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A Pharmacological Evidence-Based Algorithm in the Management of Awake Fiberoptic
Intubation

A DNP Project Presented to the Faculty of the
Nicole Wertheim College of Nursing and Health Sciences

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For the Degree of Doctor of Nursing Practice

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ABSTRACT

Awake Fiberoptic Intubation (AFOI) is the gold standard technique for difficult airway management. AFOI requires sedation, anxiolysis, and relief of discomfort without impairing ventilation, depressing cardiovascular function, a patent airway with blunting reflexes and spontaneous ventilation, when the airway is difficult. Many agents like fentanyl, midazolam, ketamine, propofol and remifentanil have been used to facilitate AFOI. This quality improvement project composed of 13 randomized control trials (RCTs) reviewed different drug regimens for AFOI anticipated difficult airway, it also included studies examining elective awake fiberoptic intubation for scheduled surgery. The empirical evidence demonstrated that the occurrence of desaturation was less with dexmedetomidine or alfentanil when compared against fentanyl, remifentanil, and propofol. This quality improvement educational module seeks to assess anesthesia providers knowledge, on the efficacy of drugs, and drug regimens for AFOI. Anesthesia providers receiving the educational intervention will include Anesthesiologists and Certified Nurse Anesthetists (CRNA). The sample will include approximately 5-10 participants. The quality improvement project will involve three phases, pre-assessment testing, an online educational presentation, and a post-assessment exam. Pre-assessment and post-assessment testing will be used to measure the effects of the intervention. Statistical analysis will be applied to assess the knowledge of the educational intervention. It is projected that provider education will improve, providing the knowledge in dosages, side effects, complications, and pharmacological therapy needed to optimize sedation when performing an AFOI.

Key terms: awake fiberoptic, awake fiberoptic intubation, awake laryngoscopy, and awake video laryngoscopy.

BACKGROUND

Introduction

Tracheal intubation is required for many surgical procedures. Difficult airway management is a challenge even for the most experienced anesthesia provider. Patients with a possible or history of difficult airway, such as a positive difficult airway screening, airway deformities, lesions, tumors, or spinal cord issues will benefit from the use of awake fiberoptic intubation (AFOI).[1-3] The incidence of encountering a difficult airway while attempting to intubate ranges from 0.3% to 13% which equals, 1 of every 250 patients or 0.4% of cases.[1] Difficult intubation and difficult mask ventilation can create a dangerous scenario known as 'can't intubate can't ventilate' (CICV),[2,3] leading to apneic brain injury and death due to inappropriate management of a difficult airway. Difficult airway management can be an unforeseen finding as there are several scores and tests which predict its occurrence before the induction of anesthesia. Several guidelines and techniques have been presented, assessed, and published to manage AFOI.

AFOI is the gold standard for securing patients' airway with an expected difficult airway.[4] Performing AFOI requires a level of sedation that limits discomfort, provides anxiolysis without affecting cardiovascular stability, and impairing spontaneous ventilation.[5-18] Conscious sedation is the desired anesthesia level for an AFOI because it allows for spontaneous ventilation to be maintained during failed intubation attempts.[5] Deep sedation often results in the loss of spontaneous breathing, leading to hypoxia, cardiovascular compromise, and ultimately death.[5-17] One of the significant challenges when seeking to perform AFOI is achieving an optimal sedation level while maintaining a patent airway that allows the patient to breathe spontaneously.

AFOI is performed utilizing a flexible fiberoptic scope and it's success depends on the experience of the anesthesia provider and the appropriate sedation level of the patient. Multiple agents such as fentanyl, remifentanil, alfentanil, midazolam, propofol, and ketamine have been utilized to achieve sedation for AFOI.[5-7] These agents can lead to cessation of spontaneous ventilation, suppress cardiac function, leading to bradycardia, hypotension, hypoxia, and aspiration.[5-7] The sedative or combination of sedatives for AFOI should provide anxiolysis, a level of amnesia that diminishes the incidence of recall, analgesia, suppress the cough and gag reflex, with minimal effects on respiratory and cardiovascular stability.[5-17]

Scope of the problem

Airway complications with the induction of anesthesia are rare but life-threatening when they occur. CICV occurs in less than 1 in 5,000 general anesthesia cases, 1 out of 50,000 requires an emergency surgical airway, but this complication accounts for 25% of anesthesia-related deaths.[19] Failed intubations occur 1 in every 2,000 elective settings, 1 in 300 during rapid sequence intubation (RSI) in obstetrics, 1 in 50 to 100 in the emergency department (ED) and intensive care unit (ICU). The rate of CICV raises to 1 in 200 in the ED.[18] Difficult intubations are often unexpected and can result in complications leading to patient injury. The median cost for all admissions coded for difficult intubation was $33,171, compared with a median cost of $12,940 for all matched admissions without difficult intubation, indicating a cost differential of $20,231.[19]

AFOI removes the stimulation caused by direct laryngoscopy due to placement of local anesthetics with different airway nerve blocks. Still, hypertension and tachycardia are often reported during the fiberoptic scope's insertion through the vocal cords. Prolonged intubation time results in hypercarbia, high blood pressure and increased heart rate. Nevertheless,

stimulation of the oropharyngeal structures and jaw thrust is considered the main stimulant for cardiovascular changes.[20] Drugs utilized to prepare for AFOI can also cause complications. The National Audit Project of the Royal College of Anesthetists (NAP4) identified over sedation as a "significant problem area leading to failed FOI"[20] and acknowledged that it "increases the likelihood of airway obstruction".[20] Hypoxia with a SpO2 < 90% occurs in 14.3% of patients undergoing AFOI.[20]

The conventional methods for AFOI, such as the utilization of benzodiazepines and remifentanil, have their shortcomings.[21,22] Airway obstruction caused by over-sedation enhances endoscopy difficulty, leading to increased risk of airway failure. Equally, over sedation leads to apnea, creating the same airway risk as when attempting direct laryngoscopy for general anesthesia.[5,20,21] The NAP4 provided multiple reports on remifentanil problems when utilized with other drugs for sedation.[21,22] Remifentanil caused respiratory depression, leading to apnea and pulmonary arrest.[21,22] The NAP4 panel viewed remifentanil as the agent most likely to lead to these events compared to other sedatives.

Today, multiple agents continue to be utilized to achieve proper sedation during AFOI, including benzodiazepines, opioids, ketamine, propofol, and dexmedetomidine. The empirical evidence supports dexmedetomidine for AFOI due to its minimal effect on respiratory depression and easy titration resulting in a patient that is easily arousable while maintaining spontaneous ventilation.[4,6,7,10,11] Dexmedetomidine is currently utilized for patients in the ICU for sedation during procedures, including AFOI and regional anesthesia. Dexmedetomidine is a high selective α2 adrenergic agonist, which possesses analgesic and anxiolytic properties, decreases salivation with miniscule respiratory depression.[5] Dexmedetomidine facilitates its effects on α2-adrenergic

receptor by activating guanine-nucleotide regulatory binding proteins causing sedation and anxiolysis within the locus coeruleus which modulates wakefulness.[5]

Recommendations are varied on maintaining spontaneous ventilation for the CICV patient during AFOI. This systematic review seeks to find the safest drug or drug combinations to achieve an adequate level of sedation for AFOI. Certain drugs may need to be avoided depending on the patient's history, condition, and American Society of Anesthesiologists (ASA) classification. The purpose of this systematic review is to review the evidence with a specific focus on the efficacy, safety profile, drug dosages, and hemodynamic stability for opioids, benzodiazepines, propofol, ketamine and dexmedetomidine in patients undergoing AFOI.

PICO

(P) In adult patients presenting for awake fiberoptic intubation (I) does an educational module and algorithm on multimodal pharmacological therapy (C) compared to opioids, benzodiazepines, propofol and ketamine alone or in combination (C) increase the anesthesia providers knowledge in dosages, side effects, complications, and pharmacological therapy? The objective of this systematic review is to develop an educational tool that describes each pharmacological therapy individually or in combination, providing the drugs most common dosage, side effects, complications, and adult age range for AFOI.

METHODOLOGY

Information Sources and Search Strategy

A literature search of randomized controlled trials was performed to compare the use of opioids, benzodiazepines, ketamine, propofol, and dexmedetomidine for AFOI for anticipated difficult airway in the adult surgical patient. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist was used to guide the search and format the

literature review.[23] The literature review seeks to review prior knowledge, identify inconsistencies, and provide a foundation of knowledge regarding medications and their use in AFOI.

The search was conducted in three electronic databases including, MedLine (ProQuest), Excerpt Medica Database (EMBASE), and Cumulative Index of Nursing and Allied Health Literature (CINAHL). The search terminology included key terms for AFOI such as "awake fiberoptic", "awake fiberoptic intubation", "awake laryngoscopy", and "awake video laryngoscopy". The literature search and screening methodology is summarized in Figure 1 in a PRISMA illustration. As of October 2020, the search was current. The Medline (ProQuest) data base yield 176 results, CINHAL stemmed 101 results and EMBASE provided 354 articles. Duplicates were removed leaving 254 articles to be reviewed. Below, Figure 1 provides a PRISMA flow diagram that details each phase of the literature review screening process.

Figure 1. PRISMA Flow Diagram
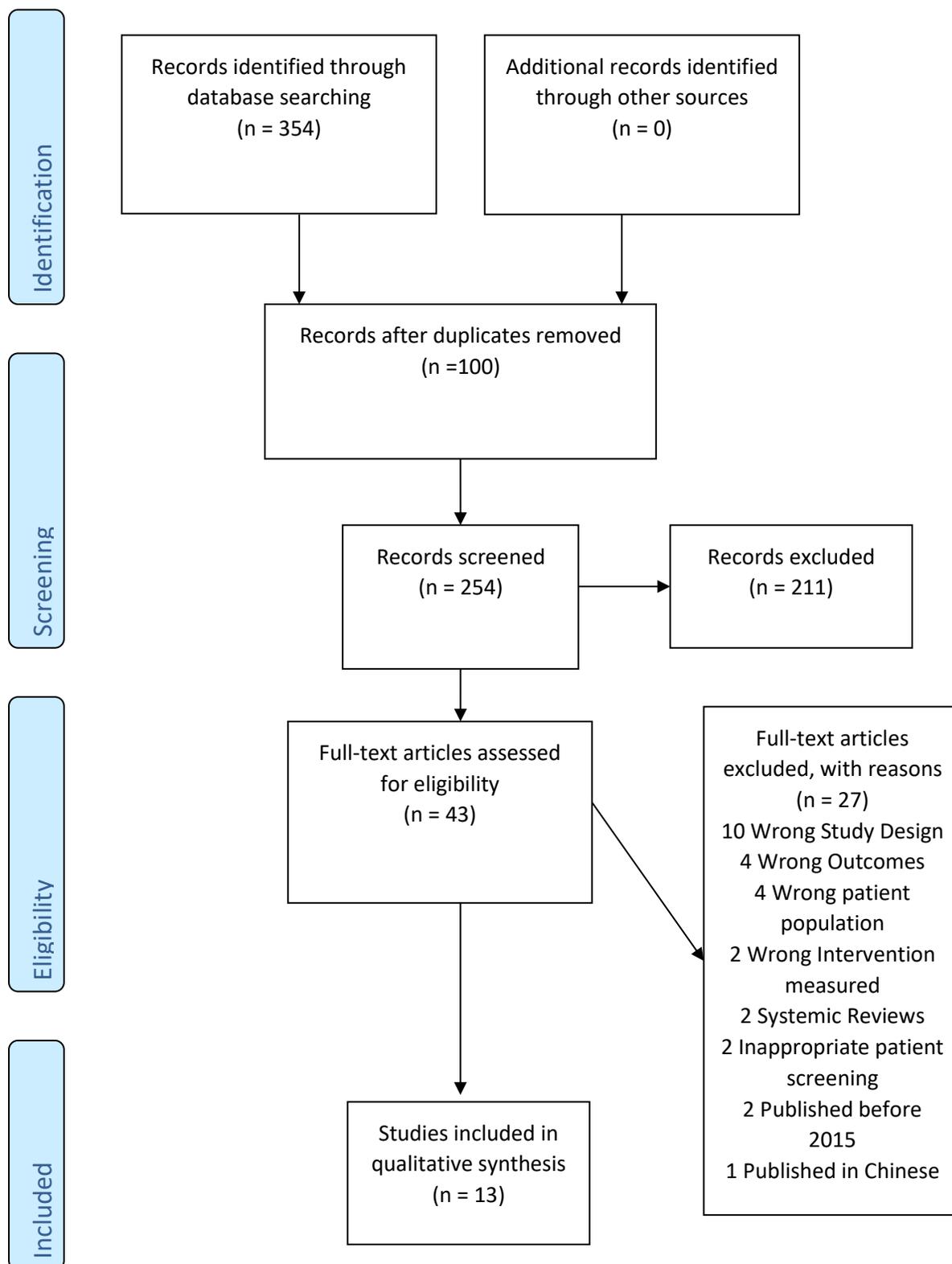
Study Selection and Screening

The PICO question was utilized to identify pertinent article titles and abstracts from the articles selected. The search strategies were limited to randomized control trials (RCTs). A total of 254 article citations and abstracts were screened and separated into a "Pertinent" folder, "Supplemental information" folder and "Disregard" folder. Twenty-seven articles were placed into the "Pertinent" folder, 10 into the "Supplemental" folder, and 211 citations were placed into the "Disregard" folder. The retrieved citations from the "Supplemental" and "Pertinent" folders were imported to Mendeley for ease of access and comparison. Duplicate articles were once again screened and eliminated. Full-text review was performed on the 27 articles that were identified based on a stringent inclusion and exclusion criteria.

