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CIRCULATORY STABILITY DURING AIRWAY SECUREMENT IN PATIENTS WITH BURN INJURIES: A COMPARATIVE OBSERVATIONAL STUDY

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Abstract

Airway placement triggers a sympathetic stress response that can be risky in burn patients, whose circulation is already strained. This comparative observational study examined hemodynamic responses to laryngeal mask airway (LMA) insertion and endotracheal tube (ETT) intubation in 50 adult burn patients undergoing short elective surgery at Hayatabad Medical Complex, Peshawar (March to August 2025). Heart rate (HR) rose significantly less with the LMA at 1 and 3 minutes after insertion. Blood pressure differences were numerical rather than statistically significant. The LMA appears to be a safe alternative to the ETT for short procedures in burn patients with up to 20 percent total body surface area (TBSA) burns, though the small sample limits generalization.

INTRODUCTION

Airway management is a core skill in general anesthesia, and haemodynamic stability is central to patient safety during it (Hill et al., 2023). Laryngoscopy and endotracheal intubation strongly stimulate the sympathetic nervous system, producing tachycardia and hypertension (Ubale & Jadhav, 2020; Teong et al., 2020). In healthy patients these changes are usually harmless, but in patients with impaired circulation they can increase the risk of morbidity and mortality (Teong et al., 2020).

Burn patients are among the most vulnerable. Increased capillary permeability reduces circulating plasma volume, cardiac output falls, and catecholamine levels rise to sustain it (Abu-Sittah et al., 2012). Burns also cause a heavy global burden. Most burn deaths occur in low- and middle-income regions, and non-fatal burns often lead to prolonged hospital stays, scarring, and disability (Sanchez et al., 2008; Smolle et al., 2017). Airway management in these patients is complicated by thermal injury, edema, and tissue damage (Garcia-Marcinkiewicz et al., 2025).

The LMA, a supraglottic device invented in the early 1980s, avoids laryngoscopy and so may reduce this stress response (Ubale & Jadhav, 2020; Jones, 1995). Earlier studies have generally favored the LMA in healthy and elective populations (Sant et al., 2025; Abid et al., 2025), but few have addressed burn patients. This study compares the two devices in that group.

METHODS

The study was a comparative observational study conducted at the Burn and Plastic Surgery Centre, Hayatabad Medical Complex, Peshawar, under the auspices of Abasyn

University. Adults aged 18 to 60 with ASA I or II status, burns of up to 20 percent TBSA, and scheduled procedures of 15 to 45 minutes under general anesthesia were eligible. Patients with ASA III or higher, recent myocardial infarction, uncontrolled hypertension, or expected airway difficulty were excluded.

Patients were recruited by convenience sampling and divided equally into an ETT group (n = 25) and an LMA group (n = 25). Laryngoscopy was performed with a Macintosh blade for the ETT group. The LMA group received an i-gel supraglottic airway. HR, systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) were recorded before insertion, immediately after insertion, and at 1, 3, and 5 minutes. Insertion attempts and complications were noted during the procedure, although these observations were not part of the pre-designed questionnaire.

Data were analyzed in SPSS version 27. Categorical variables were described with frequencies and percentages, and continuous variables with means and standard deviations. Independent-samples t-tests compared groups, and $p < 0.05$ was considered significant.

Ethical permission was obtained from the Graduate Research Committee of Abasyn University, and written consent was obtained from the Research Ethics Committee and the anesthesia in-charge at the Burn and Plastic Surgery Centre. Participation was voluntary, and data were kept confidential and anonymous.

RESULTS

Participant characteristics

The cohort included 33 men (66 percent) and 17 women (34 percent), a ratio of about 2:1. Most patients were ASA I (68 percent). Mean age was 36.2 years, mean BMI was 24.1 kg/m^2, and mean burned area was 11.9 percent TBSA.

