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Research Article

A simple but novel idea of indirect internal retraction technique of M.M. Sankar with ordinary ET tube for Anterior Cervical Discectomy and Fusion Surgery

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Abstract
Anterior cervical discectomy and fusion is a commonly performed procedure for prolapse of cervical intervertebral disc. It involves retraction of trachea-oesophageal complex medially and great vessels of neck laterally of for adequate exposure of anterior spinal column in cervical spine surgery. It is known that increased and improper surgical retraction may affect the postoperative dysphagia, hoarseness of voice and vocal cord function. However, until now no evidence supports the fact that whether the type of endotracheal tube (ordinary and flexometallic) and side of its fixation aid in surgical indirect internal retraction. we present: a prospective comparative observational study with ordinary endotracheal tube vs flexometallic endotracheal tube in right sided aproach to determine whether the type of endotracheal tube fixed on the ipsilateral side ,the concept pioneered by our senior author will prevent post operative laryngeal morbidities

Keywords: *Anterior cervical discectomy and fusion, Indirect internal retraction, Ordinary endotracheal tube, Flexometallic endotracheal tube, Endotracheal tube, vocal cord paralysis.*

Introduction

In anterior cervical spine surgery retraction is obligatory to approach the spine. To determine and compare the types of endotracheal tubes with surgical retraction and cervical spine distraction during anterior cervical discectomy and fusion surgery. we prospectively studied 201 (aged 18-65 years) patients undergoing ACDF procedure on one or two level. we randomly allocate study group B of 113 patients intubated with ordinary endotracheal tube compared with 88 patients intubated with flexometallic endotracheal tube as control group A. Both study and control group the endotracheal tubes were fixed on the ipsilateral side of the ACDF procedure. The concept of indirect internal retraction is patients intubated with ordinary endotracheal tube fixed on the same side angle of mouth so that due to inherent elasticity of plastic material the tube arches towards opposite side and indirectly internally retract the trachea-oesophageal complex away from the operating field and aid in surgical retraction and may help to prevent laryngeal morbidities. This simple novel idea is pioneered by our senior author professor M.M. Sankar. This novel method is compared with the patients

intubated with Flexometallic endotracheal tube which accommodates the normal tracheal position and curvature of airway but did not aid in tracheal retraction.

The primary postoperative outcome measures are dysphagia, hoarseness of voice, pneumonia and vocal cord paralysis. Application of cervical retractors may lead to laryngo-tracheal morbidities like hoarseness of voice, sore throat, dysphagia, and vocal cord palsy.[1] Incidence of tracheal ischaemia after ACDF has been reported to be 2-44%.[1] The relation between retractor application and using type of ETT has rarely been mentioned in the literature. Hence, this study was designed to find out using type of ETT fixed on ipsilateral side during ACDF, with a secondary objective to assess vocal cord function after extubation.

Methods

This prospective, comparative, observational study was carried out after obtaining Informed written consent was taken from patients, who underwent elective ACDF over a period of JAN2015 TO AUGUST2018 This single center case-series study involving our neurosurgery department of stanley medical college, Chennai is having high-volume of spine patients and it's excellence in spine care and clinical research infrastructure and experience. Patients who received cervical spine surgery (levels from C2 to C7) and belonging to age group of 18-65 years were included in the study. Patients having short neck, anatomical deformity or history of previous surgery at neck or cervical spine, obesity, were excluded from the study. In the operating room, Anaesthesiology team was instructed to use Fiberoptic bronchoscope/direct laryngoscope guided orotracheal intubation with appropriate size tracheal tube (7.5mm ID for female and 8.5 ID for male patients; ordinary Portex® Tracheal tube, Smiths Medical International Ltd, USA).for study group B and flexometallic tracheal tube for control group A. Cuff was inflated with air to a point at which there was no leak on auscultation at the suprasternal area, at an inspiratory pressure of 20 cm H_2O. ETT fixed on right side angle of mouth. Right sided standard modified Smith-Robinson approach followed for all ACDF surgeries on one and two disc level patients. At the end of surgery, residual neuromuscular blockade was reversed, and fibreoptic bronchoscope was inserted through either nostril. After achieving a train-of-four count (TOF) of >90%, the ETT was withdrawn while observing for mobility of vocal cords. Any abnormality in the form of oedema or bleeding in the supraglottic area was also noted. Postoperatively, the patients were observed for hoarseness of voice and dysphagia for 24 hours. Patients having any such morbidity were followed-up for subsequent 3 months.