The following inclusion criteria was implemented for potentially relevant studies: (1) RCTs comparing different methods of sedation for fiberoptic bronchoscopy or tracheal tube introduction; (2) involving adult patients with predicted difficult airway management; and (3) published in peer-reviewed journals. The main outcomes considered were hemodynamic changes that included heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), end tidal carbon dioxide ($ETCO_2$) and oxygen saturation (SPO_2), and achieving a minimal level of two on the Ramsay Sedation Scale (RSS) as this level assures the patient is cooperative, aware, and relaxed. Other information collected in the management and preparation of AFOI acquired when available include:

1. Preparation for AFOI such as airway block, inhaled or parental medications used to precondition airway.

2. Management of complications such as hypotension, bradycardia, hypoxia, and airway obstruction.

3. Patient tolerance level.

4. Patient satisfaction after the procedure regarding intubation.

Exclusion criteria included studies done in nonoperating settings, RCTs comparing different AFOI techniques, and studies involving simulation. Also, articles that utilized nonstandard medication dosages to achieve an adequate level of sedation for AFOI. Please refer to Table 1 for further details on inclusion and exclusion criteria.

Table 1: Inclusion and Exclusion Criteria

Inclusion	Exclusion
Population: • Adults (18-64 years of age) Type of procedure: • Awake fiberoptic intubation (AFOI) in patients screened or with history of difficult airway. Intervention: • Studies on the use of IV opioids, benzodiazepines, opioids, ketamine, propofol, and Dexmedetomidine to achieve adequate level of sedation for AFOI Primary outcomes: • RSS score of two or greater (Patient is cooperative, oriented, and tranquil) • Hemodynamic Stability (No rise greater than 20% (HR, SBP, DBP, MAP, ETCO2 and SPO2). • Measure of Patients Tolerance level • Airway Obstruction or Hypoxia • Number of patients that suffered bradycardia • Number of patients that suffered hypotension Type of study: • English language • Randomized controlled trials • Publication date 2015-Present	Population: • Geriatrics • Children (<18 years old) Type of procedure: • Any other form of intubation Intervention: • Medication not utilized IV for sedation Outcomes: • Anything other than mentioned Type of study: • Non-English • Publication date pre-2015 • Systematic reviews • Meta-analysis • Questionnaires • Dissertations/theses • Case reports/Studies

Collection, Analysis, and Data Items

The selected studies were examined in a systematic method. The John Hopkins research evidence appraisal tool was utilized to evaluate the studies.[24] The appraisal tool aids in rating each article with a quality and evidence level. A quality score of "I" describes an experimental study, RCT or systematic review of RCTs, with or without meta-analysis.[24] Evidence level is composed of three ratings: "A" or "High" quality stands for reliable, applicable results, study of adequate sample size with a control and definitive results; "Good" or "B" quality indicates adequate results, adequate sample size, fairly definitive conclusion based on fairly definitive literature review; lastly, "C" or "Low" quality signifies poor evidence with unreliable results, inadequate sample size for study and unclear conclusions.[24]

The articles underwent a thorough evaluation. An evidence and quality rating were given based on the John Hopkins' research evidence appraisal tool as seen in Table 1 below. Only studies with an evidence level of "I" and a quality level of "A" and "B" were utilized for this literature review. As mentioned, these levels of studies are RCTs with adequate sample size providing conclusive and replicable results which provide the highest level of reliability and validity. Information gathered during evaluation of each RCT was placed in a matrix for comparison. The matrix included: the study design and method, sample size and setting. Independent variables included opioids, benzodiazepines, ketamine, propofol, and dexmedetomidine. Dependent variables included hemodynamics, RSS, cough score and intubation score, findings, results and conclusion. The headers in the table include the authors, year published, evidence and quality level based on John Hopkins' research evidence appraisal tool and the information extracted from the articles comparing dexmedetomidine as a sole agent or comparing dexmedetomidine with other drugs or different dosages of a single drug.

RESULTS

Study Selection

A total of 354 articles were found on the initial search conducted in Medline, EMBASE, and CINAHL. One hundred articles were eliminated due to duplicates, resulting in 254 articles left for review. Abstract and title review eliminated 211 articles, a total of 43 articles were carefully screened and assessed. Utilizing the inclusion and exclusion criteria, 27 articles were eliminated due to study design, measured outcomes, patient population, intervention, language, date, and lack of patient screening. The final study selection resulted in 15 articles to address the PICO question: (P) In adult patients presenting for awake fiberoptic intubation (I) does an educational module and algorithm on multimodal pharmacological therapy (C) compared to opioids, benzodiazepines, propofol and ketamine alone or in combination (C) increase the anesthesia providers knowledge in dosages, side effects, complications and pharmacological therapy? Table 1 provides a summation of all RCTs utilized to conduct the literature review.

Dexmedetomidine

In 2016, Chopra et al[6] evaluated the use of a dexmedetomidine drip versus a control for patients undergoing AFOI. A double-blinded RCT study on 100 patients between the ages of 18-65, ASA I and II underwent AFOI for scheduled elective surgery requiring general anesthesia.[6] The study had two groups, the intravenous dexmedetomidine group and a control group. The intravenous dexmedetomidine group received dexmedetomidine (1 μg/kg) over 10 min followed by dexmedetomidine infusion at the rate of 0.7 μg/kg/h. Control group, (Group P, n=50) received IV normal saline bolus (1 ml/kg) over 10 min, followed by normal saline infusion at the rate of 0.7 ml/kg/h. Patient satisfaction score, HR, SBP, DBP, MAP and respiratory parameters were significantly better in the dexmedetomidine group ($P < 0.001$). Postintubation wakefulness in the two groups was comparable ($P=0.29$).

A randomized, placebo-controlled, double-blinded, prospective study conducted by Niyogi et al[7] in 2017, included 56 adult patients, ASA I and II, aged 18–50 years, undergoing elective cervical with cervical spondylotic myelopathy (CSM) undergoing elective cervical fixation requiring AFOI allocated patients into two groups - Group D and Group C. Group D patients received dexmedetomidine infusion at a rate of 1 μg/kg for the first 10 min followed by 0.5 μg/kg/h and Group C received 0.9% normal saline infusion in the same manner. The patient's alertness, sedation, and cardiorespiratory changes during the procedure were assessed utilizing the Observer Assessment Awareness and Sedation (OAA/S) scale. On post-operative day one, the patient's comfort during AFOI was assessed using a visual analogue scale (VAS). Patients of Group D had an acceptable level of sedation (OAA/S score: 20 to 17 with greater comfort and satisfaction (VAS: 40–60), compared to Group C (VAS: 50–90, $P < 0.001$). Moreover, hemodynamic parameters were less significantly altered in the dexmedetomidine group during AFOI. The study concluded that IV dexmedetomidine infusion during AFOI improves patient's tolerances with an acceptable level of sedation without significant hemodynamic instability and respiratory depression.

Dexmedetomidine versus Opioids

Mondal et al[10] conducted a double-blind prospective study in 2016, among 60 patients of either sex, aged 20- 60 years, belonging to ASA I and II, requiring AFOI for elective laparotomies. Patients were randomly allocated into two groups, Group A received dexmedetomidine 1 mcg/kg and Group B received Fentanyl 2 mcg/kg over 10 min. Cough score < 2 was considered as favorable intubation condition, which was achieved in 28 out of 30 patients in Group A, but only in 3 out of 30 patients in Group B. The difference was statistically significant ($P < 0.0001$). Better post-intubation score (Score 1) was found in 24 patients of

Group A and only three patients in Group B. This difference was also statistically significant ($P < 0.0001$). A higher RSS was achieved in Group A (3 ± 0.371) than in Group B (2.07 ± 0.254) ($P < 0.0001$). The study concluded that dexmedetomidine is more effective than fentanyl in producing better intubation conditions and sedation along with hemodynamic stability and less desaturation during AFOI.

In 2017, Hassan & Mahran[8] evaluated different doses of dexmedetomidine versus the use of dexmedetomidine with fentanyl. A RCT included 150 patients, ASA type I and II, ages 18-60 planned for AFOI undergoing general anesthesia for oral cancer surgery. Patients were evenly allocated into three groups; Group D1: received an infusion of 1 µcg/kg dexmedetomidine diluted in 50 ml saline over 20 min. Group D2: received an infusion of 2 µcg/kg dexmedetomidine diluted in 50 ml saline over 20 min. Group DF: received an infusion of 1 µcg/kg dexmedetomidine added to 1 µcg/kg fentanyl diluted in 50 ml saline over 20 min. Fiberoptic intubation comfort was statistically insignificant between groups ($P > 0.05$). Group D2 showed more incidence of airway obstruction than the other two groups. Hemodynamic parameters such as SBP, DBP, and HR, revealed a significant decrease from baseline until the time of intubation, after administration of the study drugs, followed by a slight significant increase after intubation and less than baseline. However, all groups were similar in hemodynamic values at all-time points with no interaction between them ($P > 0.05$). The study concluded that adding a low dose of fentanyl (1µcg/kg) to a low dose of dexmedetomidine can prevent the risk of airway obstruction associated with increasing the dose of dexmedetomidine while achieving the same favorable intubation scores.

In 2017, Eldemrdash et al[4] conducted a RCT to evaluate and compare dexmedetomidine or fentanyl efficacy for sedation during AFOI. The study was composed of 60 patients, aged 20 –

40, ASA I and II separated into two groups, Group D dexmedetomidine 1 mcg/kg, and group F fentanyl 2 µg/kg; both drugs were diluted with 50 ml saline to be infused over 10 minutes. Sedation was assessed by (RSS), intubation condition by a cough score and tolerance to intubation was evaluated by a 1-5 nominal scale. Best RSS was achieved in Group D (3 ± 0.371) ($P < 0.0001$). Cough score < 2 achieved in 25 out of 30 patients in Group D ($P < 0.0001$). Post-intubation score (Score 1) was found in 24 patients of Group D ($P < 0.0001$). Significant increase in HR (77.767 ± 10.562 beats/min) in Group F ($P < 0.0001$). Rise in MAP in Group F (92-118) ($P < 0.0001$). Twenty-eight patients of Group D were able to maintain SpO2 (>95%) ($P < 0.0001$). Dexmedetomidine appears to offer better patient tolerance, better preservation of a patent airway, spontaneous ventilation, and a reduced hemodynamic response to intubation, in comparison to fentanyl.

In 2020, Baiju et al[9] conducted an RCT on 40 patients aged 20–65 years with an ASA Grade of I, II, and III scheduled for elective surgeries and planned AFOI over 2 years. One group received fentanyl 2 mcg/kg infusion over 10 min. The other group received dexmedetomidine 1 mcg/kg infusion over 10 min. There was no significant difference in HR, SBP, DBP, MAP, and oxygen saturation between the two groups at any point of time during the study period ($P > 0.05$). The time to sedation and the time to intubation were shorter with dexmedetomidine than with fentanyl. There were no significant differences in cough score, the number of intubation attempts, HR, SBP, DBP, MAP, and oxygen saturation between the groups.

Liu et al[13] conducted an RCT in 2015 comparing remifentanil versus dexmedetomidine.[13] The study investigated the efficacy of a modified AFOI method in cases with anticipated difficult airways. In addition, the efficacy of remifentanil and dexmedetomidine as adjuvants were compared. Ninety patients ASA II and II were separated between the remifentanil group and

dexmedetomidine Group. Remifentanil group received a loading dose of remifentanil at 0.75

µg/kg infused at 0.15 µg/kg/min over 5 min, followed by a continuous infusion of 0.1 µg/kg/min.

