e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(8); 1238-1246

Original Research Article

Comparison of BlockBuster LMA and Ambu Aura Gain in Female Patients Undergoing Elective Diagnostic Laparoscopic Gynaecological Procedures under general anaesthesia: A Randomised Controlled Study

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Received: 01-05-2026 / Revised: 15-06-2026 / Accepted: 21-07-2026

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Conflict of interest: Nil

Abstract

Background and Aims: Supraglottic airway devices (SADs) are increasingly used instead of endotracheal intubation for elective laparoscopic surgery, where a high oropharyngeal leak pressure (OLP) is needed to counter the raised intra-abdominal pressure of pneumoperitoneum. We compared the LMA BlockBuster® and Ambu® AuraGain™ with respect to OLP (primary outcome) and insertion characteristics, haemodynamic response and postoperative morbidity (secondary outcomes) in women undergoing elective diagnostic laparoscopic gynaecological surgery.

Methods: In this prospective, randomized, single-blind study, 80 women of American Society of Anesthesiologists (ASA) physical status I–II, aged 18–60 years, undergoing elective diagnostic laparoscopy under general anaesthesia were randomized by computer-generated random numbers to Group BB (LMA BlockBuster®, n = 40) or Group AA (Ambu® AuraGain™, n = 40). OLP, ease and time of insertion, number of attempts, manipulations required, haemodynamic parameters, and removal and postoperative complications were recorded. Continuous data were analysed using the independent-samples t-test and categorical data using the chi-square/Fisher's exact test; $p < 0.05$ was considered significant.

Results: The groups were comparable for age, weight, ASA and Mallampati grade, and duration of surgery ($p > 0.05$). Mean OLP was significantly higher with the BlockBuster (30.55 ± 2.46 cm H_2O) than the AuraGain (26.41 ± 2.68 cm H_2O; $p < 0.0001$). Insertion was graded easy more often (62.5% vs. 45.0%; $p = 0.043$), was faster (17.77 ± 2.56 s vs. 20.05 ± 4.68 s; $p = 0.008$), required fewer attempts (95.0% vs. 72.5% first-attempt success; $p = 0.006$) and fewer manipulations ($p = 0.022$) with the BlockBuster. Haemodynamic parameters, SpO_2, removal characteristics and postoperative sore throat/dysphagia were comparable between groups ($p > 0.05$).

Conclusion: The LMA BlockBuster® provided a significantly higher oropharyngeal seal pressure and easier, faster, first-attempt insertion than the Ambu® AuraGain™, with comparable haemodynamic stability and postoperative morbidity, supporting its use for airway management during elective laparoscopic gynaecological surgery.

Keywords: Gynaecological Laparoscopy; Laryngeal Mask Airway; Oropharyngeal Leak Pressure; Randomized Controlled Trial; Supraglottic Airway Device.

DOI: 10.25258/ijcpr.18.8.185

Introduction

Gynaecological laparoscopic procedures are associated with pneumoperitoneum-related increases in intra-abdominal pressure and reduced pulmonary compliance, together with an altered risk of regurgitation and aspiration; secure and reliable airway control is therefore essential.[1] Endotracheal intubation has traditionally been used, but second-generation supraglottic airway devices (SADs), which combine a higher-pressure pharyngeal seal with an integrated gastric access channel, are now well-established alternatives for controlled ventilation during laparoscopic surgery.[2] The laryngeal mask airway (LMA), first described by Brain in 1983,[3] revolutionized airway

management by providing a supraglottic seal without laryngoscopy.[4] Second-generation devices, with higher oropharyngeal seal pressures and a dedicated gastric drainage port, are considered suitable for positive-pressure ventilation even where endotracheal intubation is not mandatory.

The LMA BlockBuster®, a second-generation SAD with a short, wide, wire-reinforced airway tube angulated at 95°, was designed to combine a high pharyngeal seal with ease of insertion, and can also serve as a conduit for LMA-guided tracheal intubation.[5,6] The Ambu® AuraGain™ is a single-use, anatomically pre-curved, polyvinyl chloride device with an integrated gastric channel and bite block that is also used as a conduit for fibreoptic-guided intubation; its thin, soft cuff has been reported to achieve seal pressures of up to 40 cm H_2O.[7]

During laparoscopic surgery, pneumoperitoneum and the Trendelenburg position reduce pulmonary compliance and raise peak airway pressure,[8] increasing the likelihood of a perilaryngeal leak around a supraglottic device. Oropharyngeal leak pressure (OLP) – the pressure at which an audible leak occurs around the device cuff – is widely used as a surrogate marker of the adequacy of the pharyngeal seal and, hence, of the safety of a SAD for positive-pressure ventilation;[9,10] a higher OLP is considered protective against leak-related complications such as gastric insufflation and aspiration.

