Original Article

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Comparison of Haemodynamic Responses Between Oxiport and Conventional Laryngoscopes During Paediatric Intubation Under General Anaesthesia: A Randomised Controlled Trial

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ABSTRACT

Introduction: Paediatric airway management presents unique challenges due to higher oxygen consumption and lower functional residual capacity, predisposing children to rapid desaturation during intubation. The Oxiport laryngoscope provides continuous oxygen insufflation during laryngoscopy, potentially improving oxygenation and haemodynamic stability.

Aim: To compare haemodynamic responses and oxygenation parameters during intubation between Oxiport laryngoscope and the conventional laryngoscope in paediatric patients up to 3 years undergoing general anaesthesia.

Materials and Methods: This single-blinded randomised controlled trial was conducted at the Department of Anaesthesiology, Dhiraj General Hospital, Vadodara, Gujarat, India, from December 2022 to January 2025. Sixty American Society of Anaesthesiologists (ASA) physical status grade I-II paediatric patients aged 6 months to 3 years were randomly allocated into two groups (n=30 each): Group O (Oxiport laryngoscope) and Group C (Conventional laryngoscope). Primary outcomes included the lowest Oxygen Saturation (SpO_2) attained, time for 1% desaturation, rate of desaturation, and haemodynamic parameters. Secondary outcomes included the number of intubation attempts, duration of laryngoscopy and intubation, and the incidence of severe desaturation (SpO_2<90%). Statistical analysis was performed using an Unpaired t-test and Chi-square test, with a p-value <0.05 considered significant.

Results: Both groups were comparable in demographic characteristics (age: 19.63±8.27 vs 19.53±8.92 months, p-value=0.963; weight: 11.33±1.97 vs 11.30±2.04 kg, p-value=0.957). The Oxiport group demonstrated significantly higher lowest SpO_2 (97.37±0.72% vs 91.87±1.14%, p-value <0.0001), longer time to 1% desaturation (17.90±1.11 vs 10.19±0.85 seconds, p-value <0.0001), and slower desaturation rate (0.0822±0.0105 vs 0.3445±0.0358%/sec, p-value <0.0001). Heart rate was significantly lower in the Oxiport group at 3 minutes (121.53±8.40 vs 126.33±8.98 bpm, p-value=0.033). Systolic and diastolic blood pressures were significantly lower in the Oxiport group from 1 minute onwards (p-value <0.0001). No severe desaturation (SpO_2<90%) occurred in the Oxiport group versus 20% in the conventional group (p-value=0.0097).

Conclusion: The Oxiport laryngoscope provides superior oxygenation and a more stable haemodynamic profile compared to conventional laryngoscopes during paediatric intubation, potentially improving safety in this vulnerable population.

Keywords: Airway management, Child, Intratracheal , Oxygen therapy

INTRODUCTION

Airway management represents one of the most essential skills in anaesthesia practice, with endotracheal intubation being the gold standard for securing the airway during surgical procedures. In paediatric patients, this critical procedure presents unique challenges due to significant anatomical and physiological differences compared to adults [1,2]. These differences not only make the technical aspects of intubation more challenging but also substantially increase the risk of rapid desaturation during the procedure, particularly in neonates and infants [3]. Paediatric patients have distinct anatomical characteristics, including a proportionally larger head, a larger tongue relative to the oral cavity, a more anterior and cephalad larynx, and a shorter trachea. Physiologically, they demonstrate higher oxygen consumption (6-8 ml/kg/min vs 3-4 ml/kg/min in adults) coupled with lower functional residual capacity, resulting in limited oxygen reserve and predisposition to rapid desaturation during apnoea [4,5]. The safe apnoea time in preoxygenated healthy adults may be several minutes, whereas in infants it can be less than 1-2 minutes [6].

