

Incidence of laryngeal complications associated with prolonged endotracheal intubation

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Abstract

Introduction: Complications attributable to intubation increase morbidity and may increase the mortality rate. **Aim:** The aim of this study was to evaluate laryngeal lesions in patients after prolonged intubation (>24 h), to correlate these lesions with the variables involved in the process of intubation and to determine the risk factors. **Materials and Methods:** This is a prospective study of patients who were intubated for more than 24 h in ENT operation theatre and critical care unit. Patients underwent for laryngoscopy on the day of extubation, weekly after extubating for two weeks then monthly upto 6 months. **Results:** 66 patients were intubated in this study, laryngeal abnormalities were seen in most patients of all groups, on the day of extubation and only patients who undergone for prolonged intubation had abnormal finding a month after extubation. **Conclusion:** At the end of one-month laryngeal findings were influenced only by the duration of intubation.

Key words: Laryngeal injuries, Intubation, Laryngoscopy, Extubation

Introduction

Laryngeal injuries following intubation have a reported incidence from 63 to 94% and permanent sequelae are reported to be about 10 to 20% in world literature.

Common injuries following long term intubation can manifest in the form of erythema, ulceration, granulation, fibrous nodule, arytenoids dislocations, subglottic stenoses, recurrent laryngeal nerve paresis and vocal fold immobility [1-4]. After extubation laryngeal examination of such patients becomes necessary to assess the nature of airway injury. This study is based on data obtained from the endoscopic recognition of intubation trauma in larynx and associated structure with the objective to determine the frequency of short and long term complications.

Materials and Methods

This prospective study was conducted at CSS Hospital in Meerut. 66 cases were included in this study. Patients required planned or emergency intubation were included in the study. Patients were aged from 15-60 years of age.

Manuscript received: 3rd October 2018
Reviewed: 12th October 2018
Author Corrected: 18th October 2018
Accepted for Publication: 24th October 2018

Sample collection- Cases were selected randomly from two setup, a) from ENT operation theatre, where planned intubations were done during routine ENT surgeries, b) from medical ICU, where emergency intubation were done as a life saving measure for emergencies.

All patients were grouped into three. **Group N1:(n=22)** included patients undergone for planned intubation for <24h, **Group N2: (n=22)** included patients undergone for emergency intubation for >24h to <7days and **Group N3:(n=22)** included patients intubated in emergency for >7 days.

Exclusion criteria- Patients with throat complains, history of gastro-esophageal reflux diseases/ thyroid surgery or addiction like tobacco, alcohol, smoking etc. were excluded from the study.

Complete laryngeal examination was done on the day of extubation and weekly for two weeks and monthly for 6 months in the form of indirect laryngoscopy, direct laryngoscopy or flexible fiberoptic laryngoscopy.

The association of laryngeal findings with intubation variables were evaluated. Various variables included nature of intubation (emergency or elective), route of intubation(oral/nasal), size of endotracheal tube, position of tube, tube characteristics, number of

attempts/reintubation, use of stilette, ventilator/ ambu bag, cuff type/pressure during the intubation period, total period of intubation, post extubation tracheostomy and associated medical illness were studied. Informed consent was obtained from all subjects.

Results

66 patients were included in the study. Laryngeal abnormalities were seen in all the patients during examination on the day of extubation. On day of extubation congestion and change in voice was present in all the cases done.

Table 1 and 2 shows the various symptoms present in all three groups N1, N2 and N3 on the day of extubation and one month after extubation. Table 3 and 4 shows various signs present on the day of extubation and after one month extubation in all three groups.

Table-1: Laryngeal Complications (Symptoms) First Day Post Extubation

Symptoms	N1(n=22)	N2(n=22)	N3(n=22)
Change in voice	22(100%)	22(100%)	22(100%)
Odynophonia	10 (45%)	7 (31.8%)	5 (22.7%)
Aphonia	2 (9%)	9 (40.9%)	4 (18.1%)
Vocal fatigue	4 (18.1%)	8 (36.6%)	7 (31.*%)
Difficulty in respiration	0	4 (18.1%)	8 (36.3%)
Throat pain	22 (100%)	7 (31.8%)	4 (18.1)
Cough	5 (22.7%)	6 (27.2%)	4 (18.1%)
Fever	1 (4.5%)	-	-
Odynophagia	5 (22.7%)	-	-
Aspiration	-	2 (9%)	4 (18.1%)
Other complaint	-	-	-