Although both the LMA BlockBuster® and Ambu® AuraGain™ have individually been shown to be effective airway devices, direct comparative data in the specific setting of gynaecological laparoscopic surgery, where a high pharyngeal seal is particularly important, remain limited.[11]

We therefore designed this randomized, single-blind study to compare the two devices with respect to OLP (primary objective) and insertion characteristics, haemodynamic response, removal characteristics and postoperative complications (secondary objectives) in women undergoing elective diagnostic laparoscopic gynaecological surgery.

Materials and Methods

Study Design and Setting: This prospective, randomized, single-blind, comparative study was conducted in the Department of Anaesthesia, Mahila Chikitsalya, J.L.N. Medical College and Associated Group of Hospitals, Ajmer, Rajasthan, after approval from the Institutional Ethics Committee [02555/Acad-iii/MCA/2024] and written informed consent from all participants.

Participants: Eighty adult women, aged 18–60 years, of ASA physical status I or II, weighing 30–70 kg, and scheduled for elective diagnostic laparoscopic gynaecological surgery under general anaesthesia in the supine position with an anticipated duration of up to 60 minutes, were eligible.

Exclusion Criteria: declined consent; mouth opening <2.5 cm; known or predicted difficult airway; abnormal airway anatomy; pregnancy; a planned head and neck procedure; or an increased risk of aspiration (non-fasted or fasting status unknown).

Randomization and Blinding: Patients were allocated in a 1:1 ratio to Group BB (LMA BlockBuster®, n = 40) or Group AA (Ambu® AuraGain™, n = 40) using a computer-generated random number table, with allocation concealed by [sealed opaque envelopes]. The outcome assessor recording postoperative data was blinded to group allocation; the anaesthesiologist performing device insertion could not be blinded because of the nature of the intervention.

Anaesthetic Protocol: After a standard pre-anaesthetic evaluation (including Mallampati grading, thyromental distance and upper lip bite test) and routine investigations, patients fasted for at least 8 hours. Standard monitoring (electrocardiography, non-invasive blood pressure and pulse oximetry) was established, and baseline heart rate (HR), systolic/diastolic/mean arterial pressure (SBP/DBP/MAP) and SpO_2 were recorded. After pre-oxygenation for 3 minutes, patients received intravenous glycopyrrolate 0.2 mg and midazolam 1 mg, followed by fentanyl 2 mcg/kg and propofol 2–3 mg/kg for induction, and atracurium 0.5 mg/kg to facilitate device insertion after confirming adequate mask ventilation.

All insertions were performed by a single anaesthesiologist experienced with both devices (>30 prior insertions of each). Device size was selected according to the manufacturer's weight-based recommendations, with standard manoeuvres (jaw thrust, neck flexion/extension, gentle push-pull) used if resistance was encountered. Anaesthesia was maintained with sevoflurane in 40% oxygen with atracurium(0.1mg/kg); intravenous paracetamol 15 mg/kg was given for postoperative analgesia.

Outcome Measures

Primary Outcome: Oropharyngeal leak pressure was noted immediately after insertion by closing the expiratory valve of the circle system at a fixed gas flow of 3lt/min and airway pressure at which equilibrium was reached was noted.[9]

Secondary outcomes: (i) ease of insertion, graded as easy (no resistance), difficult (deep rotation/jaw thrust or a second attempt required) or failed (unsuccessful after three attempts, converted to endotracheal intubation); (ii) insertion time (from

device pick-up to the first square-wave capnograph trace); (iii) number of attempts and manipulations required; (iv) HR, SBP, DBP, MAP and SpO_2, recorded at baseline, at 1, 2, 5 and 10 minutes after insertion, at device removal, and at 2 and 5 minutes after removal; (v) removal characteristics, including blood staining of the device, trauma to the lips/tongue/teeth, ease of gastric tube insertion/sump clearance, gastric fluid in the airway cavity, coughing, laryngospasm and bronchospasm; and (vi) postoperative sore throat and dysphagia, assessed over a 24-hour follow-up period.

Sample Size: Based on the OLP data reported by Jyothi et al.,[11] a sample of 40 patients per group was calculated to detect the observed between-group difference with 90% power at a two-sided α of 0.05, inflated by 10% for anticipated dropout, giving a total sample of 80.

Statistical Analysis: Data were analysed using SPSS software version 28.0 (IBM Corp., Armonk, NY, USA).

Continuous variables are expressed as mean ± standard deviation and were compared using the independent-samples t-test. Categorical variables are expressed as frequency and percentage and were compared using the chi-square test or Fisher's exact test, as appropriate. A two-sided p value < 0.05 was considered statistically significant.

Results

Eighty patients were enrolled and randomized (40 per group); all completed the study with no dropouts or protocol deviations (Figure 1).