Laryngoscopy and intubation trigger significant sympathoadrenal stress responses, manifesting as tachycardia, hypertension, and increased myocardial oxygen consumption. These haemodynamic changes, while generally well-tolerated in healthy children, can be detrimental in patients with cardiovascular comorbidities [7,8]. Various strategies have been employed to maintain oxygenation during intubation, including optimised pre-oxygenation techniques and apnoeic oxygenation. The Oxiport laryngoscope represents a significant advance in paediatric airway management, incorporating a metallic tube into standard Miller/Macintosh blades with an attachment for oxygen delivery during laryngoscopy. This design addresses limitations of earlier modifications by providing stable, reliable oxygen insufflation close to the laryngeal inlet, exploiting the principle of apnoeic diffusion oxygenation. Recent studies have demonstrated its efficacy in reducing desaturation during paediatric intubation, though its effects on haemodynamic parameters remain less explored [9-11].

The present study arises from the critical challenge of preventing rapid desaturation during paediatric intubation, a common complication that can lead to serious adverse outcomes. While various oxygen delivery techniques have been attempted, [10] there remains a gap in the comprehensive evaluation of devices that provide continuous

oxygen insufflation during laryngoscopy, particularly regarding their effects on haemodynamic stability. Hence, the present study aimed to compare haemodynamic responses and oxygenation parameters during intubation between the Oxiport laryngoscope and the conventional laryngoscope in paediatric patients up to 3 years undergoing general anaesthesia.

The primary objectives of this study were to compare the lowest SpO_2 attained during intubation between the two groups, to assess the time for 1% desaturation from baseline, to evaluate the rate of desaturation during intubation, and to compare haemodynamic parameters, including heart rate, systolic and diastolic blood pressure at various time points. The secondary objectives were to compare the number of intubation attempts required, to assess the duration of laryngoscopy and intubation, and to evaluate the incidence of severe desaturation, defined as SpO_2 less than 90%.

MATERIALS AND METHODS

This single-blinded randomised controlled trial was conducted in the Department of Anaesthesiology at Dhiraj General Hospital, S.B.K.S. Medical Institute and Research Centre, Vadodara, Gujarat, India from December 2022 to January 2025. The study protocol was approved by the Institutional Ethics Committee (IEC No: SVU/SBKS/2022-156). Written informed consent was obtained from parents/guardians of all participants. The study was registered with the Clinical Trials Registry of India (CTRI Registration Number: ctri/2025/04/084069).

Sample size calculation: Based on a study by Gandhi N et al., [9] showing a mean lowest SpO_2 of 97.77±2.81% in the Oxiport group and 92.42±3.71% in the conventional group, with 80% power and 5% significance level, the calculated sample size was 28 patients per group. The sample size was calculated using the formula:

$$n = \frac{2(Z\alpha + Z\beta)^2\sigma^2}{d^2}$$

where $Z\alpha = 1.96$ (for 5% significance level),

$Z\beta = 0.84$ (for an 80% power),

σ = pooled standard deviation, and

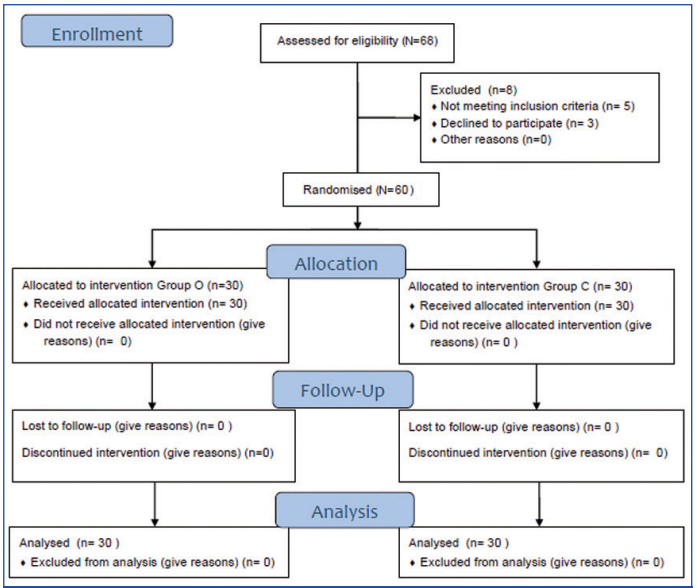
d = difference in means.

