Original Article

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Comparison Between C-Mac Videolaryngocope and Intubating Laryngeal Mask Airway for Intubation in Obese Patients

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Abstract

Background: In our study, we have done a comparison between C-mac videolaryngocope and Intubating laryngeal mask airway for intubation in obese patients. **Subjects and Methods:** 60 patients were chosen based on certain parameters and intubated with either C-mac Videolaryngoscope or Intubating Laryngeal Mask Airway. During Intubation the following parameters were recorded - total time taken for intubation, number of attempts taken for intubation, changes in the hemodynamic parameters, any special manuveure if used and any errors incountered. A Prospective observational randomised comparative study was done, appropriate tests were applied and results were obtained. **Results:** Study shows that the C-MAC video laryngoscope is associated with high success rates and shorter intubation times compared to the Intubating Laryngeal Mask Airway (ILMA) specifically, in obese patients. **Conclusion:** The study's findings indicate that "the C-MAC video laryngoscope is a better option for intubation in obese patients as compared to Intubating Laryngeal Mask Airway.

Keywords: Obesity; Body Mass Index; Difficult Airway; Videolaryngoscope; Intubating Laryngeal Mask Airway.

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Introduction

The World Health Organization's definition of Obesity highlights it as a condition with excess body fat to the extent that physical and mental health are drastically affected1. Obesity is a complex health issue which involves an inordinate quantum of body fat. Obesity is not just a matter of appearance; it's a significant health concern that can trigger other medical issues.

Obesity as a problem is not only an invitation to a many health related issues but also a nightmare for the Anaesthesiologist. It not only has its adverse implications on multiple organ systems but also makes it challenging for the anaesthesiologist to perform the various General and Regional anaesthesia techniques.

Heavy built patients witnessing different surgeries come up with colourful challenges at the time of intubation like big tongue with bulky "cheeks, increased pharyngeal masses, short neck, increased neck circumference and heavy breasts, all leading to" difficulty in BMV and intubation of these patients.[1,2]

In order to solve the problem of intubation difficulties in heavy built patients several modifications have been done in the basic model of Intubating devices and various maneuvers have been introduced.

CMAC (Karl Storz, Tuttlingen, Germany) is a videolaryngoscope that is superior to direct laryngoscopy in patients with a normal Body Mass Index (BMI), obese patients, and those patients with difficult airways.

The intubating laryngeal mask airway (ILMA; Fastrach; Laryngeal Mask Co., Henley on Thames, UK) was produced by Dr.Archie Brain at the London Hospital, Whitechapel, in 1981 to overcome difficult mask ventilation and difficult intubation. It still has a valuable role in unexpected difficult airway algorithms.

Subjects and Methods

We aim to "compare CMAC Vidoelaryngoscope and ILMA for endotracheal Intubation in obese patients with a BMI of >25kgm2 ".

Study subjects: 60 patients of ASA grade 1–3, between 18 and 65 years of age and & BMI >25 kg.m−2, who underwent elective surgery and required tracheal intubation via oral cavity, were made a part of this study. Patients were intubated with one of the devices mentioned.

Site of Study: Study was conducted in the Department of Anaesthesia at SRMS IMS, Bareilly after prior approval of Institute's ethical committee.

Study Design: Prospective observational randomised comparative study.

Source of Subjects: Patients admitted in the hospital under various surgical departments for undergoing elective surgery under General Anaesthesia.

Study Period:1st September 2022 to 28th February 2024

Inclusion Criteria:

- Patients with a BMI of 25kg/m2 and above posted for elective surgery

- Any Sex
- Age between 18 to 65 years.
- ASA grade 1, 2 and 3

Exclusion Criteria

- Refusal by the patient
- ASA 4 grade patient
- Prior history of difficult intubation
- Pregnancy
- BMI < 25
- Mouth opening< 3 cm
- Inadequate NPO (< 8 hours)
- Prior history suggesting upper respiratry tract infection

Study Methodology

Obesity was diagnosed with Body Mass Index calculation of the patients, using the following formula, -

$BMI = kg/m^2$

kg: weight in kilograms and m^2 : height in metres squared.