Baseline Characteristics: Groups BB and AA were comparable for age, weight, ASA physical status, Mallampati grade and duration of surgery (all p > 0.05) (Table 1).

Table 1: Baseline demographic and clinical characteristics

Characteristic	Group BB (n = 40)	Group AA (n = 40)	p value
Age (years), mean ± SD	29.27 ± 5.3	30.84 ± 4.3	0.149
Weight (kg), mean ± SD	66.23 ± 5.46	65.50 ± 5.68	0.559
ASA I, n (%)	29 (72.5)	30 (75.0)	0.800
ASA II, n (%)	11 (27.5)	10 (25.0)	–
Mallampati I, n (%)	31 (77.5)	32 (80.0)	0.785
Mallampati II, n (%)	9 (22.5)	8 (20.0)	–
Duration of surgery (min), mean ± SD	58.07 ± 2.46	58.74 ± 2.68	0.247

SD = standard deviation; ASA = American Society of Anesthesiologists.

Oropharyngeal leak pressure: The mean OLP was significantly higher in Group BB (30.55 ± 2.46 cm H_2O) than Group AA (26.41 ± 2.68 cm H_2O; p < 0.0001) (Table 2).

Table 2: Comparison of mean oropharyngeal leak pressure between study groups

Parameter	Group BB (n = 40)	Group AA (n = 40)	p value
OLP (cm H_2O), mean ± SD	30.55 ± 2.46	26.41 ± 2.68	<0.0001

OLP = oropharyngeal leak pressure; SD = standard deviation.

Insertion characteristics: Insertion was graded easy in 62.5% of Group BB versus 45.0% of Group AA, and failed (converted to endotracheal intubation) in 12.5% of Group AA and none of Group BB (p = 0.043). Mean insertion time was significantly shorter in Group BB (17.77 ± 2.56 s) than Group AA (20.05 ± 4.68 s; p = 0.008). First-attempt success was higher in Group BB (95.0% vs. 72.5%; p = 0.006), and fewer patients in Group BB required airway manipulations (12.5% vs. 37.5%; p = 0.022) (Table 3).

Table 3. Comparison of insertion characteristics between study groups

Parameter	Group BB (n = 40), n (%)	Group AA (n = 40), n (%)	p value
Ease of insertion – easy	25 (62.5)	18 (45.0)	0.043
Ease of insertion – difficult	15 (37.5)	17 (42.5)	
Ease of insertion – failed	0 (0.0)	5 (12.5)	
Time to insertion (s), mean ± SD	17.77 ± 2.56	20.05 ± 4.68	0.008
First-attempt success	38 (95.0)	29 (72.5)	0.006
Second-attempt success	2 (5.0)	11 (27.5)	
Manipulation – none required	35 (87.5)	25 (62.5)	0.022
Manipulation – 1 required	5 (12.5)	12 (30.0)	
Manipulation – 2 required	0 (0.0)	3 (7.5)	

SD = standard deviation.

Haemodynamic parameters: HR, SBP, DBP, MAP and SpO_2 were comparable between groups at baseline. During and after insertion, all haemodynamic parameters rose modestly in both groups, but remained comparable

between groups at all time points from baseline through 5 minutes after device removal, with no statistically significant between-group difference at any time point (all p > 0.05) (Table 4).

Table 4. Comparison of haemodynamic parameters (Group BB / Group AA) between study groups at different time intervals

Parameter	Baseline	1 min after insertion	At removal	5 min after removal	p value
HR (bpm)	81.6 / 82.5	81.5 / 81.6	83.6 / 85.0	86.9 / 86.7	>0.05
SBP (mmHg)	118.5 / 118.2	117.3 / 117.9	117.3 / 118.4	120.4 / 121.9	>0.05
DBP (mmHg)	81.1 / 80.0	77.5 / 78.2	70.2 / 72.6	72.2 / 72.6	>0.05
MAP (mmHg)	88.6 / 89.5	87.5 / 87.9	83.6 / 85.0	86.9 / 86.7	>0.05
SpO_2 (%)	99.2 / 99.3	99.2 / 99.2	99.2 / 99.1	99.1 / 99.2	>0.05

HR = heart rate; SBP = systolic blood pressure; DBP = diastolic blood pressure; MAP = mean arterial pressure; SpO_2 = peripheral oxygen saturation. Values are group means (Group BB / Group AA); none of the between-group comparisons reached statistical significance at any time point.

Removal Characteristics and Postoperative Complications: Removal-related findings (blood staining, trauma to lips/tongue/teeth, difficulty with sump clearance, gastric fluid in the airway cavity, coughing) and postoperative sore throat and dysphagia were numerically more frequent in Group AA than Group BB, but none of these differences reached statistical significance (all p > 0.05) (Table 5). No patient in either group developed laryngospasm or bronchospasm.

