*Original Article*

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# Comparison of Haemodynamic Responses to Insertion of Laryngeal Mask Airway and Endotracheal Tube

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**Abstract**

*Introduction:* Laryngeal mask airway (LMA) insertion has emerged as an alternative to endotracheal (ET) intubation for maintaining airway and anaesthesia.This study was done to compare the haemodynamic responses associated with LMA and endotracheal intubation in ASA Grade I and II patients undergoing elective surgeries. *Aim:* To compare the heamodynamic responses associated with laryngeal mask airway insertion and endotracheal intubation. *Methods:* Informed consent was taken for the study. The patient was examined and evaluated on the day before surgery. They were explained the procedure of anaesthesia to allay anxiety and apprehension. In this randomized prospective study 50 ASA Grade I and Grade II patients posted for elective surgery under general anaesthesia was entered. The patients were allocated by computer-generated random numbers into two groups of 25 patients each: Group-I (ET group) and Group- II (LMA group). All the patients were given anaesthesia in a standardized manner. Heart rate, blood pressure, oxygen saturation and ECG monitored during intubation and insertion of laryngeal mask airway at an interval of 1, 3, 5 & 10 minutes. After adequate recovery patients was extubated. *Observations:* The Parametes observed are- Mean arterial pressure (MAP), Heart rate (H.R), Oxygen saturation ($SPO_2$), Electrocardiogram (ECG) at 10min, 1min before intubation, 1min after induction, just after insertion of ET tube/LMA, 3min, 5min, 10min after intubation/LMA insertion. Data observed and analysed. Test of significance were carried out by student t-test or modified t-test. *Results:* The heart rate, systolic, diastolic blood pressure was found to be increased at laryngoscopy and endotracheal intubation or laryngeal mask insertion.But the increase in HR, SBP and DBP in the laryngeal mask airway group was not as much as in the endotracheal tube group. There was a significant difference in these haemodynamic parameters between the two groups at the end of 5 minutes. *Conclusion:* The haemodynamic responses are attenuated and short lived with laryngeal mask airway insertion as compared to laryngoscopy and endotracheal tube insertion. Laryngeal mask airway insertion is advantageous where ever there is a concern about the pressor response for airway instrumentation.

**Keywords**: LMA; Endotracheal Intubation; Haemodynamic Responses.

## Introduction

Securing a patent airway during intraoperative period is necessary to prevent morbidity and mortality of the patients. This is commonly done by the help of the endotracheal tube or laryngeal mask airway. Endotracheal intubation is normally performed by oro-tracheal or nasotrachealin order to maintain an open air passage, to deliver oxygen and anesthetic gases, to permit the suctioning of mucus and to prevent aspiration of the stomach contents into trachea. For years, even now, the endotracheal tube has served a prominent role in airway management. In recent times a new device (Brain) [1], Laryngeal mask airway is being used for maintaining airway. Endotracheal intubation requires instrumentation i.e. laryngoscopy of the upper airway where as instrument is not needed in case of LMA insertion. The disadvantage of Laryngeal mask airway is that it

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does not prevent aspiration of the stomach contents. Beside this, upper limit of the positive pressure ventilation should not exceed more 20 cm of $H_2O$. The Laryngeal mask airway is placed over glottisthat's why it comes under the heading of supraglottic airway devices. Both Endotracheal intubation as well as placement of laryngeal mask airway have undesirable reflex activities on cardiovascular, respiratory system .These reflexes may be tolerated by healthy patients but it may lead to increased morbidity and mortality to compromised patients especially in patients with cardiovascular disease. The placement of endotracheal tube and laryngeal mask airway have different degree of their effects on cardiovascular and respiratory system, so it is desirable to know as to which device is less harmful & damaging at the same time which is more useful. In 1989 Braude, Clements and Hodges [2] studied the pressor response of laryngeal mask insertion. They concluded that there were significant differences in haemodynamic changes between laryngeal mask group and endotracheal tube group.The most common problem arising out of both techniques are sudden rise in blood pressure, tachycardia and arrhythmias. There are various methods to blunt these hemodynamic responses, like by decreasing duration time of laryngoscopy less than 15 seconds, by usingIV narcotic&lidocaine drugs, vasodilator and beta blocker. Laryngeal mask airway insertion is easy to use than endotracheal intubation. In this study an effort has been made to compare the hemodynamic response of endotracheal intubation and laryngeal mask airway insertion.

