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Original Research Article

A Comparative Study between Dexmedetomidine versus Fentanyl to Facilitate Awake Fibreoptic Nasal Intubation under General Anaesthesia

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Abstract

Background: Awake fibreoptic nasal intubation (AFOI) is the gold standard for managing anticipated difficult airways. Achieving optimal sedation without compromising respiratory function and hemodynamic stability remains a clinical challenge.

Aim: To compare the efficacy and safety of dexmedetomidine versus fentanyl in facilitating awake fibreoptic nasal intubation.

Methods: This prospective, randomized, double-blind comparative study included 50 patients (ASA physical status I–II) aged 20–50 years undergoing elective surgery requiring AFOI. Patients were randomly allocated into two groups: Group D received dexmedetomidine (1 µg/kg), and Group F received fentanyl (2 µg/kg), both administered as intravenous infusion over 10 minutes. Sedation was assessed using the Ramsay Sedation Score (RSS). Intubation conditions were evaluated using cough score and post-intubation tolerance score. Hemodynamic parameters and oxygen saturation were recorded. Statistical analysis was performed using SPSS version 27, with $p < 0.05$ considered significant.

Results: Dexmedetomidine provided significantly better sedation with higher proportion of patients achieving optimal RSS scores ($p = 0.03$). Intubation conditions were superior in Group D, with reduced cough response ($p = 0.01$) and improved post-intubation tolerance ($p = 0.02$). Hemodynamic stability was better maintained with dexmedetomidine, showing minimal changes in heart rate and mean arterial pressure compared to fentanyl ($p < 0.01$). The incidence of oxygen desaturation was significantly lower in Group D (4%) than Group F (28%) ($p = 0.02$). First-attempt intubation success was higher and intubation time shorter in the dexmedetomidine group.

Conclusion: Dexmedetomidine is superior to fentanyl for awake fibreoptic nasal intubation, providing better sedation, improved intubation conditions, enhanced hemodynamic stability, and reduced respiratory complications. It can be considered the preferred sedative agent for AFOI in patients with anticipated difficult airway.

Keywords: Dexmedetomidine, Fentanyl, Awake Fibreoptic Intubation, Sedation, Difficult Airway, Hemodynamic Stability.

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Introduction

Awake fibreoptic nasal intubation (AFOI) is widely regarded as the gold standard for the management of anticipated difficult airways, particularly in patients with restricted mouth opening, anatomical abnormalities, or cervical spine instability [1]. The technique allows maintenance of spontaneous ventilation and airway reflexes while facilitating safe endotracheal intubation. Adequate sedation is a critical component of AFOI, as the procedure can cause significant discomfort, anxiety, and hemodynamic stress if performed without appropriate pharmacological support [2]. An ideal sedative agent should provide anxiolysis, analgesia, and patient cooperation without compromising respiratory drive or airway patency [3,4]. However, achieving this balance remains a clinical challenge. Traditionally, sedatives such as benzodiazepines, opioids, and propofol have been used either alone or in combination to facilitate AFOI [2,5]. Although these agents are effective, they are often

associated with adverse effects such as respiratory depression, hypoxemia, and airway obstruction. Studies have shown that the combination of opioids with benzodiazepines significantly increases the risk of apnea and hypoxemia, thereby necessitating careful monitoring [9].

Dexmedetomidine, a highly selective α2-adrenergic agonist, has emerged as a promising agent for sedation during AFOI. It provides sedation, anxiolysis, and analgesia without causing significant respiratory depression [6]. Additionally, dexmedetomidine reduces salivary secretions, which improves visualization during fibreoptic intubation and enhances procedural ease [6]. Previous studies have demonstrated that dexmedetomidine offers better patient tolerance, improved intubation conditions, and more stable hemodynamic parameters compared to other sedatives [13,14].

Fentanyl, a potent synthetic opioid, is widely used for its strong analgesic properties and rapid onset of action [7]. It is approximately 50–100 times more potent than morphine and is commonly used during airway manipulation procedures [7].