Table-2: Laryngeal Complications (Symptoms)–One Month Post Extubation

Symptoms	N1 (n=22)	N2(n=22)	N3(n=22)
Change in voice	0	2 (9%)	12 (54.5%)
Odynophonia	0	0	6 (27.2%)
Aphonia	0	0	1 (4.5%)
Vocal fatigue	0	1 (4.5%)	4 (18.1%)
Difficulty in respiration	0	0	1 (4.5%)
Throat pain	0	2 (9%)	4 (18.1%)
Cough	0	0	4 (18.1%)
Fever	0	0	0
Odynophagia	0	0	0
Aspiration	0	0	1 (4.5%)
Other complaint	0	0	-

One month post extubating, in group N1 none had laryngeal complications but in group N2, 2 patients (9.09%) patients had laryngeal complications, whereas in group N3, 8 patients (36.3%) patients had laryngeal complications.

One month after extubation no change in the voice was existing in patients of N1 group but was present in 2 patients (9.09%) of N2 group and 12 patients (54.54%) of N3 group.

Table-3: Laryngeal Complications (Signs): First Day Post Extubation

Signs	N1	N2	N3
Congestion	22 (100%)	13 (59%)	7 (31.8%)
Edema	10 (45.4%)	11 (50%)	8 (36.3%)
granulation	6 (27.2%)	9 (40.9%)	8(36.3%)
Ulceration	6(27.2%)	8 (36.3%)	6 (27.2%)
Intubation granuloma	0	0	0
Fibrous nodule	0	0	0
Interarytenoid adhesion	0	0	0
Healed furrow	0	0	0
Posterior glottis stenosis	0	0	0
Subglottic stenosis	0	0	0
URLNP	0	1(4.5%)	3 (13.6%)
BRLNP	0	0	0
Arytenoids dislocation	0	0	2 (9%)
Arytenoids fixation	0	0	0

Table-4: Laryngeal Complications (Signs): One Month Post Extubation

Signs	N1 (n=22)	N2(n=22)	N3(n=22)
Congestion	0	0	0
Edema	0	0	0
Ulceration	0	2 (9%)	2 (9%)
Granulation	0	0	0
Intubation granuloma	0	0	2 (9%)
Fibrous nodule	0	1 (4.5%)	2 (9%)
Interarytenoid adhesion	0	0	1 (4.5%)
Healed furrow	0	0	0
Posterior glottis stenosis	0	0	0
Subglottic stenosis	0	0	1 (4.5%)
URLNP	0	1 (4.5%)	3 (13.6%)
BRLNP	0	0	1 (4.5%)
Arytenoids dislocation	0	0	2 (9%)
Arytenoids fixation	0	0	0

In group N3, post extubation changes after one month were - Granulation was present in 2 patients (9%), granuloma in 2 patients (9%), interarytenoid adhesion in 1 patient (4.5%), subglottic stenosis in 1 patient (4.5%), unilateral recurrent laryngeal nerve paresis in 3 patients (13.6%) and bilateral recurrent laryngeal nerve paresis in 1 patient (9%). Among these changes most frequent change present one month post extubation was unilateral recurrent laryngeal nerve paresis.

Table-5: Laryngeal complications in relation to duration of intubation

Patients Subgroup	Laryngeal sequelae after one month
N1<24h(n=22)	0(0%)
N2<24h >7 days(n=22)	2(9%)
N3 >7 days(n=22)	11(36.3%)

Table-6: Laryngeal Complications related to Tube Used

Sequalae	Portex (high volume low pressure cuff)	Size (mm)	Tube motion
Intubation granuloma	+	9	+
Vocal cord paresis	+	8.5	+
Arytenoids subluxation	+	9	+
Subglottic stenosis(f)	+	8.5	+
Fibrous nodule	+	9	+

Table-7: Number of Attempts/ Reintubation versus Laryngeal Sequelae

Sequalae	Number of patient	History of Reintubation
Intubation granuloma	1	+
Fibrous nodule (m)	1	+
Vocal cord paresis (f)	2	+
Arytenoids subluxation (m)	2	+
Subglottic stenosis (f)	2	-

Table 5 to 7 shows various variables and their association with the laryngeal sequelae in all three groups. Analysis of the intubation variables showed oral route of intubation, use of portex tube, lateral position of tube during intubation, more number of attempts, use of stellate, CMV, reintubation were associated with post extubation laryngeal sequelae.

Discussion

In N1 group, the most common symptom was, throat pain and change in voice signifying the acute complications of intubation. In N2 and N3 groups also the most common symptom was change in voice (100%), signifying the effect of duration of intubation on the voice box. Results of our study are in accordance with the study done by Alessiet al who reported hoarseness in 96% cases in his study [5].

