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# Comparison of different Head Positions on Awake Fiber Optic Intubation

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## ABSTRACT

***Objective:*** to compare the time required to perform awake fiber optic intubation with two different head positions: conventional sniffing position and head-up ramp position in patients with difficult airways who are planning to undergo thyroid surgery.

***Study Design:*** Quasi-experimental study

***Place and Duration of Study:*** Combined Military Hospital (CMH) Quetta and Combined Military Hospital (CMH) Multan, Pakistan from Oct 2022 to Nov 2023.

***Methodology:*** We performed our study on 36 patients with enlarged goiter and difficult airways by allocating them to two separate groups, S and R. Group-S patients underwent awake fiber optic bronchoscopy in the sniffing position, and Group-R underwent awake fiber optic intubation in the up-ramp position. The time was recorded to perform a successful awake-fiber optic laryngoscopy and use the jaw thrust maneuver.

***Results:*** The mean time taken for successful awake fiber optic intubation in Group-R was considerably less than in Group-S, with a *p*-value of <0.001. The mean time taken in Group-R was 20.00±3.773 minutes, and that in Group-S was 36.28±4.29 minutes.

Conclusion: We concluded that the up ramp position was superior to the sniffing position for awake fiber optic intubation in patients with difficult airway

**Keywords:** Awake fiber optic intubation, Head-up ramp position, Sniffing position

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## INTRODUCTION

The difficult airway incidence varies between 0.3 to 13 percent, and it is responsible for thirty percent of anesthesia-related fatalities.[1] The presence of difficult airway predictors in a patient makes him or her candidate for awake fiber optic intubation. The placement of an endotracheal tube in a spontaneously breathing patient is called Awake tracheal intubation. It is accomplished using a Fiber optic bronchoscope (FOB), which is considered the gold standard for managing difficult airway situations as it has a high success rate and low risk.[2] The patients are mostly sedated for awake flexible fiber optic intubation to the extent that they maintain spontaneous breathing. However, in such sedated patients, due to loss of pharyngeal musculature tone, the base of the tongue, epiglottis, and soft palate fall back posteriorly, causing hindrance to the steering of fiber optic bronchoscope through air passages.[3] Bronchoscopy is usually done in a conventional sniffing position, which is maintained to align the oral, glottic, and tracheal axis, and various airway maneuvers are employed to remove this hindrance to bronchoscopy, like jaw thrust and head tilt.[4] However, at times, these maneuvers are not sufficient. Some authors also compare the neural head position and sniffing position.The head tilt with ramp position has also been used for successful fiber optic bronchoscopy in obese patients.[5] Patients with normal body mass index can also be subjected to this position as it has the added advantage of improved functional residual capacity.[6]

According to a meta-analysis by Tsan *et al*., there was no significant difference between the ramping and sniffing positions during endotracheal intubation.[7] A case report also shows that sitting is helpful for awake fiber optics in patients with huge goiters.[8] Neal *et al*. performed awake fiber optics in a semi-prone position for a patient with severe facial trauma and proved the possibility of awake fiber optics in a semi-prone position.[9]

An array of positioning techniques have been used for awake flexible fiberoptic bronchoscopy, and none is clearly superior to others. There is conflicting evidence, and local literature on this subject is scarce.

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Although awake fiber optic is done on very few patients, its importance cannot be undermined. Therefore, the rationale of our study is to compare the conventional sniffing position with the ramp head tilt ramp position for awake fiber optic patients with anticipated difficult airways. Our study will add to the existing literature, and we will be able to share our experience with this relatively uncommon subject.