Using this, the patients were categorized as-

- underweight (<18.5 kg/m2),
- normal BMI (18.5–22.9 kg/m2),
- overweight (23.0 –24.9 kg/m2)
- obese (≥25 kg/m2)

On the basis of guideline provided by the revised consensus of India and stated in the National Health Portal of India Patients will be distributed into two groups of 30 each and randomly allotted into each group

Group 1: Intubation done using Cmac Videolaryngoscope.

Group 2: Intubation done with the help of Intubating Laryngeaal mask airway

Data Collection Method

Pre-Anaesthetic Checkup:

We started with taking brief history of the medical condition of the patient and proceeded with the general and systemic examination. Routine investigation and any special investigation (if indicated) were done one day before surgery. Written and informed consent was taken from the patients and procedure was explained to every patient.

Complete airway examination was done at the time of Pre anaesthestic checkup itself. "Demographic (age, gender, weight, height, BMI, ASA physical status) and airway variables (thyromental distance, sternomental distance, interincisor distance, neck circumference, Mallampati grade, mouth opening, neck movement, teeth morphology, etc" were recorded.

Technique Of Anaesthesia: Pre operatively IV line was secured with a 16 or 18 G cannula. Preloading with 500ml fluid was done for each and every patient.

"When patients arrived in the operating room, standard anesthesia monitoring, including electrocardiogram, noninvasive blood pressure, heart rate, pulse oximetry (SpO2) and end-tidal carbon dioxide was applied".

All patients were pre-oxygenated in a 25° ramped position using a facemask with 5 L.min−1 100% O2 for a period of 3 to 5 minutes.

For premedication purpose – "Inj Ondanesetron(0.15mg/kg), Inj Glycopyrolate(0.005mg/kg), Inj Midazolam (0.05mg/kg), Inj Fentanyl (2mcg/kg)"

For Induction purpose following drugs were given according to the weight of Patient-

Inj "Propofol(2mg/kg), Inj Scoline(2mg/kg)".

The "Patients were divided into two groups using the sealed envelope technique; the standard C-MAC and the ILMA Groups.

In the C-MAC Group, a 7.5 mm lubricated polyvinylchloride endotracheal tube was used for women and an 8.0 mm tube for men.

In the ILMA group, for women a 7.0 mm lubricated ILMA tube was used and for men a lubricated ILMA tube of 8.0 mm was used".

In the standard C-MAC Group, routine insertion of the C-MAC blade in the oropharynnx and then inserting the endotracheal tube guided by the video on the screen was done. "For optimal visualisation (the best Cormack-Lehane view that we achieved) and insertion, the reinsertion manoeuvre and handling force manoeuvres were applied. As soon as optimal visualisation was achieved, the endotracheal tube was advanced into the trachea.

In the ILMA Group, an ILMA was fully deflated and the posterior wall of the ILMA was lubricated with 2% lidocaine jelly". ILMA was to be inserted with the standard approach that is to place the patients head in the sniffing and insert it along the arch of the palate. Once it reached the desired location an Endotracheal Tube was guided through it and the circuit was connected.

During the entire procedure of Intubation we recorded the following parameters-

1. **Total time taken for intubation:** "It refers to the total time elapsing from the time the device has entered the oral cavity till the time successful intubation is confirmed from the capnograph".
2. **Number of attempts taken for intubation:** After 3 failed attempts or time elapsed >120 secs the study was aborted
3. Changes in the hemodynamic parameters at 1 min gap taken thrice: Includes SBP DBP MAP SPO2 HR changes with the help of "an independent and unbiased observer in the operating room".
4. Any special manuveure if used was recorded.
5. Oesophageal intubation, teeth, tongue, lip or mucosal damage (bloodstaining on the device) were also recorded in the operating room".

Saturation less than 90 was recorded as hypoxaemia

Statistical Analysis: The data obtained from the study were subjected to statistical analysis using SPSS version 20.0 for further evaluation at the significance level of p-value=0.05. The data were presented as Mean ± standard deviation for continuous variables and frequency for categorical variables. Chi-square statistical analysis was done for categorical data, and for continuous data student's t-test were performed.

Results

The distribution of the cases on the basis of type of laryngoscope used and there were 50.0% cases that is 30 cases in each C-MAC (Karl Storz Video Macintosh Laryngoscope) and Intubating Laryngeal Mask Airway (LMA) group [Figure 1].