Patients in the dexmedetomidine group received a loading dose of 1 µg/kg infused over 10 min,

followed by a continuous infusion of 0.3 µg/kg/h. No statistically significant differences were

observed in the sedation scale, intubation times, and patient reactions when comparing the two

groups ($P > 0.05$). The comfort scores and airway events during intubation did not significantly

differ between the two groups. However, the remifentanil group experienced less coughing, and

less time was required for tracheal intubation when compared with the dexmedetomidine group.

No statistically significant differences were observed in the changes to the MAP, HR at any time

point between the two groups.

In 2020, Jafari et al[14] sought to compare alfentanil versus dexmedetomidine in the use of

AFOI. Sixty adult patients between 30 and 55 years old, ASA I and II, with Mallampati score I

and II were randomly allocated into two equal groups (n = 30) to receive either a loading dose of

dexmedetomidine (1 mg/kg) over 10 min, followed by 0.5 mg/kg/h infusion or an alfentanil

loading dose (20 mg/kg) over 60-90 seconds and then repeated 10 mg/kg every 1-2 minutes over

10-20 seconds to reach RSS score greater than three. Primary outcome measures on intubation

scores were assessed by vocal cord movement, limb movement, patient tolerance, cough, and

patient cooperation immediately after intubation. Time taken to achieve sedation, endoscopy

time, intubation time in the alfentanil group was significantly shorter than the dexmedetomidine

group ($P < 0.001$). Limb movement and cough were more suppressed among the alfentanil group

($P < 0.0001$). Alfentanil provided better patient satisfaction than dexmedetomidine ($P < 0.007$).

The level of patients' tolerance and cooperation during and immediately after intubation were

higher in the alfentanil group comparing dexmedetomidine *($P < 0.0001$ and $P < 0.005$;*

respectively). Nine patients in the dexmedetomidine group and two patients in the alfentanil group needed to be administered atropine ($P < 0.02$) to increase the HR, and four patients in the dexmedetomidine group and no patients in the alfentanil group needed ephedrine to increase their HR, and blood pressure. MAP in the alfentanil group was significantly more stable than in patients who received dexmedetomidine ($P = 0.0001$). Alfentanil provided significantly more stable intubation scores for AFOI compare with dexmedetomidine and patients were significantly more satisfied with fewer hemodynamic adverse effects.

Dexmedetomidine versus Fentanyl and Midazolam

Hassani et al[11] conducted a RCT in 2018, which included 52 patients between 20-60 years old with ASA I and II, undergoing elective surgery requiring AFOI were randomly allocated to two groups. 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. Hemodynamic variables, SpO2 were evaluated before and after sedation and after intubation. RSS and patient's tolerance were evaluated. Lower HR 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 the 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. Dexmedetomidine compared to fentanyl and midazolam had comparable sedation with better hemodynamic stability and SpO2 during AFOI and thus is better than fentanyl-midazolam combination for AFOI.

Yousuf et al[12] conducted a RCT in 2017 comparing the effectiveness of dexmedetomidine versus fentanyl-midazolam combination on sedation and safety during AFOI. A total of 60 patients ASA I and II of either sex, in the age group of 18–60 years having predicted difficult

intubation undergoing elective surgeries and the patients were allocated to two groups of thirty patients each. The dexmedetomidine group (Group I, n = 30) received dexmedetomidine 1 µg/kg over 10 min and the midazolam–fentanyl group (Group II, n = 30) received fentanyl 2 µg/kg plus midazolam 0.02 mg/kg over 10 min. The demographic characteristics were comparable in the two groups ($P > 0.05$). The mean RSS in the dexmedetomidine group was 3.13 ± 0.937 and in the midazolam fentanyl group was 3.16 ± 0.949, and the comparison between two groups was statistically insignificant ($P = 0.891$). Cough scores and postintubation scores were favorable in dexmedetomidine group than midazolam–fentanyl group and were statistically significant with $P < 0.001$ and 0.0001, respectively. Dexmedetomidine also showed better hemodynamics and less episodes of desaturation when compared to the midazolam-fentanyl group.

Dexmedetomidine in combination with other agents

Kumar et al[15] conducted a randomized, double-blind, comparative study in 2019, on 72 cooperative patients aged 15–45 years of either sex, ASA I and II with anticipated difficult airway (mouth opening <2 cm, thyromental distance <6.5 cm, and Mallampati Class III and IV for elective surgical procedure. The authors compared two doses of ketamine 20 mg (Group I) and 40 mg (Group II) with a typical dose of dexmedetomidine at 1 µg/kg body weight, given as an infusion over 10 min (a solution of 50 ml with normal saline). Group II patients showed less variation from their baseline values in terms of HR (ranged between 0.73% and 4.75%) and MAP (ranged between 0% and 3.97%) in comparison to Group I, HR (ranged between 0.09% and 9.81%) and MAP (ranged between 0.3% and 10.38%). Discomfort during procedure ($P < 0.001$) and recall of procedure scale ($P < 0.001$) were found significantly lower in Group II as compared to Group I. Ketamine 40 mg in comparison to 20 mg with dexmedetomidine provides better hemodynamic conditions with better tolerance and lower recall to the AFOI.

Furthermore, Kaur et al[16] conducted a blind RCT in 2019, including 100 patients of either gender aged between 18 to 60 years of age belonging to ASA-I or II, scheduled for elective surgery under general anesthesia to compare dexmedetomidine with ketamine versus dexmedetomidine with propofol during AFOI. Two experimental groups consisted of 50 patients each, both groups received IV dexmedetomidine 1µg/kg over 10 mins. The first group received dexmedetomidine with ketamine at 0.25 mg/kg IV. Patient in the second group received dexmedetomidine with propofol at 1mg/kg IV. The study concluded that hemodynamic stability pertaining to HR, SBP, DBP, MAP while maintaining adequate SpO2 was best maintained in the dexmedetomidine (1µg/kg) plus ketamine (0.25mg/kg) group. Significant decrease in MAP during fiberscope and ETT insertion in group dexmedetomidine with propofol ($P < 0.001$) as compared to dexmedetomidine with ketamine group. Higher SpO2 levels were maintained in the dexmedetomidine with ketamine group during fiberscope insertion and endotracheal intubation ($P < 0.05$). Patients were more comfortable in group dexmedetomidine with ketamine as compared to group dexmedetomidine with propofol during fiberscope placement and intubation ($P < 0.05$). Increased patient tolerance was observed in the dexmedetomidine with ketamine group ($P < 0.05$) and showed better tolerance and comfort while maintaining adequate SpO2 saturation without any hemodynamic alteration.

In 2019, El Morad et al[17] conducted a double-blind RCT of 80 patients of either gender, aged 18- 60 years, ASA I-III, who presented for difficult airway intubation due to laryngeal mass biopsy under general anesthesia. Two groups were compared, the first group utilized dexmedetomidine-propofol (group D; n = 40) the second group utilized ketamine-propofol (group K; n = 40). No statistically significant difference in cough scores were observed between the two groups ($P = 0.611$). At baseline measurement (T0), MAP and HR changes in the two

groups were comparable ($P = 0.433$ and $P = 0.136$, respectively). There was a statistically significant difference between the study groups regarding the changes in hemodynamic parameters at various points of measurements after infusion of the study medications. Patients in group D had a statistically significant lower MAP and HR after the loading dose till five minutes after intubation (from T1 to T6) ($P = 0.000$). Furthermore, a statistically significant decrease was observed between baseline values and subsequent MAP and HR measurements in group D ($P = 0.000$). The study results showed that ketamine-propofol and dexmedetomidine-propofol combination were suitable and satisfactory for AFOI. However, ketamine-propofol provided more satisfactory conditions for AFOI than dexmedetomidine; demonstrated by less time to reach the targeted sedation level (RSS > 3), shorter intubation time with fewer numbers of intubation trials, and less need of rescue dose of propofol in the ketamine with propofol group as compared to those of the dexmedetomidine group.

Table 2 Studies Included in Literature Review

Author (Year) & Level of Evidence	Study, Participants, Interventions, & Setting	Findings in Dexmedetomidine Treated Group (D Group)	Findings in the Other group (Control, Opioids, Benzodiazepines, Propofol/Ketamine)
Chopra P, Dixit MB, Dang A, Gupta V. (2016) Level 1 Quality B	Double blinded RCT of 100 healthy patients between the age groups 18-65 years. Patients belonging to American Society of Anesthesiologists Grade I or II, with Mallampati Grade I or II, scheduled for elective surgery requiring GA. DEX group, (Group D, n = 50): Received	Mean HR and MAP decreased in the DEX group and increased in the placebo group (P < 0.001). Respiratory rate decreased in DEX group and increased in the placebo group throughout the AFO (P < 0.001). RSS was higher in Group D at every point of observation until intubation (P < 0.05).	In Group P, significantly a greater number of patients had tachycardia P < 0.05 compared with Group D.

	intravenous (IV) DEX (1 µg/kg) over 10 min followed by DEX infusion at the rate of 0.7 µg/kg/h. Placebo group, (Group P, n = 50) received IV normal saline bolus (1 ml/kg) over 10 min, followed by normal saline infusion at the rate of 0.7 ml/kg/h.	Patients in Group D were significantly more satisfied than those in Group P. *Both groups were statistically comparable for hypertension during the procedure (P = 0.07).	
Niyogi S, Basak S, Acharjee A, Chakraborty I. (2017) Level 1 Quality B	Randomized, placebo-controlled, double-blinded, prospective study was conducted on 56 adult patients with cervical spondylotic myelopathy (CSM) undergoing elective cervical fixation, who were randomly allocated into two groups - Group D and Group C. Group D patients received DEX infusion at a rate of 1 µg/kg for the first 10 min followed by 0.5 µg/kg/h and Group C received 0.9% normal saline infusion in the same manner. Airway blocks with lignocaine were given to all patients before undergoing AFOI.	Group D, HR was significantly decreased (64.25 ± 8.92/min) during FOB from baseline (72 + 12.54/min) (P < 0.001). DEX group, the changes in RR were statistically insignificant (14–16/min, P = 0.328). Patients of Group D had an acceptable level of sedation (OAA/S score: 20 to 17 with greater comfort and satisfaction (VAS: 40–60). *All the patients of both groups maintained arterial SpO within the satisfactory level (98%–99%) during the study period and the changes were statistically insignificant (P = 0.321).	N/A

Hassan ME & Mahran E. (2017) Level 1 Quality A	RCT of 150 ASA 1 and 2, ages from 18 to 60 years old and surgeries dealing with oral cancer with a plan for awake nasal fiberoptic intubation as an airway management technique to deal with the difficult airway situation in these patients. This study was carried out at the National Cancer Institute– Cairo University. Group D1: Received an infusion of 1 μcg/kg dexmedetomidine. Group D2: Received an infusion of 2 μcg/kg dexmedetomidine. Group DF: Received an infusion of 1 μcg/kg dexmedetomidine added to 1 μcg/kg fentanyl.	Increasing the dose of dexmedetomidine resulted in a significant increase in airway obstruction in group D2 (with P = 0.01). In regards to hemodynamic parameters (systolic and diastolic blood pressure and HR), all groups were similar in hemodynamic values at all-time points with no interaction between them (P>0.05).	Group DF resulted in more patients with no limb movement throughout the procedure (13 patients).
Eldemrdash A, Gamaledeen N, Zaher Z, Salem AA. (2017) Level 1 Quality A	Double blinded randomized prospective study was conducted among 60 patients, aged 20 - 40 years in Aswan University Hospital, MP grade III and IV and TMD < 6.5 cm were of both sex, belonging to ASA I and II, and posted for elective abdominal	Best RSS was achieved in Group D (3 ± 0.371) (P < 0.0001) Cough score ≤ 2 achieved in 25 out of 30 patients in Group D (P < 0.0001). Post-intubation score (Score 1) was found in 24 patients of Group D (P < 0.0001). 28 patients of Group D were able to	Significant increase in HR (77.767 ± 10.562 beats/min) in Group F (P < 0.0001). Rise in MAP in group F (92-118) (P < 0.0001).

