Clinical Investigation

Improvement in Cormack and Lehane grading with laparoscopic assistance during tracheal intubation

Address for correspondence:
Dr. Anjeleena K Gupta,
H. No. 3008, B-4 Vasant Kunj,
New Delhi - 110 070, India.
E-mail: paygupta@yahoo.com

Anjeleena K Gupta, Bimla Sharma, Arvind Kumar, Jayashree Sood
Department of Anaesthesiology, Pain and Perioperative Medicine, Sir Ganga Ram Hospital, Old Rajinder Nagar, New Delhi, India

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ABSTRACT

Background: To use laparoscope as an easily available and easy to use alternative option to videolaryngoscope. **Aims:** The aim of the study was to assess the improvement in the glottic view using a conventional direct laryngoscope (DL) assisted by a laparoscope with its endovision system along with the time taken for tracheal intubation. **Settings and Design:** A prospective, double blind, randomized, controlled study was conducted in a tertiary care centre. **Methods:** Sixty patients with American Society of Anesthesiologists (ASA) physical status I and II requiring general anaesthesia and tracheal intubation for elective surgery were included in the study. The patients were anaesthetized, paralysed, DL was performed and Cormack and Lehane grade (C and L) noted, followed by the introduction of the laparoscope alongside the flange of the Macintosh laryngoscope and a further C and L grading done as seen on monitor. Demographic data, ASA physical status, airway assessment, mouth opening, modified Mallampatti class, jaw protrusion, thyromental and sternomental distances, optimal external laryngeal manipulation, time taken for intubation, pulse oximetry, blood on; tracheal tube, lip, dentition or mucosal trauma, sore throat, hoarseness of voice, excessive secretions and regurgitation were recorded. **Statistical Analysis:** Statistical analysis was done using statistics package for social sciences software (17.0 version). A *P*-value less than 0.05 was considered statistically significant. **Results:** Eighty-three percent of the patients showed improvement in glottic view after laparoscopic assistance. Eighty-one and 85% of the patients with C and L grade II and III respectively on DL had an improved glottic view with this technique. The mean time to intubate was 37 seconds. **Conclusions:** Laparoscopic assistance provided a better glottic view than DL in most patients (83%). It has a potential advantage over standard DL in difficult intubation.

Key words: Airway management, endoscopes, intubation, airway management

INTRODUCTION

Litigations related to difficult and oesophageal intubation form a significant aspect of ASA Closed Claims project database.[1] Many videolaryngoscopes such as Bullard rigid laryngoscope,[2] Glidescope,[3] angulated video intubating laryngoscope[4] and Bonfils retromolar intubation fiberscope[5] are available and have an important role to play in difficult intubation but are expensive. In our pursuit of finding a low cost, easily available and easy to use alternative option to a videolaryngoscope, we used a laparoscope to assist tracheal intubation. A laparoscope (Jarit 600–780 autoclavable, Germany 5.0 mm external diameter, 30 D lateral illumination) was connected to a standard light source (Karl Storz Xenon Nova 20131520) and a video camera [Olympus OTV–SX (3Chip)] [Figure 1]. The glottic image generated by this system was displayed on a monitor (Sony PVM–14NCE). The aims of our study were to assess (a) whether a laparoscope along with conventional direct laryngoscopy (DL) improves the visualization of the glottis as assessed by Cormack and Lehane (C and L) grade, (b) to compare the time taken for laparoscope assisted tracheal intubation in patients with respect to different C and L grades as assessed by laparoscopic assistance.

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Figure 1: Laparoscope connected to the light cable and video camera along with the endovision system

METHODS

Sixty patients, ASA physical status I–II, requiring general anaesthesia and tracheal intubation for elective surgery were included in the study. Patients with ASA III or IV and those requiring rapid sequence induction, raised intracranial pressure and cervical spine injury were excluded. A written informed consent and institutional ethics committee approval was obtained. Randomization was done by computer-generated numbers.