It was found that the mean age of the cases was 39.4±13.6 and 35.8±12.6 years respectively in group C-MAC and ILMA with female predominance in both groups and there was insignificant difference between the groups regarding all the parameters

(p>0.05) [Table 1] [Figure 2].

The comparison of hemodynamic variables was done between the groups before intubation and all the variables (HR, SBP, DBP, MAP, and SPO2) were comparable between the groups (p>0.05)[Table 2].

It was found that intubation was successful in first attempt in 63.3% cases of C-MAC than 43.0% in ILMA group whereas it was successful in third attempt in 6.7% cases of C-MAC than 20.0% in ILMA groups but the difference was insignificant (p>0.05)[Table 3][Figure 3].

The mean time taken for insertion between both groups was compared and it was found that for C-MAC 89.5±40.8 seconds was required for insertion than 105.0±41.5 for ILMA but the difference was statistically insignificant (p>0.05)[Table 4][Figure 4].

A total 8 manoeuvre were used in C-MAC as compared to 14 in ILMA[Table 5].

Hemodynamic parameters were found comparable between the groups at different time interval (p>0.05)[Table 6,7,8,9]

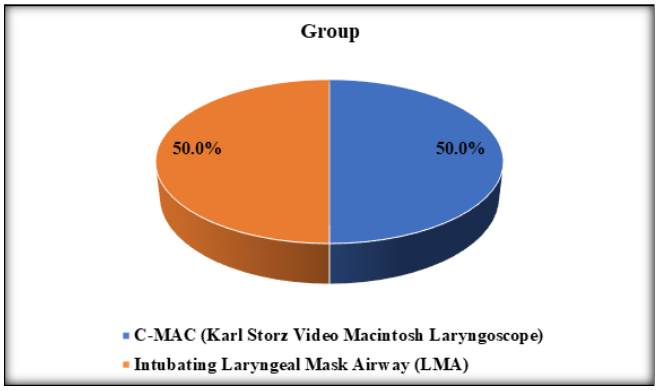

Figure 1: Distribution of the cases on the basis of group allocation

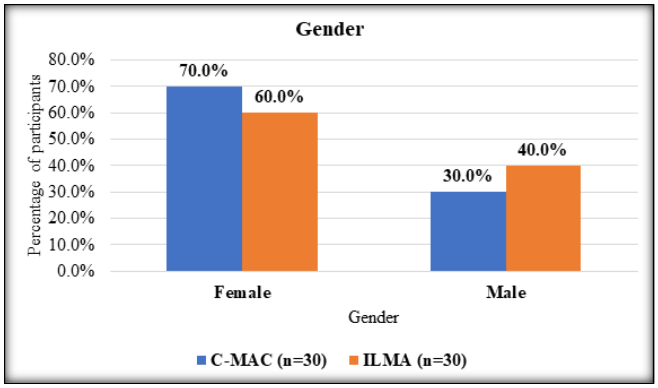

Figure 2: Gender Distribution between the two groups.

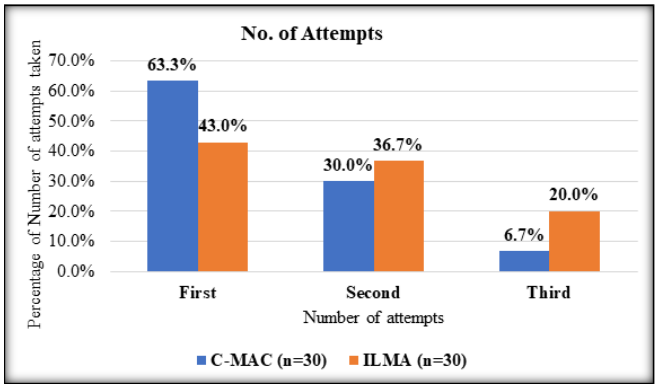

Figure 3: Number of Attempts taken for successful intubation in both the groups.

