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Research Article

COMPARATIVE STUDY BETWEEN PROPOFOL AND THIOPENTONE SODIUM IN FACILITATION OF LARYNGEAL MASK AIRWAY INSERTION

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ABSTRACT

Objective: The aim of the study is to compare the conditions to facilitate the insertion of the laryngeal mask airway (LMA) with the two most commonly used agents – thiopentone and propofol, after adequate pre-medication with midazolam and fentanyl.

Methods: It is prospective randomized study conducted on 70 patients of either sex, belonging to 20–60 years of age, and American Society of Anesthesiologists grades I and II who were admitted to elective minor surgeries under general anesthesia. Patients were randomly divided into 2 groups. Patients in both the groups received pre-induction doses of glycopyrrolate (0.2 mg), midazolam (0.04 mg/kg), and fentanyl (2 mcg/kg) and were induced with either propofol (2 mg/kg) or thiopentone (5 mg/kg), to facilitate insertion of LMA. The parameters were studied and were conditions for insertion, time taken, hemodynamic changes during insertion of LMA, and immediately thereafter.

Results: Conditions for insertion, ease of insertion was significantly greater in propofol group when compared to thiopentone group. The difference was statistically significant ($p<0.05$). The heart rate, systolic blood pressure, and diastolic blood pressure were compared between the 2 groups. It was observed that there was a fall in all these parameters in both groups, but it was more pronounced in the propofol group. Although this was statistically extremely significant ($p<0.001$), it was not clinically significant.

Conclusion: It was concluded that, due to better ease of insertion, lesser time taken for insertion, and better recovery profiles observed with propofol, it seemed to be slightly superior to thiopentone as an induction agent for insertion of the LMA.

Keywords: Better ease of insertion, Propofol, Thiopentone, Laryngeal mask airway.

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INTRODUCTION

The laryngeal mask airway (LMA) is probably one of the most important inventions in anesthesia in recent times. A quest to find an alternative device for airway management apart from the conventional endotracheal tube paved the way for the invention of the LMA by Dr. Archie Brain at the London Hospital, White Chapel, in 1981. Its introduction was primarily as a means of offering some of the advantages of endotracheal intubation while avoiding the fundamental disadvantage of visualization of cords and forcing them apart [1,2].

The LMA is inserted blindly into the hypopharynx. When the cuff is inflated, it forms a low-pressure seal around the laryngeal inlet, permitting gentle positive-pressure ventilation. It has revolutionized the management of patients who would otherwise have received anesthesia by the conventional face mask. It enables the anesthesiologist to have both his/her hands-free [3,4].

The insertion of the LMA requires the upper airway reflexes to be obtunded sufficiently, to prevent undesired patient responses such as coughing, gagging, and laryngospasm. If general anesthesia is used, insertion requires a depth similar to that necessary for insertion of an oropharyngeal airway, but not as deep as is needed for tracheal intubation. The absence of motor response to a jaw thrust is a reliable method of assessing the adequacy of depth of anesthesia for LMA insertion [5,6]. Various induction agents and their combinations have been used to facilitate its insertion with least side effects. Trials have been done using midazolam, thiopentone, propofol, each alone, or in combinations, with or without muscle relaxants such as succinylcholine or low-dose atracurium. Hence, the present study is designed to compare the conditions to facilitate the insertion of the LMA with the two most commonly used agents - thiopentone and propofol, after adequate pre-medication with midazolam and fentanyl and to compare the responses occurring during LMA insertion following induction with propofol and thiopentone sodium

METHODS

A prospective randomized study is conducted in the operating rooms of Gandhi Medical College and Hospital, Secunderabad, over a period of 18 months (November 2019–June 2021). After institutional ethical committee approval study was done with IEC number -IEC/GMC/2020/01/30.

70 patients undergoing minor surgical procedures under general anesthesia.

Inclusion criteria

Age between 20 and 60 years of age belonging to American Society of Anesthesiologists (ASA) grade I and II undergoing minor surgical procedures under general anesthesia.

Excluded criteria

Morbidly obese patients or likeliness of being a case for difficult intubation (mouth opening <2 fingers), allergy to any drugs, uncontrolled hypertension emergency surgical procedure, history of smoking, chronic bronchitis, asthma, upper respiratory tract infections.