Preoperative assessment of the airway included Mallampatti classification[6] (Samsoon and Young[7] modification), jaw protrusion test, mouth opening, thyromental and sternomental distances. The airway assessment could not be carried out in two paediatric patients (aged 7 months and 1 year); therefore, they were excluded from the study.

Difficult airway was considered if mouth opening less than 4.5 cm, Mallampatti classification III or IV, jaw protrusion B or C, thyromental distance <7 cm[8] and sternomental distance <12.5 cm. Improvement in the glottic view was considered if a decrease in C and L grading by one grade or more occurred, following the insertion of the laparoscope.

After premedication and standard monitoring, anaesthesia was induced with propofol (1.5 mg/kg), fentanyl (1.5 μg/kg) and vecuronium bromide (0.1 mg/kg). After positive pressure ventilation, an initial DL was performed by a Macintosh laryngoscope. The glottic view was graded by a separate anaesthesiologist not involved in intubation. The intubator was blinded to the first laryngoscopy score. An assistant (OT technician) introduced the laparoscope along the flange of the Macintosh laryngoscope (from the right-hand side of the anaesthesiologist) about 3-4 cm into the oral cavity keeping the light cord at 6 o'clock position and the glottic view as seen on the monitor was further graded by the anaesthesiologist [Figure 2]. The difference in C and L grading[9] obtained by a Macintosh laryngoscope and that following laparoscope assistance was our primary outcome measure. An oral tracheal tube (TT) was then introduced from the right lateral corner of the mouth into the glottic aperture guided by endovision display. An anaesthesia circuit with the capnometer was attached to the TT. Positioning of the TT was confirmed by capnographic trace and chest auscultation. The time to intubation (TTI) was recorded as the time from insertion of the Macintosh blade into the mouth until the display of endtidal carbon dioxide trace on the monitor. TTI after laparoscopic assistance in patients with different C and L grades (as assessed by laparoscopic assistance) was our secondary outcome measure. Use of optimal external laryngeal manipulation (OELM) or stylet to aid intubation was recorded. Anaesthesia was maintained with end tidal sevoflurane (1–2%) in 33% oxygen and nitrous oxide and vecuronium bromide (0.1 mg/kg) as boluses. If more than one attempt was needed for intubation, the patient received bag and mask ventilation between the attempts. Successful intubation or failure to intubate (defined as failure after three attempts) was taken as the primary end point of the study. At the end of the surgery, neuromuscular blockade was reversed and the trachea extubated. The placement of orogastric tube, desaturation (SpO_2<95%), blood on; TT, lip, dentition or mucosal trauma, sore throat, hoarseness of voice, excessive secretions, gastric regurgitation, bronchospasm and laryngospasm were noted.

A sample size of 60 patients was calculated to detect a difference of 25% proportions with respect to improvement in the primary outcome (C and L grade). Our study had a power of 0.8 with a set at 0.05. The results were statistically analyzed using statistics package for social sciences (SPSS) software, (17.0 version; SPSS Inc., Chicago, IL, USA). Data were described as mean±SD or (95% CI) and number (percentage) as appropriate. A *P*-value less than 0.05 was considered statistically significant.

RESULTS

Sixty patients were enrolled over a period of 1 month. However, two paediatric patients were excluded from the study as their airway could not be assessed. Patient characteristics and airway parameters were as per Table 1. The airway parameters of all the patients are given in Table 2.