	surgeries, maxillofacial surgeries. undergoing AFOI were made into two groups, group D Dexmedetomidine 1 mcg/kg, and group F Fentanyl 2 µg/kg, both drugs was diluted with 50 ml saline to be infused over 10 minutes.	maintain SpO2 (≥95%) (P < 0.0001)	
Baiju B, G G, K P, Antony J, Jayaprakash R. (2020) Level 1 Quality B	Prospective randomized double-blind study was done on 40 patients aged 20–65 years belonging to ASA Grades 1, 2, and 3 scheduled for elective surgeries and planned for AFOI at a hospital in central Kerala. Two groups of patients with 20 patients in each group were studied for a period of 2 years. One group received fentanyl 2 mcg/kg infusion over 10 min. The other group received dexmedetomidine 1 mcg/kg infusion over 10 min.	There was no significant difference in HR, systolic blood pressure, diastolic blood pressure, mean arterial blood pressure and oxygen saturation between the two groups at any point of time during the study period ($P>0.05$). The mean time to sedation in the fentanyl group was 7.750 ± 1.499 min and in the dexmedetomidine group was 5.250 ± 0.952 min ($P<0.001$).	The mean time of intubation in the fentanyl group was 14.10 ± 1.861 min and in the dexmedetomidine group was 11.25 ± 1.333 min ($P<0.001$).
Mondal S, Ghosh S, Bhattacharya S, Choudhury B, Mallick S, Prasad A. (2015) Level 1 Quality B	This randomized double-blind prospective study was conducted on a total of 60 patients scheduled for elective laparotomies, ASA I and II. Two groups:	Cough score ≤2 in 30 patients in Group D, but only in 3 out of 30 patients in Group F (P < 0.0001). Better post-intubation score (Score 1) was	25 patients in Group F suffered from significant desaturation (SpO ≤94%). Group F rise of MAP was statistically

	Group D received dexmedetomidine 1 mcg/kg and Group F received fentanyl 2 mcg/kg over 10 min. Patients in both groups received glycopyrrolate 0.2 mg intravenous, nebulization with 2% lidocaine 4 ml over 20 min and 10% lidocaine spray before undergoing AFOI.	found in 24 patients of Group D (P < 0.0001). Higher RSS was achieved in Group D (3 ± 0.371) (P < 0.0001). 26 patients of Group D were able to maintain SpO ($\geq$95%) (P < 0.0001). The post-intubation HR (75 ± 6.48 beats/min) decreased significantly in comparison with baseline value (77.466 ± 5.75 beats/min) in Group D (P value 0.005).	significant (P < 0.0001). Significant increase in HR in the post-intubation period (113 ± 16.482 beats/min) in comparison with the baseline value (77.767 ± 10.562 beats/min) in Group F (P <0.0001).
Hassani V, Farhadi M, Mohseni M, et al. (2018) Level 1 Quality B	In this randomized clinical trial, 52 patients 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. 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.	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 Group D. *Both groups had comparable RSS and tolerance during intubation.	Group F had significantly more cases with no reaction during bronchoscopy (p=0.02).
Yousuf A, Ahad B, Mir A, Mir A, Wani J, Hussain S. (2017) Level 1 Quality A	This prospective, randomized study was conducted on a total of sixty patients of the ASA I and II of either sex, in the age group of 18–60 years having predicted difficult	HR of Group D at postintubation was 87.33 ± 9.14 (P < 0.0001). The mean SBP of Group D at postintubation was 127.37 ± 7.568.	HR mean for Group F at postintubation 98.40 ± 4.91 with (P < 0.0001). Mean RSS score for Group F was 3.16 ± 0.949

	intubation undergoing elective surgeries. After premedication and topicalization of airways, dexmedetomidine group (Group D, n = 30) received dexmedetomidine 1 µg/kg over 10 min and midazolam–fentanyl group (Group F, n = 30) received fentanyl 2 µg/kg plus midazolam 0.02 mg/kg over 10 min.	Mean DBP of Group I at postintubation was 84.00 ± 5.705 The mean RSS in Group D was 3.13 ± 0.937. 27 patients had a favorable cough score of ≤2. 22 patients in Group D had a favorable Post intubation score. *The comparison between the two groups of post intubation HR, mean SBP, DBP, desaturation, cough score, and post intubation was significant (P<0.05) favoring dexmedetomidine.	The mean SBP of Group F was 133.2 ± 6.96. 13 patients in Group F had desaturation (SpO2 <95%) with P = 0.024. 4 patients had a favorable cough score of ≤2. 5 patients in Group D had a favorable Post intubation score.
Liu HH, Zhou T, Wei JQ, Ma WH. (2015) Level 1 Quality A	RCT. 90 adult patients with an American Society of Anesthesiologists classification of grade I-II underwent a modified AFOI procedure following airway evaluation. Rem group vs Dex Group. Rem group received a loading dose of 0.75 µg/kg infused at 0.15 µg/kg/min over 5 min, followed by a continuous infu- sion of 0.1 µg/kg/min. Patients in the Dex group received a	The mean time to achieve sedation with Dex, was 673.1 sec. *HR and MAP at five points no significant differences between groups (P>0.05). *NO statistically significant differences were observed in the sedation scale, intubation times and patient reactions when comparing the two groups (P>0.05).	The mean time to achieve sedation with Rem was 531.2.

	loading dose of 1 µg/kg infused over 10 min, followed by a continuous infusion of 0.3 µg/kg/h.		
Jafari A, Kamranmanesh M, Aghamohammadi H, Gharaei B, Solhpour A (2020) Level 1 Quality B	60 adult patients between 30 and 55 years old of ASA I & II, with Mallampati score I & II who were undergoing elective urologic surgery. allocated into two equal groups (n = 30) to receive either a loading dose of dexmedetomidine (1 mg/kg) over 10 min, followed by 0.5 mg/kg/h infusion or alfentanil a loading dose (20 mg/kg) over 60-90s and then repeated 10 mg/kg every 1-2 min over 10-20s to reach Ramsay Sedation Scale (RSS) ≥3.	7 patients had no cough in dexmedetomidine group comparing 21 patients in alfentanil group (p < 0.0001). HR and MAP decreased significantly the end of drug infusion (RSS ≥3), dexmedetomidine group (p = 0.001).	Time taken to achieve sedation, endoscopy time, intubation time in the alfentanil group (p<0.001). Limb movement and cough more suppressed among the alfentanil group (p < 0.0001). Alfentanil provided better patient satisfaction (p < 0.007). {atients' tolerance and cooperation during and immediately after intubation were higher in the alfentanil group (p < 0.0001).
Kumar A, Verma S, Tiwari T, Dhasmana S, Singh V, Singh G. (2019) Level 1 Quality A	RCT-Randomized, double-blind, comparative study was conducted in 72 cooperative patients aged 15–45 years of either sex ASA I and II with anticipated difficult airway (mouth opening <2 cm, thyromental distance <6.5 cm, and Mallampati Class III and IV) posted for elective surgical	There was a significant difference in mean HR in comparison to baseline values in Group I at all points (P < 0.001) except at 2 min (P = 0.147). Group I HR variations (ranged between 0.09% and 9.81%). MAP in Group I showed a declining trend in comparison to the baseline values at all	Patients of Group II were deeply sedated and showed better tolerance to intubation (P < 0.001). Cough was less severe in terms of grading described before in Group II (P = 0.023). Significantly higher proportion of patients of Group II

	procedure. Two Groups: Group I (dexmedetomidine 1 µg/kg + ketamine 20 mg) or Group II (dexmedetomidine 1 µg/kg + ketamine 40 mg) of 36 patients using computer-generated random table.	times of observation (P < 0.001). Level of discomfort was more and statistically significant (P < 0.001) in Group I.	was easiest to intubate (P = 0.041). Group II patients showed less variation from their baseline values in terms of HR (ranged between 0.73% and 4.75%) MAP in Group II showed an uprising trend in comparison to baseline values at all times (P < 0.001, at 10 min after intubation P = 0.033) Group II patients showed less variation from their baseline values in terms of MAP (ranged between 0% and 3.97%) There was lesser recall of fiberscopy procedure in Group II (P < 0.001),
Kaur B, Garg A, Kumar P, Yadav DN (2019) Level 1 Quality B	Blind RCT of 100 total patients (ASA I and ASA II), study was conducted in Department of Anesthesia and intensive care, Government Medical College, Rajindra Hospital, Patiala: Two experimental groups 50 patient in each experimental group. Both received IV dexmeditomidine	There is better hemodynamic stability pertaining to HR, SBP, DBP, MAP while maintaining oxygen saturation in dexmedetomidine (1µg/kg) plus ketamine (0.25mg/kg) group. Higher SpO2 levels where maintained in the DK group during fiberscope insertion and endotracheal intubation (p<0.05).	Significant decrease in MAP during fiberscope insertion and ETT insertion in group DP (P value= <0.001) as compare to group DK.

	1μg/kg over 10 mins. Group-DK patients received ketamine 0.25 mg/kg IV and Group-DP patients received propofol 1mg/kg IV.	Patients were more comfortable in group DK as compare to group DP during fiberscope and intubation (p<0.05). Better patient tolerance was observed in group DK (p<0.05).	
El Mourad MB, Elghamry MR, Mansour RF, Afandy ME. Comparison of intravenous dexmedetomidine-propofol versus ketofol for sedation during awake fiberoptic intubation: A prospective, randomized study. 2019	Double-blind RCT of 80 patients of either gender, aged 18 - 60 years, ASA I-III, and difficult airway intubation due to laryngeal mass who were candidates for laryngeal mass biopsy under general anesthesia. Two groups the dexmedetomidine-propofol (group D; n = 40) or ketofol (group K; n = 40).	Patients in group D had statistically significant lower MAP and HR after the loading dose till five minutes after intubation (from T1 to T6) (P = 0.000). *No statistically significant difference in cough scores were observed between the two groups (P = 0.611). No hypoxic episodes (SpO2 < 92%) or apneic attacks were noted. Patients' satisfaction levels were similar in the two groups (P = 0.687).	Time to reach RSS ≥ 3 and intubation time were significantly shorter (P = 0.000*) with fewer number of intubation attempts in the K group. The number of patients that needed rescue doses of propofol was also significantly less in group K (P = 0.035).

DISCUSSION OF LITERATURE REVIVIEW

Summary of the Evidence

This quality improvement project included the review of 13 RCTs assessing different drug regimens utilized during AFOI for anticipated difficult airway in patients scheduled for surgery. Dexmedetomidine was the most studied drug for AFOI. Dexmedetomidine was compared to normal saline, various opioids and IV anesthetics administered in different dosages, combinations, and associations, throughout the multiple RCTs. Chopra et al[6] and Niyogi et al[7]

each conducted a double-blinded RCT in adults 18 and older, ASA I and II, utilizing a

dexmedetomidine IV bolus followed by a dexmedetomidine drip and compared it against the use

of normal saline. Dexmedetomidine provided optimum conditions and conscious sedation during

AFOI. Both studies concluded that IV dexmedetomidine infusion during AFOI improves

patient's tolerances with an acceptable level of sedation without significant hemodynamic

instability and respiratory depression while maintaining stable hemodynamics.

      Dexmedetomidine was compared versus fentanyl in three studies, Mondal et al[10] and

Eldemrdash et al[4] both agree that dexmedetomidine provides the best patient tolerance, maintains

a patent airway and spontaneous respiration with reduce hemodynamic effects when compared to

fentanyl. Unfortunately, Baiju et al[9] concluded that were no significant differences in the use of

fentanyl versus dexmedetomidine for AFOI. Hassani et al[11] and Yousuf et al[12] both conducted a

RCT comparing dexmedetomidine versus the use of fentanyl and midazolam. Dexmedetomidine

provided better hemodynamic stability, less episodes of desaturation, cough scores and post

intubation scores when compared to the fentanyl-midazolam group. Hassan and Mahran[8]

evaluated different IV doses of dexmedetomidine versus the use of IV dexmedetomidine along

with IV fentanyl drip and concluded that the use of a dexmedetomidine infusion of 1 μcg/kg with

a 1 μcg/kg fentanyl diluted in 50 ml saline over 20 minutes is safer than raising the dose of

dexmedetomidine to 2 μcg/kg as it prevents the risk of airway obstruction seen with the higher

dose of dexmedetomidine. Remifentanil provided less coughing and faster intubation times when

compared to dexmedetomidine in the study conducted by Lie et al[13]. There were no statistically

significant differences in hemodynamics, patient reactions, or patient tolerance between the two

groups. In the study conducted by Jafari et al[14], alfentanil proved to be superior when compared

to dexmedetomidine. Alfentanil provided shorter intubation time, suppressed limb movement

and cough. Patient satisfaction, tolerance and cooperation were better with alfentanil than
dexmedetomidine.

In the RCT completed by Kaur et al[16,] the researchers compared dexmedetomidine with
ketamine versus the use of dexmedetomidine with propofol. Dexmedetomidine with ketamine
was superior as patients showed increased comfort, tolerance, and hemodynamic stability while
maintaining adequate SpO2. Morad et al[17] studied the difference between ketamine-propofol and
dexmedetomidine-propofol; both combinations were suitable and satisfactory for AFOI.
However, the ketamine-propofol group provided more satisfactory conditions for AFOI than
dexmedetomidine as it reached the target sedation level faster and shorter intubation time. Kumar
et al[15] identified that when utilizing dexmedetomidine with ketamine, the best dose of IV
ketamine for AFOI is 40 mg instead of 20 mg. The group given 40 mg of ketamine showed
better hemodynamic stability, lower discomfort and recall during the procedure.