Table 5: Comparison of removal characteristics and postoperative complications between study groups

Adverse effect / finding	Group BB (n = 40), n (%)	Group AA (n = 40), n (%)	p value
Blood staining on device	2 (5.0)	4 (10.0)	0.398
Trauma to lips/tongue/teeth	3 (7.5)	6 (15.0)	0.291
Difficult sump/gastric tube clearance	4 (10.0)	7 (17.5)	0.331
Gastric fluid in airway cavity	2 (5.0)	4 (10.0)	0.398
Coughing	2 (5.0)	3 (7.5)	0.646
Laryngospasm/bronchospasm	0 (0.0)	0 (0.0)	–
Postoperative sore throat	5 (12.5)	6 (15.0)	0.747
Postoperative dysphagia	6 (15.0)	7 (17.5)	0.763

Chi-square/Fisher's exact test for all comparisons.

Leak Pressure and Insertion Time

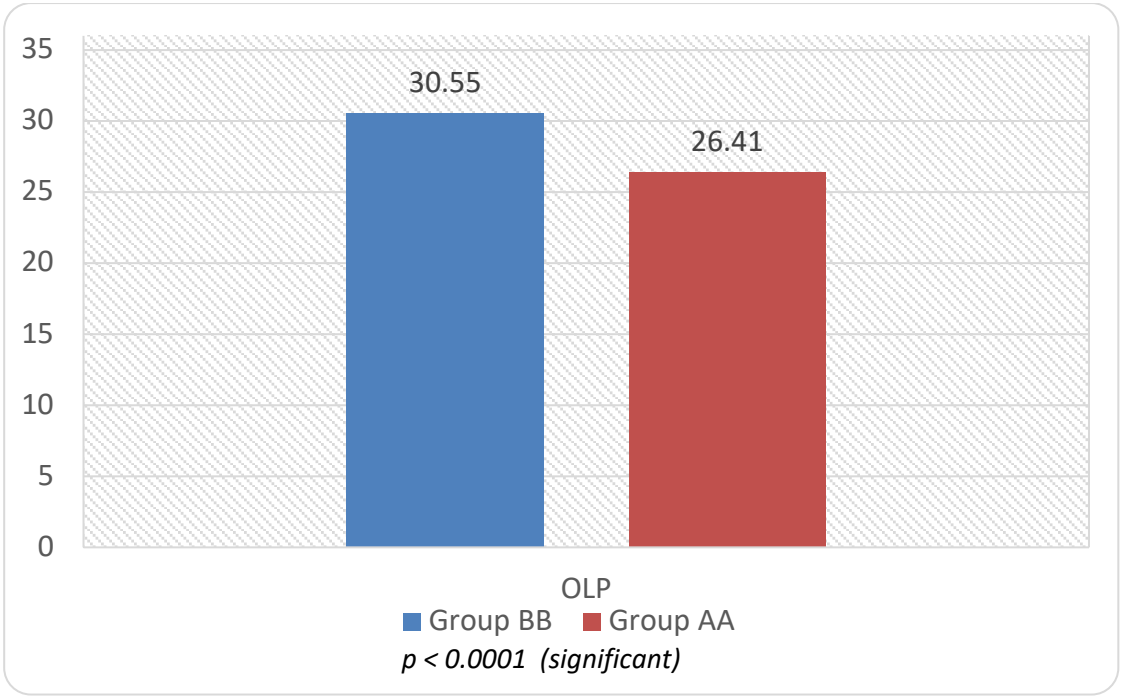

Figure 1: Oropharyngeal Leak Pressure (cm H_2O)