## Materials

A. Patients

B. Drugs and Equipments

*A. Patients*

The study was conducted on fifty (50) adult patients undergoing elective surgery under general anesthesia of ASA Grade I and Grade II. The patients were both sexes and ranged from 20-60 years, admitted in department of surgery under general anesthesia considered for this study. Informed consent was obtained in all cases.The patients were divided into two groups at random (25 patients in each group) Group-I (ET group) and Group- II (LMA group).

Patients undergoing various procedures like diagnostic laparoscopy, Appendectomy, simple mastectomy, cholecystectomy, wound debridement etc. were selected for the study.

*Exclusion Criteria*

1. History of respiratory problems.
2. History of angina, palpitations, syncopal attacks.
3. Baseline heart rate <60 per minute.
4. Baseline systolic pressure <100mm Hg.
5. Treatment with beta blocker or calcium channel blockers.
6. Electrocardiogaphic abnormalities.
7. Hepatic, renal problems.
8. Regurgitation prone conditions.
9. Mallampati grade III and grade IV
10. More than one attempts to intubate or insertion of laryngeal mask airway.
11. Duration of endotracheal intubation or laryngeal mask airway Insertion more than 20 sec.

The investigation carried out before subjecting the patients for surgery were haemogram, urine analysis, blood chemistry, electrocardiogram and chest X-ray.

*Methods*

Informed consent was taken for the study. The patient was examined and evaluated on the day before surgery. They were explained the procedure of anaesthesia to allay anxiety and apprehension. In this randomized prospective study 50 ASA Grade I and Grade II patients posted for elective surgery under general anaesthesia was entered. Premedication such as oral benzodiazepines (alprazolam 0.25mg) was given at bed time on the day before surgery. The patients were allocated by computer-generated random numbers into two groups of 25 patients each:

*Group-I (ET group) and Group- II (LMA Group)*

On the day of surgery pre operative baseline heart rate and blood pressure was noted. Intravenous cannulation with 18G cannula was done. Intravenous infusion was started with Ringer lactate solution. Non invasive blood pressure monitor ECG and pulse oximeter probe were connected to the patient prior to induction of anaesthesia.

*Anaesthetic Technique*

All the patients were pre-oxygenated for three minutes. Induction of anaesthesia was done with

Propofol2mg/kg, Fentanyl 1µg/kg, and after check ventilation vecuronium 0.08mg/kg body weight was given to all patients as a inducing agent. Patients were ventilated with 100% oxygen for a brief period and intubation with the aid of laryngoscope or insertion of laryngeal mask of appropriate size was used. Time taken for intubation or insertion of laryngeal mask airway did not exceed 20 seconds. Anaesthesia was maintained with intermittent positive pressure ventilation with nitrous oxide and oxygen (66:33), isoflurane 1% and injection vecuronium (0.08mg/kg).

Heart rate, blood pressure, oxygen saturation and ECG monitored during intubation and insertion of LMA at an interval of 1, 3, 5 & 10 minutes. After completion of Surgery neuromuscular block was reversed by titrated dose of Neostigmine and Glycopyrrolate intravenously. After adequate recovery patients was extubated.

**Observations and Results**

The Parameters observed are- Mean arterial pressure (MAP), Heart rate (H.R), Oxygen saturation ($SPO_{2)}$, Electrocardiogram (ECG), at 10min, 1min before induction, 1min after induction, just after insertion of ET tube/LMA, 3min, 5min, 10min after intubation/LMA insertion. Data observed and analysed. Test of significance were carried out by student t-test or modified t-test.

