ORIGINAL RESEARCH PAPER

Anaesthesiology

REVISITING THE SHIKANI OPTICAL STYLET IN THE MODERN ERA OF AIRWAY MANAGEMENT: COMPARATIVE PERFORMANCE, EDUCATIONAL UTILITY, AND RELEVANCE IN RESOURCE-LIMITED SETTINGS.

KEY WORDS: Shikani Optical Stylet, airway management, difficult airway, education, resource-limited settings, COVID-19

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ABSTRACT

Background: The Shikani Optical Stylet (SOS) offers an innovative solution for airway management by combining visualization and maneuverability in a single device. Despite the advent of video laryngoscopy and fiberoptic bronchoscopy, these tools remain inaccessible in many low-resource settings. This study evaluates the comparative performance of SOS against the conventional Macintosh laryngoscope and explores its relevance for educational use, difficult airway scenarios, and resource-limited or pandemic-stricken environments. **Methods:** Ninety adult ASA I–II patients scheduled for elective surgeries under general anesthesia were randomly divided into three groups: Group SP (SOS via paraglossal approach), Group SM (SOS via midline approach), and Group DL (Macintosh laryngoscope). Parameters assessed included first-pass success, time to intubation, glottic visualization (Cormack-Lehane), ease of use (VAS), complications, haemodynamic changes, and need for additional maneuvers. The utility of SOS in simulation-based training, difficult airway management, and COVID-19 settings was evaluated through a narrative literature review. Results: First-pass success was 100% in the DL group, 76.66% in SM, and 70% in SP. Time to intubation was shortest with DL (28.90 ± 6.25s) compared to SM (56.96 ± 46.09s) and SP (70.16 ± 49.69s). Ease of intubation (VAS) was highest in the DL group (1 ± 0), followed by SM (2.03 ± 1.3) and SP (2.9 ± 2.38). Haemodynamic responses showed a transient rise in heart rate and blood pressure in all groups post-intubation, with the DL group exhibiting the highest peak values. With experience, both SOS groups showed improved performance. Literature suggests SOS enables minimal aerosol generation, better cervical spine stability, and direct anatomical training benefits. Its low cost and reusability make it viable in educational and low-resource settings. **Conclusion:** The Shikani Optical Stylet remains a valuable airway device for modern practice, especially where video laryngoscopes or fiberoptic scopes are unavailable. Its simplicity, effectiveness, and training potential make it essential in anesthesia education and emergency preparedness.

INTRODUCTION

Effective airway management is vital in anesthesia and critical care. Direct laryngoscopy using the Macintosh blade, though long considered the gold standard, often requires optimal positioning and alignment of airway axes. These prerequisites make it less suitable for patients with cervical spine injuries, limited neck mobility, or in scenarios requiring minimal manipulation such as during pandemics like COVID-19 [1,2].

Video laryngoscopes (VLs) and fiberoptic bronchoscopes have expanded the airway management toolbox but remain costly, fragile, and often unavailable in peripheral or low-resource settings [3,4]. The Shikani Optical Stylet (SOS) addresses this gap by offering a low-cost, reusable, semi-rigid fiberoptic-guided intubation tool that enables indirect visualization of the glottis without alignment of anatomical axes [5].

Originally developed in the 1990s, the SOS has seen a resurgence of interest due to its utility in educational programs and its applicability in difficult airway situations. Recent literature also highlights its role in minimizing aerosol generation, thus proving valuable during the COVID-19 pandemic [6,14]. This paper revisits its utility, comparing it to direct laryngoscopy and evaluating its performance, teaching value, and role in austere settings.

MATERIALS AND METHODS

This study, evaluation of clinical efficacy of fibreoptic stylet(Model- Shikani Optical Stylet i.e SOS manufactured by Clarus Medical) for endotracheal intubation was conducted in a tertiary care centre and hospital .The study was conducted after obtaining approval from the institutional ethical committee and the written informed consent from patients.This prospective randomized study was conducted on 90 adult ASA physical status I–II patients aged 18–60 years, scheduled for elective surgeries requiring endotracheal intubation under general anesthesia. Patients were randomized into three equal groups:

- **Group SP**: Intubation using SOS via paraglossal approach
- **Group SM**: Intubation using SOS via midline approach
- **Group DL**: Intubation using Macintosh laryngoscope

Exclusion criteria included anticipated difficult airway, obesity (BMI > 30), pregnancy, and patients with ASA III–IV status.