Considering potential dropouts (N=60), 30 patients were recruited in each group (n=30).

Inclusion criteria: It included patients with ASA physical status I or II, aged between 6 months and 3 years, of either gender, who were scheduled for elective surgery necessitating endotracheal intubation with no known history of allergy and hypersensitivity to the study drugs, and with the willingness of parents/guardians to sign written informed consent.

Exclusion criteria: It included individuals with a history of prior hypoxic events, upper or lower respiratory tract infections, poor cardiovascular or respiratory reserve, congenital heart disease, anaemia with haemoglobin less than 12 g/dL, ASA status grade III or higher, oral anomalies such as cleft lip and palate, as well as those requiring nasal intubation. Patients with known allergy, sensitivity or any other form of reaction to study drugs, and patients and/or their legally acceptable representatives not willing to provide their voluntary written informed consent for participation were excluded in the study.

Randomisation: A total of 68 patients were screened, of which 8 were excluded (5 did not meet inclusion criteria, 3 declined to participate), resulting in 60 patients being enrolled and randomised. Patients were randomly allocated into two groups using the chit method, Consolidated Standards of Reporting Trials (CONSORT) [Table/Fig-1].



[Table/Fig-1]: CONSORT Flow diagram.

Study Procedure

This was a single-blinded study where the operators could not be blinded due to the nature of the intervention, but outcome assessors were blinded to group allocation. Data analysis was performed by a blinded statistician. ASA physical status grade I-II paediatric patients aged 6 months to 3 years were randomly allocated into two groups as follows:

- Group O (n=30): Intubation with Oxiport laryngoscope
- Group C (n=30): Intubation with a conventional Miller blade laryngoscope

Anaesthetic technique: After shifting to the operating room, intravenous access was secured with 24-G cannula. Standard monitoring included pulse rate, Non Invasive Blood Pressure (NIBP), SpO_2, and Electrocardiography (ECG). Preoxygenation was performed with 100% oxygen at 6 L/min using the Jackson and Rees circuit for 5 minutes. Premedication included intravenous glycopyrrolate (0.004 mg/kg), ondansetron (0.1 mg/kg), midazolam (0.02 mg/kg), and paracetamol (10 mg/kg). Induction was achieved with propofol or ketamine (2 mg/kg), followed by succinylcholine (2 mg/kg) to facilitate intubation.

In group O, oxygen was insufflated at 2 L/min through the auxiliary port during laryngoscopy. Appropriately sized endotracheal tubes were used according to standard weight/age formulas. Anaesthesia was maintained with sevoflurane, oxygen, and nitrous oxide (50:50), with atracurium for muscle relaxation. Postoperative anaesthetic protocol included neuromuscular blockade reversal with neostigmine (0.05 mg/kg) and glycopyrrolate (0.008 mg/kg), followed by monitoring in the postanaesthesia care unit for at least 30 minutes with continuous SpO_2, heart rate, and blood pressure monitoring.

Outcome measures: Primary outcomes included lowest SpO_2 during intubation, time for 1% desaturation from baseline, rate of desaturation, and haemodynamic parameters (heart rate, systolic and diastolic blood pressure) measured at baseline and at 0, 1, 2, 3, 5, 10, 15, 30, 45, 60, 75, 90, and 120 minutes postintubation. Secondary outcomes included the number of intubation attempts, duration of laryngoscopy and intubation, and incidence of severe desaturation (SpO_2 <90%) [12].