Table 1 showing age, weight and sex distribution in both the groups. The Group I comprises of 18 females and 7 males and s group II also comprises of 18 female and 7 males. The ages ranged from 21 to 59 and 21 to 58 in the Group I and Group II respectively. The range for weight was 48 to 64 Kgs and 46 to 63 kgs in the Group I and Group II respectively. There was no statistically significant difference. The demographic data was comparable in both the groups in

Table 2 Show heart rate between two groups and there was no significant difference at 10 min before induction in these readings (p> 0.05). Preinduction readings are taken as basal values. At 1 min before induction a slight increase in heart rate was observed. It was not statistically significant (P>0.5). At 1min after induction in both groups there was rise in heart rate in both the groups but the rise was significantly low in the LMA group it was statistically significant (P<0.05). Three minutes after intubation and laryngeal mask airway insertion. In both group, heart ratewas increased which was statically significant (P<0.05). The Heart rate in both the groups five minutes after intubation / insertion of laryngeal mask airway. The parameters were still high in intubation group. The values in the LMA group were nearing the basal values. The difference was statistically significant (P<0.05). The heart rate 10 minutes after intubation/laryngeal mask airway insertion in both groups values were nearing the basal values. There was no statistically significant difference( P>0.05).

Table 3 Show Mean arterial pressure between two groups. There was no significant difference at 10 min before induction in these readings (p> 0.05). Preinduction readings are taken as basal values. At 1 min before induction due to premedication by benzodiazepam in both groups there was decrease in bothmean arterial pressure. The fall was not significant in the same group as well as between the two groups. At 1min after induction in both groups there was fall in mean arterial pressure. The fall is not significant in the same group as well as between the two groups (P>0.5).

There was rise in mean arterial pressure in both the groups but the rise was significantly low in the LMA group it was statistically significant (P<0.05). At 3 minutes after intubation and laryngeal mask airway insertion. In both groupmean arterial pressure were increased which was statically significant( P<0.05). The mean arterial pressure in both the groups five minutes after intubation / insertion of laryngeal mask airway still high in intubation group. The values in the LMA group were nearing the basal values. The difference was statistically significant (P<0.05). The mean arterial pressure 10 minutes after intubation/laryngeal mask airway insertion in both groups that the values were nearing the basal values. There was no statistically significant difference( P>0.05).

Table 4 showing oxygen saturation ($SPO_2$) between two groups.There was no significant difference at 10 min before induction in these readings (p> 0.05). At 1 min before induction due to premedication by benzodiazepam in both groups there was decrease $O_2$ saturation. The fall was not significant in the same group as well as between the two groups.At 1min after induction in both groups there was O2 saturation. The fall is not significant in the same group as well as between the two groups. It was not statistically significant (P>0.5). There was increase in oxygen saturation at 3, 5, 10 minutes after intubation and laryngeal mask airway insertion in both groups which was not statistically significant (P>0.05).

**Table 1:** Anthropometric data

| Group | Age ( Years) Mean | Weight (Kg) Mean | Male Mean | Female Mean |
|---|---|---|---|---|
| Group I (n=25) | 32.2 | 55.64 | 7 | 18 |
| Group II (n=25) | 33.52 | 54.76 | 7 | 18 |

**Table 2:** Heart Rate (H.R)

| Time | Group I (Mean ± SD) | Group II (Mean ± SD) | P value |
|---|---|---|---|
| 10 min before induction | 84.32±10.4 | 83.8±6.55 | 0.834 |
| 1 min before induction | 89.8±9.87 | 94.12±5.932 | 0.07 |
| 1 min after induction | 82.2±8.55 | 85.72±7.58 | 0.13 |
| Just after airway insertion | 113.3±7.45 | 109.3±6.033 | 0.043 |
| 3 minute after intubation/ insertion of LMA | 104±9.96 | 98.16±9.299 | 0.03 |
| 5 minute after intubation/ insertion of LMA | 95.8±10.8 | 89.4±8.47 | 0.02 |
| 10 minute after intubation/ insertion of LMA | 86.52±10.59 | 83.32±6.06 | 0.198 |

**Table 3:** Mean Arterial Pressure (M A P)

| Time | Group I (Mean ± SD) | Group II (Mean ± SD) | P value |
|---|---|---|---|
| 10 min before induction | 95.71±7.16 | 93.57±7.39 | 0.3052 |
| 1 min before induction | 90.73±6.879 | 86.37±8.61 | 0.054 |
| 1 min after induction | 87.41±6.084 | 83.427±7.948 | 0.053 |
| Just after airway insertion | 112.51±7.17 | 91.86±6.47 | 0.0001 |
| 3 minute after intubation/ insertion of LMA | 106.04±6.94 | 90.13±5.93 | 0.0001 |
| 5 minute after intubation/ insertion of LMA | 99.75±6.79 | 86.56±5.60 | 0.0001 |
| 10 minute after intubation/ insertion of LMA | 89.507±6.06 | 85.84±5.43 | 0.053 |

