

# Study of role of malleable stylet vs gum elastic bougie in facilitation of tracheal intubation with and without use of cricoid pressure

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## Abstract

**Background:** Use of gum elastic bougie is recommended by anesthesiologists, especially in difficult intubation. However stylet is still routinely used as an aid to difficult intubation worldwide. We aimed to compare the two towards their role in facilitation of intubation while applying cricoid pressure, as applying cricoid pressure may cause difficulty with tracheal intubation by distorting larynx. **Methods:** Six hundred patients posted for surgical procedure under general anesthesia were randomly allocated to 4 equal groups of 150 participants each, formed on the basis of bougie/stylet usage and Cormack-Lehane/Cook grading. The groups were compared for differences in glottic view, change in laryngeal view while applying cricoid pressure, number and duration of attempts of laryngoscopy, hemodynamic changes and complications, if any. **Results:** The view of larynx significantly worsened in majority of cases when cricoid pressure was applied. Percentages of patients intubated in first attempt were more in bougie group than in stylet group. With regards to stress response all the four groups were comparable. The usage of bougie was not associated with significant increase in complications either. **Conclusion:** Applying cricoid pressure worsens the laryngeal view. Percentage of patients intubated in first attempt were more in bougie group than in stylet group and patients who were not able to be intubated with stylet were intubated with bougie easily suggesting use of bougie eases tracheal intubation while applying cricoid pressure

**Key Word:** malleable stylet, gum elastic bougie, tracheal intubation, cricoid pressure

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## INTRODUCTION

In difficult airway situation, bougie and stylet are tried to circumvent the situation. In patients with full stomach; cricoid pressure, applied to prevent regurgitation and aspiration, may cause difficulty with tracheal intubation by distorting laryngeal view.<sup>2-4</sup> To overcome this

difficulty, the use of stylet and/or gum elastic bougie is recommended as an aid to difficult intubation worldwide.<sup>5-7</sup> We studied usage of stylet and of bougie with/without use of cricoid pressure w.r.t. their differences in glottic view, change in laryngeal view while applying cricoid pressure, number and duration of attempts of laryngoscopy, hemodynamics and complications.

## METHODOLOGY

The present study was a hospital based prospective observational study conducted at a tertiary care government teaching hospital over the period of two years. Patients with age group of 18-75years, ASA<sup>8</sup> grade I/II and with Mallampati classification<sup>9</sup> (MPC) grade I, II and III undergoing elective surgery under general anesthesia were included in the study. Patients with difficult mask ventilation, patients with pathology in

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neck, upper respiratory tract and upper alimentary tract, patients at risk of pulmonary aspiration of gastric contents and those not willing to consent for the study were excluded. Total 600 patients posted for surgical procedure under general anesthesia, selected as per mentioned criteria, were randomly allocated to either of the 4 groups of 150 participants each as follows:

- Group A-Bougie usage and Cormack-Lehane grading<sup>10</sup> with/without cricoid pressure (Bougie CL)
- Group B-Bougie usage and Cook's modified grading<sup>11</sup> with/without cricoid pressure (Bougie Cook)
- Group C-Stylet usage and Cormack-Lehane grading with/without cricoid pressure (Stylet CL)
- Group D-Stylet usage and Cook's modified grading with/without cricoid pressure (Stylet Cook)

Detailed pre-anesthetic evaluation was done prior to surgery and patients were investigated according to institutional protocol, along with detailed airway assessment. In the operation room, standard monitors were attached. Intravenous access secured and Ringer Lactate was started. All patients were pre-medicated with Injection Glycopyrrolate 4 mcg/kg, Ranitidine 50 mg and Midazolam 0.03 mg/kg iv. After pre-oxygenation, induction was done with inj. Fentanyl 2 mcg/kg and inj. Propofol 2 mg/kg i.v. and intubation was facilitated with Injection Vecuronium Bromide 0.1mg/kg IV and maintained with oxygen:nitrous oxide (40%:60%) and Sevoflurane(1-3%). Muscle relaxation was maintained by intermittent bolus of Vecuronium. Diclofenac Sodium 1.5 mg/kg IM was given after intubation. The patient's head and neck were kept in optimal intubating position during intubation. Laryngoscopy was performed with a size 3 blade in order to grade the laryngeal view. After recording the best view of the larynx, a brief period of controlled hyperventilation with 100% oxygen was resumed. Laryngoscopy was repeated while applying cricoid pressure and the view of the larynx was graded again. Cricoid pressure was maintained at 30 N until intubation and, inflation of the cuff was completed. The intubation procedure was performed according to study protocols as described. In the bougie group, a well-lubricated gum elastic bougie was gently passed. Correct placement in the trachea was indicated by the sensation of 'clicks' as the distal end of bougie slides over the tracheal rings. Once the bougie was thought to be in the trachea, the tracheal tube was threaded over the bougie by the anesthesiologist. The bougie was withdrawn and the breathing circuit was connected to the tube. Successful