Limitations

This quality improvement project has some limitations. The main limitation
is the inability to perform a formal synthesis to identify the best approach for every step of AFOI
due to the array of the available studies. A meta-analysis was performed only for few, more
homogeneous results, and its findings should be interpreted with caution. Furthermore, given that
the success rate of AFOI was high throughout the different methods and the complications were
rare in all the RCTs, no specific strategy could be declared superior to the others, and more
extensive studies are required. The use of dexmedetomidine when compared to opioids, ketamine
and propofol improved AFOI intubation outcomes, but this does not mean the other methods are
unsafe or failed to provide the appropriate conditions to execute AFOI successfully.
Additionally, major life-threatening adverse events were collected in the different RCTs without

standardized definitions. A second limit is the reasonably low number of patients included in all

the randomized controlled trials. This quality improvement project has relevant strengths; as it

sought to identify the safety and effectiveness in the best pharmacological approach to AFOI. All

evidence was based only on RCTs, many of them comparing dexmedetomidine to other current

practices for AFOI.

Recommendations

This quality improvement project focused on AFOI, but recently the use of video

laryngoscope for awake intubation has been found feasible and safe. New equipment and

intubation techniques should be studied as fiberoptic intubation may soon become obsolete due

to technological advances. The success of dexmedetomidine for AFOI is prominent throughout

this project. Hurtado et al[25] has developed a protocol for the use of dexmedetomidine, see below

Figure 2. Dexmedetomidine possesses unique properties which render it suitable for sedation and

analgesia during the perioperative period. It can be utilized as a premedication, an anesthetic

adjunct for general and regional anesthesia, or postoperative sedative in which analgesia is

similar to benzodiazepines. Dexmedetomidine is a highly selective potent α2-adrenoceptor

agonist providing sedative, analgesic, and anxiolytic properties and reduced salivary secretion,

with minimal respiratory depression.[25] No clinically relevant respiratory depression has been

reported. Dexmedetomidine provides hemodynamic and sympathoadrenal stability by reducing

the circulating catecholamines, attenuating the response to endotracheal intubation without

completely abolishing the cardiovascular response.[25] As seen through the literature, a sedation

regimen using low dose dexmedetomidine combined with titrated doses of benzodiazepines,

opioids, ketamine, and propofol has successfully been used for airway manipulation. A target-

controlled infusion can provide consistent pharmacodynamics effects with safe and predictable

sedation levels.[25]

Figure 2 Awake Fiberoptic Intubation - Adult Treatment Protocol by Hurtado *et al*[25].
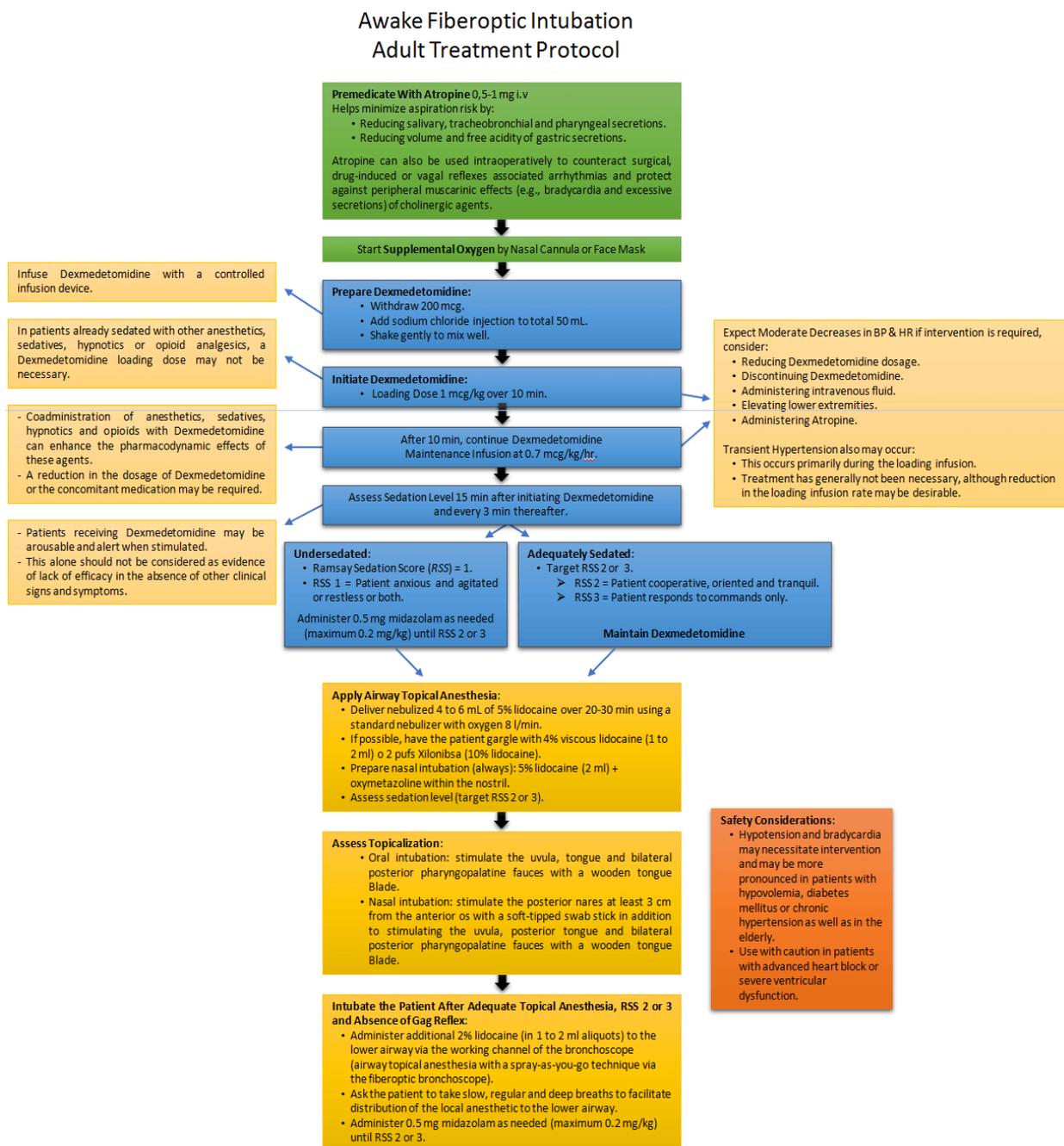
CONCLUSION

A protocol for AFOI is difficult to identify as there are many drugs and dosages utilized. A wide range of approaches can be effective and safe. Translating an evidence based protocol for the clinician will depend on the providers knowledge and choice of pharmacological therapy. Also, the choice of drugs utilized will be dependent on the patient's co-morbidities and ASA classification. This quality improvement project sought to identify what drug regimen provided the best conditions for AFOI. Throughout the literature, dexmedetomidine was the most studied drug compared to each study versus another pharmacological regimen. It is concluded that dexmedetomidine is effective, well-tolerated, associated with better intubation conditions, and reduced recall for AFOI; because of this, it is a vital drug to consider when preparing to conduct an AFOI.

IMPLEMENTATION

The primary objective of this quality improvement project is to assess the healthcare providers' current knowledge in AFOI drug regimen and provide empirical evidence on drugs currently being utilized successfully to perform AFOI. To successfully achieve the goal of this quality improvement project, a series of actions will be conducted that involved a specific group of anesthesia providers willing to participate in the intervention. These actions will be identified in the sections below in determining the study outcome.

Settings and Participants

The study took place at Mount Sinai Medical Center located in Miami Beach, Florida and will solely focus on Miami Beach Anesthesiology Associates (MBAA). MBAA is a privately owned anesthesia practice that provides anesthesia services at Mount Sinai Medical Center, the

primary study participants will be Anesthesiologists and CRNAs. The participants will be

contacted and recruited through the MBAA email list making participation completely voluntary.

The recruited participants will be provided a survey link with the educational intervention which

consists of a pre-test, voice over PowerPoint educational module and post-test. All participants

will be asked to provide feedback regarding their experiences with the educational program. The

anticipated sample size will be between 5-10 participants.

Description of Approach and Project Procedures

The primary methodology of the project is to administer an online educational

intervention composed of a narrated PowerPoint to providers that focus on the benefits of

varying medications and their use during AFOI. A survey composed of three phases will be

distributed via email to the email list provided by MBAA. The first phase of the project will be

composed of a preassessment test that will collect demographic data and identify the current

drugs and drug regimen utilized by the providers when conducting an AFOI. Existing knowledge

of this process will be identified using the preassessment survey, the data collected will be

utilized to compare the impact achieved by the voice over PowerPoint presentation.

Once the surveyor completes the pre-assessment in phase one, the second phase will

contain a narrated PowerPoint presentation. The primary means of learning will be an online

PowerPoint presentation with information on the empirical evidence regarding different drugs

and drugs regimens currently utilized for AFOI. The surveyor will be able to click and view the

presentation. Current literature will focus on the utilization of dexmedetomidine, alfentanil,

propofol, ketamine and midazolam for AFOI. The presentation will focus on the drug regimen

that provided the most optional conditions for AFOI which were dexmedetomidine and alfentanil

as well as provide data comparing the other drugs and their effects when utilized for AFOI.

The third phase of the project will involve the completion of the post-assessment test to identify the learned knowledge of the project and how the providers felt about the information presented in the PowerPoint presentation. The data collected will provide feedback regarding the impact of the educational intervention and will determine the efficacy of the participants learning. The pre- and post-assessment will be compared and analyzed in extracting relevant information regarding the effectiveness of the online intervention. At the end of the educational tool, feedback will also demonstrate if the educational module requires changes going forward and if the providers will benefit from future projects being presented in an online format in the future.

Protection of Human Subjects

For this quality improvement project, the recruitment population will include Anesthesiologists and CRNAs that are part of the MBAA who work with patients at Mount Sinai Medical Center. The study population is essential because anesthesia providers perform AFOI when is warranted for surgical cases. Recruitment activities will be conducted by email invitations to all anesthesiologists and CRNAs currently employed and practicing at Mount Sinai Medical Center. MBAA will provide their email list allowing their anesthesia members to be utilized for this educational intervention. If the anesthesia providers agree to participate, they will click on the link provided in the email which will prompt the providers to complete the three-phase survey. There will be no penalties if any participants who decide to withdraw from the QI project. There are no perceived risks to the study as it only requires the time spent by each participant in the educational intervention.

Data Collection

  For the quality improvement project, the primary instruments to be used will include a pre-assessment and post assessment assessing knowledge to determine the effects of the intervention. Both tests will be conducted by utilizing a three-phase survey developed in Qualtrics. The survey will be composed of the pre-assessment, followed by the video presentation and post-assessment. The data collected will determine if participants have a clear understanding of the most effective drugs and drug regimen for AFOI based on the most recent data. The pre-assessment survey and post assessment survey will be the same composed of 15 questions that focuses on current practice and baseline knowledge using Qualtrics. In this manner, the pretest survey will gauge knowledge and attitudes in the educational program while the post-test survey will determine if the participants have learned from the intervention and application of their knowledge to the surgical practice environment. The instrument reliability and validity will be measured in accordance with the intervention and its effectiveness for the providers. The data collected will be confidential and no subject identifiers will be recorded during any component of the study.

Data Management and Analysis Plan

  The co- investigator for the project will be the DNP student who will be responsible for administering the survey. The investigator conducted the statistic that will be utilized to evaluate, compare, and analyze the pre-assessment and post assessment. Each question will be compared and analyzed, and the responses recorded to identify the knowledge base before and after the intervention was provided. Absolutely no personal identifiers will be recorded or requested, this assures the protection of the study participants confidentiality. The impact of the intervention will be measured solely on the results of the pre- and posttest survey questions. Through

statistical analysis, the study results will likely identify patterns that will be used to determine the

effectiveness of educational intervention and how it affects all clinicians' actions and behaviors.

The co-investigator will store the data collected in a password-protected laptop computer.

IMPLEMETATION RESULTS

Pre/Post-Test Demographics

The pre/post-test demographics are show in Table 3, shown below.