In the study, 24 out of 29 (83%) patients showed

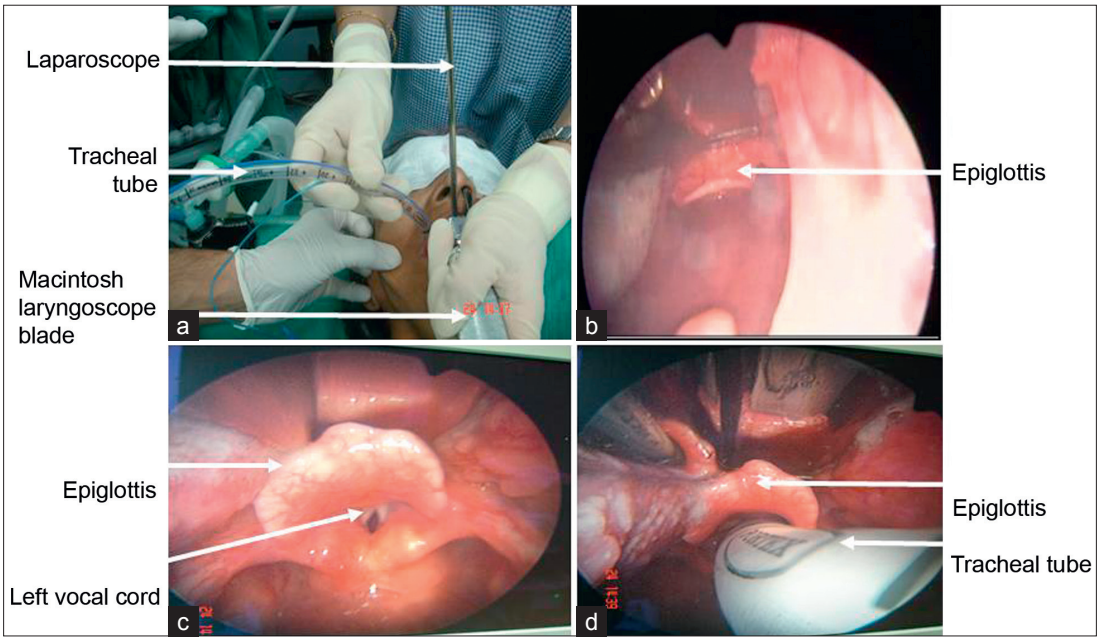

Figure 2: (a) External view of Macintosh laryngoscope, laparoscope and tracheal tube; (b) glottic view on direct laryngoscopy using a Macintosh blade; (c) glottic view on laparoscope assistance; (d) passage of the tracheal tube through the glottis

improvement in the glottic view as assessed by the C and L grade. Of the 16 patients with grade II view on DL, 13 improved to grade I view and out of 13 patients of grade III view on DL, 8 improved to grade I view, while 3 improved to grade II view after laparoscopic assistance [Figure 3]. None of the patients had grade IV view on DL. Thus, 13 out of 16 (81%) patients with C and L grade II and 11 out of 13 (85%) patients with C and L grade III on DL showed improvement in glottic view on laparoscopic assistance. OELM to assist during intubation was required in 14 patients [Table 1].

Time to intubation with respect to different C and L grading is shown in Table 3. The average intubation time was 37 seconds. Except for two patients in the study, the rest required a single attempt for intubation. One patient with swelling in the right submandibular area, could not be intubated by this technique while the other required a second attempt for intubation to thread the stylet through TT. Three patients complained of sore throat. There was no incidence of desaturation or oesophageal intubation, trauma to lip, teeth, pharynx, hoarse voice, excessive secretions, gastric regurgitation, bronchospasm or laryngospasm.

Table 1: Patient characteristics and airway data (*n*=58)

Sex (M:F)	18:40
Age (years)	40 ± 17
Weight (kg)	63 ± 16
Height (cm)	157 ± 7
ASA (I/II)	40:18
Mallampatti class (I/II/III/IV)	34/16/6/2
Jaw protrusion (A/B/C)	48/9/1
Thyromental distance (cm)	7.9 ± 0.6
Sternomental distance (cm)	13.8 ± 1.3
C and L grade on DL (I/II/III/IV)	29/16/13/0
C and L grade with LS (I/II/III/IV)	50/6/2/0
OELM used for C and L grade I on DL	4
OELM used for C and L grade II on DL	2
OELM used for C and L grade III on DL	8

Continuous data are expressed as number (*n*), mean±SD, C and L: Cormack and Lehane, OELM: Optimal external laryngeal manipulation, DL: Direct laryngoscopy, LS: Laparoscope assisted direct laryngoscopy, SD: Standard deviation. Jaw protrusion test – A: Ability to protrude lower teeth beyond upper teeth. B: Ability to approximate upper and lower teeth. C: Inability to approximate upper and lower teeth, ASA: American society of anaesthesiologists

DISCUSSION

In our study, an overall 83% of the patients showed improvement in C and L grade by laparoscopic assistance over DL. Out of these 81% and 85% of the patients who showed improvement were those with C and L grade II and III respectively on DL. The TTI was 37 seconds which was comparable to 36–80 seconds as documented with other rigid endoscopes.[3-5] Sore throat was present in three patients.