tracheal intubation was confirmed by capnography. In stylet group, a malleable metal stylet was well lubricated and placed in the tracheal tube. The distal end was bent into a 'hockey stick' shape. Once the tube was thought to have entered the trachea, the stylet was withdrawn and the breathing circuit was connected. In all patients in whom tracheal intubation was successful, the time from removal of the facemask to successful tracheal intubation (confirmed by a normal capnogram) was recorded. In the bougie group, the time from removal of the facemask to the correct placement of the bougie by confirming 'click' or 'distal hold up' sensation (T1) and the time from the placement of the bougie to successful tracheal intubation (T2) were measured separately. Total time for intubation was taken as the sum of T1 and T2. When tracheal intubation failed at the first attempt, but succeeded at the second attempt, the sum of the time taken for the first and the second attempts was noted (excluding the ventilation period between attempts). In both groups, each attempt at tracheal intubation was allowed not more than 60sec. If the trachea could not be intubated at the first attempt, one more attempt was allowed. If tracheal intubation failed with two attempts, another method (cross-over to the other device) was used and one more attempt was allowed. If arterial hemoglobin oxygen saturation (SpO<sub>2</sub>) decreased below 95%, the study was abandoned immediately and appropriate treatment was instituted. If all attempts at intubation failed, the case was excluded from the study and trachea was intubated using another method. At the end of surgery, neuromuscular block was reversed with injection Glycopyrrolate 8 mcg/kg + Neostigmine 0.05 mg/kg I.V. and the patients were extubated. The study had prior approval from the Institutional Ethics Committee. Statistical analysis was carried out by SPSS and GraphPadInstat. ANOVA application, Chi square test, students t test wherever applicable.

## RESULTS

In the present study, 600 patients posted for surgical procedure under general anesthesia were randomly allocated to 4 groups of 150 participants each, on the basis of usage of either stylet or bougie and application of cricoid pressure and comparisons drawn. The groups didn't differ significantly with respect to mean age, sex weight and ASA status of the participants. The differences between all the studied parameters of airway assessment were also not statistically significant. (P>0.05). (Table 1)

**Table 1:** Comparison of airway assessment among the groups

PARAMETERS	Group-A (Bougie CL)	Group-B (Bougie Cook)	Group-C (Stylet CL)	Group-D (Stylet Cook)
<b>No of Patients</b>	150	150	150	150
<b>Inter-Incisor Gap(cm)</b>	5.85	4.81	5.86	5.82
Mean SD	0.55	0.63	0.55	0.56
<b>Mento-Hyoid Distance(cm)</b>	5.87	5.86	5.87	5.90
Mean SD	0.35	0.38	0.34	0.36
<b>Mento-Thyroid Distance(cm)</b>	7.63	7.49	7.65	7.63
Mean SD	0.45	0.59	0.45	0.43
<b>Mento-SternalDistance(cm)</b>	14.30	14.31	14.27	14.34
Mean SD	0.79	0.89	0.79	0.83