All patients received standard monitoring (ECG, NIBP, SpO_2), preoxygenation, induction with fentanyl, propofol, and vecuronium. Intubations were performed by first-year anesthesia residents trained on manikins. Objectives assessed included:

Primary Objectives-

1. To evaluate clinical efficacy of SOS in the terms of-
a) The first pass success in the form of number of attempts required for intubation.
b) Time required for intubation.
c) Ease of insertion. (VAS 1-10)
2. To assess the visualisation of glottis according to Cormack Lehane grading.
3. To study the learning curve of SOS with both the approaches.
4. To compare the clinical efficacy of SOS by paraglossal and midline approach.

Secondary Objectives:-

1. To assess and compare haemodynamic changes baseline, post-induction, immediately post-intubation, and 5 minutes later, during intubation with SOS and conventional direct laryngoscopy.
2. To assess the intraoperative and postoperative complications in form of sore throat,hoarseness,bleeding etc.

Statistical Analysis

Sample size was calculated to detect a 20% difference in intubation time among groups with 80% power and a significance level of 0.05, requiring 30 patients per group. Statistical analysis was performed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA).

Continuous variables such as intubation time, haemodynamic parameters, and visual analogue scores were expressed as mean ± standard deviation and analyzed using one-way analysis of variance (ANOVA), followed by post-hoc Tukey's test for pairwise comparisons. Categorical variables, including first-pass success rate and incidence of complications, were compared using the Chi-square test or Fisher's exact test where appropriate. A p-value < 0.05 was considered statistically significant.

Intubation with Shikani optical stylet (SOS)

RESULTS

Demographically data in all 3 groups were comparable.

Ease Of Intubation In Context To Number Of Attempts:

Table No.1: Number Of Patients According To Number Of Attempts.

Attempts	Group-SP	Group-SM	Group-DL
1	21(70%)	23(76.66%)	30(100%)
2	4(13.33%)	3(10%)	0
3	5(16.66%)	4(13.33%)	0
Total	30	30	30
p-value	0.011, S		

In DL group all the 30 (100%) patients were intubated in first attempt. In SP group,21 patients(70%) were intubated in first attempt,while in SM group 23 patients(76.66%) were intubated in first attempt.The difference in number of attempts required for intubation between the 3 groups was statistically significant(p=0.011).

Further, these 3 groups were divided into 3 sequential subgroups of 10 patients each.(table no .2)

Table No.2: Number Of Patients According To Number Of Attempts.

Subgroups	Group-SP	Group-SM	Group-DL	p value
First 10 patients	2± 0.94	2± 0.94	1± 0	0.0091 S
Second 10 patients	1.1 ±0.31	1± 0	1± 0	0.3811 NS
Third 10 patients	1.3± 0.67	1.1± 0.31	1 ±0	0.2998 NS

The mean intubation attempt in group DL in all the 3 sequential subgroups was 1 ±0. In group SP, the mean intubation attempt in first subgroup of 10 patients was 2± 0.94,while in second and third subgroup, it was 1.1 ±0.31, 1.3± 0.67 respectively.In group SM, the mean intubation attempt in first,second and third subgroup of patients was 2± 0.94, 1± 0, 1.1± 0.31 respectively.The difference in mean intubation attempt between 3 groups in first 10 patients was statistically significant(p=0.0091),while in second subgroup(p=0.3811) and third subgroup(p=0.2998) it was non significant and thus comparable.

Time Of Insertion Of ETT (TOI):

Time of intubation /time of insertion of ETT was calculated as time calculated from insertion of SOS/DL into the mouth upto insertion of ETT into the trachea (including time of visualization of glottis.

Table No. 3: Distribution Of Patients In Relation To TOI.

TOI in seconds	Group-SP	Group-SM	Group-DL
10-50s	16(53.33%)	21(70%)	30
51-100s	5(16.66%)	3((10%)	-
101-150s	6(20%)	3(10%)	-
151-200s	3(10%)	3(10%)	-
Total	30	30	30
Mean± SD	70.16 ±49.69	56.96± 46.09	28.90± 6.25
p-value	0.0002, HS		
	Multiple comparison		
	Group-SP vs Group-SM	Group-SP vs Group-DL	Group-SM vs Group-DL
Mean difference (p-value)	13.2 (0.590)	41.26 (<0.001)	28.06 (0.021)

In DL group, mean time of insertion in group DL was 28.90± 6.25s.In group SP, mean time of insertion of ETT was 70.16 ±49.69s . In group SM,. Mean time of insertion of ETT was 56.96± 46.09s . In group SP and DL, the difference in mean time of insertion was highly significant (p<0.001),while in SM and DL it was significant(p=0.021). In group SP and SM, the difference in mean time of insertion of ETT was not significant(p=0.590) and therefore was comparable.

