



Original Contribution

Obstructive sleep apnea as a risk factor associated with difficult airway management - A narrative review

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ARTICLE INFO

Article history:

Received 13 October 2017

Received in revised form 14 December 2017

Accepted 21 December 2017

Available online xxxx

Keywords:

Obstructive sleep apnea

Difficult airway

Difficult intubation

Difficult mask ventilation

Airway management

ABSTRACT

Study objective: The association between obstructive sleep apnea (OSA) and difficult airway had been studied in various clinical trials but the relationship between the two conditions has not been clearly established. The objective of this narrative review is to determine if OSA is a risk factor associated with difficult airway.

Design: The OVID Medline in process, Medline (vis Pub Med), EMBASE, Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, Web of Science and SCOPUS were searched up to April 2016 using specific keywords. Inclusion criteria were: [1] airway management in patients with a diagnosis of OSA, [2] comparison of airway management between OSA and non-OSA patients, [3] publications or abstracts in the English language. The incidence of difficult airway between OSA and non-OSA patients was compared using Chi-square analysis or Fisher's exact test.

Main results: Ten studies were included in the final review. Overall, the incidence of difficult tracheal intubation was higher in OSA patients versus non-OSA patients [56/386 (14.5%) vs. 69/897 (7.7%); $P = 0.0002$]. OSA patients also have a higher incidence of difficult mask ventilation [115/4626 (2.5%) vs. 471/64,684 (0.7%); $P < 0.0001$]. Compared to non-OSA patients, OSA was not associated with difficulty in the use of a supraglottic airway (SGA) device [10/663 (1.5%) vs. 162/15,171 (1.1%); $P = 0.38$]. No studies compared difficult surgical airway in OSA and non-OSA patients.

Conclusions: OSA was found to be a risk factor associated with difficult tracheal intubation and difficult mask ventilation. There was no association between OSA and difficult SGA use.

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1. Introduction

Obstructive sleep apnea (OSA) is a common sleep-disordered breathing characterized by repetitive opening and closure of the upper airway during sleep that affects alveolar gas exchange. The prevalence of OSA in the general adult population varies between 3 and 17% depending on gender and age subgroups [1], but it is often underdiagnosed in a vast majority of patients due to the lack of awareness and limited access to sleep centers [2,3]. As there is an increased risk of serious cardiopulmonary adverse events in patients with a high propensity for OSA, a thorough and detailed assessment in addition to meticulous perioperative management is warranted [4,5].

OSA is associated with a number of upper airway anatomical changes including oropharyngeal crowding, narrowing of the upper airway, macroglossia, retrognathia, thick neck, reduced mandibular length, inferiorly positioned hyoid bone and retro position of the maxilla [6–8]. The

above-mentioned anatomical features are common risk factors for both difficult intubation/ventilation and OSA [6]. There have been case reports of patients with OSA being difficult to intubate [9–11]. Several larger scaled studies [8,11–16] favor an association between OSA and difficult airway management while other studies did not find such an association [17–20]. At present, there is no overall consensus on the association between OSA and difficulties in airway management.

Considering the increasing prevalence of OSA, and the lack of clear association between OSA and difficult airway, the objective of this narrative review is to determine if OSA is a risk factor associated with the four aspects of difficult airway - difficult intubation, difficult mask ventilation, failed SGA use, and difficult creation of surgical airway.

2. Materials and methods

The definition of a difficult airway is not consistent in medical literature. The 2013-updated report on practice guidelines for management of the difficult airway by the American Society of Anesthesiologists defines a difficult airway as the clinical situation in which a conventionally trained anesthesiologist experiences difficulty with facemask

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ventilation of the upper airway, difficulty with tracheal intubation, or both [21]. Difficult facemask or supraglottic airway (SGA) ventilation occurs when it is impossible for the anesthesiologist to provide adequate ventilation due to one or more of the following: inadequate mask or SGA seal, excessive gas leak, or excessive resistance to the ingress or egress of gas. Difficult laryngoscopy is defined by a situation where it is not possible to visualize any portion of the vocal cords after multiple attempts at conventional laryngoscopy. Multiple attempts at SGA placement or tracheal intubation, in the presence or absence of tracheal pathology define difficult SGA placement and difficult tracheal intubation respectively [21].

Other classically accepted definitions include failure to intubate by an experienced practitioner, three or more attempts at laryngoscopy or endotracheal tube passage and/or a poor view of the vocal cords on direct laryngoscopy (Cormack and Lehane Grade 3 and 4). Depending on the definition that is used, the incidence of airway difficulty and subsequent airway problems can be extremely variable [22].

The spectrum of upper airway management broadly comprises of four aspects: mask ventilation, use of a SGA device, tracheal intubation and creation of a surgical airway. Acknowledging the increased use of alternatives to direct laryngoscopy, the 2013-Canadian Airway Focus Group defines a difficult airway as one where an experienced provider anticipate or encounters difficulty with any or all of facemask ventilation, direct or indirect (e.g. video) laryngoscopy, tracheal intubation, SGA use, or surgical airway [23]. The definition of difficult mask ventilation, SGA use, tracheal intubation, surgical airway varies amongst various studies [8,11–19,30–32].