Laparoscope-assisted intubation along with a conventional laryngoscope is a new approach.[10] Laparoscopes are now freely available in most setups without the additional cost of a videolaryngoscope designed to tackle difficult airway, to provide a clear anatomical view of the glottic area, to be able to 'look around the corner',[3] and to view the glottis via the

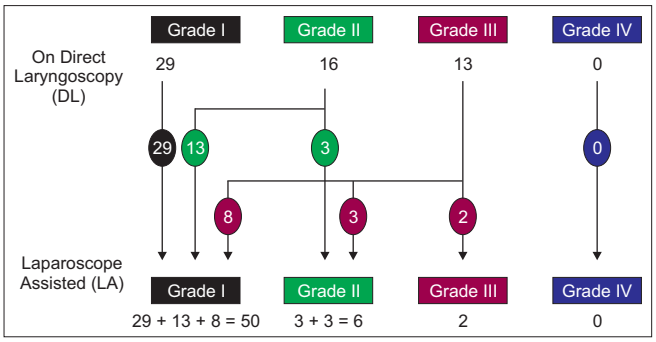

Figure 3: Cormack and Lehane grading

Table 2: Airway parameters

Airway parameter	Normal airway *n* (%)	Difficult airway *n* (%)
Mouth opening	41 (71)	17 (29)
Mallampatti class	50 (86)	8 (14)
Jaw protrusion	40 (69)	18 (31)
Thyromental distance	50 (86)	8 (14)
Sternomental distance	51 (88)	7 (12)

Data expressed as number (%), difficult airway considered: Mouth opening < 4.5 cm, Mallampatti class III or IV, Jaw protrusion B or C, thyromental distance < 7 cm, sternomental distance < 12.5 cm

Table 3: Time to intubation (seconds)

TT1 with respect to C and L grade	Mean ± SD (95% CI)
Overall TTI	37±12 (34-40)
C and L grade I	35±10 (33-38)
C and L grade II	51±18 (46-56)
C and L grade III	32±11 (29-35)

Values are expressed as mean±SD (95% CI lower-upper value), TTI: Time to intubation, C and L: Cormack and Lehane, SD: Standard deviation, CI: Confidence interval

camera without aligning the oral, pharyngeal and laryngeal axes. Therefore, a potential C and L grade III or IV glottic view should become a C and L grade I or II view with laparoscopic assistance.[11] This notion has been confirmed by our study. The intubation process involves two aspects, the first being the visualization of the glottis and the second comprising of the negotiation of the TT through the glottis. Laparoscope-assisted intubation improves the first aspect and thus, avoids the trauma associated with the visualization of the glottis in difficult airways. It is well recognized that a good laryngoscopic view does not necessarily predict an easy intubation.

Ravishankar *et al*. used a rigid nasendoscope connected to a video camera to intubate a child with Pierre Robin syndrome.[12] They hypothesized that if the tongue is lifted away from the posterior pharyngeal wall, glottic view from the pharynx is suitable with 70 D lateral illumination but we achieved the same with 30 D lateral illumination. The longer length of the scope offered the additional advantage of allowing the assistant and the anaesthesiologist to share the airway and at the same time allowing introduction of the TT from the lateral corner of the mouth. We used the conventional TT polyvinyl chloride without shaping it as 'J' as used by Ravishankar *et al*.