## METHODOLOGY

After seeking the Ethical Approval from CMH Quetta and CMH Multan (CMH-QTA-IERB/03/2023 & ERC/155/2023), we carried out our bi-center, quasi-experimental study at anaesthesia Departments of the Combined Military hospital (CMH) Multan and Quetta, Pakistan from October 2022 TO November 2023. We calculated the sample size with the help of the WHO sample size calculator, keeping anticipated patient population (P1) to experience successful intubation in first attempt with ramping to be 70.0%10 and anticipated patient population (P2) to ) to experience successful intubation in first attempt with sniffing position to be 7.3%.[10]

**Inclusion Criteria:** Patients of either gender, aged 20 to 65 with enlarged goiter covering the whole neck with reduced submandibular space compliance and anticipated difficult bag max ventilation and intubation who were to undergo awake-fiber optic intubation and were chemically and clinically euthyroid with ASA Status II were included. Difficult airway was defined as Mallampatti classification greater than two and neck circumference>40 cm.[11,12]

**Exclusion Criteria:** Patients with psychiatric problems, ASA status III OR IV were excluded.

We included 18 patients in each Group. We randomized groups into Group S and Group R. The randomization was done through a sealed envelope technique after applying inclusion and exclusion criteria.

The patients were booked through the outpatient department for elective thyroidectomy. The patients were subjected to a thorough pre-anesthesia assessment before preparing them for surgery. Group S patients underwent awake fiber optic bronchoscopy during the sniffing position, and Group R underwent awake fiber optic intubation in the up-ramp position (Figure). The sniffing position was made by placing an 8cm ring pillow under the patient's head so that it tilted. The external auditory meatus aligned the sterna notch in the horizontal plane. In contrast, in Group R patients ramp position was made in Group R patients by placing three soft pillows beneath the head and upper body so that the external auditory meatus was in the horizontal plane with the sternal notch.

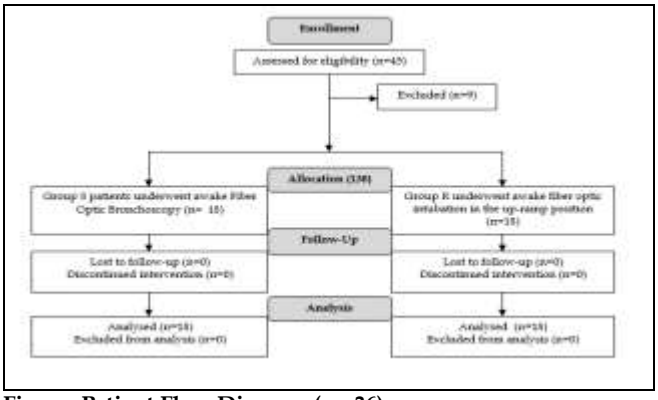


**Figure: Patient Flow Diagram (n= 36)**

All Group S patients were explained the procedure on the day of surgery. Intravenous access was gained through a 16 gauge cannula (BB.raun) under local anesthesia. Standard monitoring (pulse oximeter, electrocardiography, non-invasive blood pressure, and temperature probe) was attached to the patients. The patient's airway was anesthetized using aerosolized lignocaine 2%. The oral and pharyngeal reflexes were blunted by anesthetizing oral and pharyngeal mucosa with 10% lignocaine spray and gargles. The elevation of the operating and position of the anesthesiologist was adjusted to ensure that the fiber-optic was kept straight as it entered the patient's nasal cavity. The appropriate-sized endotracheal tube was loaded over a 5mm external diameter flexible fibreoptic bronchoscope. Preoxygenation was performed with 100% oxygen with tidal volume ventilation for three to five minutes to achieve an end-expiratory oxygen concentration greater than 90%. The patients were premedicated with midazolam 0.01mg/kg and propofol 0.2mg /kg. The bronchoscopy was performed with "spray as you go" 13 with 1% lignocaine. Since patients spontaneously breathed, oxygen flow was kept at 3 liters per minute, and suction was used intermittently to remove secretions. When difficulty was encountered during the steering of the bronchoscope, a jaw thrust maneuver was performed with an additional bolus of 0.2mg /kg of propofol. The time taken to perform successful awake-fiber optic intubation was recorded.