However, fentanyl is associated with dose-dependent respiratory depression and may lead to hypoxemia, particularly when combined with other sedatives [8,9]. Despite these limitations, fentanyl continues to be used due to its efficacy in attenuating airway reflexes. Several studies have compared different sedative agents for AFOI, but the optimal drug remains a topic of ongoing research. While dexmedetomidine has shown advantages in terms of hemodynamic stability and minimal respiratory depression, fentanyl remains a commonly used alternative due to its analgesic potency and familiarity among clinicians [14,15].

Therefore, this study was designed to compare dexmedetomidine and fentanyl in facilitating awake fibreoptic nasal intubation, with a focus on intubation conditions, sedation quality, patient tolerance, and hemodynamic stability.

Materials and Methods

Study Design: Prospective, randomized, double-blind comparative study.

Study Setting: Department of Anaesthesiology, Chirayu Medical College, Bhopal.

Study Duration: 10 months.

Sample Size: 50 patients (25 per group), calculated using statistical power analysis ($\alpha = 0.05$, $\beta = 0.8$).

Inclusion Criteria

1. ASA I–II patients
2. Age 20–50 years
3. Mallampati Grade III/IV
4. Thyromental distance < 6.5 cm
5. Restricted mouth opening

Exclusion Criteria

1. Pregnancy
2. Drug/alcohol abuse
3. Bradycardia
4. Nasal pathology or recent epistaxis
5. Cardiac failure
6. Drug allergy

Randomization and Groups

- **Group D:** Dexmedetomidine 1 µg/kg
- **Group F:** Fentanyl 2 µg/kg(Administered over 10 minutes)

Procedure

1. Preoperative fasting: 6–8 hours
2. Premedication: Ranitidine, alprazolam, ondansetron
3. Airway preparation:
    - Xylometazoline nasal drops
    - Lidocaine jelly
    - Nebulization with 2% lidocaine
4. Monitoring: ECG, NIBP, SpO_2, HR, RR

After Sedation:

1. Fibreoptic bronchoscope used for nasal intubation
2. Parameters assessed:
    - Ramsay Sedation Score (RSS)
    - Cough score
    - Post-intubation tolerance
    - Hemodynamic variables

Statistical Analysis

1. Software: SPSS version 27
2. Quantitative data: Mean ± SD
3. Qualitative data: Percentage
4. Tests:
    - Student's t-test
    - Chi-square test
5. Significance level: $p < 0.05$

Results

A total of 50 patients were enrolled in the study and randomly allocated into two groups: Group D (dexmedetomidine, n=25) and Group F (fentanyl, n=25). All patients completed the study and were included in the final analysis.

The demographic characteristics including age, gender distribution, weight, and ASA physical status were comparable between the two groups, with no statistically significant differences observed ($p > 0.05$), indicating adequate randomization (Table 1).

Table 1: Demographic Profile of Patients

Parameter	Group D (Dexmedetomidine)	Group F (Fentanyl)	p-value
Age (years)	34.6 ± 7.8	35.2 ± 8.1	0.78
Gender (M/F)	14 / 11	13 / 12	0.79
Weight (kg)	64.5 ± 8.2	65.1 ± 7.9	0.82
ASA I / II	15 / 10	16 / 9	0.76

Sedation levels assessed using the Ramsay Sedation Score (RSS) demonstrated that patients in the dexmedetomidine group achieved significantly deeper and more appropriate sedation compared to the fentanyl group ($p = 0.03$). A higher proportion of patients in Group D attained an RSS of 3, indicating cooperative and tranquil sedation, whereas Group F showed relatively lighter sedation levels (Table 2).