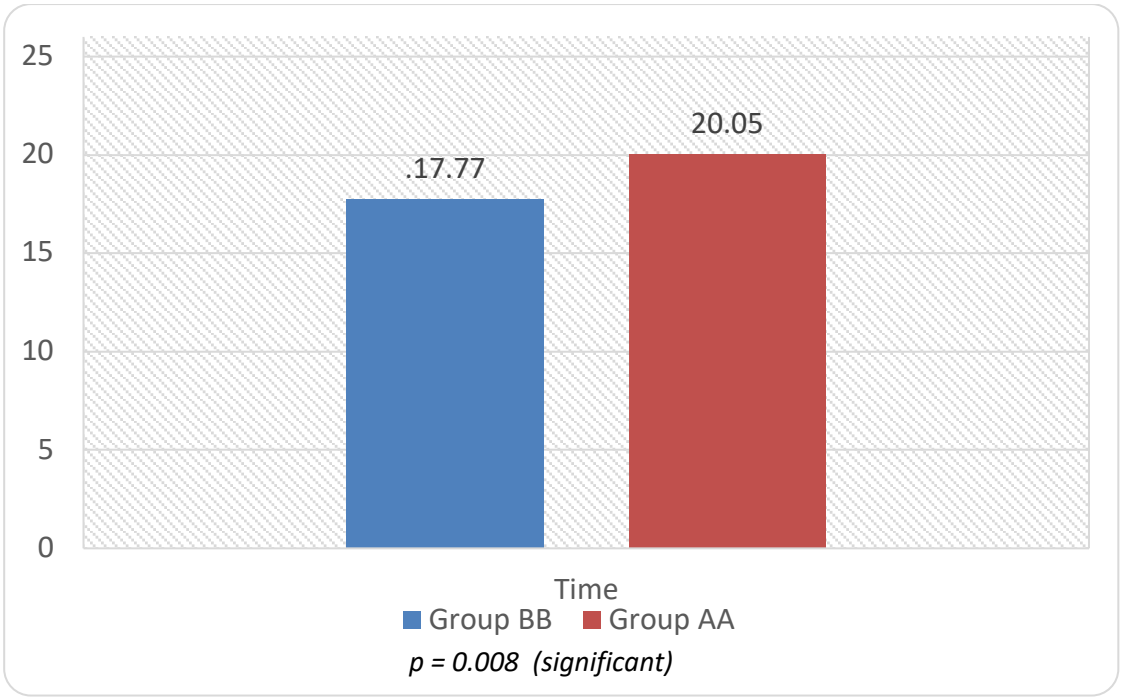

Figure 2: Time Taken for LMA Insertion (sec)

Ease of Insertion and Attempts

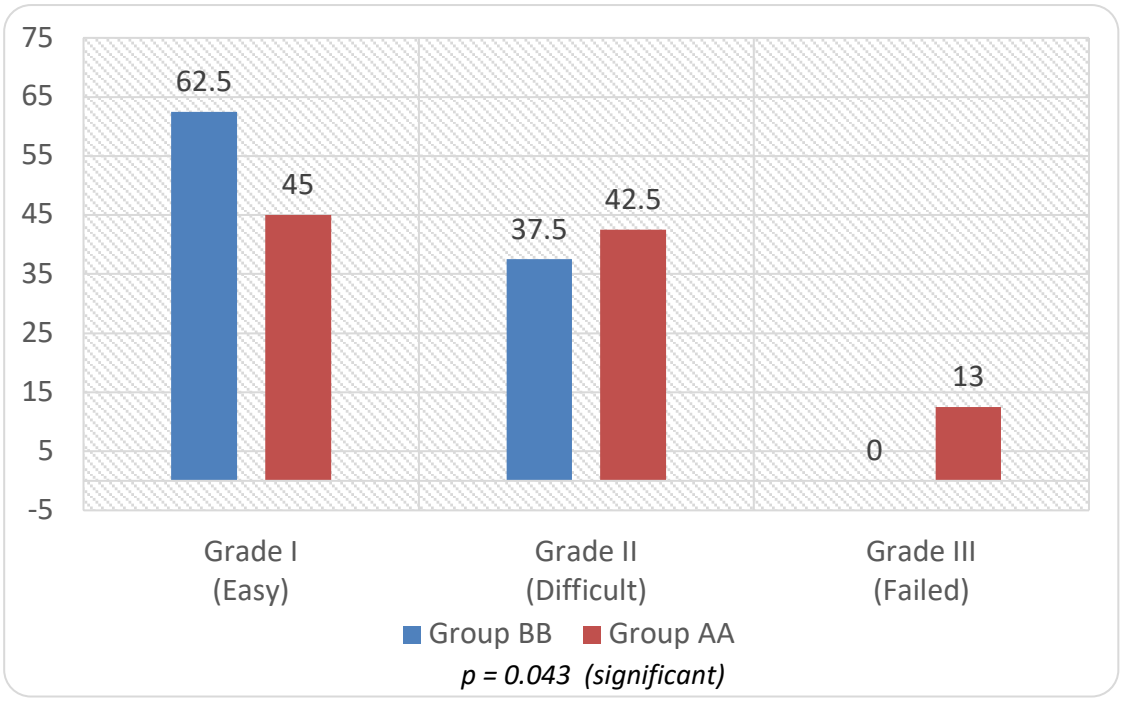

Figure 3: Ease of Insertion (%)