STATISTICAL ANALYSIS

Data were analysed using Statistical Package for Social Sciences software version 25.0. Continuous variables were expressed as mean±standard deviation and compared using an unpaired t-test. Categorical variables were expressed as frequencies and percentages and compared using the Chi-square test. Correlation

between intubation time and lowest SpO_2 was assessed using Pearson's correlation coefficient. A p-value <0.05 was considered statistically significant.

RESULTS

All 60 enrolled patients completed the study protocol with no dropouts. Both groups received their allocated interventions and were included in the final analysis. Both groups were comparable regarding demographic characteristics and baseline vital parameters, with no statistically significant differences (p-value >0.05), ensuring a valid comparison between groups. The intubation characteristics were similar between groups with no significant differences in first-attempt success rate or duration of laryngoscopy and intubation (p-value >0.05) as shown in [Table/Fig-2].

Parameters	Group O (n=30)	Group C (n=30)	t-value	p-value
Demographic characteristics				
Age (months)	19.63±8.27	19.53±8.92	0.047	0.963
Gender (M:F)	16:14	15:15	0.067	0.796
Weight (kg)	11.33±1.97	11.30±2.04	0.054	0.957
ASA status (I:II)	22:8	22:8	<0.001	1.000
Baseline vital parameters				
Heart rate (bpm)	118.33±8.13	118.40±8.90	0.032	0.975
Systolic BP (mmHg)	96.90±3.40	96.87±3.61	0.034	0.973
Diastolic BP (mmHg)	59.43±2.81	59.40±3.03	0.043	0.966
SpO_2 (%)	99.47±0.51	99.50±0.51	0.233	0.817
Intubation characteristics				
Number of attempts (1/2)	28/2 (93.3%/6.7%)	28/2 (93.3%/6.7%)	<0.001	1.000
Duration of laryngoscopy (sec)	7.51±0.65	7.77±0.50	1.751	0.085
Duration of intubation (sec)	19.12±1.47	19.77±1.19	1.898	0.063

[Table/Fig-2]: Demographic, baseline characteristics and intubation parameters. (N=60)
*Test used: Unpaired t-test for continuous variables, Chi-square test for categorical variables. A p-value <0.05 considered statistically significant

The Oxiport group demonstrated significantly superior oxygenation parameters compared to the conventional group. The mean lowest SpO_2 was 5.5% higher in the Oxiport group (97.37±0.72% vs 91.87±1.14%, p-value <0.0001). Time for 1% desaturation was nearly doubled in the Oxiport group (17.90±1.11 vs 10.19±0.85 seconds, p-value <0.0001), and the desaturation rate was four-fold slower (0.082±0.0105 vs 0.34±0.0358%/sec, p-value <0.0001). Regarding desaturation severity, the Oxiport group showed no severe desaturation events compared to 20% in the conventional group (p-value=0.0097), with 76.7% experiencing only mild desaturation versus 6.7% in the conventional group. Correlation analysis revealed that both groups showed a negative correlation between intubation time and lowest SpO_2, but this correlation was weaker in the Oxiport group (r-value=-0.378, p-value=0.039) compared to the conventional group (r-value=-0.541, p-value=0.002), suggesting better tolerance to prolonged intubation attempts with the Oxiport laryngoscope as shown in [Table/Fig-3].

Parameters	Group O (n=30)	Group C (n=30)	p-value
Primary oxygenation outcomes			
Lowest SpO_2 attained (%)	97.37±0.72	91.87±1.14	<0.0001**
Time for 1% desaturation (sec)	17.90±1.11	10.19±0.85	<0.0001**
Slope of desaturation (%/sec)	0.082±0.0105	0.34±0.0358	<0.0001**
Severity of desaturation			
Mild (SpO_2 95-99%)	23 (76.7)	2 (6.7)	<0.0001**
Moderate (SpO_2 90-94%)	7 (23.3)	22 (73.3)	<0.0001**
Severe (SpO_2 <90%)	0	6 (20.0)	0.0097**
Correlation Analysis			
Correlation coefficient (r)	-0.378	-0.541	
p-value	0.039*	0.002**	

[Table/Fig-3]: Oxygenation parameters and severity of desaturation (N=60).