Table 3: Pre/Post-Test Participant Demographics

Demographics	n (%)
Total Participants	8 (100%)
Gender	
Male	6 (100%)
Female	2 (25%)
Age	
25-35	3 (37.5%)
36-45	4 (50%)
46-55	0 (0%)
56-66	1 (12.5%)
Ethnicity	
Latino/a	6 (75%)
Caucasian	0 (0%)
African American	1 (12.5%)
Asian	1 (12.5%)
Position/Title	
CRNA	7 (87.5%)
MD/DO	1 (12.5%)
Years of Experience	
Less than 1 year	0
1 to 5 years	4 (50%)
6 to 10 years	2 (25%)
More than 10 years	2 (25%)

There were eight participants in the pretest and posttest demographics, all the participants

completed the survey and reviewed the online narrated PowerPoint presentation. The age ranges

represented were 25 through 35 years old's (n=3, 37.5%), 36 through 45 years was the most

represented age group (n=4, 50%) and 56 through 66 (n=1, 12.5%). Most of the participants were

male (n=6, 75%), as opposed to female (n=2, 25%). There were also a range of ethnicities represented: African American (n=1, 29.63%), Asian (n=1, 12.5%), and Latino/a (n=1, 12.5 %). Information was obtained regarding the participant's role at the clinic. Most of the participants were CRNAs (n=7, 87.5%) and one MD (n=1, 12.5%). The participants were questioned about the length of time practicing, finding that the practice period ranged: less than one year (n=0, 0%), 1 to 5 years (n=4, 50%), 6 to 10 years (n=2, 25%), and more than 10 years (n=2, 25%).

Pre-Test Identification of current knowledge of medications utilized for AFOI

This section of the survey focuses on identification of the current drugs being utilized when performing an AFOI and the current knowledge on dexmedetomidine and alfentanil. The most utilized drug classes are benzodiazepines (n=7, 87.5%), and dexmedetomidine (n=7, 87.5%), followed by ketamine (n=5, 62.5%) and lastly opioids (n=1, 12.5%). The most utilized opioids if one is administered are remifentanil (n=7, 87.5%) and fentanyl (n=1, 12.5%). The mechanism of action of dexmedetomidine is well known by these participants, the question was answered correctly by all eight participants (n=8, 100%). When asked about the location of the brain where dexmedetomidine functions and dexmedetomidine side effects more than half of the study participants answered correctly (n=5, 62.5%). Only half of the study participants (n=4, 50%) knew the mechanism of action of alfentanil which based on recent studies should be the opioid utilized when performing AFOI.

Table 4: Difference in Pre- and Post-Test Knowledge

Questions	Pre-test	Post-test	Difference
Dexmedetomidine Mechanism of Action?	100%	100%	0
Where does dexmedetomidine work in the brain?	62.5%	100%	48.5%
The most common side effects of dexmedetomidine			
Which sedative provides optimum sedation for awake fiberoptic while maintain spontaneous ventilation?	62.5%	100%	48.5%

Which drug according to recent RCTs provides optimum conditions for awake fiberoptic intubation?	50%	87.5%	37.5%
Alfentanil's mechanism of action	50%	62.5%	12.5%
What is the best initial loading dosage of alfentanil for awake fiberoptic	37.5%	62.5%	25%

In Table 4, knowledge is compared between the pre-test and post-test based on the percentage of participants that answered the questions correctly. Overall, the knowledge of the participants did improve after watching the narrated PowerPoint presentation as this is reflected by higher scores in all questions for the post test. The mechanism of alfentanil had the lowest percentage increase (n=1, 12.5%) with only one more person answering correctly on the post test. However, there was a (25%) increase in participants that were able to identify the best recommended dosage of alfentanil for AFOI in the post test. Lastly, the questions tailored towards the knowledge of dexmedetomidine all achieved a (100%) on the post test.

**Table 5: Utilization of Dexmedetomidine and Alfentanil for AFOI**

	Pre-test	Post-test	Difference
How likely are you to utilize dexmedetomidine and alfentanil for awake fiber optic intubation?	62.5%	87.5%	25%

It was noted that practitioners are more likely to utilize dexmedetomidine and alfentanil based on the post-test results. This result suggests that the narrated PowerPoint presentation provided the necessary information leading to practitioners feeling incline to incorporating these two medications into their AFOI drug regimen.

Summary

Overall, the results reflected an improvement in knowledge based on the pre-test and post-test scores. Knowledge showed an average improvement of (24.5%). The post-test demonstrated that (25%) of participants are "Extremely Likely" to incorporate dexmedetomidine

and alfentanil to their drug regimen when performing AFOI. The information provided allowed the participants to feel comfortable in utilizing dexmedetomidine and alfentanil for their AFOI. Based on the results the intervention increased the anesthesia providers knowledge in drug dosages, side effects, complications, and pharmacological therapy.
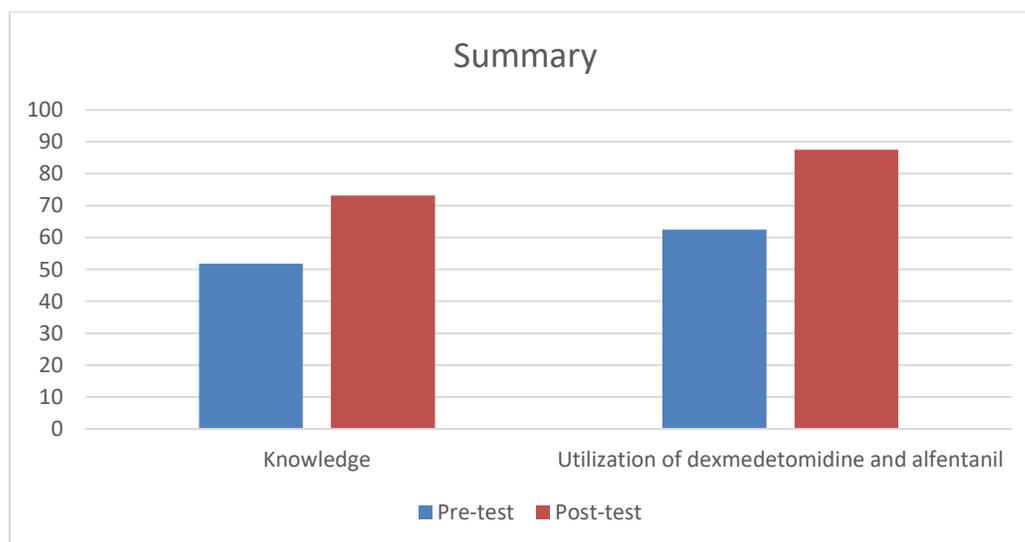
IMPLEMENTATION DISCUSSION

Limitations

Limitations of the study include a small sample size; the survey was emailed to the MBAA email list which was composed of 31 emails but only 8 participants completed the study. A larger sample size is preferable to strengthen the results of the study as well as provide a sample population that reflects the anesthesia providers at Mount Sinai Medical Center. The survey link which contained the pre-test, narrated PowerPoint presentation and post-test was online available for two weeks, increasing the timeline may have generated more responses. The email with the request to participate in the study was sent only once, follow up emails might have also aided in generating more responses. Lastly, the project was implemented completely online hindering its delivery by other methods.

Future Implications to Advanced Nursing Practice

The outcomes of the study supported an increase in knowledge in determining strategies available to anesthesia providers for disseminating information on new drug regimen, dosages, side effects, complications, and pharmacological therapy for AFOI. Improving knowledge of drugs and drug regimen utilized for AFOI impacts anesthesia providers to utilize the empirical evidence for best practice and patient safety. Published articles encompass different topic areas and its imperative to provide a method that effectively translates the research to practice for anesthesia providers.
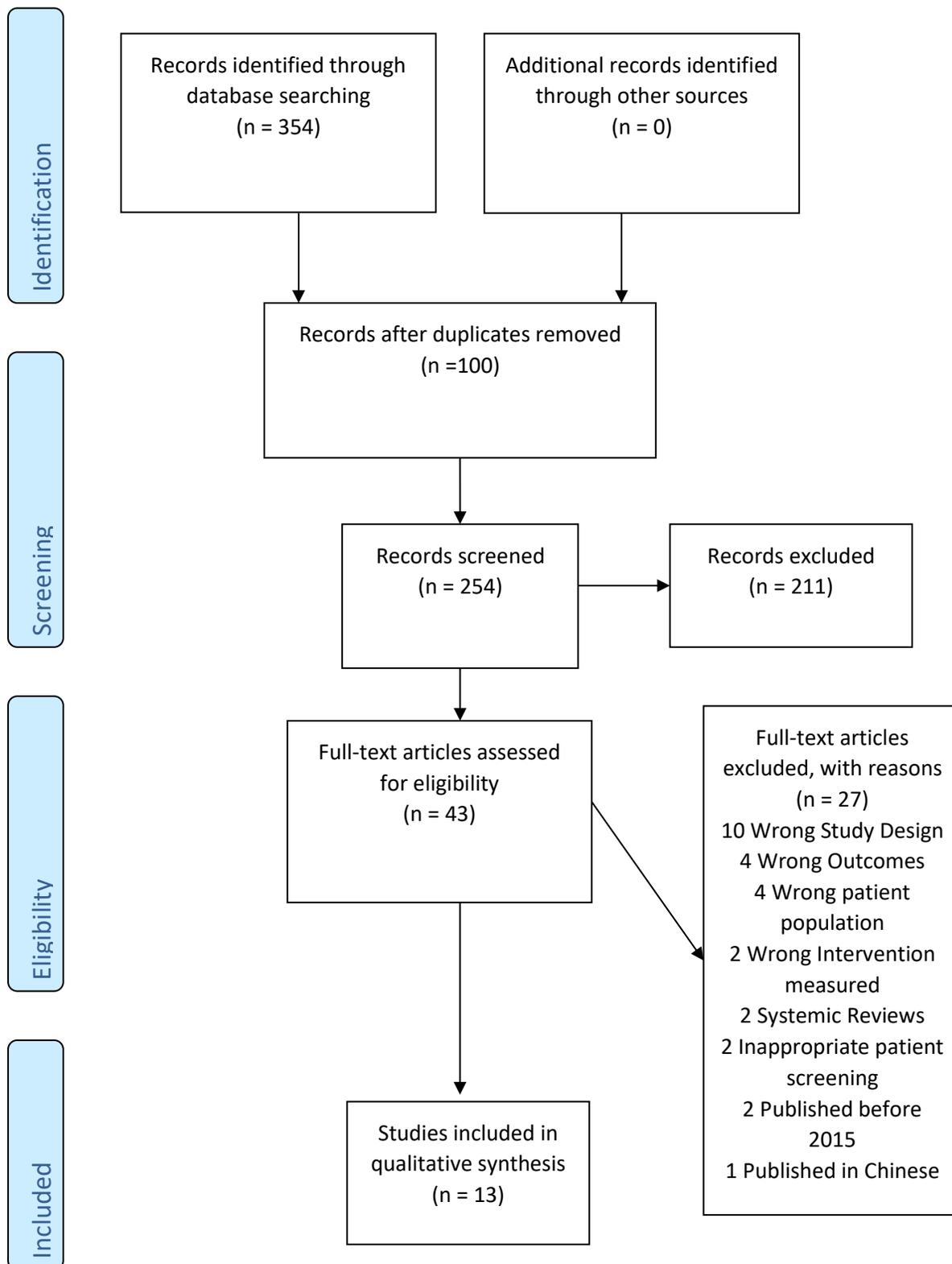
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Appendix A: PRISMA Flow Diagram

Appendix B Matrix Table

Table 2 Studies Included in Literature Review

Author (Year) & Level of Evidence	Study, Participants, Interventions, & Setting	Findings in Dexmedetomidine Treated Group (D Group)	Findings in the Other group (Control, Opioids, Benzodiazepines, Propofol/Ketamine)
Chopra P, Dixit MB, Dang A, Gupta V. (2016) Level 1 Quality B	Double blinded RCT of 100 healthy patients between the age groups 18-65 years. Patients belonging to American Society of Anesthesiologists Grade I or II, with Mallampati Grade I or II, scheduled for elective surgery requiring GA. DEX group, (Group D, n = 50): Received intravenous (IV) DEX (1 μg/kg) over 10 min followed by DEX infusion at the rate of 0.7 μg/kg/h. Placebo group, (Group P, n = 50) received IV normal saline bolus (1 ml/kg) over 10 min, followed by normal saline infusion at the rate of 0.7 ml/kg/h.	Mean HR and MAP decreased in the DEX group and increased in the placebo group (P < 0.001). Respiratory rate decreased in DEX group and increased in the placebo group throughout the AFO (P < 0.001). RSS was higher in Group D at every point of observation until intubation (P < 0.05). Patients in Group D were significantly more satisfied than those in Group P. *Both groups were statistically comparable for hypertension during the procedure (P = 0.07).	In Group P, significantly a greater number of patients had tachycardia P < 0.05 compared with Group D.
Niyogi S, Basak S, Acharjee A, Chakraborty I. (2017) Level 1 Quality B	Randomized, placebo-controlled, double-blinded, prospective study was conducted on 56 adult patients with cervical spondylotic myelopathy (CSM) undergoing elective	Group D, HR was significantly decreased (64.25 ± 8.92/min) during FOB from baseline (72 + 12.54/min) (P < 0.001). DEX group, the changes in RR were statistically	N/A

	cervical fixation, who were randomly allocated into two groups - Group D and Group C. Group D patients received DEX infusion at a rate of 1 µg/kg for the first 10 min followed by 0.5 µg/kg/h and Group C received 0.9% normal saline infusion in the same manner. Airway blocks with lignocaine were given to all patients before undergoing AFOI.	insignificant (14–16/min, P = 0.328). Patients of Group D had an acceptable level of sedation (OAA/S score: 20 to 17 with greater comfort and satisfaction (VAS: 40–60). *All the patients of both groups maintained arterial SpO within the satisfactory level (98%–99%) during the study period and the changes were statistically insignificant (P = 0.321).	
Hassan ME & Mahran E. (2017) Level 1 Quality A	RCT of 150 ASA 1 and 2, ages from 18 to 60 years old and surgeries dealing with oral cancer with a plan for awake nasal fiberoptic intubation as an airway management technique to deal with the difficult airway situation in these patients. This study was carried out at the National Cancer Institute– Cairo University. Group D1: Received an infusion of 1 µcg/kg dexmedetomidine. Group D2: Received an infusion of 2 µcg/kg dexmedetomidine. Group DF: Received an infusion of 1 µcg/kg	Increasing the dose of dexmedetomidine resulted in a significant increase in airway obstruction in group D2 (with P = 0.01). In regards to hemodynamic parameters (systolic and diastolic blood pressure and HR), all groups were similar in hemodynamic values at all-time points with no interaction between them (P>0.05).	Group DF resulted in more patients with no limb movement throughout the procedure (13 patients).