Every patient included in the study was fully explained about the nature of the study and informed consent was obtained.

Pre-anesthetic evaluation

Patients were visited on the previous day of surgery, and the procedure was explained to them. An informed written consent was taken from

all patients. Airway assessment was done. A detailed medical history was taken, and systematic examinations were carried out and relevant investigations were advised. Basic laboratory investigations such as complete hemogram, blood sugar, routine urine analysis, bleeding time, and clotting time were carried out routinely in all patients. ECG and chest X-ray were done in all patients above 40 years of age.

All patients were pre-medicated with ondansetron 4 mg and midazolam 1 mg IV.

On arrival at the operation theater, an intravenous line was secured and the patient's baseline vital data were recorded using pulse oximeter (for O_2 saturation), ECG, and NIBP. Both groups received Inj. Fentanyl (1.5 mcg/kg) along with Inj. Glycopyrrolate (10 mcg/kg) before induction. All patients were pre-oxygenated for 3 min with 100% oxygen using fresh gas flow of 8lt/min. Patients who were given IV propofol as induction agent were included in Group P and those receiving thiopentone sodium were included in Group T.

Group P received IV propofol 2 mg/kg and Group T received IV thiopentone sodium 5 mg/kg.

The induction agent was injected at a constant rate over 30 s. The loss of verbal contact and eyelash reflex would be assessed. After this, jaw relaxation was assessed by anesthesiologist after loss of eyelash reflex. If jaw relaxation was not adequate, it was reassessed after every 15 s. Once jaw relaxation was adequate, LMA insertion was attempted.

Overall conditions for insertion of LMA were assessed as excellent, satisfactory, or poor on the basis of total score obtained by summing up the individual scores.

- Maximum score of 18
- Excellent: 18
- Satisfactory: 16–17
- Poor <16.

The hemodynamic parameters, namely pulse rate and non-invasive blood pressures (systolic blood pressure [SBP] and diastolic blood pressure [DBP]), were monitored at baseline, at the time of induction and 1 min, 2 min, and 3 min after insertion of LMA.

LMA was inserted by the standard method described by Brain. Following insertion of LMA, anesthesia was continued with 66% N2O + 33% O_2 + Sevoflurane/Desflurane.

Statistical analysis

Statistical analysis was done using SPSS 23.0 version. Data were analyzed using students "t" test for the continuous variables (age, weight, and hemodynamic parameters) and Chi-square test for categorical variables (conditions for LMA insertion). A value of $p<0.05$ was considered statistically significant.

RESULTS

Seventy adult patients of ASA- Grade I and II between 20 and 60 years of age, of either sex, posted for minor surgeries under general anesthesia were selected for the study. They were randomly divided into two groups - Group P and Group T. The study was undertaken to compare thiopentone (Group T) with propofol (Group P), as induction agents for insertion of the LMA.

The mean age in Group P was 33.49 years and in Group T was 34.37 years. Age incidences between two groups were comparable. The sex distribution in the two groups was comparable, Group P had 15 male patients which constituted 42.86% and 20 female patients making up for 57.14%, whereas Group T had 13 male patients (37.14%) and 22 female patients (62.86%) (Table 1).

Jaw relaxation was completed in 32 patients in propofol group compared to 27 in thiopentone group. 3 patients in propofol group had partial jaw opening as of 8 in thiopentone group. However, nil jaw opening was not encountered in any of the patients in either group. However, the difference between the 2 groups was not statistically significant (p=0.101).

There was easy insertion of LMA in 33 patients in propofol group compared to 26 in thiopentone group. It was considered difficult in 2 patients in propofol group and in 9 patients in thiopentone group. However, insertion was possible in all patients. The statistical analysis by Chi-square test showed that ease of insertion was significantly better in patients who were administered propofol compared to those given thiopentone (p=0.0215).

Coughing was observed in 2 patients in thiopentone group and in none of the patients in propofol group (p=0.151). Biting occurred in none of the patients in propofol group and in 1 patient belonging to thiopentone group (p=0.314).

Partial airway obstruction occurred in 2 patients in thiopentone group but none in propofol group (p=0.151) (Table 2).