Table 1. Demographic and clinical characteristics of participants (n = 50)

Variable	Category / Statistic	Value
Age (years)	Mean ± SD (range)	36.16 ± 15.98 (18–60)
BMI (kg/m^2)	Mean ± SD (range)	24.08 ± 2.48 (18–28)
Burned area (% TBSA)	Mean ± SD (range)	11.88 ± 5.49 (2–20)
Gender	Male / Female	33 (66.0%) / 17 (34.0%)
ASA physical status	Class I / Class II	34 (68.0%) / 16 (32.0%)

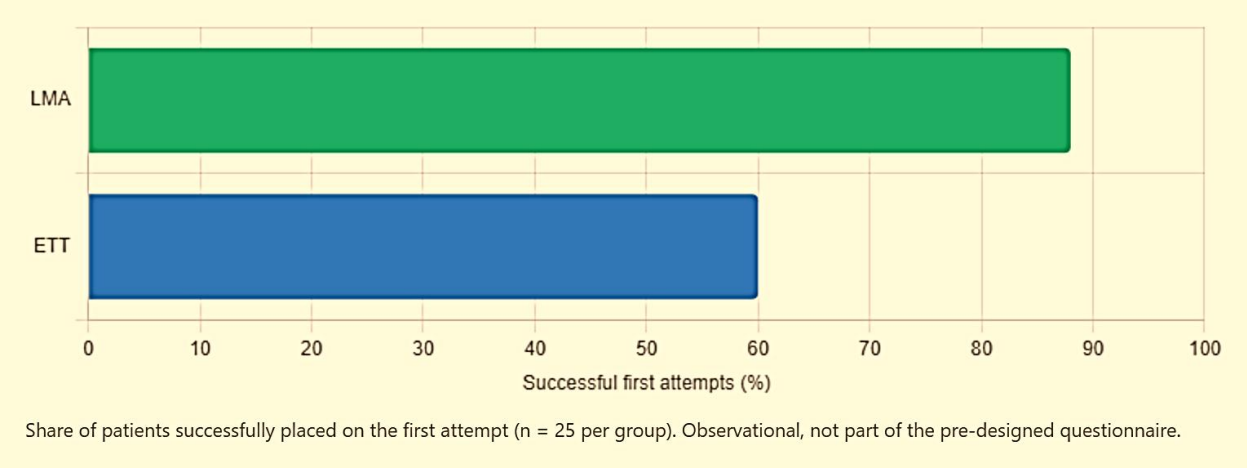
Airway personnel and device characteristics

Anesthesia technologists performed most airway placements, and the devices were evenly split between groups.

Table 2. Airway personnel, device allocation, burn type, and insertion attempts (n = 50)

Variable	Category	Frequency	Percentage
Personnel performing airway	Anesthesia technologist	38	76.0%
	Anesthesia technician	9	18.0%
	Anesthesiologist	3	6.0%
Device	ETT	25	50.0%
	LMA	25	50.0%
Burn type	Superficial	28	56.0%
	Mixed (superficial + deep)	22	44.0%
Insertion attempts	First	37	74.0%
	Second	12	24.0%
	More than two	1	2.0%

Informal observations showed that the LMA group had 22 first-attempt successes (88 percent) and 3 second-attempt successes, with no complications recorded. In the ETT group, 15 patients (60 percent) were intubated on the first attempt, 9 on the second, and 1 needed more than two attempts. Three ETT patients reported sore throat, and one patient had minor laryngeal bleeding.



Share of patients successfully placed on the first attempt (n = 25 per group). Observational, not part of the pre-designed questionnaire.

Figure 1. First-attempt insertion success by device

Heart rate

Before insertion, mean HR was slightly higher in the ETT group, but the difference was not significant (p = 0.329). The ETT group then showed a sustained rise: at 1 minute, HR was 105.4 bpm versus 90.8 bpm with the LMA (p = 0.003), and at 3 minutes it was 107.0 versus 93.6 bpm (p = 0.010). By 5 minutes the groups had converged, and the difference was no longer significant (p = 0.242).