	dexmedetomidine added to 1 μcg/kg fentanyl.		
Eldemrdash A, Gamaledeen N, Zaher Z, Salem AA. (2017) Level 1 Quality A	Double blinded randomized prospective study was conducted among 60 patients, aged 20 - 40 years in Aswan University Hospital, MP grade III and IV and TMD < 6.5 cm were of both sex, belonging to ASA I and II, and posted for elective abdominal surgeries, maxillofacial surgeries. undergoing AFOI were made into two groups, group D Dexmedetomidine 1 mcg/kg, and group F Fentanyl 2 µg/kg, both drugs was diluted with 50 ml saline to be infused over 10 minutes.	Best RSS was achieved in Group D (3 ± 0.371) ($P < 0.0001$) Cough score ≤ 2 achieved in 25 out of 30 patients in Group D ($P < 0.0001$). Post-intubation score (Score 1) was found in 24 patients of Group D ($P < 0.0001$). 28 patients of Group D were able to maintain SpO2 ($\geq 95\%$) ($P < 0.0001$)	Significant increase in HR (77.767 ± 10.562 beats/min) in Group F ($P < 0.0001$). Rise in MAP in group F (92-118) ($P < 0.0001$).
Baiju B, G G, K P, Antony J, Jayaprakash R. (2020) Level 1 Quality B	Prospective randomized double-blind study was done on 40 patients aged 20–65 years belonging to ASA Grades 1, 2, and 3 scheduled for elective surgeries and planned for AFOI at a hospital in central Kerala. Two groups of	There was no significant difference in HR, systolic blood pressure, diastolic blood pressure, mean arterial blood pressure and oxygen saturation between the two groups at any point of time during the study period ($P>0.05$).	The mean time of intubation in the fentanyl group was 14.10 ± 1.861 min and in the dexmedetomidine group was 11.25 ± 1.333 min ($P<0.001$).

	patients with 20 patients in each group were studied for a period of 2 years. One group received fentanyl 2 mcg/kg infusion over 10 min. The other group received dexmedetomidine 1 mcg/kg infusion over 10 min.	The mean time to sedation in the fentanyl group was 7.750 ± 1.499 min and in the dexmedetomidine group was 5.250 ± 0.952 min ($P<0.001$).	
Mondal S, Ghosh S, Bhattacharya S, Choudhury B, Mallick S, Prasad A. (2015) Level 1 Quality B	This randomized double-blind prospective study was conducted on a total of 60 patients scheduled for elective laparotomies, ASA I and II. Two groups: Group D received dexmedetomidine 1 mcg/kg and Group F received fentanyl 2 mcg/kg over 10 min. Patients in both groups received glycopyrrolate 0.2 mg intravenous, nebulization with 2% lidocaine 4 ml over 20 min and 10% lidocaine spray before undergoing AFOI.	Cough score ≤ 2 in 30 patients in Group D, but only in 3 out of 30 patients in Group F ($P < 0.0001$). Better post-intubation score (Score 1) was found in 24 patients of Group D ($P < 0.0001$). Higher RSS was achieved in Group D (3 ± 0.371) ($P < 0.0001$). 26 patients of Group D were able to maintain SpO ($\geq 95\%$) ($P < 0.0001$). The post-intubation HR (75 ± 6.48 beats/min) decreased significantly in comparison with baseline value (77.466 ± 5.75 beats/min) in Group D (P value 0.005).	25 patients in Group F suffered from significant desaturation (SpO $\leq 94\%$). Group F rise of MAP was statistically significant ($P < 0.0001$). Significant increase in HR in the post-intubation period (113 ± 16.482 beats/min) in comparison with the baseline value (77.767 ± 10.562 beats/min) in Group F ($P <0.0001$).

Hassani V, Farhadi M, Mohseni M, et al. (2018) Level 1 Quality B	In this randomized clinical trial, 52 patients 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. 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.	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 Group D. *Both groups had comparable RSS and tolerance during intubation.	Group F had significantly more cases with no reaction during bronchoscopy (p=0.02).
Yousuf A, Ahad B, Mir A, Mir A, Wani J, Hussain S. (2017) Level 1 Quality A	This prospective, randomized study was conducted on a total of sixty patients of the ASA I and II of either sex, in the age group of 18–60 years having predicted difficult intubation undergoing elective surgeries. After premedication and topicalization of airways, dexmedetomidine group (Group D, n = 30) received dexmedetomidine 1 µg/kg over 10 min and midazolam–fentanyl group (Group F, n = 30) received fentanyl 2 µg/kg plus midazolam 0.02 mg/kg over 10 min.	HR of Group D at postintubation was 87.33 ± 9.14 (P < 0.0001). The mean SBP of Group D at postintubation was 127.37 ± 7.568. Mean DBP of Group I at postintubation was 84.00 ± 5.705 The mean RSS in Group D was 3.13 ± 0.937. 27 patients had a favorable cough score of ≤2. 22 patients in Group D had a favorable Post intubation score. *The comparison between the two groups of post intubation HR, mean SBP, DBP, desaturation, cough score, and post intubation was	HR mean for Group F at postintubation 98.40 ± 4.91 with (P < 0.0001). Mean RSS score for Group F was 3.16 ± 0.949 The mean SBP of Group F was 133.2 ± 6.96. 13 patients in Group F had desaturation (SpO2 <95%) with P = 0.024. 4 patients had a favorable cough score of ≤2. 5 patients in Group D had a favorable Post intubation score.

		significant (P<0.05) favoring dexmedetomidine.	
Liu HH, Zhou T, Wei JQ, Ma WH. (2015) Level 1 Quality A	RCT. 90 adult patients with an American Society of Anesthesiologists classification of grade I-II underwent a modified AFOI procedure following airway evaluation. Rem group vs Dex Group. Rem group received a loading dose of 0.75 µg/kg infused at 0.15 µg/kg/min over 5 min, followed by a continuous infu- sion of 0.1 µg/kg/min. Patients in the Dex group received a loading dose of 1 µg/kg infused over 10 min, followed by a continuous infusion of 0.3 µg/kg/h.	The mean time to achieve sedation with Dex, was 673.1 sec. *HR and MAP at five points no significant differences between groups (P>0.05). *NO statistically significant differences were observed in the sedation scale, intubation times and patient reactions when comparing the two groups (P>0.05).	The mean time to achieve sedation with Rem was 531.2.
Jafari A, Kamranmanesh M, Aghamohammadi H, Gharaei B, Solhpour A (2020) Level 1 Quality B	60 adult patients between 30 and 55 years old of ASA I & II, with Mallampati score I & II who were undergoing elective urologic surgery. allocated into two equal groups (n = 30) to receive either a loading dose of dexmedetomidine (1 mg/kg) over 10 min,	7 patients had no cough in dexmedetomidine group comparing 21 patients in alfentanil group (p < 0.0001). HR and MAP decreased significantly the end of drug infusion (RSS ≥3), dexmedetomidine group (p = 0.001).	Time taken to achieve sedation, endoscopy time, intubation time in the alfentanil group (p<0.001). Limb movement and cough more suppressed among the alfentanil group (p < 0.0001). Alfentanil provided better patient

	followed by 0.5 mg/kg/h infusion or alfentanil a loading dose (20 mg/kg) over 60-90s and then repeated 10 mg/kg every 1-2 min over 10-20s to reach Ramsay Sedation Scale (RSS) ≥3.		satisfaction (p < 0.007). {atients' tolerance and cooperation during and immediately after intubation were higher in the alfentanil group (p < 0.0001).
Kumar A, Verma S, Tiwari T, Dhasmana S, Singh V, Singh G. (2019) Level 1 Quality A	RCT-Randomized, double-blind, comparative study was conducted in 72 cooperative patients aged 15–45 years of either sex ASA I and II with anticipated difficult airway (mouth opening <2 cm, thyromental distance <6.5 cm, and Mallampati Class III and IV) posted for elective surgical procedure. Two Groups: Group I (dexmedetomidine 1 μg/kg + ketamine 20 mg) or Group II (dexmedetomidine 1 μg/kg + ketamine 40 mg) of 36 patients using computer-generated random table.	There was a significant difference in mean HR in comparison to baseline values in Group I at all points (P < 0.001) except at 2 min (P = 0.147). Group I HR variations (ranged between 0.09% and 9.81%). MAP in Group I showed a declining trend in comparison to the baseline values at all times of observation (P < 0.001). Level of discomfort was more and statistically significant (P < 0.001) in Group I.	Patients of Group II were deeply sedated and showed better tolerance to intubation (P < 0.001). Cough was less severe in terms of grading described before in Group II (P = 0.023). Significantly higher proportion of patients of Group II was easiest to intubate (P = 0.041). Group II patients showed less variation from their baseline values in terms of HR (ranged between 0.73% and 4.75%) MAP in Group II showed an uprising trend in comparison to baseline values at all times (P < 0.001, at 10 min after intubation P = 0.033) Group II patients showed less

			variation from their baseline values in terms of MAP (ranged between 0% and 3.97%) There was lesser recall of fiberscopy procedure in Group II (P < 0.001),
Kaur B, Garg A, Kumar P, Yadav DN (2019) Level 1 Quality B	Blind RCT of 100 total patients (ASA I and ASA II), study was conducted in Department of Anesthesia and intensive care, Government Medical College, Rajindra Hospital, Patiala: Two experimental groups 50 patient in each experimental group. Both received IV dexmedetomidine 1μg/kg over 10 mins. Group-DK patients received ketamine 0.25 mg/kg IV and Group-DP patients received propofol 1mg/kg IV.	There is better hemodynamic stability pertaining to HR, SBP, DBP, MAP while maintaining oxygen saturation in dexmedetomidine (1μg/kg) plus ketamine (0.25mg/kg) group. Higher SpO2 levels where maintained in the DK group during fiberscope insertion and endotracheal intubation (p<0.05). Patients were more comfortable in group DK as compare to group DP during fiberscope and intubation (p<0.05). Better patient tolerance was observed in group DK (p<0.05).	Significant decrease in MAP during fiberscope insertion and ETT insertion in group DP (P value= <0.001) as compare to group DK.
El Mourad MB, Elghamry MR, Mansour RF, Afandy ME. Comparison of intravenous dexmedetomidine-propofol versus ketofol for sedation during awake fiberoptic	Double-blind RCT of 80 patients of either gender, aged 18 - 60 years, ASA I-III, and difficult airway intubation due to laryngeal mass who were candidates for laryngeal mass biopsy under general anesthesia. Two	Patients in group D had statistically significant lower MAP and HR after the loading dose till five minutes after intubation (from T1 to T6) (P = 0.000). *No statistically significant difference in	Time to reach RSS ≥ 3 and intubation time were significantly shorter (P = 0.000*) with fewer number of intubation attempts in the K group. The number of patients that needed rescue doses of

| intubation: A prospective, randomized study. 2019 | groups the dexmedetomidine-propofol (group D; n = 40) or ketofol (group K; n = 40). | cough scores were observed between the two groups (P = 0.611). No hypoxic episodes (SpO2 < 92%) or apneic attacks were noted. Patients' satisfaction levels were similar in the two groups (P = 0.687). | propofol was also significantly less in group K (P = 0.035). |

Appendix C: IRB Exemption Letter

FIU | **FLORIDA INTERNATIONAL UNIVERSITY**

MEMORANDUM

To:	Dr. Yasmine Campbell
CC:	Weslin Roldan
From:	Elizabeth Juhasz, Ph.D., IRB Coordinator *EJ*
Date:	April 8, 2021
Protocol Title:	**"A Pharmacological Evidence-Based Algorithm in the Management of Awake Fiberoptic Intubation: A Quality Improvement Project"**

The Florida International University Office of Research Integrity has reviewed your research study for the use of human subjects and deemed it Exempt via the **Exempt Review** process.