Heart rate increased immediately postintubation in both groups but showed significantly better attenuation in the Oxiport group at 3 minutes (121.53±8.40 vs 126.33±8.98 bpm, p-values=0.033), with a trend toward lower values throughout the observation period. Systolic blood pressure showed significantly better control in the Oxiport group from 1minute postintubation onwards, with differences of 6-8 mmHg maintained throughout the observation period (all p-values<0.0001). Diastolic blood pressure demonstrated similar patterns to systolic pressure, with significantly lower values in the Oxiport group from 1 minute onwards, indicating better attenuation of the hypertensive response to intubation (all p-value <0.0001) as shown in [Table/Fig-4].

DISCUSSION

The present study demonstrated remarkable advantages of the Oxiport laryngoscope in maintaining oxygenation during paediatric intubation. The primary finding of a mean lowest SpO_2 of 97.37% in the Oxiport group versus 91.87% in the conventional group represents a clinically significant 5.5% difference that could prevent hypoxaemia-related complications. This improvement aligns closely with Gandhi N et al., who reported a mean lowest SpO_2 of 97.77% with Oxiport versus 92.42% with the Miller blade in neonates and infants [9]. Similarly, Dias R et al., found the mean lowest SpO_2 of 97.55% with Oxiport versus 95.9% with the conventional Miller blade [11]. The consistency across studies reinforces the reliability of the Oxiport device in maintaining superior oxygenation.

	Heart Rate (bpm)			Systolic BP (mmHg)			Diastolic BP (mmHg)		
Time Point	Group O	Group C	p-value	Group O	Group C	p-value	Group O	Group C	p-value
Baseline	118.33±8.13	118.40±8.90	0.975	96.90±3.40	96.87±3.61	0.973	59.43±2.81	59.40±3.03	0.966
0 min	133.40±8.15	133.47±8.84	0.975	105.90±3.54	106.93±3.61	0.264	66.33±3.24	67.37±3.14	0.206
1 min	129.63±8.21	132.77±8.76	0.157	102.67±3.55	108.77±3.63	<0.0001**	63.87±3.14	68.73±3.21	<0.0001**
2 min	125.60±8.32	129.57±8.87	0.079	99.40±3.52	105.70±3.65	<0.0001**	61.30±3.08	66.97±3.21	<0.0001**
3 min	121.53±8.40	126.33±8.98	0.033*	97.27±3.51	102.70±3.67	<0.0001**	59.57±3.01	65.13±3.22	<0.0001**
5 min	119.37±8.44	123.23±9.06	0.091	96.00±3.45	100.60±3.67	<0.0001**	58.03±2.96	63.27±3.23	<0.0001**
10 min	117.23±8.41	120.93±9.10	0.102	94.87±3.42	98.50±3.67	0.0002**	56.87±2.87	61.40±3.22	<0.0001**
15 min	115.57±8.43	118.90±9.15	0.145	94.10±3.44	97.47±3.67	0.0004**	56.17±2.85	60.43±3.22	<0.0001**
30 min	114.90±8.43	118.17±9.16	0.158	93.67±3.45	96.83±3.66	0.0008**	55.77±2.86	59.87±3.22	<0.0001**
60 min	112.77±8.42	116.10±9.14	0.140	92.50±3.45	95.57±3.64	0.0012**	54.83±2.85	58.73±3.22	<0.0001**
120 min	109.57±8.38	112.97±9.09	0.126	90.67±3.43	93.73±3.61	0.0012**	53.20±2.82	57.10±3.22	<0.0001**

[Table/Fig-4]: Haemodynamic parameters at different time points.