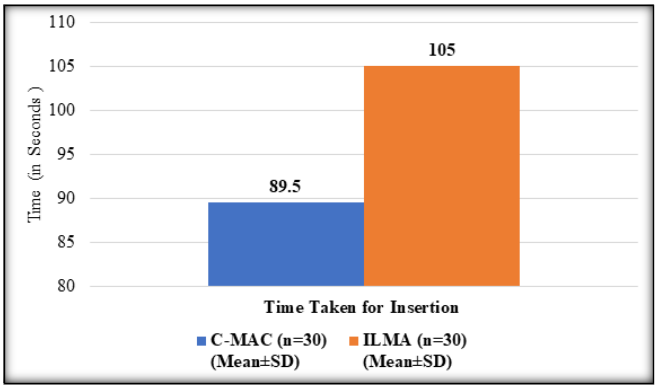

Figure 4: Time Taken for Insertion of endotracheal tube in both the groups.

Table 1: Demographic and anthropometric comparison between the two groups.

Demographic Data		Groups		p-value
		C-MAC (n=30)	ILMA (n=30)	
Age (Years)		39.4±13.6	35.8±12.6	0.292
Weight (Kg)		67.2±7.9	71.9±9.7	0.54
Height (m)		1.59±0.09	1.64±0.08	0.072
BMI (kg/m2)		26.5±1.13	26.7±1.3	0.490
Gender	Female	21 (70.0%)	18 (60.0%)	0.417
	Male	9 (30.0%)	12 (40.0%)	

Table 2: Distribution of studied patients based on Hemodynamic parameters between both groups

Hemodynamic Details (Before Induction)	Groups		p-value
	C-MAC (n=30)	ILMA (n=30)	
HR (bpm)	80.3±8.2	80.9±8.1	0.777
SBP (mmHg)	133.8±15.9	131.6±14.2	0.574
DBP (mmHg)	80.3±7.9	79.6±9.9	0.763
MAP (mmHg)	98.1±9.6	96.9±9.7	0.632
SpO2	100±0.0	100±0.0	1.00

Table 3: Distribution of the studied patients based on the number of attempts between both groups

No. of Attempts	C-MAC (n=30)	ILMA (n=30)	p-value
First	19 (63.3%)	13 (43.0%)	0.189
Second	9 (30.0%)	11 (36.7%)	
Third	2 (6.7%)	6 (20.0%)	

Table 4: Distribution of studied patients based on Time taken for insertion between both groups

Time Taken for Insertion	C-MAC (n=30) (Mean±SD)	ILMA (n=30) (Mean±SD)	p-value
(Seconds)	89.5±40.8	105.0±41.5	0.150

Table 5: Distribution of studied patients based on Manoeuvre used in both groups

Variables	C-MAC (n=30) (Mean±SD)	ILMA (n=30) (Mean±SD)	p-value
Manoeuvre (Present/Absent)	8 (26.7)	14 (46.7)	0.107
Guedels Airway	0 (0.0)	3 (10.0)	0.076
Bougie	0 (0.0)	4 (13.3)	0.038
Bougie and Guedels Airway	0 (0.0)	3 (10.0)	0.076
Cricoid Pressure	0 (0.0)	1 (3.3)	0.313
Stellate	4 (13.3)	3 (10.0)	0.687
Smaller size ETT	3 (10.0)	0 (0.0)	0.076
Smaller size LMA	1 (3.3)	0 (0.0)	0.313

Table 6: Distribution of studied patients based on Heart rate between both groups

Heart Rate	C-MAC (n=30)	ILMA (n=30)	p-value
	Mean±SD	Mean±SD	
Pre-intubation	80.3±8.2	80.9±8.1	0.777
1 min	100.9±13.6	105.9±15.6	0.191
2 min	96.4±17.5	102.9±21.1	0.199
3 min	83.4±9.9	86.6±10.8	0.236

Table 7: Distribution of studied patients based on SBP between both groups

SBP	C-MAC (n=30)	ILMA (n=30)	p-value
	Mean±SD	Mean±SD	
Pre-intubation	133.8±15.9	131.6.0±14.2	0.574
1 min	157.9±15.9	157.7±17.5	0.963
2 min	146.7±22.2	149.1±30.7	0.927
3 min	134.0±17.2	130.4±18.3	0.436