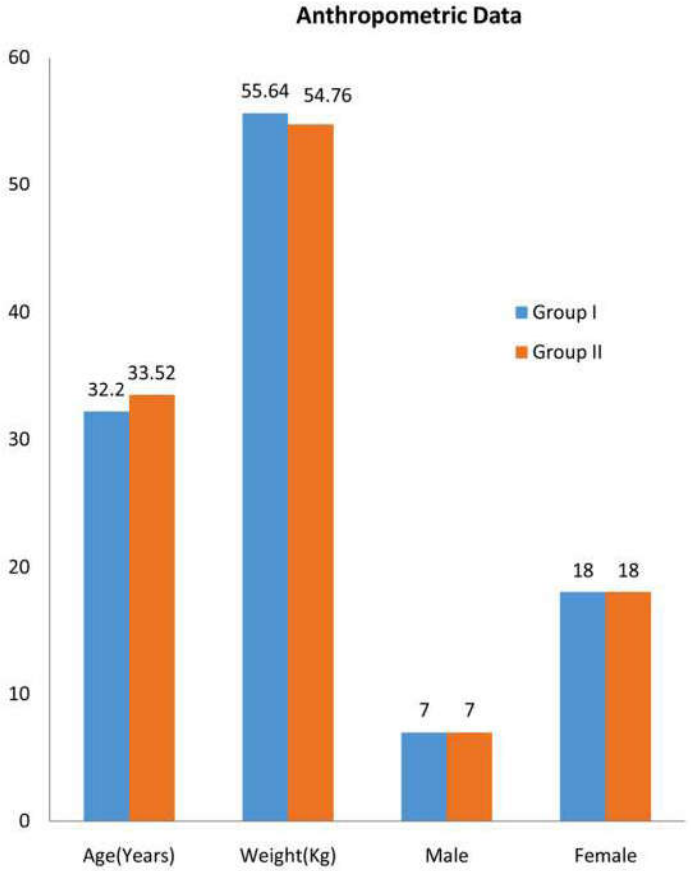


**Fig. 1:**

**Table 4:** Oxygen Saturation ($SPO_2$)

| Time | Group I (Mean ± SD) | Group II (Mean ± SD) | P value |
|---|---|---|---|
| 10 min before induction | 98.68±0.69 | 98.60±0.65 | 0.674 |
| 1 min before induction | 97.84±1.03 | 97.8±0.82 | 0.8796 |
| 1 min after induction | 97.4±0.80 | 97.2±1.0 | 0.269 |
| Just after airway insertion | 96±1.00 | 97±0.8 | 0.06 |
| 3 minute after intubation/ insertion of LMA | 97.2±1.08 | 97.5±0.08 | 0.2971 |
| 5 minute after intubation/ insertion of LMA | 98.08±0.86 | 98.5±0.70 | 0.0711 |
| 10 minute after intubation/ insertion of LMA | 98.48±1.05 | 98.92±0.64 | 0.0804 |