The percentage of patients in Group A (Bougie CL) with Cormack-Lehane grade 1, 2, 3 and 4 were 52%, 16%, 24.66% and 7.33% respectively. After applying cricoid pressure, these percentages of grades changed to CL 1, 2, 3 and 4 as 22%, 26%, 30% and 22% respectively. Laryngeal view remained the same in 44% of patients, worsened by one grade in 28% of patients, worsened by two grades in 22% of patients and improved in 6% of patients. Statistically, view of larynx worsened when cricoid pressure was applied ( $p < 0.05$ ). Similarly, the percentage of patients in Group C (Stylet CL) with Cormack-Lehane grade 1, 2, 3 and 4 were 54%, 20.66%, 19.33% and 6% respectively. After applying cricoid pressure, these percentages of grades changed to CL 1, 2, 3 and 4 as 24.66%, 22%, 36.66% and 16.66% respectively. Laryngeal view remained the same in 46% of patients, worsened by one grade in 28% of patients, worsened by two grades in 20% of patients and improved in 6% of patients. Statistically view of larynx worsened when cricoid pressure was applied ( $p < 0.05$ ).

**Table 2:** Comparison of groups for Cormack Lehane and Cook's optimal view (without and with cricoid pressure)

Cormack-Lehane Grading				
	Group A (Bougie CL) (N = 150) Without pressure	Group A (Bougie CL) (N = 150) With pressure	Group C (Stylet CL) (N = 150) Without pressure	Group C (Stylet CL) (N = 150) With pressure
<b>1 (I)</b>	78 (52%)	33 (22%)	81 (54%)	37 (24.66%)
<b>2 (II)</b>	24 (16%)	39 (26%)	31 (20.66%)	33 (22%)
<b>3 (III)</b>	37 (24.66%)	45 (30%)	29 (19.33%)	55 (36.66%)
<b>4 (IV)</b>	11 (7.33%)	33 (22%)	9 (6%)	25 (16.66%)
Cook's Grading				
	Group B (Bougie Cook) (N = 150) Without pressure	Group B (Bougie Cook) (N = 150) With pressure	Group D (Stylet Cook) (N = 150) Without pressure	Group D (Stylet Cook) (N = 150) With pressure
<b>1</b>	83(55.33%)	36(24%)	75(50%)	27(18%)
<b>2 (2a)</b>	28(18.66%)	44(29.33%)	23(15.33%)	43(28.66%)
<b>3 (2b)</b>	30(20%)	46(30.66%)	40(26.66%)	47(31.33%)
<b>4 (3a)</b>	9(6%)	24(16%)	12(8%)	33(22%)

Table 2 also shows that percentage of patients in Group B (Bougie Cook) with Cook's grades 1, 2(2a), 3(2b) and 4(3a) were 55.33%, 18.66%, 20% and 6% respectively. After applying cricoid pressure, the percentages of grades changed to Cook's grade 1, 2, 3 and 4 as 24%, 29.33%, 30.66% and 16% respectively. From above table it can be seen that laryngeal view remained the same in 43.33% of patients, worsened by one grade in 30% of patients, worsened by two grades in 20% of patients and improved in 6.66% of patients. Statistically, view of larynx

worsened when cricoid pressure was applied ( $p < 0.05$ ). Table 2 also shows percentage of patients in Group D (Stylet Cook) with Cook's grade 1, 2(2a), 3(2b) and 4(3a) were 50%, 15.33.0%, 26.66% and 8% respectively. After applying cricoid pressure, these percentages of grades changed to Cook's grade 1, 2(2a), 3(2b) and 4(3a) as 18%, 28.66%, 31.33% and 22% respectively. From above table it can be seen that laryngeal view remained the same in 40% of patients, worsened by one grade in 30% of patients, worsened by two grades in 22% of patients and