Distribution Of Patients According To TOI In 3 Subgroups Of 10 Patients Each:

These 30 patients from each group were further divided sequentially in 3 subgroups of 10 patients each to determine the improvement in time factor required for the intubation and determine the learning curve in i.e first 10 patients,second 10 patients,third 10 patients.(table no. 4)

Table No.4: TOI Required In 3 Subgroups Of 10 Patients Each, Arranged Sequentially.

Time in seconds	Subgroup of patients	Group-SP	Group –SM	Group-DL	p value
TOI(mean ±SD)	First 10 patients	119.0 ±45.15	105.6± 50.4	29.7± 6.66	<0.001
	Second 10 patients	44.8±26.29	32.1 ±10.97	28.3± 6.83	0.2197
	Third 10 patients	39.1±36.96	29.2± 15.55	28.7 ± 5.81	0.6138

The mean time of insertion of ETT in group SP, SM and DL, in first subgroup of 10 patients was 119.0 ± 45.15s, 105.6± 50.4s, 29.7± 6.66s respectively. .The mean time of insertion of ETT in group SP,SM,and DL in second subgroup of 10 patients was 44.8±26.29,32.1±10.97s,.28.3± 6.83s, respectively.The mean time of insertion of ETT in group SP,SM,and DL in last subset of 10 patients was 39.1±36.96s, 29.2±15.55s, 28.7±5.81s respectively.

The difference in mean time of insertion in groups SP,SM and DL was highly significant in first subgroup of 10 patients (p<0.001).In second and last subgroup of 10 patients ,the difference in mean time of insertion was non significant and therefore was comparable.

Distribution Of Patients According To Ease Of Insertion:

The degree of difficulty of tracheal intubation with SOS was rated by operator on a visual analogue scale of difficulty ranging from 1-10(Table no 5).

Table No.5: Distribution Of Patients According To Ease Of Insertion .

VAS score	Group SP	Group SM	Group DL
1	15(50%)	20(66.66%)	28(93.33%)
2	2(6.66%)	2(6.66%)	

3	2(6.66%)	2(6.66%)	2(6.67%)
4	4(13.33%)	2(6.66%)	
5	2(6.66%)	1(3.33%)	
6	1(3.33%)	3(10%)	
7	2(6.66%)		
8			
9			
10	2(6.66%)		
Mean VAS± SD	2.9± 2.38	2.03 ±1.3	1± 0
P value	0.0002 HS		

100% patients were intubated with least difficulty in DL group. In SP and SM group,63.33% and 80% patients were intubated with least difficulty respectively.The mean VAS score in group SP was 2.9± 2.38,while in group SM and DL ,it was 2.03 ±1.3 and 1± 0 respectively. The difference in mean VAS score between 3 groups was highly significant (p=0.0002 HS)

However when all the 3 groups were further divided into sequential subgroups of 10 patients each ,the mean VAS was on decreasing scale in group SP as well as group SM.(table no.6)

Table No.6: Mean VAS Score In Sequential Subgroups Of Patients In 3 Groups -

Subgroups of patients	Group-SP	Group-SM	Group-DL	p value
First 10	5.6± 1.83	3.9± 1.85	1.1± 0	0.001HS
Second 10	1.8± 1.26	1.2± 0.93	1± 0	0.18 NS
Third 10	1.2 ±1.08	1± 0	1± 0	0.1368 NS

The difference in mean VAS between 3 subgroups was highly significant in first subgroup(p=0.001) was non significant in second and third group.

