in the study and the population was arbitrarily divided into 2 groups, gradual comprising of 68 patients and abrupt comprising of 50 patients. The two methods were compared in terms of success and speed of decannulation.

The results demonstrate five major findings. First, clinicians (Neurosurgeons and ENT surgeons) are able to identify patient factors that they believe are important in the process of decannulation. Second, of the various factors thought to be influential in the clinician's decision of decannulation, only cough reflex, number of suctioning required per day, X-ray STN and use of antibiotics for more than 7 days were found to be statistically significant. Third, the success or failure of decannulation is not dependent on the mode of decannulation. Abrupt decannulation is not inferior to gradual decannulation in terms of results. Fourth, clinicians are able to define decannulation failure and identify what they believe are acceptable rates of failure. Fifth, the clinician's decision is the best for decannulation.

Clinicians in our survey indicated that, in determining whether to decannulate a tracheostomised patient, the patient's level of consciousness, cough effectiveness, secretions, BHT, CXR, STN, endoscopy, duration of tracheostomy, ventilation for more than 7days, COPD, tracheal swab and antibiotics for more than 7 days be evaluated. Although all these factors were thought to be influential in decision of decannulation , only cough reflex, number of suctioning required per day, X-ray STN and use of antibiotics for more than 7 days were found to be statistically significant. We propose that a cough effectiveness, secretions, BHT< 20seconds, CXR, STN and use of antibiotics for more than 7 days be tested as factors to consider in determining whether to decannulate a tracheostomised patient.

Table-1: Comparison of factors affecting decannulation

		GRADUAL	ABRUPT	CHI-SQUARE(p value)
CONSCIOUSNESS	CONSCIOUS	48	35	0.945
	UNCONSCIOUS	20	15	
COUGH REFLEX	STRONG	41	21	0.049**
	POOR	27	29	
NO OF SUCTION	<3	54	31	0.037**
	>3	14	19	
BHT	<20 sec	2	0	NA
	>20 sec	66	50	
CXR	YES	63	42	NA
	NO	5	8	
STN	YES	63	26	0.000**
	NO	5	24	
ENDOSCOPY	YES	11	7	0.745
	NO	57	43	
DURATION	<1 week	0	1	0.424
	1-4 weeks	11	10	
	>4 week	57	39	
VENTILATION> 7 DAYS	YES	14	12	0.659
	NO	54	38	
COPD	YES	0	3	NA
	NO	68	47	
TRACHEAL SWAB	POSITIVE	10	11	0.306
	NEGATIVE	58	39	
ANTIBIOTICS > 7 DAYS	YES	27	33	0.005**
	NO	41	17	
OUTCOME	SUCCESS	67	47	0.179
	FAILURE	1	3	

** significant at level of 0.05

The outcome was compared with the mode of decannulation, gradual versus abrupt. It was statistically insignificant thereby implying that results of abrupt decannulation are comparable to that of gradual in terms of success at 1 monthly follow up. Hence, abrupt decannulation is not inferior to gradual. In fact it has benefits in terms of cost, hospital stay, psychological factors, early recovery and rehabilitation.

Bach and Saporito[12] defined successful decannulation as 'extubation or decannulation and site closure with no consequent respiratory symptoms or blood gas deterioration for at least 2 weeks'. Ceriana and colleagues [13], in evaluating the feasibility of a decisional flowchart for weaning from tracheostomy, defined failure as the 'need to reopen the tracheotomy because of an acute episode or progressive worsening of arterial blood gases not corrected by the application of noninvasive mechanical ventilation'. The two research groups documented reinsertion of artificial airways in 35% of patients at 2 weeks and 3% of patients at 3 months, respectively.[12,13] Stelfox *et al*[1] suggest that most clinicians would consider reinsertion of an artificial airway within 48 to 96 hours following planned tracheostomy removal to constitute a decannulation failure. Furthermore, clinicians appeared to consider a decannulation failure rate of 2% to 5% to be acceptable. In our study we have defined decannulation failure as any patient who required reinsertion of an artificial airway within a period of 1 month. Our results were comparable to world literature. Total failure rate was 3.39%, 1.47% in the gradual group and 6.00% in the abrupt group which was statistically insignificant indicating that abrupt decannulation is as good as or at least not inferior to gradual decannulation technique in terms of outcome.

Wasserzug *et al*[14] have showed 100% success with one stage abrupt decannulation in their 24 patients of head and neck oncological surgeries upto a follow up period of 5 months. Although they have done it in a different study population, they have provided a good and strong evidence for the safety and success of the more feared abrupt decannulation.

Dennison[15] (n = 35) and Frank *et al*[16] (n = 68) report failure rates in patients with acute brain injury in rehabilitation facilities of 2% and 6%, respectively. Chaote *et al*[17] reported a failure rate of 4.8% in their study.

Mackiewicz-Nartowicz *et al*[18] conducted a study to analyze factors that may influence positive decanulation in patients with tracheotomy performed because of the traumatic brain injury, stroke or cardiac arrest. They confirmed that young age (less than 40), traumatic brain injury and short time of tracheotomy are the positive decannulation factors.

Christopher[19] highlighted that the respiratory therapist plays an integral role in tracheostomy tube decannulation. Involvement of the RT in a team approach to scientific study of current and new approaches to tracheostomy decannulation is likely to improve quality of care and outcomes.

Among our 4 decannulation failure patients, two had died, one after 13 days and the other after 3 weeks of decannulation. These patients had severe head trauma and were unconscious at the time of decannulation. Death seems unlikely to be because of decannulation procedure in these patients because had it been so it should have been within first 24 hours of decannulation. Death in these patients is hence attributable to their neurological status, other undetected co-morbidities or nature itself. Among the other two failures, repeat tracheostomy was done when they presented to emergency and airway was secured.

This study has concluded that the clinician usually consider the following factors before decannulation; strong cough reflex, no of suctioning < 3 per day, BHT > 20 seconds, availability of CXR and X-ray STN and prior use of antibiotics for more than 7 days. The success or failure of decannulation is independent of mode of decannulation, gradual or abrupt. The result of abrupt decannulation is as favorable as gradual in terms of success at a follow up of 1 month. Follow up period of 1 month for defining successful decannulation is fair enough.

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