2.1. Literature search strategy

We identified and reviewed published articles that identified patients with OSA by either history or polysomnography and involved airway manipulation or maneuvers. A systematic search of the literature was accomplished using multiple sources including the OVID Medline in process, Medline (vis Pub Med), EMBASE, Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, Web of Science and SCOPUS up to April 2016. The search strategy involved using the keywords and terms “obese/morbid obese/OSA, difficult mask ventilation, difficult intubation, difficult laryngoscopy, difficult supraglottic/extraglottic airway, difficult laryngeal mask airway, difficult surgical airway, cricothyrotomy, cricothyroidotomy”. We included only those studies that were in English.

Study selection was done by two authors (A.T. and D.W.), independently and were then crosschecked to avoid missing any potential studies. In the first phase, the articles were screened by the titles and the abstracts of the search results. Once the articles were shortlisted and excluding the irrelevant ones, they were reviewed in full and then selected for the analysis according to the eligibility criteria and the outcomes.

The following information was collected from each publication: author, year of publication, type of study, sample size, number of patients in each category of airway management and airway management techniques.

2.2. Statistical analysis

The incidence of difficult airway (intubation, mask ventilation, use of supraglottic airway, creation of surgical airway) between OSA and non-OSA patients was compared using Chi-square analysis or Fisher's exact test. Statistical testing were performed using SPSS Statistics for Mac v 21.0 (IBM Corp, Armonk, NY) or Vassarstats.net/newcs.html - a web-based statistical program. A *P* value <0.05 was considered statistically significant.

3. Results

Four hundred and fifty-six studies were identified after literature search from various resources (Fig. 1). Two hundred and seventy-nine studies were excluded due to irrelevancy and another nine were duplicates. The abstracts of 168 studies were screened. One hundred and twenty-two reviews, 31 case reports and case series, one editorial and two letters to editor were excluded. Two additional studies were excluded due to the lack of outcome data on difficult airway. Ten studies were included in the final review (Fig. 1).

The studies included for the comparison of difficult tracheal intubation between OSA and non-OSA patients are depicted in Table 1. Studies comparing difficult mask ventilation and failed SGA use in OSA and non-OSA patients are listed in Tables 2 and 3 respectively. No studies examined difficult surgical airway in OSA vs non-OSA patients.

3.1. Obstructive sleep apnea and difficult tracheal intubation (Table 1)

Hiremath et al. compared fifteen patients recorded as difficult to intubate (Cormack and Lehane grade 4) to 15 demographically matched control subjects recorded as easy intubation (Cormack and Lehane grade 1) [8]. Eight out of 10 OSA patients (defined by apnea-hypopnea index (AHI ≥ 10)) were difficult to intubate versus 7 out of 20 non-OSA patients, *P* = 0.05.

Siyam et al. studied 36 surgical patients with polysomnography-confirmed OSA [11], matching two or three demographically control patients for every OSA patient. OSA patients had a higher incidence of difficult intubation vs non-OSA patients [8/36 (21.9%) vs 2/77 (2.6%); *P* = 0.003].

In Kim et al.'s study, 90 patients with polysomnography-confirmed OSA were compared with non-OSA patients matched for age and sex [12]. The incidence of difficult intubations was higher in OSA patients vs non-OSA patients [15/90 (16.7%) vs 3/90 (3.3%); *P* = 0.003]. Amongst patients with OSA, AHI was significantly higher in patients with difficult intubation as compared to patients without difficult intubation. (67.4 ± 22.5 versus 49.9 ± 28.0 events/h; *P* = 0.026).

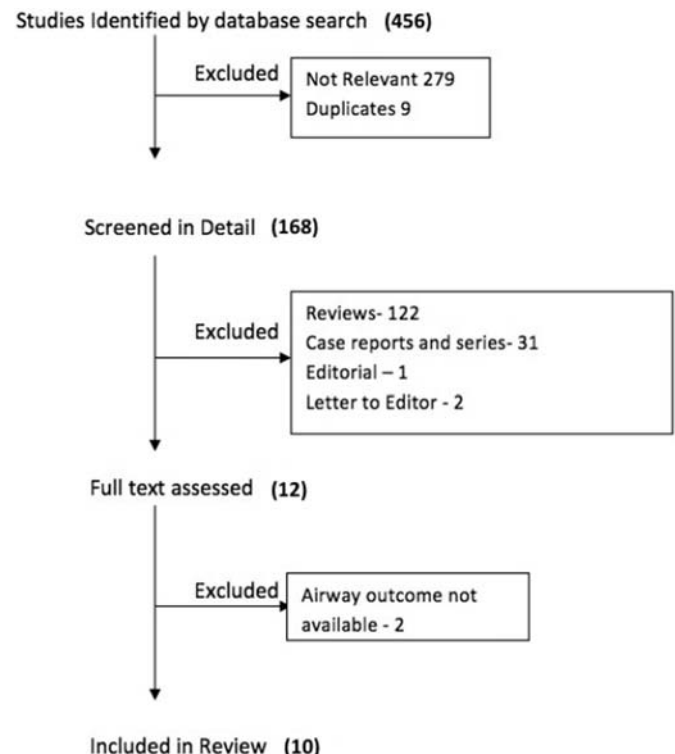


Fig. 1. The scientific articles assessed and included in the review.

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