RESEARCH ARTICLE

Comparing the Efficacy of Dexmedetomidine versus Fentanyl and Midazolam During Awake Fiberoptic Intubation

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Background: Awake oral flexible fiberoptic intubation (AFOI) is used in patients with expected difficult airways. Different drugs have been used for sedation and yet we need to define ideal drug with proper sedation and safety, less changes in hemodynamic stability and less airway compromise. We aimed to compare the efficacy of dexmedetomidine with fentanyl and midazolam during AFOI.

Methods: In this randomized clinical trial, 52 patients undergoing elective surgery and candidate for AFOI were randomly allocated to two groups. First group received 1mcg/kg of dexmedetomidine in 10 minutes and then infusion of 0.5 mcg/kg/h and second group received 2 mcg/kg fentanyl and then 1 mg midazolam. Hemodynamic variables, O2 saturation (SpO2) were evaluated before and after sedation and after intubation. Ramsey sedation scale (RSS) and patient's tolerance were evaluated during bronchoscopy and intubation.

Results: Lower heart rate after intubation (p=0.008) and higher SpO2 before sedation (p<0.001) and after intubation (p=0.02) were observed in dexmedetomidine group compared to fentanyl group. The need for propofol for further sedation was comparable between groups (11.5% vs. 7.7%, respectively; p=0.63). Both groups had comparable RSS and tolerance during intubation.

Conclusion: Dexmedetomidine compared to fentanyl and midazolam had comparable sedation with better hemodynamic stability and O2 saturation during AFOI.

Keywords: awake fiberoptic intubation; dexmedetomidine; midazolam; fentanyl

Awake nasal or oral flexible fiberoptic intubation (AFOI) is used in patients with expected difficult airways, failed intubation, compromised airway, lower airway pathology and possible neck injury [1-2]. Adequate preparation is needed prior to AFOI to provide patient comfort and optimal intubation while preventing any airway compromise [2]. Selecting an ideal sedation agent ensuring this purpose is necessary [3].

Several sedative agents have been used for sedation during AFOI such as dexmedetomidine, fentanyl, remifentanil, propofol, ketamine, and benzodiazepines [1,4-7]. These drugs have some advantages and disadvantages. Benzodiazepines, opioids and propofol although causing sedation and attenuating hemodynamic response, can cause respiratory depression [1,8]. Recent reports were indicative of safety and efficacy of dexmedetomidine without depressing respiratory function [2-4,9-12]. Using dexmedetomidine, patients are easily arousable and hemodynamic variables are better controlled [13].

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Determining proper sedation agents with better intubating conditions and lower side effects during AFOI is necessary. In this study, we evaluated the efficacy of dexmedetomidine versus fentanyl plus midazolam during AFOI.

Methods

In this randomized triple blinded clinical trial, 52 patients between 20-60 years old with ASA I-II undergoing elective surgery under general anesthesia with awake fiberoptic intubation at Rasul Akram Hospital, Tehran, Iran were included. Exclusion criteria were pregnant women, patients unable to cooperate (mentally retarded or unconscious), AV block in electrocardiogram (ECG), those addicted to opium or sedative, allergy to any of the studied drugs, urgent surgery, uncontrolled asthma or complications during the study including laryngospasm, bronchospasm, bleeding, Ramsey sedation scale >4 at the drugs peak effect or any hemodynamic change in need of medical intervention. The ethics committee of Iran University of Medical Sciences approved the study protocol and all patients gave informed consent. The study was registered to Iranian Registry of Clinical Trials with trial registration code of IRCT20161220031487N9.

Patients were blinded to the allocated group. Also, the anesthesiologist applying the awake fiberoptic technique and the anesthesiologist recording the observations were also unaware of the type of medication given to each patient.

Using computer-generated random number table, patients were randomly assigned to group D and F. Group D (n=26)

received dexmedetomidine 1 mcg/kg in 10 minutes and then 0.5 mcg/kg/h. Group F (n=26) received fentanyl 2 mcg/kg and midazolam 1 mg IV.

All patients had 6 hour fasting prior to surgery. Pre-medications were ringer lactate serum 5 cc/kg in 30 minutes and 5 mg IV hyoscine. Lidocaine 10% spray was applied at the base of the tongue, oropharynx and hypopharynx. In the operation room, multichannel monitor was applied to record baseline heart rate (HR), Mean arterial pressure (MAP), O2 saturation (SpO2) and ECG. HR, MAP and SpO2 were measured before drug injection, peak drug effect (15 minutes for dexmedetomidine and 5 minutes for fentanyl and midazolam) and after intubation. Bronchoscopy was performed only after reaching the administered medications peak effect and when Ramsay sedation scale (RSS) ≥2, intubation was performed orally via fiberoptic technique. Propofol was administered if proper sedation was not achieved.