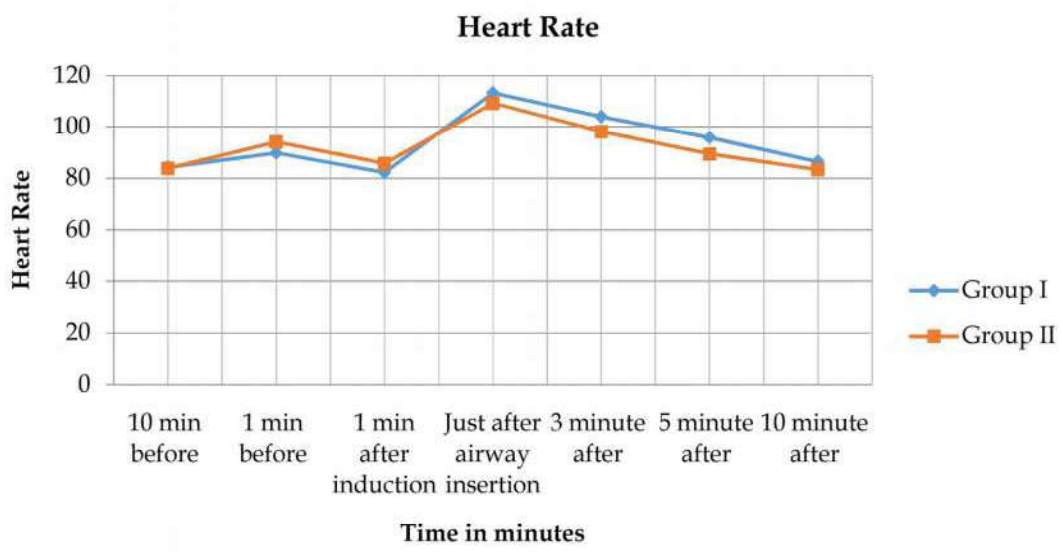


**Fig. 2:**

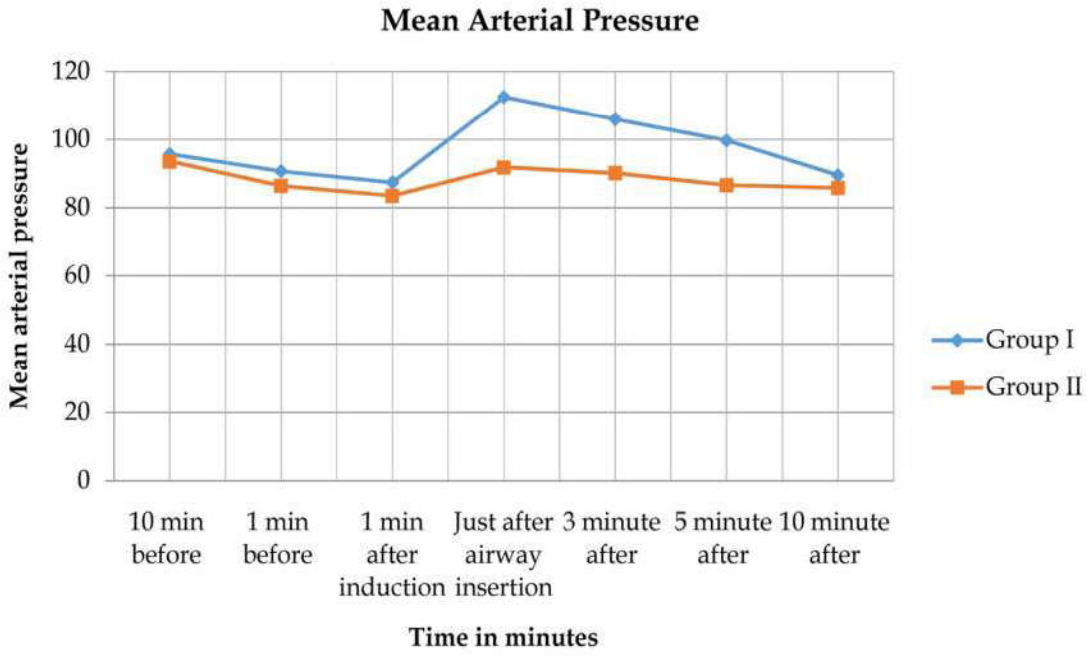


**Fig. 3:**

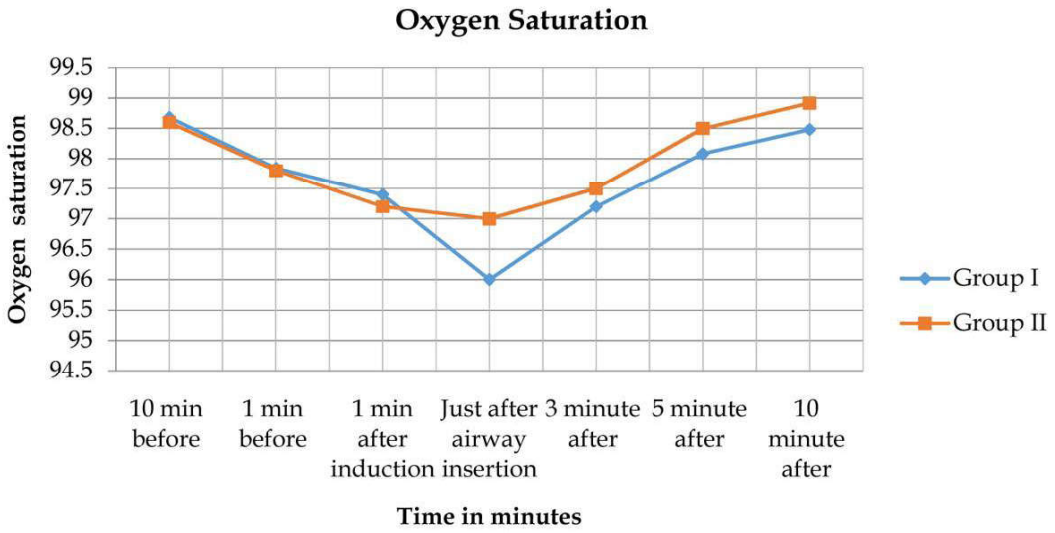


**Fig. 4:**

## Discussion

There is steep rise in hemodynamic changes observed during Laryngoscopy while stimulating respiratory tract (Reid and Brace [4] 1940). Since Endotracheal tube is inserted into glottis and continuous stimulating resultinghemodynamic responses. The pressor response to tracheal intubation may be harmful to patients with ischemic heart disease, hypertension or cerebrovascular disease (prys-Roberts [25], Green, and Medoche et al). This factor addsto high rate of morbidity & mortality in this group of patients.

Attempts are made to attenuate this response with a variety of pharmacological agents and more recently help of fibre optic laryngoscopy was investigated. In 1985, Brain [38]described laryngeal mask airway is a supra glottis device which is placed over glottis Moreover insertion of laryngeal mask airway does not need laryngoscopy.

There are plentiful receptors in the vicinity over vocal cords, epiglottis, hypo pharynx and arytenoids cartilage and hemodynamic changes are mainly due to stimulation of mechanoreceptors in the laryngopharyngeal wall, epiglottis, and vocal cords.

In our study we tried to compare the cardiovascular response to laryngeal mask airway insertion and tracheal intubation.It is found that the anthropometric data of both groups were comparable.

In our study, it was found that mean arterial pressure were increased in both Group I & Group II, just after insertion of laryngeal mask airway or endotracheal intubation but in case of Group I ($p<0.05$) significant rise of mean arterial pressure was there. In the Group II, mean arterial pressure has reached to its initial value at three minutes whereas in case of Group Iit took ten minutes to achieve the initial value. There was a statistically significant difference inthe mean arterial pressures for both groups at the end of five minutes ($P<0.05$).