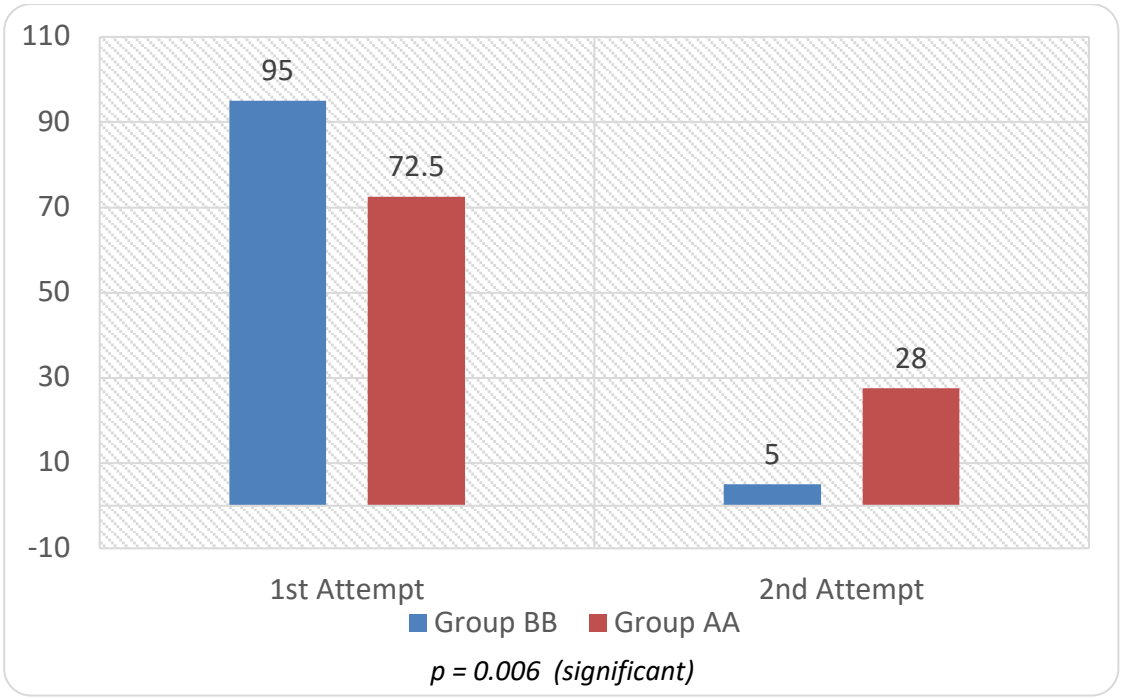

Figure 4: Number Of Insertion Attempts (%)

Manipulation Frequency

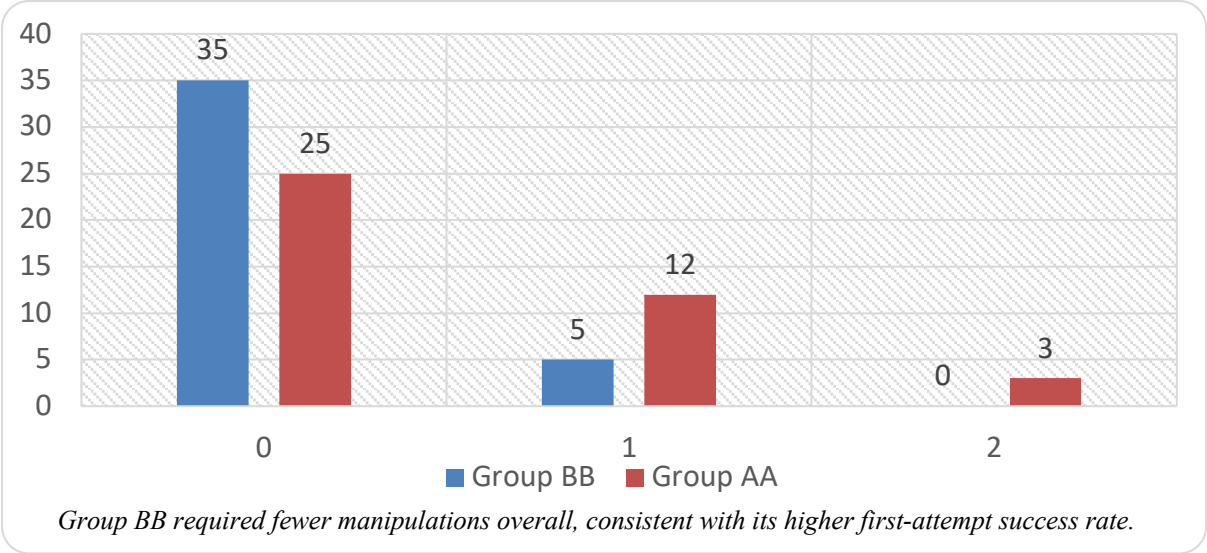

Figure 5: Number of manipulations required during insertion (n)