On the day of the operation, all Group R patients explained the process. Intravenous access was gained,

and standard monitoring was attached to the patients. The patient's airway was anesthetized. After this, the patients were helped to assume a ramped position. Three soft pillows were positioned beneath the patient's head and upper body so that the external auditory meatus was in a horizontal plane with a sternal notch. The elevation of the operating and position of the anesthesiologist was adjusted to ensure that the fiber-optic was straight as it entered the patient's nasal cavity. An appropriately sized endotracheal tube was loaded over a 5mm external diameter flexible fibreoptic bronchoscope. Preoxygenation was performed with 100% oxygen with tidal volume ventilation for three to five minutes to achieve an end-expiratory oxygen concentration greater than 90%. The patients were premedicated with midazolam 0.01mg/kg and propofol 0.2mg /kg. The bronchoscopy used the "spray as you go" method with 1% lignocaine. Since patients spontaneously breathed, oxygen flow was kept at 3 liters per minute, and suction was used intermittently to remove secretions. When difficulty was encountered in the steering bronchoscope, a jaw thrust maneuver was performed with an additional bolus of 0.2mg /kg of propofol. The time taken to perform successful awake-fiber optic intubation was recorded. Other recorded parameters were age, weight, ASA status, and gender.

The statistics were performed with the help of the Statistical Package of Social Sciences (SPSS) version 26. Quantitative and qualitative variables were analyzed. Mean with standard deviation were computed for quantifiable parameters, and frequency and percentages were calculated for qualitative variables. Chi-square test was used for the comparison of categorical variables, and an independent sample t-test was used to compare mean values.

## RESULTS

A total of 36 patients were included in the study after the application of inclusion and exclusion criteria. The Group R and S included 18 patients each. The mean age in Group R was 44.83±8.18 years, while the mean age in Group S was 45.11±8.33 years with a p-value of 0.445, as there was no significant statistical difference. The mean weight of Group R patients was 79.33±5.099 kilograms, and the mean weight of Group S patients was 79.56±7.92 kilograms. There were 6(33.3%) males and 12(66.7%) females in Group R, and there were 8(44.4%) males and 10(55.6%) females in Group S, which showed female predominance as displayed in Table-I.

The comparison of both techniques was made in terms of the time taken to perform the awake fiberoptic intubation. The mean time taken for awake fiber optic intubation in Group R was considerably less than in Group S, with a *p*-value of <0.001. The mean time taken in Group R was 20.00±3.77 minutes, and that in Group S was 36.28±4.29minutes. Similarly, the use of jaw thrust indicated difficulty in intubation which only 2(11.1%) Group R patients compared to 9(50%) Group S patients. 16(88.9%) patients in Group R did not require jaw thrust as compared to 9(50%) patients in Group S which required jaw thrust to aid awake fiber optic intubation as displayed in Table-II.

**Table-I: Demographic Characteristics of the Study Groups (n=36)**

| | | Group-R n=18 | Group-S n=18 | *p*-value |
|---|---|---|---|---|
| Age (years) Mean±SD | | 44.83±8.18 | 45.11±8.33 | 0.920 |
| Weight (kilograms) Mean±SD | | 79.33±5.099 | 79.56±7.90 | 0.918 |
| | | n (%) | n (%) | |
| Gender | Male | 6(33.3) | 12(66.7) | 0.367 |
| | Female | 8(44.4) | 10(55.6) | |

**Table-II: Comparison of Time Required For Awake Fiber Optic in Study Groups and Use of Jaw Thrust (n=36)**

| | | Group-R n=18 | Group-S n=18 | *p*-value |
|---|---|---|---|---|
| Time Taken For Awake Fiber Optic Intubation (minutes) Mean±SD | | 20.0±3.77 | 36.28±4.29 | <0.001 |
| | | n (%) | n (%) | |
| Jaw Thrust Maneuver | Yes | 2(11.1) | 16(88.9) | 0.014 |
| | no | 9(50.0) | 9(50.0) | |

## DISCUSSION

We found that the ramped-up position was better than the sniffing position for awake fiberoptic intubation as it required little maneuvering and was time-effective, too. The sniffing position posed difficulty in navigating the flexible fiberoptic bronchoscope. It required jaw thrust and frequent alterations in direction and resulted in a lag of time, which is an important consideration that causes some techniques to fall out of favor.[13]