Results

A total of 201 patients of ASA physical status I and II (148 and 53 in number, respectively) were enrolled in this study. The age Range: 18–52 years with male/female ratio of 112:88. The mean weight was 61.6 ± 12.2 kg (Range: 45-90 kg). The mean duration of ACDF surgery for GROUP A was 47 min (Range: 30-60 min) and GROUP B was 22 min (Range 15-45 min). One/two vertebral disc level procedures were performed in 180,21 patients, respectively. There are 88 patients in Group A (flexometallic ET Tube group) post operatively developed dysphagia in 10(8.8%), hoarseness of voice in 26(22.88%) and vocal cord palsy in 6(5.28%). There are 113 patients in Group B (ordinary ET Tube group) developed dysphagia in 4(4.52%), hoarseness of voice in 6(6.78%) and vocal cord palsy in 0%.

Compared with the literature marked reduction of dusphagia, hoarseness of voice and vocal cord palsy is seen in our study with ordinary endotracheal tube fixed on right side of mouth in right sided Smith-Robinson approach. Patient age and gender were not significantly different between groups, but 15% of patients in the control group A reported smoking compared with only 3% in the study group B.

Six patients (5.28%) required treatment for vocal cord palsy in GROUP A. Five of them required medical therapy (steroids), and 1 conservative therapy (speechtherapy). Patients who received steroids had vocal cord dysfunction and hoarseness; they all recovered completely.

Table 1 Demographics of Patients Who Experienced Dysphagia, hoarseness of voice and vocal cord Palsy Compared With the Control Group.

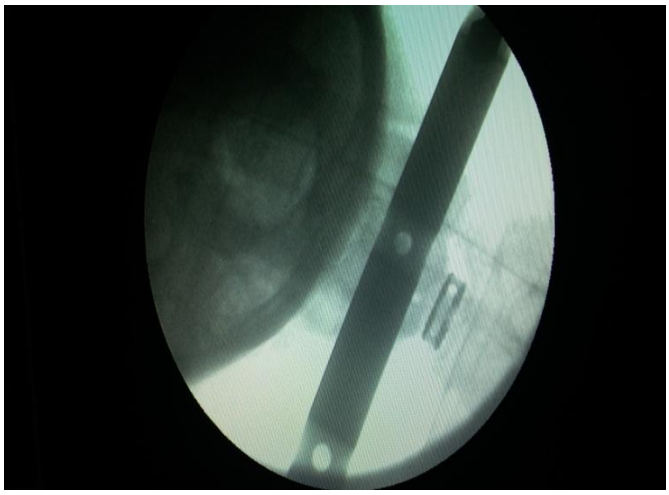
	Parameter	Dysphagia		Hoarseness of voice		Vocal cord palsy		Total	
								Group A	Group B
1	Patients	Group A	Group B	Group A	Group B	Group A	Group B	88	113
1	Patients	10	4	26	6	6	0		
2	Operating time							<1/2 hour	>1/2 hour
3	Gender male%	0.6%	0.12%	5.2%	0.24%	0.18%	0%	53(46.64%)	59(66.67%)
4	Smoker%	50%	60%	0%	50%	50%	0%	21(18.48%)	19((21.47%)
5	Average VAS score	5	1	-	-	-	-	5	6
6	NDI Score	Mild disability	No disability	Mild disability	No disability	Severe disability	No disability	Mild to moderate disability	Mild to moderate disability

Abbreviations: NDI- Neck Disability Index,VAS –Visual Analogue Scale

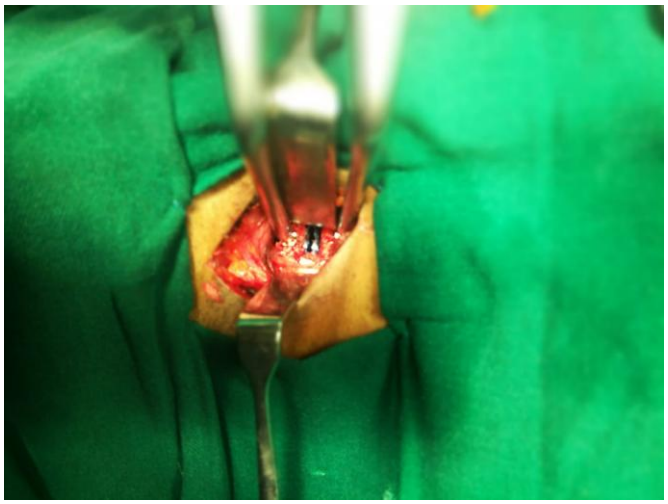
Table 2 Surgical Variables of Patients Who Experienced Dysphagia /Recurrent Laryngeal Nerve Palsy (RLNP) Compared

	Level of surgery	Dysphagia		Hoarseness of voice		Vocal cord palsy	
		GROUP A	GROUP B	GROUP A	GROUP B	GROUP A	GROUP B
1	C2 –C3 HNP	-	-	--	--	--	--
2	C3-C4 HNP	-	-	-	-	--	--
3	C4-C5 HNP	1	2	4	2	--	--
4	C5-C6 HNP	3	--	6	1	2	--
5	C6-C7 HNP	6	2	16	3	4	--