Hence, it was observed that, the only parameter which was statistically significant between propofol group and thiopentone group was the ease of insertion of LMA. It was found to be significantly easier in patients who were administered propofol for induction of anesthesia.

Mean time taken for loss of verbal contact in Group P is 54.14 and in Group T, it is 65.71 ($p\leq0.001$) (Table 3).

Mean time to loss of eyelash reflex in Group P is 68 s and in Group T, it is 81.14 s ($p<0.001$) (Table 4).

Mean time taken for Jaw Relaxation in Group P is 83.57 s and in Group T, it is 104.71 s ($p\leq0.001$) (Table 5).

Mean time taken for successful LMA insertion in Group P is 96.29 s and in Group T, it is 123 s ($p\leq0.001$). The statistical analysis by students unpaired "t" test showed that the time needed for insertion in Group P was significantly less when compared to that of Group T (Table 6).

The baseline heart rates in both the groups were comparable. At post-LMA- 1 min, 2 and 3 min, there was a fall in the heart rate in both groups, but drop was more in the propofol group. Statistical analysis using student's unpaired "t" test showed that the fall in heart rate in the propofol group was statistically very significant at post-LMA (1 min) ($p<0.0001$), post-LMA (2 min) ($p\leq0.001$), and post-LMA (3 min) ($p\leq0.001$) (Fig. 1).

The SBP and DBP at baseline were comparable between the 2 groups. However, post-LMA there was drop in the SBP and DBP in both groups,

Table 1: Demographic distribution of study

Demographic details	Group		Total
	Group P	Group T	
Age (year)			
≤30	19	19	38
31–40	5	7	12
41–50	11	5	16
51–60	0	4	4
Total	35	35	70
Gender			
Male	15	13	28
Female	20	22	42
Weight	53.83±5.4	52.89±4.8	
Number of attempts for LMA insertion, n (%)			
1	32 (91.43)	26 (74.29)	58
2	3 (8.57)	9 (25.71)	12

LMA: Laryngeal mask airway

Table 2: Conditions for LMA insertion

Conditions	Grade	Description	Group P (n=35)	Group T (n=35)	p-value
Jaw relaxation	3	Full	32	27	0.101
	2	Partial	3	8	
	1	Nil	0	0	
Ease of insertion	3	Easy	33	26	0.0215
	2	Difficult	2	9	
	1	Impossible	0	0	
Coughing	3	Nil	35	33	0.151
	2	+	0	2	
	1	++	0	0	
Biting	3	Nil	35	34	0.314
	2	+	0	1	
	1	++	0	0	
Gagging	3	Nil	35	35	0.02
	2	+	0	0	
	1	++	0	0	
Laryngospasm/airway obstruction	3	Nil	35	33	0.151
	2	Partial	0	2	
	1	Total	0	0	

Table 3: Time to loss of verbal contact

Group	Time to loss of verbal contact, mean±SD	p (t-test)
Group P	54.14±11.788	<0.001
Group T	65.71±7.683	

SD: Standard deviation

Table 4: Time to loss of eyelash reflex

Group	Time to loss of eyelash reflex, mean±SD	p (t-test)
Group P	68.00±12.017	<0.001
Group T	81.14±8.409	

SD: Standard deviation

Table 5: Time taken for jaw relaxation

Group	Time to jaw relaxation, mean±SD	p (t-test)
Group P	83.57±13.149	<0.001
Group T	104.71±10.977	

SD: Standard deviation

Table 6: Time to successful LMA insertion

Group	Time to successful LMA insertion, mean±SD	p (t-test)
Group P	96.29±11.716	<0.001
Group T	123.00±12.078	