Discussion

In this randomized, single-blind trial comparing the BlockBuster® LMA and Ambu® AuraGain™ in women undergoing elective diagnostic laparoscopic gynaecological surgery, the BlockBuster achieved a significantly higher oropharyngeal seal, together with easier, faster, first-attempt insertion, while haemodynamic stability, removal-related trauma and postoperative morbidity were similar between the two devices. During laparoscopic gynaecological surgery, pneumoperitoneum and the Trendelenburg position reduce pulmonary compliance and increase peak airway pressure; a higher OLP therefore provides a wider safety margin against perilaryngeal leak, gastric insufflation and aspiration during positive-pressure ventilation.[8,9] The silicone cuff of the BlockBuster, which is more elastic and malleable than the polyvinyl chloride cuff of the AuraGain, has been proposed as the structural basis for its higher sealing pressure.[12]

Our OLP findings are consistent with several recent Indian comparative studies. Jyothi et al. reported a higher mean OLP with the BlockBuster (33.8 cm H_2O) than the AuraGain (23.4 cm H_2O),[11] Gaur et al. found a similar advantage for the BlockBuster in anaesthetized preschool children (29.08 vs. 26.6 cm

H_2O; $p < 0.0001$),[13] and Garg et al. reported a comparable difference (29.9 vs. 22.7 cm H_2O; $p = 0.001$) in adults undergoing elective surgery.[14] Kumar et al. found the same direction of effect during controlled ventilation in children (24.72 vs. 17.20 cm H_2O; $p = 0.001$).[15] The BlockBuster was also easier and faster to insert, with a higher first-attempt success rate, findings that mirror those of Gaur et al. and Garg et al., both of whom attributed this advantage to the anatomically curved, soft-tipped design of the BlockBuster device.[13,14] Jyothi et al. similarly reported a shorter insertion time for the BlockBuster (12.25 s vs. 17.65 s).[11] In contrast, Manohar et al. reported a longer insertion time and more attempts with the BlockBuster LMA than the Ambu Aura Gain,[16] a discrepancy that may reflect differences in operator experience or patient population and underscores the operator-dependent nature of SAD insertion. Consistent with our finding of fewer airway manipulations required with the BlockBuster, Singh et al. found comparable manipulation and gastric-tube insertion times between the BlockBuster and the LMA ProSeal.[17] Haemodynamic parameters did not differ significantly between the groups at any time point in our study, in agreement with Jyothi et al. and Garg et al., both of whom reported comparable HR and blood pressure responses between the two devices.[11,14] This suggests that neither device produces a greater pressor response than the other during insertion or removal, an important consideration when either device is used in patients where haemodynamic stability is a priority. Removal-related trauma and postoperative sore throat and dysphagia were numerically, but not significantly, more frequent with the AuraGain in our study, a pattern also observed by Garg et al., who reported a higher (though non-significant) incidence of sore throat and displacement with the AuraGain.[14] Agrawal et al. similarly found low and comparable rates of postoperative morbidity between second-generation SADs when inserted by experienced anaesthesiologists,[18] consistent with the favourable overall safety profile of both devices observed here.

Taken together, these findings suggest that the LMA BlockBuster® may be particularly suited to short elective laparoscopic procedures where rapid, secure, high-pressure airway control is desired, whereas the Ambu® AuraGain™, despite requiring marginally more attempts and manipulations, remains a safe and effective alternative, with its wide gastric channel offering practical utility where gastric decompression is a priority.

Limitations

1. This was a single-centre study with a modest sample size; multicentre validation with larger samples is needed to confirm generalizability.
2. The study population was restricted to ASA I–II adult women undergoing short diagnostic laparoscopic procedures; findings may not extend to higher ASA grades, paediatric patients, or longer or more complex laparoscopic surgery.
3. All insertions were performed by a single, experienced anaesthesiologist, which minimized operator-related variability but may limit generalizability to less experienced operators.
4. The anaesthesiologist performing device insertion could not be blinded because of the nature of the intervention.

Conclusion

In women undergoing elective diagnostic laparoscopic gynaecological surgery, the BlockBuster® LMA provided a significantly higher oropharyngeal leak pressure and easier, faster, first-attempt insertion than the Ambu® AuraGain™, with comparable haemodynamic stability, removal characteristics and postoperative morbidity. Both devices were clinically effective and safe for airway management during positive-pressure ventilation in this setting, but the BlockBuster LMA superior sealing pressure and ease of insertion may make it the preferable choice for short elective laparoscopic gynaecological procedures.

Declarations

Ethics Approval and Consent to Participate: This study was approved by the Institutional Ethics Committee of Jawaharlal Nehru Medical College and Associated Group of Hospitals, Ajmer, Rajasthan (Reference number: 10004981) [02555/Acad-iii/MCA/2024] approved at meeting held 16.07.2024. Written informed consent was obtained from every participant prior to inclusion in the study.

Availability of Data and Materials: The datasets generated and/or analysed during the current study are available from the corresponding author on reasonable request.

Authors' Contributions: AK: conception, supervision, critical revision of the manuscript. BT: data collection, analysis, manuscript drafting. SM: study design, data collection, manuscript drafting and editing. All authors read and approved the final manuscript.