Table 8: Distribution of studied patients based on DBP between both groups

DBP	C-MAC (n=30)	ILMA (n=30)	p-value
	Mean±SD	Mean±SD	
Pre-intubation	80.3±7.9	79.6±9.9	0.763
1 min	85.03±7.1	89.2±10.0	0.231
2 min	90.8±11.2	88.9±14.2	0.567
3 min	83.7±8.7	80.5±9.6	0.181

Table 9: Distribution of studied patients based on MAP between both groups

MAP	C-MAC (n=30)	ILMA (n=30)	p-value
	Mean±SD	Mean±SD	
Pre-intubation	98.1±9.6	96.9±9.7	0.632
1 min	115.7±9.1	111.8±11.0	0.140
2 min	109.2±12.9	108.7±18.7	0.904
3 min	100.3±9.9	97.2±9.6	0.223

Discussion

In the present study, the mean age of the cases was 39.4±13.6 and 35.8±12.6 years respectively in group C-MAC and ILMA with female predominance in both groups and there was an insignificant difference between the groups regarding all the parameters (p>0.05). Mean weight, height, BMI, and ASA grade "were also comparable between the groups (p>0.05)". Our findings were in accordance with the findings of Jakhar R et al,[3] "who randomly" allocated patients into two groups, one undergoing intubation with CMAC laryngoscope "(intubation done with CMAC laryngoscope, n = 33) and other with ILMA group (intubation done using [ILMA, n = 32]). They found that the demographic characteristics of the study population in both groups were comparable" with no significant differences observed (p>0.05). Turna CK et al,[4] also reported comparable demographic variables between groups including age, height, weight, gender, ASA, and BMI. Again no significant differences were noted (p>0.05). In the study by Bhat R et al5 it was seen that the "mean age was 36.92 ± 15.1 years in the direct group as compared to 37.02 ± 15.13 years in the C-MAC group. The mean weight in the direct group was 50.54 ± 8.46 kg and 48.8 ± 7.90 kg in the C-MAC group". They found no statistically significant differences in age or weight between the two groups(p>0.05).

In our study it was found that "intubation was successful in first attempt in 63.3% cases of C-MAC than 43.0% in ILMA group whereas it was successful in third attempt in 6.7% cases of C-MAC than 20.0% in ILMA groups but the difference was insignificant (p>0.05)". Our findings were consistent with the findings of Jakhar R et al.[3] They observed a higher first attempt intubation rate (96.97%) with the CMAC laryngoscope "(32 out of 33 patients) compared to 81.25% in ILMA group (26 out of 32 patients). Additionally, Intubation success defined as completion within the first or second attempt, was achieved in all patients (100.0%) in CMAC group while it was successful in only 26 out of 30 patients (87.50%) even after two attempts in the ILMA group (P =0.054)". Although, the overall intubation success rate was higher in the C-MAC group, the difference was not statistically significant (p>0.05). Özdil S et al,[6] did a study in which he ILMA with Glidecope video laryngoscope for the purpose of intubation "in the presence of rigid neck collar. He found that the total intubation success rate was almost similar (up to 96%) with both the devices". According to a study by Bhat R et al,[5] who compared intubation with Direct laryngoscopy and C-MAC laryngoscope,[7] "patients (14%) in the direct group required >1 attempt of intubation whereas, in the C-MAC group, 3 patients (6%) required a second attempt".

In our study the comparison of mean Time taken for insertion was done it was found that for C-MAC 89.5±40.8 seconds was required for insertion which was very much lesser than 105.0±41.5 seconds for ILMA but the difference was statistically insignificant (p>0.05). Our findings correlate with the observations of study conducted by Jakhar R et al3 who reported statistically significant difference between both groups in relation to the the total time taken for successful intubation. In the CMAC group it was significantly shorter (P <0.0001) (33.13 ± 11.82 s) in comparison to the ILMA "group" (55.71 ± 19.28 s). Özdil S et al,[6] in their study also reported significantly longer total intubation duration for ILMA as compared to glidescope (85.6 ± 13s vs. 43.5 ± 13 s; P < 0.001)". With reference to the study conducted by Bhat R et al,[5] "the time taken for intubation time was 33.8 ± 9.12 s (mean) in the direct group and 24.8 ± 8.56 s in the C-MAC group (P = 0.001)". Ambulkar R et al,[7] also observed that the total time taken for securing the airway by tracheal tube "by novices in the VL group had a median value of 97.5 s (69.7–134.5) in comparison to 94 s (56–106) in the MAC group (P = 0.318). Rajan S et al,[8] also compared the C-MAC VL D blade to the MAC laryngoscope to assist nasotracheal intubation. He observed that the time required for intubation was much less in the VL group (24 vs 68 s). Jiang J et al,[9] conducted a research and found that the VL helped in improving the first attempt success rate", visualization of the larynx and shortened the time required for nasotracheal intubation. In yet another study,"glidescope showed a 92% first attempt intubation success rate in comparison to 84% with ILMA in morbidly obese patients who underwent bariatric surgery. However, time taken to secure airway with the help of ETT was found to be comparable between the glidescope and ILMA (49 s using the glidescope and 61 s using ILMA, P = 0.86)". Overall our study adds to the growing evidence that videolaryngoscopes are a valuable tool for managing airways, potentially leading to better