SD: Standard deviation, LMA: Laryngeal mask airway

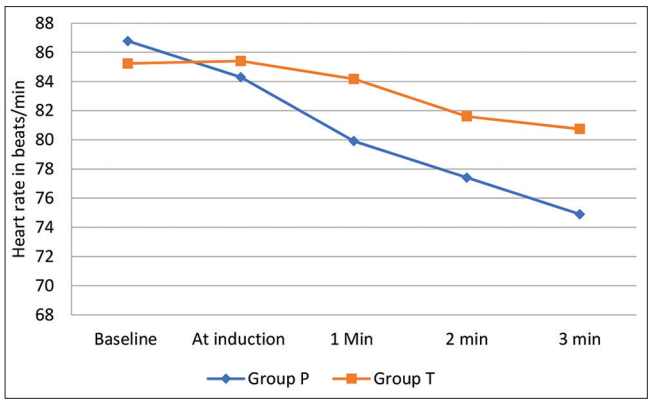

Fig. 1: Comparison of change in mean pulse rate between two groups

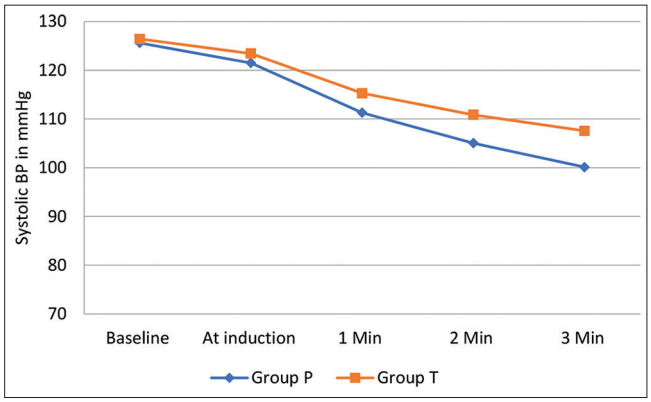

Fig. 2: Comparison of change in mean systolic blood pressure between two groups

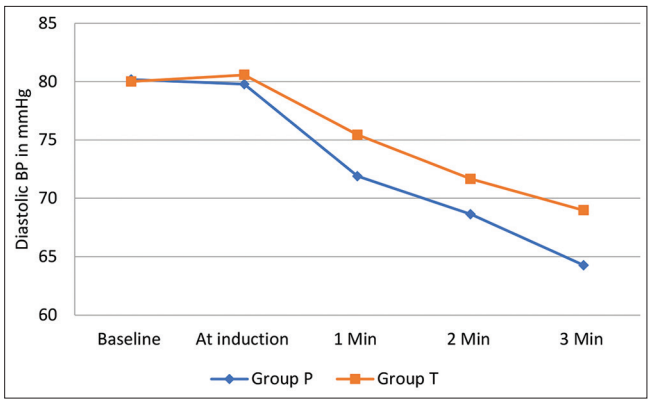

Fig. 3: Comparison of change in diastolic blood pressure between two groups

with the fall being more pronounced in the propofol group. Statistical analysis using student's unpaired "t" test showed that the fall in SBP and DBP at post-LMA 1 min, 2 min, and 3 min was statistically extremely significant ($p<0.05$). However, these hemodynamic changes were not clinically significant (Figs. 2 and 3).

DISCUSSION

The LMA has revolutionized airway management in many patients who would have otherwise undergone endotracheal intubation or received anesthesia through the conventional facemask. This device with its ease

of use helps the anesthesiologist by keeping his hands free for other work. It also avoids the adverse effects of endotracheal intubation. Laryngeal mask also provides an effective and simple solution to many problems of difficult intubation. With the use of LMA, muscle relaxation is unnecessary, laryngoscopy is avoided, and hemodynamic changes are minimized during insertion.

Insertion of the LMA requires adequate mouth opening and that the pharyngeal and laryngeal reflexes be obtunded to a sufficient degree, to avoid coughing or gagging which would make correct positioning difficult or even impossible. A variety of agents has been used to make LMA insertion smooth, with least side effects and cost-effectiveness [7,8].

Thiopentone, which is routinely used for induction of anesthesia, has been used for insertion of LMA. Similarly, propofol, a relatively newer induction agent, has also been employed for LMA insertion. However, each of these has its disadvantages when used alone. For example, thiopentone when administered without pre-medication may produce undesirable responses such as coughing or gagging. Propofol when given as a sole agent requires to be given in high doses which is likely to cause several adverse reactions including hypotension, apnea, and pain on injection. Hence, in this study, an attempt has been made to compare and assess the suitability of conditions for the insertion of the LMA using either propofol (2 mg/kg) IV or thiopentone (5 mg/kg) IV, as induction agents.