Table 2: Ramsay Sedation Score (RSS)

RSS Score	Group D (n=25)	Group F (n=25)	p-value
2	3 (12%)	8 (32%)	
3	17 (68%)	12 (48%)	
4	5 (20%)	5 (20%)	0.03*

Assessment of intubation conditions using cough score revealed significantly better outcomes in the dexmedetomidine group. More than half of the patients in Group D exhibited no coughing during fibreoptic intubation, whereas moderate coughing was more frequently observed in the fentanyl group ($p = 0.01$), indicating smoother intubation conditions with dexmedetomidine (Table 3).

Table 3: Cough Score during Intubation

Cough Score	Group D	Group F	p-value
1 (No cough)	14 (56%)	6 (24%)	
2 (Mild)	9 (36%)	10 (40%)	
3 (Moderate)	2 (8%)	9 (36%)	0.01*

Post-intubation tolerance scores were significantly better in the dexmedetomidine group. A majority of patients in Group D demonstrated excellent tolerance with minimal discomfort, whereas a higher proportion of patients in the fentanyl group experienced moderate to poor tolerance ($p = 0.02$) (Table 4).

Table 4: Post-Intubation Tolerance

Score	Group D	Group F	p-value
1 (Excellent)	16 (64%)	7 (28%)	
2 (Good)	8 (32%)	12 (48%)	
3 (Poor)	1 (4%)	6 (24%)	0.02*

Hemodynamic parameters showed significant differences between the two groups during and after intubation. While baseline heart rate and mean arterial pressure were comparable, Group F exhibited a significant increase during intubation, whereas Group D maintained stable values ($p < 0.01$). This suggests superior hemodynamic stability with dexmedetomidine (Table 5).

Table 5: Hemodynamic Parameters - Heart Rate (beats/min)

Time Point	Group D	Group F	p-value
Baseline	82 ± 6	83 ± 7	0.65
During Intubation	86 ± 7	95 ± 8	0.001*
Post-intubation	84 ± 6	92 ± 7	0.002*

Mean Arterial Pressure (mmHg)

Time Point	Group D	Group F	p-value
Baseline	92 ± 5	93 ± 6	0.71
During Intubation	95 ± 6	108 ± 7	0.001*
Post-intubation	94 ± 5	104 ± 6	0.001*

The incidence of oxygen desaturation ($SpO_2 < 90\%$) was significantly lower in the dexmedetomidine group compared to the fentanyl group (4% vs 28%, $p = 0.02$), indicating better respiratory safety (Table 6).

Table 6: Oxygen Desaturation

Parameter	Group D	Group F	p-value
Desaturation	1 (4%)	7 (28%)	0.02*

Furthermore, intubation success rate and procedural efficiency were better in the dexmedetomidine group. First-attempt success was higher, and the mean intubation time was significantly shorter compared to the fentanyl group ($p < 0.05$), indicating improved procedural ease (Table 7).

Table 7: Intubation Success and Time

Parameter	Group D	Group F	p-value
First Attempt Success	24 (96%)	20 (80%)	0.04*
Intubation Time (sec)	32 ± 6	45 ± 8	0.001*

Discussion

The present study was conducted to compare the efficacy of dexmedetomidine and fentanyl in facilitating awake fibreoptic nasal intubation (AFOI) in patients with anticipated difficult airway. The findings of this study demonstrate that dexmedetomidine provides superior intubation conditions, better sedation quality, improved patient tolerance, enhanced hemodynamic stability, and reduced respiratory complications compared to fentanyl.

In the current study, both groups were comparable in terms of demographic variables, confirming that the observed differences in outcomes were attributable to the pharmacological effects of the study drugs rather than confounding factors. This baseline comparability strengthens the internal validity of the study.

Sedation is a crucial determinant of success in AFOI. In our study, dexmedetomidine achieved significantly better Ramsay Sedation Scores compared to fentanyl, with a higher proportion of patients attaining an optimal sedation level (RSS 3), indicating a calm, cooperative, and responsive patient. This finding is consistent with previous studies by Tsai et al. [13] and Mondal et al. [14], who reported superior sedation and patient comfort with dexmedetomidine. The sedative effect of dexmedetomidine, mediated through central α2-receptor agonism, allows preservation of spontaneous respiration while maintaining adequate sedation depth, which is critical during awake procedures.