In our study, 81% and 85% of the patients with C and L grades II and III on DL demonstrated improvement respectively. TTI in our study was 37 seconds which is comparable to that of angulated video intubating laryngoscope (35 seconds).[4] In studies with Bonfils[5] and Glidescope[3] videolaryngoscopes much longer intubation times of 80 seconds and 46 seconds respectively have been reported. In our study, no decreasing trend was noted in the TTI with increasing number of intubations, thus demonstrating no learning curve for the technique. OELM is reported to reduce the incidence of difficult laryngoscopy.[13,14] OELM enabled intubation by aligning oropharyngeal Laryngeal axes in 24% of the patients in our study.

The technique requires good hand and eye coordination as the endoscopist has to focus his/her attention continuously on the monitor. In situations of unavailability or unfamiliarity with the use of flexible fiberscope, the laparoscope can be easily used to assist intubation for unanticipated difficult airway. It even provides a better magnification and a steady view on the monitor. The technique is simple and closely resembles conventional intubation.

This technique allows looking at the video display on monitor which is far more comfortable than looking into the eye piece of an endoscopic device in a critical situation. As the operator remains in the usual intubation position and can easily change the view from the oropharynx to the monitor and vice versa, it allows nearly simultaneous observation of the video display, patient and monitor. The technique provides display for multiple viewers, demonstration, supervision and teaching purpose and also allows video-taping for subsequent review or documentation of the intubation procedure. Theoretically, this technique provides an atraumatic intubation as it is done under direct vision.

Our study has few limitations. The technique cannot be used in patients with small mouth opening and space occupying lesions of the oral cavity. We also did not compare the tracheal intubation time using the conventional Macintosh laryngoscope and laparoscope-assisted intubation.

Our study demonstrated that laparoscopic assistance improved the glottic view seen during conventional laryngoscopy. The technique finds use in cases of unexpected difficult airways and in routine teaching programmes. However, further studies are needed to evaluate its role in facilitating TT insertion, reducing TTI for difficult airway and decreasing pharyngolaryngeal adverse effects.

REFERENCES

1. Miller CG. Management of the difficult intubation in closed malpractice claims. ASA Newsletter 2000;64:13–6.
2. Bjoraker DG. The Bullard intubating laryngoscopes. Anesth Rev 1990;17:64–70.
3. Sun DA, Warriner CB, Parsons DG, Klein R, Umedaly HS, Moult M. The Glidescope® video laryngoscope: Randomized clinical trial in 200 patients. Br J Anaesth 2005;94:381-4.
4. Weiss M, Hartmann K, Fischer JE, Gerber AC. Use of angulated video-intubation laryngoscope in children undergoing manual in-line neck stabilization. Br J Anaesth 2001;87:453-8.
5. Halligan M, Weldon B, Charters P. A clinical appraisal of the Bonfils intubating fibrescope. Br J Anaesth 2002;89:671–2.
6. Mallampati SR, Gatt SP, Gugino LD, Desai SP, Waraksa B, Freiberger D, *et al*. A clinical sign to predict difficult tracheal intubation: A prospective study. Can Anesth Soc J 1985;32:429–34.
7. Samsoon GL, Young JR. Difficult tracheal intubation: A retrospective study. Anaesthesia 1987;42:487–90.
8. Frerk CM. Predicting difficult intubation. Anaesthesia 1991; 46:1005–8.
9. Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. Anaesthesia 1984;39:1105–11.
10. Gupta AK, Sharma B, Kumar A, Sood J. Endoscope assisted intubation: An approach to airway management. Anesth Analg 2007;104:465–6.
11. Farooq M. Is endoscope assisted intubation a useful addition to difficult airway management. Anesth Analg 2007;105:540–1.
12. Ravishankar M, Kundra P, Agarwal K, Kutralam NS, Arun N, Vijaykumar OP. Rigid nasendoscope with video camera system for intubation in infants with Pierre-Robin sequence. Br J Anaesth 2002;88:728–32.
13. Krantz MA, Poulos JG, Chaouki K, Adamek P. The laryngeal lift: A method to facilitate endotracheal intubation. J Clin Anesth 1993;5:297–301.
14. Wilson ME, Spiegelhalter D, Robertson JA, Lesser P. Predicting difficult intubation. Br J Anaesth 1988;61:211–6.

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