

# Comparison of the 'D blade' with the conventional blade of C-MAC<sup>®</sup> for endotracheal intubation in patients with simulated limitation of cervical movements

Shyamsunder Kamath\*, Anitha Shenoy

Email: shyamsunderkamath@yahoo.co.in

## Abstract

**Background:** The C-MAC<sup>®</sup> videolaryngoscope enables better visualisation of glottis for rapid and successful endotracheal intubation. **Aim:** The present study is aimed at comparing the conventional C-MAC<sup>®</sup> blade with new 'D' blade in patients with simulated cervical spine immobilisation. **Methods:** This was a prospective, randomised and crossover study. Eighty patients were randomised to one of two groups: Group CD or Group DC (CD - Conventional blade first, DC-D blade first). Patients in each group had laryngoscopy performed with both the blades in random order following which the patient's trachea was intubated using the blade used for second laryngoscopy. **Results:** The mean ( $\pm$  SD) age was 39.4 ( $\pm$  12.4) years. There were 33 male and 47 female patients. The average weight was 57.2 kg. No patient had a grade 3 or 4 view at initial laryngoscopy (without cervical spine immobilisation) with Macintosh blade and hence not excluded. 75 patients had a grade 1 view and 5 patients with grade 2 view with D blade whereas 63 patients had a grade 1 view and 17 patients had a grade 2 view with the conventional blade. The difference was clinically and statistically very significant. The time taken for laryngoscopy and intubation, and the overall satisfaction score did not differ between the groups. **Conclusions:** The D blade of C-MAC<sup>®</sup> videolaryngoscope enables better visualisation of glottis as compared to the conventional blade, for endotracheal intubation in patients with simulated limitation of cervical movements. The time taken for laryngoscopy, endotracheal intubation and the overall satisfaction score did not differ between the two blades.

**Keywords:** C-MAC<sup>®</sup>, D blade, videolaryngoscope, cervical immobilisation.

## Introduction

The visualisation of the glottis for rapid and successful endotracheal intubation has been made easier with the invention of videolaryngoscopes. Although Glidescope was the first popular videolaryngoscope, many others have been marketed

since<sup>1-5</sup>. The C-MAC<sup>®</sup> videolaryngoscope from Karl Storz is a videolaryngoscope with a blade similar to Macintosh blade, the conventional C-MAC<sup>®</sup> blade (*Figures 1 and 2*).<sup>6</sup> It is a modification of Macintosh blade, with similar curvature of the blade. The premise is that anaesthesiologists are familiar with a Macintosh blade and converting it into a videolaryngoscope would be the most desirable method. Thus, the C-MAC<sup>®</sup> is generally available with a conventional C blade. A comparison of three videolaryngoscopes, the GlideScope, C-MAC<sup>®</sup>, and McGrath showed that the C-MAC<sup>®</sup> reduces,<sup>7</sup> but does not replace routine stylet use for intubation

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**Shyamsunder Kamath, MD**  
Associate Professor of Anaesthesiology,  
Kasturba Medical College, Manipal

**Anitha Shenoy, MD, FRCA**  
Professor of Anaesthesiology,  
Kasturba Medical College, Manipal

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**Figure 1:** Conventional C-MAC® blade.



**Figure 3:** C-MAC® with D'Blade

in morbidly obese patients.<sup>8</sup> However, for use in situations where the larynx is very anterior, a new D blade with a greater curvature than the conventional blade has been marketed (*Figure 3*). The D blade has been found to be very useful in prehospital emergency situations.<sup>9</sup> The present study is aimed at comparing the conventional blade of the C-MAC® with the new D blade for endotracheal intubation in patients with simulated cervical spine immobilisation.

### Patients and methods

This was a prospective, randomised and crossover study. The Institutional Ethical Committee approval as well as the informed consent from patients were

obtained. Eighty patients aged between 18 – 65 years, weighing 40 – 80 kg, belonging to ASA I and II, scheduled for elective surgery under general anaesthesia requiring orotracheal intubation were studied. The patients requiring awake tracheal intubation/rapid sequence induction of anaesthesia or having anticipated difficult airway, those scheduled for neck surgeries and patients requiring throat pack / nasogastric tube were excluded from the study.