outcomes for patients and smoother procedures for the medical teams. However, "the mean time required for the purpose of tracheal intubation varied between the studies. The reason behind this difference could be the demographically different patient populations who were a part of these studies, different video laryngoscopes used, and different methodologies tried".

A total 8 manoeuvres were used in C-MAC as compared to 14 in ILMA. About 16 patients (48.48%) who belonged to the CMAC group needed external laryngeal pressure/manipulation. However, none of the patients required a bougie for guiding ETT in CMAC group. Sixteen patients (50%) belonging to the ILMA group required alternative maneuvers to assist intubation. In ILMA group, Chandy's maneuver was utilized in 11 patients out of a total of 32 patients (34.38%) and ILMA size was altered in five out of the same 32 patients (15.63%). Bhat R et al,[5] reported that the VL and MAC groups were comparable for the need of optimization maneuvers (p>0.05)". Turna CK et al,[4] reported that grade I MMPC was in 9 cases of Airtraq and 7 cases of ILMA, grade in 14 and 17 cases respectively (p>0.05). Manoeuvre present in 22 of 40 cases in Airtarq group and 16 of 40 cases in ILMA group (p>0.05).

In our study we examined various hemodynamic parameters such as heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and SpO2 at different points of time, pre-intubation, at 1 min, 2 min and 3 min. Interestingly we found out that all these parameters were comparable across all time points (p>0.05), indicating almost stable hemodynamics throughout the procedure. Similarly, Turna CK et al,[4] conducted a study where they monitored similar parameters during anaesthesia induction, device insertion and intubation "twice by an independent unbiased observer in the operating room". "They revealed that in the Airtraq Group, one patient's SpO2 decreased to 95%, but it did not go below 92% for any of the patients. The MAP was increased after device insertion in the ILMA Group ($p < 0.05$)". Additionally they observed that "heart rate changes were similar between the groups. Minor complications were comparable between both the groups". In contrast Jhakar R et al,[3] reported that the "heart rate was significantly higher at one and 3 min postintubation in ILMA group in comparison to the CMAC group. Additionally systolic blood pressure, diastolic blood pressure, and mean blood pressure were significantly higher at 3 min postintubation in the ILMA group compared to the CMAC group which was in contrast to the present study. This could be attributed to factors such as more manipulation required to obtain adequate ventilation after insertion, the increased number of attempts required for intubation, and higher taken to secure the airway in ILMA group."

Conclusion

The study's findings indicate that "the C-MAC video laryngoscope is associated with high success rates and shorter intubation times compared to the Intubating Laryngeal Mask Airway (ILMA). Specifically, in obese patients, the C-MAC appears to be an effective approach for endotracheal intubation. However, further" research is warranted to strengthen these conclusions.

Effective management of a difficult airway is paramount for anesthesiologists to ensure patient safety and mitigate the risk of litigation. Devices like video laryngoscopes, which facilitate safer and quicker intubation, are likely to gain popularity in the future as they offer enhanced patient care and procedural efficiency.

The study's results underscore the importance of continuous advancements in airway management technology to meet the evolving needs of patients and healthcare providers.

Conflict of Interest: All authors declare no conflict of interest.

Source of Funding: None.

Consent

As per university standards, the authors have collected and preserved written participant consent.

Ethical Approval

As per university standards, the author(s) has collected and preserved written ethical permission.

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