Barclay, Wall and Wareham et al [8] (1994) have performed randomized prospective study to examine the effects of tracheal intubation and laryngeal mask insertion. They have concluded that there were very small effects on mean arterial pressure and heart rate on insertion of laryngeal mask but significantly increased effects of both factor (mean arterial pressure and heart rate) ontracheal intubation with reference to pre induction values and this is exactly similar to our finding in our study.

In the present study, heart rate was increased in both group I & Group II, just after insertion of laryngeal mask airway or endotracheal intubation but there was significant increase in Group I than Group II ($P<0.05$). Heart rate in Group II reached its initial value within three minutes but it took ten minutes in case of Group I to achieve initial value. And also there was a significant difference of heart rate between these two groups at five minutes ($P<0.05$).

Wilson IG, Fell D, Robinson SL [24](1994) conducted a study on cardiovascular response to laryngeal mask insertion. They have concluded that there was a gradual increase of heart rate in case of endotracheal intubation than the laryngeal mask

airway insertion and also it remained higher for a longer period with endotracheal intubation.

In the present, study the oxygen saturation was comparable in the both groups and there was no statistically difference between them (P>0.05). The oxygen saturation was slightly decreased just after insertion of laryngeal mask airway or endotracheal intubation. The drop found was less in case of Group II than Group I.

In our study, the ECG changes in the both group I and Group II were comparable and there was no statistically significant difference between them. In Group I, ventricular ectopic occurred in three patients out of twenty five patients just after endotracheal intubation but it was transient and less than six in number per minute.

## Conclusion

Results of the present study are consistent with the previous studies in that the haemodynamic response to laryngeal mask insertion is less than to that of endotracheal intubation.

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