All the patients were assessed on the previous day by Observer 1 and kept fasting according to the standard guidelines. Premedication consisted of lorazepam 1 mg (< 50 kg body weight) or 2 mg (> 50 kg body weight) orally the night before and 2 hours prior to the surgery. The patients were monitored in the operating room using electrocardiograph monitoring lead II, noninvasive blood pressure and pulse oximeter. Intravenous (IV) access was secured and anaesthesia induced with propofol 2-2.5 mg/kg IV. Post induction monitors included capnograph (ETCO<sub>2</sub>) and peripheral nerve stimulator. Effective mask ventilation was confirmed and muscle relaxation achieved using vecuronium bromide 0.1 mg/kg IV. Anaesthesia was maintained with isoflurane (1.5% in 6-8 L/min oxygen), intermittent positive pressure ventilation using a semiclosed circle absorber in addition to boluses of propofol as required.



**Figure 2:** Videolaryngoscopic view of endotracheal intubation using C-MAC®.

After induction of anaesthesia and establishing neuromuscular blockade, direct laryngoscopy

was performed by Observer 2 using Macintosh laryngoscope to assess visibility of the glottis. If the laryngeal view was Cormack and Lehane grade 3 or 4, the patients were excluded from the study. If the laryngeal view was grade 1 or 2, the pillow under the head was removed and cervical spine manually immobilised by Observer 3 (the anaesthesiologist in-charge of the case). Observer 3 (he/she) also helped in monitoring the patients.

The patients were randomised to one of two groups: Group CD or Group DC. Patients in Group CD had laryngoscopy performed with conventional blade of C-MAC® first and then with D blade following which the patient's trachea was intubated using D blade. Patients in Group DC had laryngoscopy performed with the D blade first and then with conventional blade following which the patient's trachea was intubated using the conventional blade. Thus, every patient had first laryngoscopy with a Macintosh laryngoscope in the neutral position. This was followed by laryngoscopy using the conventional and the D blade, the order of which was randomised.

#### Following parameters were recorded

- **The time to laryngoscopy** was recorded as the time from the beginning of the insertion of the laryngoscope into the oral cavity until obtaining the optimal laryngeal view.
- The best laryngoscopic view was graded after permitting external laryngeal manoeuvre as necessary. The grading was as follows:
  - Grade 1:* All portions of the glottis seen (both vocal cords, arytenoids and the glottic chink)
  - Grade 2:* Only posterior part of vocal cords and arytenoids seen.
  - Grade 3:* Only epiglottis seen
  - Grade 4:* Epiglottis not seen.
- **The time to intubate** (in seconds) was recorded as the time from the beginning of the insertion of the endotracheal tube (ETT) until visualisation of black line of the tube just above the vocal cords. If intubation was unsuccessful, each of the further attempts excluding the period of interposed ventilation was timed separately.

- The **total time of intubation(s)** was taken as the sum of the time taken at each attempt at intubation until successful intubation was achieved.
- The **number of intubation attempts** was counted as each approach of the ETT to the glottic entrance after the visualisation of the glottis.
- An **overall satisfaction score** of the intubating conditions was rated by Observer 2 on a scale from 0 to 2.
  - 0 = Poor (intubation not possible with the designated videolaryngoscope even after external laryngeal manipulation and two attempts)
  - 1 = Moderate (external laryngeal manipulation required to visualise vocal cords, two attempts required or a bougie used to aid endotracheal intubation)
  - 2 = Good (Grade 1 or 2 view without laryngeal manipulation, intubation successful in the first attempt).
- Any trauma during intubation was assessed using presence of blood on the endotracheal tube after extubation and postoperative sore throat.

All quantitative data were compared using Student's t test and qualitative data using Chi-square test. The sample size was determined to be 40 in each group to detect a difference of twenty seconds for intubation between the groups with a power of 80% and an alpha error of 0.05.

#### Results

A total of 80 patients were studied. The demographic data of the patients is given in *Table 1*.