Bowing and indirect internal retraction of trachea-oesophageal complex by ordinary endotracheal tube towards left side when fixing it with right side angle of mouth – C ARM intra operative cervical spine view AP and LATERAL views



Ordinary Endotracheal tube fixed on right side angle of mouth for right sided Smith-Robinson approach



Right side anterior cervical discectomy procedure with minimal retraction shows good exposure

Discussion

During ACDF surgery, retractor is placed in soft tissue of neck for better visualization of anterior spinal column. Cervical retraction increases tracheal cuff pressure thereby causing ischaemic injury to the tracheal mucosa, which may be responsible for occurrence of postoperative sore throat, dysphagia, and hoarseness. Endotracheal tube intubation may cause direct pressure on the RLN and cause vocal cord paralysis. From an anatomical perspective, it is relevant to know that the anterior branch of the RLN innervates the thyroarytenoid and lateral cricoarytenoid muscles, and that the endotracheal tube may cause nerve ischemia by inducing pressure onto the nerve and submucosal surface. In the present prospective observational study with the objective of identifying ways to reduce the rate of RLNP, the authors found that ordinary endotracheal tube fixed on right angle of mouth on right sided approach internally retract the trachea oesophageal complex due to inherent elastic bowing of the ordinary Et tube towards left when compare to flexometallic ET tube which is resistant to kinking but contouring itself to the curvature and deviation of the trachea which results in need for more retraction in right sided Smith-Robinsin approach, but ordinary ET tube reduce the rate of symptomatic palsy from 2.2% to 0 % in patients with right-sided approach in our study.

Increased incidence of tracheal morbidity is related to longer duration of intubation and surgical retraction.[7] Complications like dysphonia and dysphagia are reported to persist even beyond 5 years after ACDF.[8] Laryngeal complications after ACDF include vocal cord paralysis secondary to recurrent laryngeal nerve injury.[3,9] Temporary unilateral vocal cord paralysis has been reported in the range of 0.98–8%. The incidence of permanent paralysis has been observed to be in between 0.15 and 3.5%.[9] These complications occur as a result of direct surgical trauma, nerve division, pressure or stretch induced neuropraxia, and ETT-related vocal fold palsy.[3,10] Audu and colleagues[11] reported 3.2% incidence of vocal cord palsy after ACDF which is comparable to the results of our study (2.7%).

Endotracheal intubation has been implicated for laryngeal morbidities such as vocal cord palsy with reported incidence of 15–94%.[12] Although the exact pathophysiology of post-intubation airway complications is not known, damage due to forceful retraction thought to be responsible. Retractor blades may impinge upon the nerve thereby pushing it against the thyroid lamina. The cuff pressure is recommended to be kept within 20–30 cm H_2O to provide adequate seal without compromising mucosal perfusion.[13] Capillary pressures of trachea decrease when the retractor pressure greater and causing tracheal ischaemia. The severity of ischaemia is proportional to the pressure exerted by the surgical retraction and the time of exposure. Hence, maintenance of retractor pressure below tracheal mucosal capillary pressure is recommended, but the clinical evidence of efficacy of this practice in preventing tracheal morbidity is lacking.

It is reported that the intraoperative increase pressure on trachea and diminished electromyographic activity is associated with higher incidences of postoperative hoarseness.[9] These data further support the role of retractor/ETT interactions in vocal cord paralysis after ACDF.[9] Intraoperative recurrent laryngeal nerve monitoring for preventing its injury is one of the options but, not always feasible.

Normal venous and lymphatic pressures of trachea are 12 mmHg (16 cm H_2O) and 3–5 mmHg; respectively.[14] Hence, retractor pressure maintained below this level may still affect these pressures. Retractor pressures above these values may provoke congestion and oedema of the tracheal mucosa. Adjustment of application of retractors may help prevent tracheal morbidity, but it has major limitations, surgical retraction pressure must be sufficient enough to medialise the trachea for adequate exposure of cervical spine, simultaneously allowing adequate perfusion of trachea. To overcome above obstacles the indirect internal retraction technique of senior author helps in reducing laryngeal complications

Conclusion

The complications following cervical spine surgery, the risk of dysphagia, hoarseness of voice and vocal cord palsy was estimated and found to be lesser with indirect internal retraction technique with ORDINARY ET TUBE used by our senior author than that of FLEXOMETALLIC TUBE which is commonly used nowadays in anterior cervical discectomy and fusion surgery. Even though rare, the complications of ACDF were found tobe resolve completely and dysphagia is temporary spine surgeons can avoid them by using this simple technique. Small sample size and single centre study are limitations for this study. A multicentre larger prospective randomized study would be required to validate these findings.

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Conflict of interest: None declared

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