Intubation quality and airway block were evaluated using following measures:

A. RSS was used to assess agitation. It is a 6-point scale and measured as follows:

1. Patient is anxious and agitated or restless, or both
2. Patient is cooperative, oriented, and tranquil
3. Patient responds to commands only
4. Patient exhibits brisk response to light glabellar tap or loud auditory stimulus
5. Patient exhibits a sluggish response to light glabellar tap or loud auditory stimulus
6. Patient exhibits no response

B. Patient's tolerance during bronchoscopy and intubation on a 5-point scale (1 = no reaction; 2 = slight grimacing; 3 = severe grimacing; 4 = verbal objection; and 5 = defensive movement of head, hands, or feet [14].

C. Patient's tolerance score immediately after orotracheal intubation on a 1–3 scale (1 = calm and cooperative, 2= restless, 3= complete resistance and in need of rapid general anesthesia) [3].

The duration from bronchoscopy to intubation and times tried for intubation were recorded.

Statistical Analysis

Statistical analysis was performed using SPSS 20 (SPSS Inc., Chicago, IL, USA). Results were presented as means and standard deviations (SD) or frequency and percent. Independent T-test and chi square test were used to compare results between groups. P values <0.05 were considered significant.

Results

Demographic characteristics were comparable between groups (Table 1).

Among hemodynamic changes, only heart rate after intubation was significantly lower and SpO2 before sedation and after intubation were significantly higher in dexmedetomidine group. There were also comparable differences in SBP, DBP and MAP after intubation, with no significant differences (Table 2).

The median (min-max) try for fiberoptic bronchoscopy in dexmedetomidine and fentanyl group were 1 (1-3) and 1 (1-2), respectively, with no significant difference between groups (p=0.77). Three patients (11.5%) in dexmedetomidine group and 2 patients (7.7%) in fentanyl group were in need of propofol for further sedation (p=0.63).

(Table 3) demonstrates the RSS, patient's tolerance during bronchoscopy and intubation and immediately after orotracheal intubation and intubation duration. RSS was similar between groups. Considering tolerance as no reaction or some reaction, fentanyl group had significantly more cases with no reaction during bronchoscopy (p=0.02), while during intubation the rate was not significant (p=0.13).

Table 1- Demographic findings of groups

		Dexmedetomidine	Fentanyl	P value
Gender	Male	16 (61.5%)	17 (65.4%)	0.77
	Female	10 (38.5%)	9 (34.6%)	
Age (years)		45.92±8.49	48.11±9.58	0.38
Weight (kg)		75.03±9.75	78.57±18.42	0.39
ASA	I	10 (38.5%)	14 (53.8%)	0.26
	II	16 (61.5%)	12 (46.2%)	

Table 2- Hemodynamic and Spo2 changes between groups

	Dexmedetomidine	Fentanyl	P value
SBP before sedation	130.26±13.09	127.50±27.88	0.64
SBP 5 minutes after sedation	122.00±11.49	123.42±31.42	0.82
SBP after intubation	134.84±12.94	146.24±30.79	0.08
DBP before sedation	83.26±5.88	86.07±16.93	0.42
DBP 5 minutes after sedation	78.53±8.44	79.57±14.65	0.75
DBP after intubation	86.96±10.34	92.84±19.86	0.18
MAP before sedation	99.11±7.37	104.08±18.28	0.20

Table 2- Hemodynamic and Spo2 changes between groups (Continued)

	Dexmedetomidine	Fentanyl	P value
MAP 5 minutes after sedation	92.19±11.13	94.61±17.11	0.54
MAP after intubation	100.15±12.72	109.84±22.31	0.06
HR before sedation	81.61±13.14	87.03±10.33	0.10
HR 5 minutes after sedation	72.30±12.85	76.15±11.84	0.26
HR after intubation	81.53±19.50	95.52±16.81	0.008
SpO2 before sedation	98.15±1.40	96.26±1.66	<0.001
SpO2 5 minutes after sedation	99.65±0.84	99.38±0.80	0.24
SpO2 after intubation	99.26±1.00	98.48±1.44	0.02