A total number of 70 patients belonging to age group 20–60 years who belong to ASA Grade I or 2 were included in the study. They were to undergo general anesthesia for various minor surgical procedures. The aim of the study is to compare the responses occurring during LMA insertion following induction of anesthesia with IV propofol or thiopentone sodium. The two groups were comparable in age, gender, weight, ASA physical status, and MPS. This finding was similar to various other studies [9].

In this study, jaw opening was found to be full in 32 patients in Group P as against 27 patients in Group T. It was partial in 3 patients in Group P and 8 patients in Group T. However, none of the patients in either group had nil mouth opening. The statistical analysis using Chi-square test revealed no significant difference between the two groups (p=0.101).

None of the patients in the propofol group had coughing, whereas 2 patients in the thiopentone group had mild coughing. However, this difference was not statistically significant (p=0.151).

None of the patients in Group P experienced biting, as against 1 patient in Group T. This difference was also not significant statistically (p=0.314). None of the patients in Group P experienced laryngospasm or airway obstruction, whereas 2 patients in Group T had partial airway obstruction. Laryngospasm was not observed in any patient in Group T also. This was not statistically significant (p=0.151). Overall, ease of insertion of the laryngeal mark airway was considered easy in 32 patients in the propofol group compared to 26 patients in the thiopentone group. It was difficult in 3 patients in Group P and 9 patients in Group T. However, it was not impossible in any patient. Statistical analysis using Chi-square test revealed that the ease of insertion was significantly greater in Group P when compared to Group T (p=0.02).

Amr and Amin [10] compared the conditions for insertion of LMA using propofol or thiopentone and observed a greater incidence of coughing and gagging in those who received thiopentone. Insertion conditions for I-gel supraglottic airway device showed significantly higher incidence of jaw relaxation. No significant difference was found in the incidence of breath holding, lacrimation, and stridor between the groups. The incidence of coughing/movement was significantly less in Groups I and III. Insertion time was significantly less in Groups I and III. The changes in MABP and HR were significantly less in Groups I and III.

Dwivedi *et al*. [11] study was done for comparison of hemodynamic response of LMA using either butorphanol or fentanyl in combination with propofol. After insertion of LMA, statistically significant drop in mean heart rate, SBP, DBP, and mean BP was noted in Group F as compared to Group B. Concluded that the use of propofol-butorphanol combination produces stable hemodynamics as compared to propofol- fentanyl combination.

Gurjar *et al*. [12] studied on 100 patients of ASA grade I/II divided in two groups (50 in each group). Group A received inj. midazolam 0.03 mg kg^{-1}IV and Group B received inj. dexmedetomidine 0.4 mcg kg^{-1}. Induction was done with inj. propofol 2.5 mg/kg IV. Ease of PLMA insertion without using muscle relaxant was studded. Time taken and number of insertion attempts, intraoperative hemodynamic parameters, and complications were recorded. The resistance to mouth opening was significantly less (p=0.003) in Group B (significant resistance encountered in 2% cases) in compare to Group A (14% cases). The PLMA insertion conditions were better in Group B compared to Group A (p<0.05). Time taken (11.48±3.34 s) and number of attempts in PLMA insertion were significantly less (p<0.05) in Group B when compared to Group A (11.48±3.34 s) without significant intraoperative hemodynamic changes except at 5th min post-insertion. Concluded that midazolam and dexmedetomidine both are acceptable in PLMA insertion. Dexmedetomidine produces better conditions for the insertion of PLMA with greater hemodynamic stability and less post-operative complications as compared to midazolam.

The observations made in our study are comparable to these studies.

In this study, the mean time taken for loss of verbal contact was 54.14 s with propofol and 65.71 s in Group T. This time is significantly shorter with propofol compared to thiopentone sodium. The mean time taken for loss of eyelash reflex was 68 s in Group P and 81.14 s in Group T. This time is significantly shorter with propofol compared to thiopentone sodium (p<0.01). Jaw relaxation has taken a longer time in thiopentone group with p=0.0001 which is highly significant. Mean time for successful LMA insertion, it was significantly shorter with propofol compared with thiopentone sodium. With thiopentone group, the LMA insertion has taken a mean of 123 s while propofol has taken 96.29 s. Talwar *et al*. compared the time taken for LMA insertion in a similar fashion between two groups, one which received propofol and the other thiopentone. Time taken in the propofol group was 4.31+0.27 min (mean+SD), as compared to 4.62+0.64 min (mean+SD). Statistical analysis indicated the difference in the time taken to be significant (p=0.03). Sengupta *et al*. [6] compared propofol and thiopentone for facilitation for LMA insertion. They observed that time taken for LMA insertion in Group P was less than that in Group T which was statistically very highly significant. The results of our study also are comparable to these studies. The results align with a different study that compared the conditions surrounding the LMA insertion in 70 unmedicated patients treated with either midazolam-alfentanil-thiopentone or midazolam-alfentanil-propofol. Although full jaw opening was not found statistically significant, the clinical significance of the finding is essential [13].