Thus a learning curve was evident in the SOS groups, with improved performance across sequential patient subgroups in terms of number of intubation attempts, time required to intubation and ease of intubation. (figure.1)

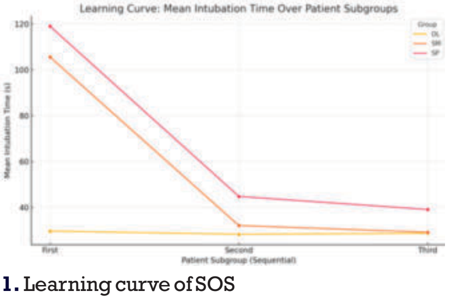

Figure 1. Learning curve of SOS

Haemodynamic Variability:
Table No. 7 Haemodynamic Variability

Parameter	DL	SM	SP	
HR baseline(bpm)	82.3 ± 6.5	83.1 ± 5.8	84.0 ± 7.2	p=0.642
HR postintubation	102.4 ± 8.1	92.8 ± 6.4	91.7 ± 5.9	p<0.001
SBP baseline(mmhg)	122.5 ± 9.3	121.2 ± 8.7	123.4 ± 9.6	p=0.588
SBP peak	146.8 ± 10.2	132.9 ± 7.5	130.7 ± 8.	p<0.001
MAP baseline	88.4 ± 6.9	87.1 ± 7.2	88.9 ± 6.7	p=0.561
MAP peak	103.7 ± 7.8	95.6 ± 6.1	94.8 ± 5.9	p<0.001

Statistically significant differences in **peak HR, SBP, and MAP** were observed among groups (p < 0.001). Baseline haemodynamics were comparable (non-significant).

SOS groups had **attenuated cardiovascular responses**, reinforcing their suitability in high-risk patients.

Cormack Lehane grading (p = 0.129) and complications were statistically non significant(p=0.363) in all the 3 groups.

DISCUSSION

The findings of this study affirm that while direct laryngoscopy offers immediate advantages in terms of first-pass success and intubation speed, the Shikani Optical Stylet is a viable alternative and proves equally efficacious after a span of learning curve with distinct advantages of haemodynamic stability and complications over direct laryngoscopy . Notably, it does not require alignment of the oral, pharyngeal, and laryngeal axes, making it particularly useful in patients with cervical spine immobilization, restricted neck mobility, or difficult airway anatomy [5,7,13].

Our results align with previous findings by Young et al. [8] and Phua et al. [10], which demonstrate that SOS performance improves significantly with experience. In educational contexts, the SOS enables direct visualization of airway structures, reinforcing anatomical understanding and enhancing trainee skills [9,15]. A study by Xue et al. [15] confirmed the steep learning curve, with intubation success increasing after only a few attempts.

Haemodynamic responses to laryngoscopy and intubation are well-documented, with sympathetic stimulation leading to transient increases in heart rate and blood pressure. In our study, the Macintosh group exhibited the highest haemodynamic fluctuations, likely due to more pronounced laryngopharyngeal stimulation. The relatively attenuated response in the SOS groups supports its utility in patients with cardiovascular comorbidities or those at risk of perioperative haemodynamic instability.

From a pandemic preparedness perspective, the SOS enables intubation with reduced aerosol generation, limiting the risk of viral transmission to healthcare workers [6,14]. It also allows for a greater distance between the provider's face and the patient's airway compared to traditional direct laryngoscopy.

In resource-limited settings, the SOS's affordability, reusability, and portability are major advantages. Gaeta et al. [11] and Kovacs & Law [4] highlight the importance of low-cost, durable devices in disaster and prehospital medicine. Merli et al. [12] and Zhang et al. [18] also support its application in difficult and prehospital intubations.

Furthermore, SOS has shown utility in emergency and critical care settings. Chen et al. [17] demonstrated its efficacy in the emergency department, while Ho et al. [16] described its successful use in nasotracheal intubation. Comparative studies have also validated its use against VLs in difficult airway scenarios [13,19,20].

Thus, the Shikani Optical Stylet fulfills a critical gap in airway management, balancing performance, cost, haemodynamic safety, and training value, especially in environments where VLs or fiberoptic scopes are unavailable.

CONCLUSION

The Shikani Optical Stylet is a clinically and educationally valuable tool in modern airway management. While its initial learning curve is steeper compared to direct laryngoscopy, it offers distinct advantages including reduced haemodynamic response, improved safety in cervical spine and limited-mobility cases, and minimal aerosol generation—critical during pandemics. Its affordability, reusability, and effectiveness in both clinical and teaching settings make it especially suitable for resource-limited environments. We recommend its wider adoption in airway management protocols, simulation-based education, and global health initiatives.

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Nil

Conflict Of Interest
None

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