Table 3- RSS, patient's tolerance during bronchoscopy and intubation and immediately after intubation and intubation duration

		Dexmedetomidine	Fentanyl	P value
RSS		3.03±1.11	3.11±0.99	0.79
Duration of intubation (seconds)		143.53±35.92	77.80±11.09	0.02
Tolerance during bronchoscopy	no reaction	0	6 (23.1%)	----
	severe grimacing	22 (84.6%)	17 (65.4%)	
	verbal objection	4 (15.4%)	3 (11.5%)	
Tolerance during intubation	no reaction	6 (23.1%)	11 (42.3%)	-----
	slight grimacing	0	1 (3.8%)	
	severe grimacing	1 (3.8%)	1 (3.8%)	
	verbal objection	19 (73.1%)	13 (50%)	
Tolerance after intubation	calm and cooperative	15 (57.7%)	17 (65.4%)	0.56
	restless	11 (42.3%)	9 (34.6%)	

Discussion

In this study we compared the efficacy of 1 mcg/kg dexmedetomidine following 0.5 mcg/kg/h infusion with fentanyl 2 mcg/kg and midazolam 1 mg IV and observed similar RSS and sedation with lower heart rate after intubation and better oxygen saturation in dexmedetomidine group.

Different agents including benzodiazepines, opioids and ketamine as well as dexmedetomidine are recommended for AFOI to improve sedation with hemodynamic stability [1,4-7]. Recent studies are indicative of better efficacy of dexmedetomidine compared to other agents in sedation and keeping stable hemodynamics without respiratory suppression [2-4,9-13].

As mentioned, in our study, dexmedetomidine group compared to fentanyl and midazolam group had lower heart rate after intubation. Although not significant, this group had lower systolic and diastolic blood pressure and MAP than fentanyl and midazolam group indicative of more hemodynamic stability. Similarly, Chu et al. [3] also reported reduced hemodynamic response in oral cancer patients receiving dexmedetomidine. Yusuf and colleagues [15] also reported better hemodynamic response in dexmedetomidine group compared to fentanyl-midazolam group.

In patients receiving dexmedetomidine compared to fentanyl, Mondal and colleagues [2] observed better hemodynamic stability. Sayeed et al. [16] also reported more changes in HR, MAP, and SBP in midazolam–fentanyl group. In the study of Yavacaoglu et al. [17] dexmedetomidine compared to esmolol was able to prevent the hemodynamic responses to tracheal intubation. Unlike these, Ryu et al. [18] comparing remifentanil with dexmedetomidine, found no significant difference in MAP and HR.

A decrease in heart rate and blood pressure is reported following dexmedetomidine use. These hemodynamic changes are results of an inhibition of central sympathetic outflow and increased vagal activity [19-20].

Studies have reported that dexmedetomidine does not decrease arterial oxygen saturation <90 [8]. In our study, patients receiving dexmedetomidine also experienced less desaturation and lower decrease in O2 saturation. Mondal and colleagues [2] also observed lower desaturation rate in dexmedetomidine compared to fentanyl group. Similarly, Yusuf and colleagues [15] reported lower rate of desaturation in dexmedetomidine group. Rye et al. [18] also reported lower desaturation rate in dexmedetomidine group compared to remifentanil. Lower O2 saturation has also been reported in other studies for patients receiving fentanyl before and during intubation [21]. Opioids including fentanyl suppress respiratory center and thus increase the

risk of hypoxia and desaturation, while dexmedetomidine has respiratory-sparing effect.

The sedation rate was comparable between both groups in our study. Similar to our findings, Yousuf and colleagues [15] observed no significant difference in sedation rate between dexmedetomidine and fentanyl-midazolam group. Ryu et al. [18] also found no significant differences of sedation level between groups. Unlike these findings, Mondal and colleagues [2] reported better sedation for dexmedetomidine compared to fentanyl.

We observed that dexmedetomidine patients had more intolerance during bronchoscopy but had similar tolerance during intubation. Chu et al. [3] observed better tolerance to intubation without respiratory depression and upper airway obstruction in dexmedetomidine group (1 mcg/kg) compared with fentanyl group (1 mcg/kg). These differences could be due to the time interval for each drug to reach its peak effect.

In conclusion, dexmedetomidine compared to fentanyl and midazolam had comparable sedation with better hemodynamic stability and O2 saturation during AFOI and thus is better than fentanyl-midazolam combination for AFOI.

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