Although the literature on awake fiber optic intubation in different positions is scarceRuetzler *et al.*,[14] conducted similar research. Their methodology included two phases of intubation. In the initial phase,

patients underwent endotracheal intubation while positioned in the standard sniffing posture in a supine orientation. Subsequently, in the second phase, the angle of inclination of the operating table was adjusted by 25° from the horizontal plane through a flexion at the hip joint while maintaining the flexion at the atlanto occipital joint. The quality of the laryngoscopic view was evaluated using the Cormack and Lehane classification and the POGO (Percentage of Glottic Opening) score of [15]. The position in the second phase was similar to that in our patients. They performed their trial with a significant sample of 780 patients and found that ease of intubation and glottis view improved with ramping. The possible explanation for the ease of intubation in a ramped-up position is that the tendency of the tongue to fall back is less, which improves the laryngeal view. Ramping also improves the posturing of an anesthetist who stoops in a sniffing position to acquire an adequate laryngeal view. However, they used conventional intubation instead of awake fiberoptic intubation.

Earlier sniffing positions were considered ideal for direct laryngoscopy under anesthesia, but they are being replaced gradually and slowly with ramped positions. The orthodox anesthetists still consider sniffing position as the gold standard, but literature and research hold a different perspective. The ramping was mainly reserved for obese patients, where it was thought to improve functional residual capacity.[15] prevent early desaturation, and improve bag-mask ventilation. Shirazy *et al*.,[16] presented the findings of their case series. They stated the fact that obese people lose the anatomical balance of their airways due to hypercapnia, which makes it difficult to access their airways. This balance can be restored by ramping in the upper half of their body, which aligns the external auditory meatus with the manubrio sterni. They showed that it improved non-invasive ventilation in obese patients. Unlike the other studies where position analysis was done on asleep patients, their patients were awake like our patients, and the tendency of the tongue to fall is considered minimal. They emphasized that ramping proved beneficial.[15] Therefore, we employed ramping in awake fiber optic. The success of awake fiber optics is usually attributed to operators' dexterity, and little regard was given to positioning. However, our study implied that positioning during awake fiber optics is also an important consideration. In our study, one experienced anaesthetist performed all the awake intubations. This removed the bias that might have arisen due to performance variability.

Collins *et al*., performed video laryngoscopy on patients with difficult airways in both ramped and sniffing positions. They established that the ramped-up position proved better than the sniffing position in getting the best laryngeal view.[17] We, however, employed this positioning in awake patients undergoing fiber optic intubation who had difficult airways.

Liu *et al*., compared head positions for awake fiber optic intubation. They compared three positions: neutral, sniffing, and head extended position. According to them, the extended neck position provided the best laryngeal view. Their extended neck position was similar to our ramped-up position as they placed a pillow under the patient's shoulder. They established that the extended neck position required minimum time for awake fiber optic intubation, the percentage of glottis opening score was highest with this position, and post-operatively, patients had a minimal frequency of hoarseness. 18 Their study's findings were similar to ours; their extended neck position was called head up ramped position in our study. The difference was only in nomenclature.

The ramping also provides the advantage of enhanced functional residual capacity, which is of great value as FRC is our main oxygen reserve and preservation of oxygen reserve prevents desaturation and improves the safety of intervention.[11-19] The finding of our study also showed that the time required for awake fiber optic in a ramped-up position was lower than intubation in a conventional sniffing position. This shows an element of ease, allowing the operator to perform this task quickly. The time effectiveness also reduces the patient’s apprehension and discomfort.

## LIMITATION OF THE STUDY

The study was performed in two different centers, and the dexterity of the operator performing fiber optic intubations could have been a source of bias.

## ACKNOWLEDGMENT

We are grateful for the departmental help in conducting the study.

## CONCLUSION

We concluded that the head-up ramp position was superior to the sniffing position for awake fiber optic intubation in patients with difficult airways.

**Conflict of Interest:** None.

**Funding Source:** None.

**Authors' Contribution**

Following authors have made substantial contributions to the manuscript as under:

US & NUS: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

AR & CAA: Conception, data analysis, drafting the manuscript, approval of the final version to be published.

KSA & AN: Data acquisition, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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