The heart rates before pre-medication and after pre-medication were comparable between the 2 groups. After insertion of LMA, there was a fall in the heart rates in both groups at 1 min, 2 min, and 3 min, but the fall was more pronounced in Group P when compared to Group T. The statistical analysis using student's unpaired 't' test showed that difference was extremely significant (p<0.001). Similarly, the arterial blood pressures (systolic, diastolic) were comparable at baseline values and before insertion of the LMA. There was no statistically significant difference between the 2 groups. However, after insertion of the LMA at 1 min, 2 min, and 3 min, there was a fall in the arterial blood pressure which was more in Group P compared to Group T. These results were considered statistically extremely significant (p<0.0001).

Saloi *et al*. [14] study conducted using induction agents, namely propofol and its equipotent dose of thiopentone, for LMA insertion, and to compare

their side effects in patients undergoing minor surgeries requiring general anesthesia. 80 patients aged 18–60 years undergoing minor surgeries (≤45 min) under general anesthesia fitting into the ASA physical status I and II and Mallampati score (MPS) 1 and 2. The participants were randomly divided into two groups in a 1:1 ratio. Group A received propofol (2.5 mg/kg), while Group B received thiopentone (5 mg/kg) injections for induction of anesthesia. Pre-medication with midazolam (0.04 mg/kg) injection and fentanyl (1.5 mcg/kg) injection was provided to patients in both groups. Group A had a higher and statistically significant ease of insertion. The mean insertion time was notably different between the two groups. The difference in the overall response to insertion showed no statistical significance in the two groups. Statistically, a significant difference was found in falls in heart rate and various blood pressure levels between the groups. Concluded that propofol at a rate of 2.5 mg/kg was found to be superior to thiopentone at a rate of 5 mg/kg as far as suppression of upper airway reflexes in LMA insertion which is in correlation with other studies [15-17].

It should be noted that in this study, specific doses were used for the administration of thiopental and propofol, and the administration of additional doses of drugs was not considered. Although many other studies have evaluated the effects of these drugs in combination with other drugs such as ketamine, remy fentanyl, and atracurium, this study is the only study to combine the four types of drugs individually and in combination with each other to neutralize other disadvantages and this can be a strength of the current study. Moreover, to confirm the results of this study, it is recommended that more clinical trials with these drug combinations should be performed in patients with various diseases and undergoing other types of surgery [18-20].

Limitations of the study

The anesthetists who assessed induction side effects were not blinded to the induction technique. The study did not include patients at extremes of age and ASA grade >II who may require surgical interventions. Cost-benefit calculation and patient satisfaction assessment could have been done. The study did not evaluate in detail post-operative complications such as nausea and vomiting, considering prophylaxis was provided in such patients by giving anti-emetic drugs.

CONCLUSION

Ease of insertion of LMA was significantly greater in patients who were induced with propofol. The time taken for insertion was also considerably lesser with propofol induction, compared to induction with thiopentone. However, there was no difference in the incidence of jaw opening, coughing, gagging, laryngospasm/airway obstruction, and patient movements between the two groups. The severity of undesired responses was found to be more in thiopentone group compared to propofol group, but they were not statistically significant. The hemodynamic parameters showed a statistically significant fall in heart rate and blood pressure in the propofol group compared to thiopentone group. However, these changes were not of clinical significance. Both propofol and thiopentone serve the purpose of insertion of the LMA. However, in view of better ease of insertion, lesser time taken for insertion, and better recovery profiles associated with propofol seems to be marginally superior to a thiopentone sodium to facilitate insertion of the LMA.

CONFLICT OF INTEREST

Nil.

FUNDING

Nil.

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