The time for 1% desaturation nearly doubled in the Oxiport group (17.90 vs 10.19 seconds), remarkably consistent with Gandhi N et al., who reported 17.69 seconds with Oxiport versus 10.4 seconds with a conventional blade [9]. The slower desaturation rate observed (0.0822 vs 0.3445%/sec) represents a four-fold reduction, demonstrating the efficacy of continuous oxygen insufflation. This extended safe apnoea time is particularly crucial given the findings of Steiner JW et al., who demonstrated that deep laryngeal oxygen insufflation significantly prolongs the apnoeic window in paediatric patients [10]. The physiological mechanism underlying these benefits relates to apnoeic oxygenation principles described by Weingart SD and Levitan RM, where oxygen continues to be absorbed from alveoli, creating a negative pressure gradient that the Oxiport blade exploits by delivering oxygen directly to the laryngeal inlet [12].

The current study revealed no severe desaturation episodes in the Oxiport group compared to a 20% incidence in the conventional group, corroborating findings by Dias R et al., who reported no severe desaturation with Oxiport versus 12.5% with conventional blade [11]. This complete prevention of severe hypoxaemia has profound clinical implications, as severe desaturation can trigger bradycardia, hypotension, and cardiac arrest in paediatric patients. The clinical significance becomes more apparent when considering the work of Mort TC, who demonstrated that critically ill patients have minimal physiological reserve, with safe apnoea times as short as 23 seconds in compromised patients [13]. The current findings suggest the Oxiport laryngoscope could provide a crucial additional safety margin in these high-risk scenarios.

The correlation analysis revealed a weaker negative correlation between intubation time and lowest SpO_2 in the Oxiport group (r-value=-0.378) compared to the conventional group (r-value=-0.541), suggesting better tolerance to prolonged intubation attempts. This protective effect aligns with principles of apnoeic oxygenation demonstrated by Wimalasena Y et al., who showed that apnoeic oxygenation was associated with decreased desaturation rates during rapid sequence intubation in an Australian helicopter emergency medicine service, reducing the incidence of desaturation from 23% to 11% with implementation of nasal cannula oxygen delivery during intubation [14].

The current study provides novel insights into haemodynamic responses during paediatric intubation with the Oxiport laryngoscope. The significantly lower heart rate at 3 minutes and sustained lower blood pressures from 1 minute onwards suggest better attenuation of the sympathoadrenal response. These findings align with observations from studies using other advanced airway devices. Altun D et al., reported better haemodynamic stability with McGRATH™ video-laryngoscope compared to conventional laryngoscopy in adults, while Orozco JA et al., found lower heart rate and blood pressure responses with Airtraq™ compared to Macintosh laryngoscope in paediatric patients [15,16].

The haemodynamic benefits likely result from the prevention of hypoxaemia-induced stress and potentially a more controlled intubation process allowed by extended safe apnoea time. The maintenance of adequate oxygenation prevents the cascade of physiological stress responses that typically accompany desaturation, including catecholamine release, tachycardia, and hypertension. This haemodynamic stability is particularly important in paediatric patients with limited cardiovascular reserve or those with concomitant cardiac conditions.

The success of the Oxiport laryngoscope should be contextualised within the broader landscape of apnoeic oxygenation techniques. Patel A and Nouraei SA groundbreaking work with THRIVE (Transnasal Humidified Rapid-Insufflation Ventilatory Exchange) demonstrated that high-flow nasal oxygen at 70 L/min could extend apnoea times up to 65 minutes in adults with difficult airways [17]. While THRIVE provides superior oxygen delivery, it requires specialised equipment and flow rates impractical for many paediatric settings. The Oxiport laryngoscope, delivering oxygen at 2 L/min directly to the laryngeal inlet, represents a more accessible alternative that still provides significant clinical benefit.