improved in 8 % of patients. Statistically, view of larynx worsened when cricoid pressure was applied ( $p < 0.05$ ). The mean time T1 was  $13.03 \pm 0.91$  sec in Group A (Bougie CL), in Group B (Bougie Cook)  $12.81 \pm 0.79$ , in Group C (Stylet CL)  $13.41 \pm 0.87$  and in Group D (Stylet Cook) it was  $13.49 \pm 0.83$  seconds. The difference was statistically significant. The mean time T2 was  $14.69 \pm 2.30$  sec in Group A (Bougie CL), in Group B (Bougie Cook)  $15.04 \pm 2.16$  sec, in Group C (Stylet CL)  $17.68 \pm 5.43$  and in Group D (Stylet Cook) it was  $18.41 \pm 5.98$  seconds. The difference was statistically significant. As for number of attempts required for intubation amongst groups, in group A (Bougie CL) 92.66% of patients were intubated in first attempt, while 7.33% required second attempt with bougie. In group C (Stylet CL) 84.0% of patients were intubated in first attempt, while 16.0% required second attempt, out of which 7.33% were intubated with stylet and 8.66% required bougie for intubation. In group B (Bougie Cook) 92.0% of patients were intubated in first attempt while 8.0% required second attempt with bougie. And in group D (Stylet Cook) 80.0% of patients were intubated in first attempt while 20.0% required second attempt, out of which only 6.0% were intubated in second attempt with stylet and 14.0% required bougie for intubation. The difference was statistically significant ( $p < 0.05$ ). The mean heart rate, mean arterial pressures (systolic/diastolic) didn't vary much between groups, but went up significantly from the baseline during intubation and one minute after across the groups. The values did come down after 5 minutes passed after the intubation, but didn't reach the baseline in any of the four groups across parameters. Incidence of complications across the four groups were minimal and comparable.

## DISCUSSION

Preoperative airway evaluation of patients would decrease the rate of anesthesia related adverse respiratory event. But no test is 100% sensitive and specific. So some difficult tracheal intubations are missed and some false positive may occur. An unexpected difficult intubation is always possible for which difficult intubation drill has been described. It includes use of many instruments like stylet and gum elastic bougie. Also airway management in patients with full stomach is challenging to the anesthesiologist. To prevent regurgitation of gastric contents, application of cricoid pressure has become a standard practice. However, applying cricoid pressure may cause difficulty with tracheal intubation by distorting larynx. The aim of our study was to compare the ease of tracheal intubation facilitated by a gum elastic bougie or a malleable stylet while applying cricoid pressure. The differences between all the studied parameters of airway

assessment were not statistically significant. ( $P > 0.05$ ). These findings sit perfectly well with previously available evidence<sup>12,14,15</sup> by McNeils *et al*<sup>16</sup> and Noguchi *et al*<sup>15</sup> The degree of difficulty of intubation is reflected by the duration required for it. In the present study duration of intubation was less by 5.5 seconds in the bougie than stylet group suggesting that intubation in bougie group had favorable difficulty level. Also percentages of patients requiring two attempts were higher in stylet group 16% to 20% than bougie group 7% to 8% showing that intubation with bougie is easier than stylet. In a previous similar study of 100 patients by Gataure, P.S. *et al*<sup>12</sup>, mean time taken for intubation in bougie group in first attempt was 14.4 sec and in second attempt it was 30.1 sec. It was 15.1 sec in first attempt and 36.6 sec in second attempt in stylet group; the difference being statistically significant. Similarly, Noguchi *et al*<sup>15</sup> observed that T1 was  $14 \pm 2$  seconds and T2 was  $19 \pm 3$  seconds for bougie group. When a bougie was used, there were no statistical differences in T1 and T2 and total time for intubation between the 'easy' (grade 1 and 2a) and 'restricted' (grade 2b and 3a) group. When a stylet was used, the duration of intubation in the patient with 'restricted' view was five seconds longer than that of easy patients. It can be seen that results are comparable to above studies. The success rate of tracheal intubation in the bougie group was observed to be significantly higher than that in the stylet group, a finding corroborative of that of Gataure P.S. *et al*<sup>12</sup>. The view of larynx worsened in almost half of the cases across groups when cricoid pressure was applied, while improvement was observed in very few cases. These findings were comparable to results in a similar study of 157 patient by Nolan *et al*<sup>20</sup>. The observed rates of complications were insignificant and comparable among the four study groups.

## CONCLUSION

In the present study, we observed that applying cricoid pressure worsens the view of larynx. It was found that when view of larynx was 'easy', the duration of tracheal intubation was short while with 'restricted' view duration was prolonged significantly in stylet group. In contrast, there were no marked differences between 'easy' and 'restricted' groups when bougie was used. Also percentages of patients intubated in first attempt were more in bougie group than in stylet group and patients who were not able to be intubated with stylet were intubated with bougie easily suggesting use of bougie eases tracheal intubation while applying cricoid pressure.

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