Table 3. Heart rate (bpm) by device and time point

Time point	ETT (mean ± SD)	LMA (mean ± SD)	p-value
Before insertion	103.64 ± 16.06	99.60 ± 12.71	0.329
Immediately after insertion	106.68 ± 26.91	99.32 ± 18.79	0.268
1 minute	105.40 ± 18.18	90.80 ± 15.27	**0.003**
3 minutes	106.96 ± 18.14	93.60 ± 16.82	**0.010**
5 minutes	101.84 ± 23.07	95.12 ± 16.50	0.242

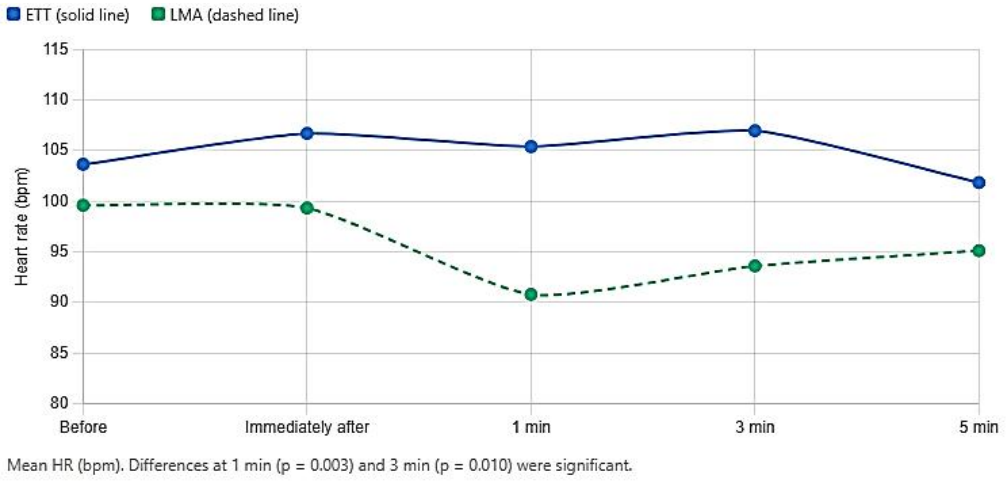


Figure 2. Mean heart rate by device and time point

Systolic and diastolic blood pressure

SBP was significantly lower in the ETT group before insertion (107.8 vs. 119.1 mmHg, p = 0.025). After insertion, the ETT group had numerically higher values, with the largest gap immediately after insertion (127.9 vs. 120.1 mmHg), but none of the post-insertion differences were significant. DBP showed the same pattern, with no significant differences at any time point.

Table 4. Systolic and diastolic blood pressure (mmHg) by device and time point

Time point	SBP ETT		SBP LMA		p (SBP)	DBP ETT	DBP LMA	p (DBP)
Before insertion	107.8 12.97	±	119.1 20.64	±	**0.025**	69.64	73.40	0.165
Immediately after	127.9 18.63	±	120.1 22.29	±	0.183	83.08	71.40	0.099
1 minute	116.7 14.90	±	116.1 25.47	±	0.925	72.60	76.04	0.370
3 minutes	116.6	±	116.0	±	0.911	71.40	70.40	0.754

5 minutes	13.09 111.9 16.64	±	25.47 97.5 ± 44.71	0.138	71.60	70.52	0.761

Mean arterial pressure

MAP was significantly higher in the LMA group before insertion (88.9 vs. 78.2 mmHg, p = 0.019). After insertion the groups were similar, and no differences reached significance. At 5 minutes, MAP was essentially identical (86.2 vs. 86.0 mmHg, p = 0.969).

Table 5. Mean arterial pressure (mmHg) by device and time point

Time point	ETT (mean ± SD)	LMA (mean ± SD)	p-value
Before insertion	78.2 ± 18.82	88.9 ± 11.37	**0.019**
Immediately after insertion	93.9 ± 11.59	92.5 ± 14.66	0.710
1 minute	86.0 ± 9.65	89.2 ± 19.29	0.473
3 minutes	85.8 ± 9.13	84.9 ± 15.01	0.803
5 minutes	86.2 ± 14.06	86.0 ± 14.78	0.969