**Table 1:** Demographic data

No of patients (n)	80
Age (y) (mean ± SD)	39.4 ± 12.4
Gender (M/F) (n)	33/47
Weight in kg (mean ± SD)	57.2 ± 10.2
Height in cm (mean ± SD)	162.3 ± 6.2
BMI (mean ± SD) (kg/m <sup>2</sup> )	21.6 ± 3.0

No patient had a Grade 3 or 4 view at the first laryngoscopy using Macintosh laryngoscope and thus none were excluded. 75 patients had a Grade 1 view with D blade and 5 patients with Grade 2 view whereas with the conventional blade, 63 patients had a Grade 1 view and 17 had a Grade 2 view (*Table 2*). The difference was very significant both clinically and statistically.

**Table 2:** Laryngoscopic view

Cormack-Lehane Grade	Conventional blade	D blade
1	63	75
2	17	5

Chi square test:  $p = 0.0103$

The time for laryngoscopy was significantly shorter with the D blade although this is not clinically significant. The time for intubation was, however not different (*Table 3*). Overall satisfaction score was two in both groups. No patient had any evidence of trauma such as blood on the ETT/sore throat.

**Table 3:** Time taken for laryngoscopy and intubation

	Conventional blade	D blade	p value
Time for laryngoscopy (s)	15.21 ± 10.48	10.35 ± 8.08	0.0013
Time for intubation (s)	20.55 (40) ± 14.99	19.11 (37) ± 10.05	0.069

Student's t test

## Discussion

The C-MAC<sup>®</sup> is a videolaryngoscope which has minimal learning curve as the blade available with it is a modification of Macintosh blade familiar to every anaesthesiologist. The insertion of this conventional blade of C-MAC<sup>®</sup> is similar to Macintosh laryngoscope blade but visualisation of larynx is better as the camera shifts the viewing point to the pharynx. A comparison of the C-MAC<sup>®</sup> videolaryngoscope with the Macintosh, Glidescope and Airtraq laryngoscopes in easy and difficult

laryngoscopy scenarios in manikins showed that the C-MAC<sup>®</sup> was easiest to use, especially in difficult airways.<sup>10</sup>

Movement of the cervical spine may still occur in spite of cervical immobilisation. This is possibly minimised by using videolaryngoscopes although this is controversial<sup>11,12</sup>. The D blade is more curved and is designed to improve the visualisation of larynx in difficult airways.<sup>13</sup> However, easy laryngoscopy itself does not translate into easy endotracheal intubation. The endotracheal tubes must be shaped into a hockey stick shape or a 'J' shape with the use of stylet. Better visualisation enables better guidance of the endotracheal tube into the glottis. Despite very good visualisation of the glottis, it is known that the insertion and advancement of the ETT with videolaryngoscopes may occasionally fail<sup>14</sup>. In the rare situation where laryngeal viewing is not possible even with a videolaryngoscope, the passage of a bougie or a tube guide might be easier and less blind using a videolaryngoscope. Cavus *et al*, described the successful use of C-MAC<sup>®</sup> size 4 blade in the first attempt in three patients who had unexpected difficult laryngoscopy (Cormack and Lehane Grade 3, 4 and 4 respectively) with an improvement to Cormack-Lehane (Cook's modification) Class 1, 2a, and 2b, respectively by using it in a modified manner by uploading the epiglottis, which is known as "straight blade technique".<sup>6</sup>

The study was of crossover design and the comparison of two blades shows distinctly the improved visualisation with the use of the D blade. However, the present study included patients with simulated difficult airway due to cervical immobilisation only. It is possible that the D-blade may prove more useful over the conventional blade of the C-MAC<sup>®</sup> videolaryngoscope in other kinds of predicted difficult airways but this need to be studied.

## Conclusions

The new D blade of the C-MAC<sup>®</sup> videolaryngoscope enables better visualisation of the glottis as compared to the conventional blade of the C-MAC<sup>®</sup> for endotracheal intubation in patients with simulated

limitation of cervical movements. The time taken for laryngoscopy, endotracheal intubation and the overall satisfaction score do not differ between the two blades.

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