Acknowledgements: The authors thank the Department of Obstetrics and Gynaecology, Government Mahila Chikitsalaya, Jawaharlal Nehru Medical College and Associated Group of Hospitals, Ajmer, for their cooperation during the conduct of this study.

Figure Legend:

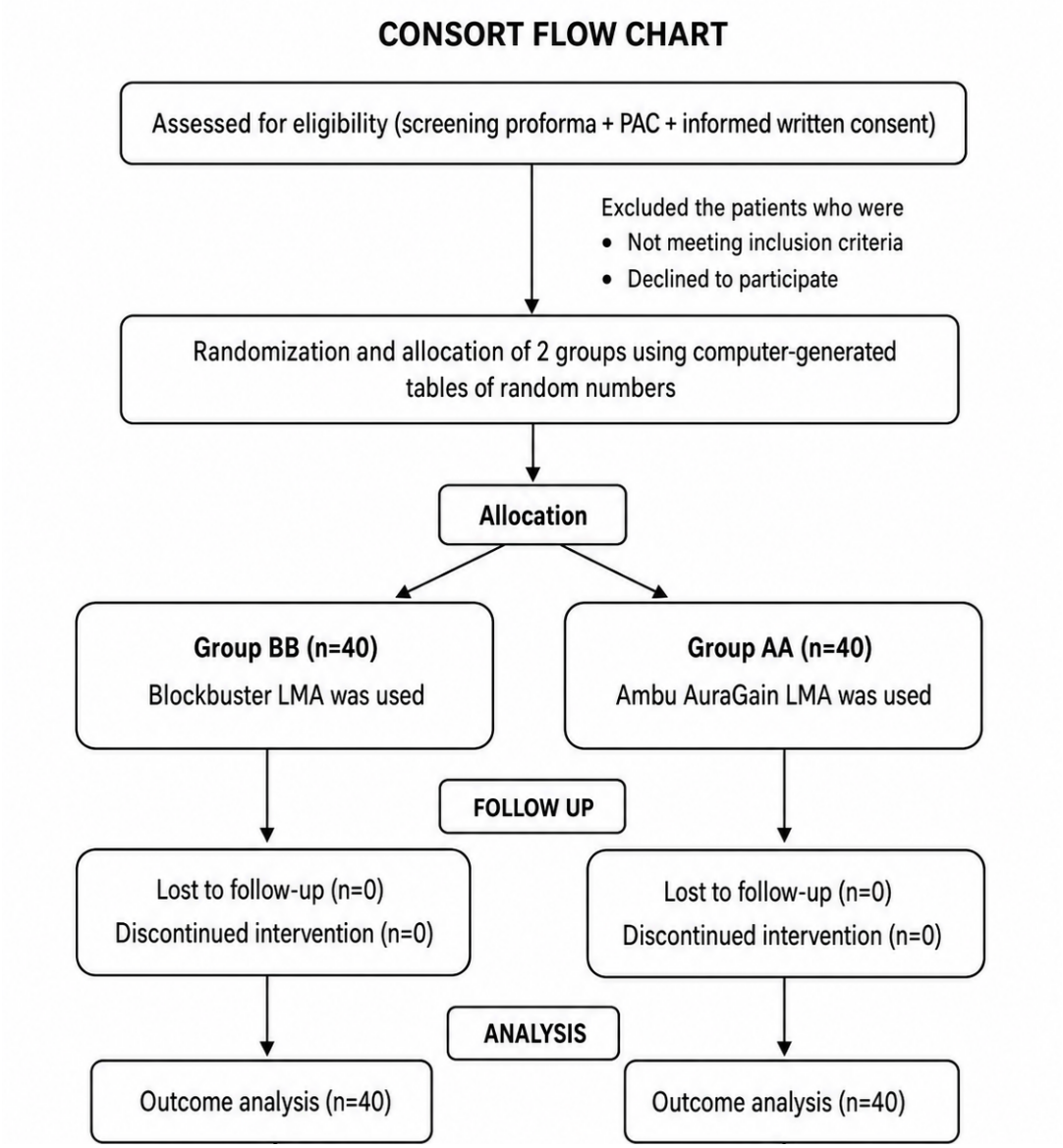

Figure 6: CONSORT flow diagram of patient enrolment, randomization, allocation, follow-up and analysis. Eighty women scheduled for elective diagnostic laparoscopic gynaecological surgery were assessed for eligibility [total number screened and reasons for exclusion to be inserted]. Eighty patients were randomized (40 to Group BB, receiving the LMA BlockBuster®; 40 to Group AA, receiving the Ambu® AuraGain™). No patients were lost to follow-up or discontinued the intervention; all 80 patients were included in the outcome analysis.

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