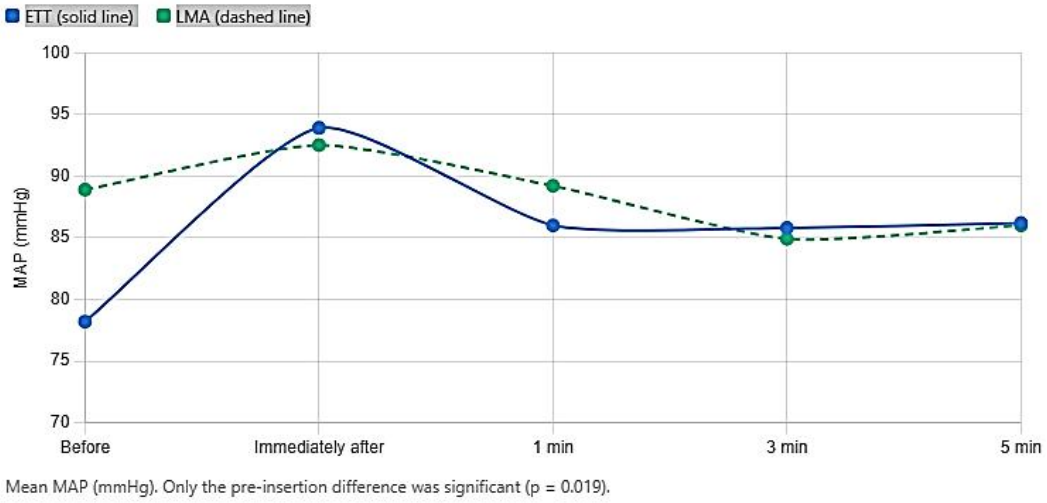


Figure 3. Mean arterial pressure by device and time point

Discussion

The clearest finding was the heart-rate response. The ETT group showed a sustained tachycardia for the first three minutes, while the LMA group's heart rate fell below its pre-insertion level. Sant et al. (2025) reported a similarly attenuated heart-rate surge after ProSeal LMA insertion, with changes returning to baseline within about ten minutes. Jarineshin et al. (2015) found a marked tachycardic surge after intubation with minimal change under the LMA, and the present results mirror this pattern.

The blood pressure results were less decisive. The ETT group had higher numerical SBP and DBP immediately after insertion, which fits the sympathetic response described in the literature. Ubale and Jadhav (2020) reported ETT-related rises of roughly 20 to 25 mmHg in SBP and DBP, compared with smaller LMA changes. Here, however, the differences did not reach significance. The LMA group's higher pre-insertion MAP may also have affected the post-insertion comparisons. Ziyaeifard et al. (2012) reported a similar lack of significant hemodynamic difference between devices in cataract surgery, while noting that LMA insertion was less traumatic.

The informal observations also favored the LMA. Abid et al. (2025) reported faster LMA insertion and fewer airway trauma events in a larger cross-sectional study of 384 patients, and Saha (2024) found fewer complications with the LMA. Pushparani et al. (2024) reported that the LMA was associated with a smaller pressure response. Elnafad et al. (2024), studying critically ill tracheostomy patients who were older and heavier, found no heart-rate difference between devices. This contrast suggests that the LMA's advantage may depend on the patient population and procedure.

Limitations

The sample was small, with 25 patients per group, and convenience sampling was used. Patients with TBSA above 20 percent and those needing longer or more complex operations were excluded, so the findings may not extend to severe burns. Hemodynamic monitoring stopped at 5 minutes, which may miss later differences. Anesthetic depth and analgesic dosing were not assessed, and the pre-insertion MAP imbalance may have influenced the post-insertion comparisons. Insertion attempts and complications were recorded informally rather than through a validated protocol, so those findings are anecdotal.

Conclusion

In short elective procedures in adult burn patients with up to 20 percent TBSA, the LMA produced a significantly smaller heart-rate response than endotracheal intubation during the first three minutes. It also appeared to achieve first-attempt success more often and cause fewer complications, though these observations were informal. Blood pressure differences were numerical rather than significant. The LMA therefore appears to be a safe alternative to the ETT in this setting. Larger studies with longer follow-up, higher TBSA categories, and formal complication tracking are needed before it is recommended as a routine substitute. Both devices should remain available in the operating room in case one fails.

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