In our study, Odynophagia was not seen in patients of group N2 and group N3 but was present in 5 patients (22.7%) of group N1, who were intubated for less than 24 hours (group N1).

Those patients were relieved completely after 15 days. In a study done by Alessiet al reported odynophagia in 22 patients (76%) out of his 29 patients [5].

In present study 6 patients had aspiration out of 66 (9%). Alessiet al in his study reported aspiration in 10 out of 29 patients (34%) [5]. In present study 8 patients had complain of post intubation stridor (12.1%) out of which 5 (7.5%) got tracheostomised.

In group N2, Out of 22 patients 13 (59%) had congestion of the vocal cords, 8 patients (36.3%) had ulceration involving vocal processes of both arytenoids and inter-arytenoid region, but after a month the lesions

responded well to medical therapy. Alessiet al has reported ulceration in 23 patients out of 29 (79%) [5].

In group N3, 2 patients (9%) had intubation granuloma formation after one month despite medical therapy. Alessiet al reported intubation granuloma in 5 patients out of 22 (22.7%), who were having ulceration previously [2].

Pontes et al also reported intubation granuloma in 22.7% of the cases. However incidence of granuloma varies from 1:800 to 1:30 as reported in world literature [6].

2 patients (9%) of group N3 had a fibrous nodule on right true vocal cord at the junction of anterior 1/3rd and posterior 2/3rd.

One patient was given voice therapy and improved drastically. One patient had a nodule on left true vocal cord and responded to conservative management.

Total 3 cases (13.6%) of group N3 were identified with unilateral recurrent laryngeal nerve paresis, out of which one recovered with conservative management where as two had to be tracheostomised, out of which one was successfully decannulated and the other one was kept on follow up.

One case from group N3 was reported with bilateral recurrent laryngeal nerve paresis (4.5%) and was managed conservatively as she had no significant difficulty in respiration.

One case from N3 group, subglottic stenosis was detected after intubation for > 12 days. Spruance JS et al found that intubation less than 7 days leads to reversible changes in larynx and subglottic areas, but when this time was increased beyond 14 days, the changes were irreversible [7].

Whited et al reported 2% stenosis in patients with intubation between 3 and 5 days and it was increased to 5% when intubation period was between six and ten days [8].

Present study reported no permanent laryngeal injury following intubation < 24 hours after one month of extubation. Patients with intubation > 24 hours to < 7 day (group N2) were presented with 9% complications. Incidence of laryngeal trauma in patients with intubation > 7 days was found to be 36.3%.

The presence of laryngeal complications at the end of one month after extubation was highly related only to the duration of intubation. This is in accordance with the studies done by Whited RE and Kastanos Net al [8,9].

Nasal intubation was done mainly in N1 and N2 group. Only nasal bleeding was seen in 4 patients, which stopped on its own and no surgical intervention was required. Gaynor EB et al proposed more frequent use of nasal intubation to reduce laryngeal trauma as compared to oral intubation [10].

However Brandwein et al suggested that the length of intubation tube should also be considered if a nasotracheal intubation is done with a tube intended for orotracheal use, the increased distance traversed by the tube will result in the balloon cuff being situated just beneath the vocal cords [11].

Anatomically this may be a setup for compression injury to recurrent laryngeal nerve. Probably the most important factor in producing a traumatic injury to larynx and trachea is the pressure applied by the tube to the underlying structures.

In all the patients with laryngeal sequelae, low pressure high volume cuff was used there by indicating the importance of duration of intubation, which played a major role in causing them.

Conclusion

Initial laryngeal injuries are quite common but most of the patients tend to recover, as these are superficial mucosal injuries. The patients, who had undergone for intubation more than 7 days had permanent laryngeal complications. Thus one month post extubation, duration of intubation was the only predictor of post extubation laryngeal sequelae.

This study also showed that laryngeal injuries on the day of extubation were associated with larger tube size, emergency intubation and longer duration of intubation. Use of appropriate tube size and monitoring of duration of intubation is of paramount importance.

Funding: Nil, **Conflict of interest:** Nil

Permission from IRB: Yes

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How to cite this article?

Bansal A., Arora K. Incidence of laryngeal complications associated with prolonged endotracheal intubation. *Ophthal Rev: Tro J ophtha & Oto*.2018;3(4):85-90.doi: 10.17511/jooo.2018.i4.03.
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