IRB Protocol Exemption #:	IRB-21-0143	**IRB Exemption Date:**	04/07/21
TOPAZ Reference #:	110218		

As a requirement of IRB Exemption you are required to:

1) Submit an IRB Exempt Amendment Form for all proposed additions or changes in the procedures involving human subjects. All additions and changes must be reviewed and approved prior to implementation.
2) Promptly submit an IRB Exempt Event Report Form for every serious or unusual or unanticipated adverse event, problems with the rights or welfare of the human subjects, and/or deviations from the approved protocol.
3) Submit an IRB Exempt Project Completion Report Form when the study is finished or discontinued.

Special Conditions: N/A

For further information, you may visit the IRB website at http://research.fiu.edu/irb.

EJ

Mount Sinai
MEDICAL CENTER

4/29/21

Re: IRB Waiver for Quality Improvement Projects

The following students have proposed some interdepartmental education. These quality improvement projects are internal projects. Internal review board approval is not necessary for departmental improvement projects.

The projects will involve surveying anesthesia providers from Miami Beach Anesthesiology Associates at Mount Sinai Medical Center of Florida. There will be pretest questionnaires, a 15
minute virtual Power Point presentation, and then post-test questionnaire.
No actual interventions will affect patients or
clinical processes

The following projects have been proposed and approved by our educational department.

1. "A Pharmacological Evidence-Based Algorithm in the Management of Awake Fiberoptic Intubation"
   Principal Investigator: Weslin Roldan

2. Educational Intervention Regarding the Effectiveness of Single Dose Intraoperative Methadone Reducing Post-Operative Opioid Consumption at 24-48 Hours: A Quality Improvement Project."
   Principal Investigator: Israel Lopez Jr.

Sincerely
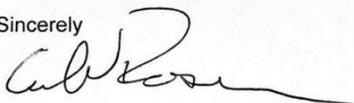
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Mount Sinai Primary & Specialty Care
· Aventura   · Key Biscayne   · Sunny Isles Beach
· Coral Gables · Miami Shores   · Mount Sinai Cardiology
· Hialeah   · Skylake   of the Florida Keys

Mount Sinai Free-Standing Emergency Departments
· Aventura
· Hialeah

Mount Sinai Comprehensive Cancer Center
4300 Alton Road
Miami Beach, FL 33140
Phone: 305.674.2121
msccc.com

Appendix D: QI Project Consent Form

**Nicole Wertheim College of Nursing and Health Sciences
Department of Nurse Anesthetist Practice**

Uses a pharmacological Evidence-Based Algorithm in the Management of Awake Fiberoptic Intubation.

Dear Mount Sinai Miami Beach Anesthesiology Associates:

My name is Weslin A. Roldan and I am a student from the Anesthesiology Nursing Program Department of Nurse Anesthetist Practice at Florida International University. I am writing to invite you to participate in my quality improvement project. The goal of this project is to improve health care provider knowledge on the risk and benefits of utilizing certain drugs during awake fiberoptic intubation. You are eligible to take part in this project because you are a member of the Anesthesia Department at Mount Sinai Medical Center.

If you decide to participate in this project, you will be asked to complete and sign a consent form for participation. Next, you will complete a pre-test questionnaire, which is expected to take approximately 5 minutes. You will then be asked to view an approximately 15 minute long educational presentation online. After watching the video, you will be asked to complete the post-test questionnaire, which is expected to take approximately 5 minutes. No compensation will be provided.

Remember, this is completely voluntary. You can choose to be in the study or not. If you'd like to participate or have any questions about the study, please email or contact me at wrold001@fiu.edu or 786-200-12454.

Thank you very much.

Sincerely,

Weslin A. Roldan, SRNA, BSN, CCRN

Appendix E: QI Project Survey

Pretest and Posttest Questionnaire:

Management of Awake Fiberoptic Intubation

INTRODUCTION

The primary aim of this QI project is to improve the knowledge of utilizing dexmedetomidine for awake fiber optic intubation (AFOI) to optimize sedation, maximize patient comfort while maintaining spontaneous ventilation.

Please answer the question below to the best of your ability. The questions are in multiple choice format. These questions are meant to measure knowledge and perceptions on identification, referral, management, and patient education on the use of dexmedetomidine for AFOI.

PERSONAL INFORMATION

1. **Gender:** Male   Female   Other
2. **Age:** _____
3. **Ethnicity:** Latino/a   Caucasian   African American   Asian Other
4. **Position/Title:** SRNA   CRNA   MD/DO
5. **Years of experience:**   Less than 1 year   1 to 5   6 to 10   more than 10 years

QUESTIONNAIRE

1. **What group or groups of medication do you use for AFOI?**
   a. Opioids
   b. Benzodiazepines
   c. Propofol
   d. Ketamine
   e. Dexmedetomidine

   f. Other

2. **If an opioid is utilized, which one do you prefer?**

   a. Fentanyl

   b. Remifentanil

   c. Sufentantil

   d. Alfentanil

   e. Other

3. **Please select dexmedetomidine mechanism of action?**

   a. α2 adrenergic antagonist, sedative properties, nonanalgesic, and anxiolytic, antisialogogue, with clinical significant respiratory depression.

   b. α2 adrenergic agonist, sedative properties, analgesic, and anxiolytic, antisialogogue, with respiratory depression.

   c. α2 adrenergic agonist, sedative properties, analgesic, and anxiolytic, antisialogogue, with nonclinical significant respiratory depression.

   d. α2 adrenergic antagonist, sedative properties, analgesic, and anxiolytic, antisialogogue, with respiratory depression.

4. **Where does dexmedetomidine work in the brain?**

   a. Brain stem

   b. Locus coeruleus

   c. Amygdala

   d. Hypothalamus

5. **The most common side effects of dexmedetomidine are?**

   a. Low or High blood Pressure, Bradycardia, dry mouth, hyperglycemia.

   b. Low or High blood pressure, bradycardia, dry mouth, hypoglycemia.

   c. Low blood pressure, bradycardia, dry mouth, hyperglycemia.

   d. High Blood pressure, bradycardia, dry mouth, hypoglycemia.

6. **According to multiple randomized control studies which sedative provides optimum sedation for AFOI while maintaining spontaneous ventilation?**

   a. Ketamine

   b. Propofol

   c. Etomidate

    d. Dexmedetomidine

7. **Which drug according to a recent randomized control trial provides optimum conditions for AFOI?**
    a. Ketamine
    b. Etomidate
    c. Propofol
    d. Alfentanil

8. **Alfentanil mechanism of action?**
    a. Opioid antagonist at the delta receptor, low toxicity, short duration, blunts airway reflex, does not cause bradycardia and hypotension.
    b. Opioid agonist at the mu receptor, low toxicity, short duration, blunts airway reflex, does not cause bradycardia and hypotension.
    c. Opioid agonist at the mu receptor, low toxicity, short duration, blunts airway reflex, does not cause bradycardia and hypotension.
    d. Opioid agonist at the delta receptor, low toxicity, short duration, blunts airway reflex, does cause bradycardia and hypotension.

9. **What is the best initial dosage of dexmedetomidine and alfentanil for AFOI?**
    a. Dexmedetomidine 1mcg/kg over 10 minutes/Alfentanil 20mcg/kg over 60-90s.
    b. Dexmedetomidine 1mcg/kg over 10 minutes/Alfentanil 40mcg/kg over 60-90s.
    c. Dexmedetomidine 1mcg/kg over 10 minutes/Alfentanil 10mcg/kg over 60-90s.
    d. Dexmedetomidine 1mcg/kg over 10 minutes/Alfentanil 30mcg/kg over 60-90s.

10. **How likely are you to utilize dexmedetomidine and alfentanil for awake fiber optic intubation?**
    a. Extremely likely
    b. Somewhat likely
    c. Neither likely or unlikely
    d. Somewhat unlikely
    e. Extremely Unlikely

Appendix F: Educational Module

Slide 1

A Pharmacological Evidence-Based Algorithm in the Management of Awake Fiberoptic Intubation

WESLIN A. ROLDAN, BSN, RN, DNP CRNA STUDENT

ANN B. MILLER, DNP, CRNA

Slide 2

Learning Goals

From this quality improvement project, you will:
- Discuss Dexmedetomidine
- Understand different drug regimens for awake fiberoptic intubation (AFOI)
- Identify the best medications for AFOI
- Obtain an educational algorithm for the use of medications during AFOI

Slide 3

Background

- 1 of every 250 patients are difficult airways
- The gold standard is AFOI
- 'Can't intubate can't ventilate' (CICV) 1 in 5,000
- Conscious sedation is the desired anesthesia level

Slide 4

Scope of the Problem

- Life-threatening anesthesia related airway complications
- Over Sedation
- Increased healthcare costs when AFOI fails due to inadequate level of anesthesia
- Adequate level of conscious sedation must be achieved

Slide 5

Dexmedetomidine

- Currently utilized for patients in intensive care units, sedation during procedures, including AFOI and regional anesthesia
- A high selective α2 adrenergic agonist
  - possesses analgesic and anxiolytic properties
  - decreases salivation
  - miniscule respiratory depression
- Activates guanine-nucleotide regulatory binding proteins causing sedation and anxiolysis within the **locus coeruleus**.

Slide 6

Dexmedetomidine Vs Fentanyl and Midazolam

- Dexmedetomidine compared to fentanyl and midazolam had comparable sedation
- Better hemodynamic stability and SpO2 during AFOI with dexmedetomidine
- Cough scores and postintubation scores were favorable in dexmedetomidine group
- Dexmedetomidine showed better hemodynamics and less episodes of desaturation when compared to the fentanyl-midazolam group

Slide 7

Dexmedetomidine Vs Fentanyl

- Dexmedetomidine is more effective than fentanyl in producing intubation conditions and sedation
- Dexmedetomidine maintains hemodynamic stability and less desaturation during AFOI
- Adding a low dose of fentanyl to a low dose of dexmedetomidine prevents airway obstruction
- Dexmedetomidine offers better:
  - Patient tolerance
  - Better preservation of a patent airway
  - Spontaneous ventilation
  - Reduced hemodynamic response to intubation

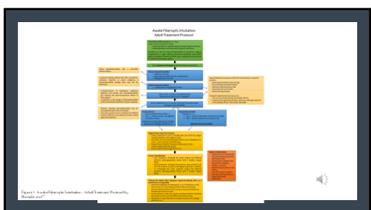**Slide 8**

Dexmedetomidine Vs Other Opioids

Dexmedetomidine Vs Remifentanil
- No statistically significant differences were observed in the sedation scale, intubation times, and patient reactions
- The comfort scores and airway events during intubation did not significantly differ
- The remifentanil group experienced less coughing, and less time was required for tracheal intubation

Dexmedetomidine Vs Alfentanil
- Time taken to achieve sedation, endoscopy time, intubation time in the alfentanil group was significantly shorter
- Limb movement and cough were more suppressed among the alfentanil group.
- Alfentanil provided better patient satisfaction than dexmedetomidine
- The level of patients' tolerance and cooperation during and immediately after intubation were higher in the alfentanil group

Slide 9

Alfentanil

- Opioid agonist at the mu receptor, low toxicity, short duration, blunts airway reflex, does not cause bradycardia and hypotension.
- Less expensive and more cost effective than dexmedetomidine
- Alfentanil 20mcg/kg over 60-90seconds
- causes less intense respiratory depression than that of fentanyl
  - lower total body clearance
  - a smaller volume of distribution
  - shorter half-life

Slide 10

Awake Fiberoptic Intubation
Adult Treatment Protocol

Figure 1. Awake Fiberoptic Intubation – Adult Treatment Protocol by Roldan and

Slide 11

Take home points

- Dexmedetomidine possesses unique properties which render it suitable for sedation and analgesia during the perioperative period
- It can be utilized as a premedication, an anesthetic adjunct for generalized regional anesthesia, or independently
- A highly selective potential central α2-adrenoreceptor agonist providing sedative, analgesic, and anxiolytic properties and reduced salivary secretion with minuscule respiratory depression
- No clinically relevant respiratory depression has been reported
- Provides hemodynamic and sympathoadrenal stability by reducing the circulating catecholamines, attenuating the response to endotracheal intubation

Slide 12

References