Intubation conditions, as assessed by cough score, were significantly better in the dexmedetomidine group. A majority of patients in this group exhibited minimal or no coughing during fibreoptic intubation, indicating better suppression of airway reflexes. In contrast, patients receiving fentanyl had a higher incidence of moderate coughing. Similar findings were reported by Eldemrdash et al. [15] and Panwar et al. [18], who demonstrated that dexmedetomidine provides smoother intubation conditions. This can be attributed to its sympatholytic and antisialagogue properties, which improve visualization and reduce airway reactivity.

Post-intubation tolerance was also significantly improved in the dexmedetomidine group, with a greater proportion of patients demonstrating excellent tolerance. This reflects better patient cooperation and comfort during the procedure. These findings are in agreement with Yadav et al. [17], who observed improved patient compliance and reduced discomfort with dexmedetomidine-based sedation regimens.

Hemodynamic stability is another critical factor during AFOI, as airway manipulation can induce significant sympathetic responses. In the present study, dexmedetomidine maintained stable heart rate and mean arterial pressure throughout the procedure, whereas fentanyl was associated with significant increases in both parameters during and after intubation. These results are consistent with previous studies [13,14], which have shown that dexmedetomidine attenuates stress responses due to its central sympatholytic action. In contrast, fentanyl, although effective in blunting pain, may not adequately suppress the sympathetic response to airway instrumentation.

Respiratory safety is a key consideration in awake intubation techniques. In our study, the incidence of oxygen desaturation was significantly lower in the dexmedetomidine group compared to the fentanyl group. This finding aligns with the pharmacological profile of dexmedetomidine, which produces minimal respiratory depression.

Conversely, fentanyl is known to cause dose-dependent respiratory depression, as demonstrated in earlier studies by Bailey et al. [9], which reported increased risk of hypoxemia and apnea with opioid use. The reduced incidence of desaturation in the dexmedetomidine group highlights its safety advantage in maintaining airway patency and ventilation.

Additionally, procedural efficiency was improved with dexmedetomidine, as evidenced by higher first-attempt success rates and shorter intubation times. This may be due to better patient cooperation, reduced coughing, and improved visualization conditions. These findings further support the use of dexmedetomidine as an ideal sedative agent for AFOI. Despite these strengths,

certain limitations of the study must be acknowledged. The sample size was relatively small, which may limit the generalizability of the findings. Additionally, the study was conducted at a single center, and subjective scoring systems such as sedation and tolerance scores may introduce observer bias, although efforts were made to minimize this through blinding. Overall, the findings of this study strongly support the superiority of dexmedetomidine over fentanyl for sedation during awake fibreoptic nasal intubation. Its ability to provide optimal sedation, maintain hemodynamic stability, preserve respiratory function, and improve intubation conditions makes it a more suitable and safer agent in patients with anticipated difficult airway.

Conclusion

The present study demonstrates that dexmedetomidine is superior to fentanyl in facilitating awake fibreoptic nasal intubation in patients with anticipated difficult airway. Dexmedetomidine provided significantly better sedation quality, smoother intubation conditions with reduced cough response, and improved post-intubation tolerance. Additionally, it maintained greater hemodynamic stability and was associated with a lower incidence of respiratory complications, particularly oxygen desaturation.

In contrast, while fentanyl offered adequate analgesia, it was associated with comparatively poorer intubation conditions, greater hemodynamic fluctuations, and higher risk of respiratory depression. Therefore, dexmedetomidine can be considered a more effective and safer sedative agent for awake fibreoptic intubation. Its favorable pharmacological profile makes it particularly suitable in scenarios where maintenance of spontaneous ventilation and airway reflexes is critical.

Further large-scale, multicentric studies are recommended to validate these findings and establish standardized sedation protocols for awake fibreoptic intubation.

Ethical Considerations

- Ethical clearance obtained
- Informed consent taken

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