The mechanisms of apnoeic oxygenation have been extensively studied, with Weingart SD and Levitan RM, describing how continuous oxygen delivery maintains alveolar oxygen tension during apnoea [12]. They emphasised that preoxygenation combined with apnoeic oxygenation can extend safe apnoea time from less than 1 minute to 8 minutes in healthy patients. However, Mort TC work highlighted that this benefit is markedly reduced in critically-ill patients, where only 19% achieved a PaO_2 increase of at least 50 mmHg after preoxygenation. This underscores the importance of devices like the Oxiport that provide continuous oxygen delivery throughout the intubation procedure [13,18].

The findings gain additional significance when considering the work of Xue FS et al., who demonstrated that the surgical site significantly influences postoperative hypoxaemia risk [19]. They found hypoxaemia incidence of 52% after thoracoabdominal surgery, 38% after upper abdominal surgery, and only 7% after peripheral surgery. Patients undergoing major surgeries who experience intraoperative hypoxaemia face compounded risk for postoperative complications. The Oxiport laryngoscope's ability to prevent intraoperative desaturation could potentially reduce this cascade of respiratory complications.

Furthermore, the complete prevention of severe desaturation in the present Oxiport group becomes particularly relevant considering that postoperative hypoxaemia is associated with prolonged hospital stays, increased costs, and higher mortality. The initial investment in specialised equipment like the Oxiport laryngoscope may be offset by a reduction in hypoxaemia-related complications and their associated healthcare costs.

While the current study focused on the Oxiport laryngoscope for tracheal intubation, it's important to consider alternative airway management strategies in the paediatric difficult airway algorithm. Jagannathan N et al., demonstrated that Supraglottic Airway Devices (SGAs) could be successfully used for primary airway management in 96% of children with difficult airways [20]. SGAs offer the advantage of easier insertion and can serve as a conduit for fiberoptic intubation when needed. However, the Oxiport laryngoscope maintains the advantage of direct visualisation and definitive airway control through endotracheal intubation while providing continuous oxygenation.

The integration of various airway management techniques represents the modern approach to paediatric airway management. The Oxiport laryngoscope fills a specific niche - providing enhanced oxygenation during direct laryngoscopy when tracheal intubation is the primary goal. For scenarios where intubation proves difficult, having SGAs as backup devices, as suggested by Jagannathan N et al., provides a comprehensive airway management strategy [20].

The clinical applications of the Oxiport laryngoscope extend beyond routine intubations. In emergency scenarios where rapid sequence intubation is required, the device's ability to maintain oxygenation during the apneic period becomes invaluable. The principles demonstrated in helicopter emergency medicine by Wimalasena Y et al., translate directly to paediatric emergency departments and intensive care units, where rapid, safe intubation is critical [14].

Future research should evaluate the Oxiport laryngoscope in specific high-risk populations, including premature infants, children with congenital heart disease, and those requiring emergency intubation. Comparison with video laryngoscopes equipped with oxygen delivery systems would provide valuable insights into optimal device selection for different clinical scenarios. Additionally, cost-effectiveness analyses comparing the device cost against potential reduction in hypoxaemia-related complications would inform healthcare policy decisions. The development of paediatric-

specific apnoeic oxygenation protocols incorporating the Oxiport laryngoscope could standardise its use and maximise clinical benefit. Training programs should emphasise not just the technical aspects of device use but also the physiological principles underlying apnoeic oxygenation to ensure appropriate patient selection and optimal outcomes.

Limitation(s)

The study's limitations include its single-centre design and exclusion of patients with difficult airways. The operators were not blinded, which could potentially introduce bias. Long-term outcomes were not assessed. Future research should evaluate the Oxiport laryngoscope in challenging airways and compare it with video laryngoscopes.

CONCLUSION(S)

The Oxiport laryngoscope demonstrated superior performance in maintaining oxygenation and haemodynamic stability during paediatric intubation, effectively preventing severe desaturation and attenuating stress responses. These findings support its adoption as a valuable tool for enhancing safety in paediatric airway management, particularly in settings where advanced airway devices may not be available. The combined benefits of improved oxygenation and cardiovascular stability make it an important advancement in paediatric anaesthesia practice.

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