Research Article

Airway Events in Non-Obese Vs Class I and II Obese Elective Surgical Patients

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ABSTRACT

Background: Overweight and obesity have become more common in India over the past few decades. Obesity changes anatomy and physiology, which makes maintaining the airway during surgery more difficult. In comparison to the general population, it is currently unknown what percentage of patients undergoing elective surgery are obese. The objective of this study was to compare the prevalence of obese elective surgical patients to the general population and to determine major and minor airway events in non-obese and class I and II obese elective patient groups.

Material and methods: This study included 100 patients 18-60 years of age undergoing an elective surgical procedure. JAPI 2009 criteria for obesity was used and patients were divided into non-obese, class I obesity, and class II obesity categories. On a pre-structured proforma, specific information regarding the decision to use a supraglottic airway device (SAD), direct laryngoscopy, and the occurrence of airway events were recorded. Major airway events were defined as unrecognized oesophageal intubation; a 'cannot intubate cannot ventilate' emergency; the need for unplanned reintubation or cricothyroidotomy; or respiratory arrest. Minor airway events were defined as: desaturation to SpO2 < 90%; failed mask ventilation; aspiration; airway trauma and difficult intubation; or recognized oesophageal intubation.

Result: Overall, airway events were higher in obese patients (p-value = 0.0072). An increase in weight class from non-obese to obesity class I (p-value = 0.17), and from class I to class II (p-value = 0.06) was associated with significantly higher airway events. Airway event rates increased with BMI: 8.57% (6/70) in non-obese, 19.04% (4/21) in class I obesity, and 55.55% (5/9) in class II obesity.

Conclusion: In the elective surgical population obesity is more prevalent compared to the general population. Our findings suggest that minor events are frequent in obese patients compared to non-obese patients. Obesity was associated with increased rates of difficult intubation, airway trauma, and desaturation.

Keywords: Airway events, High BMI, Obesity, Elective surgical anaesthesia.

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INTRODUCTION

Overweight and obesity have become more common in India over the past few decades. There are believed to be more than 135 million people who suffer from obesity. Because of sedentary lives and a diet heavy in calories, obesity is becoming more and more common. [1] According to the National Family Health Survey-5 (NFHS-5), 24% of women and 23% of men are obese. [2]

Obesity has been linked to several systemic diseases and is a risk factor for many comorbidities. Adiposity growth in obese people affects anatomy and physiology, making perioperative airway management more challenging. Reduced pulmonary compliance and functional residual capacity (FRC) are common in obese patients. [3,4,5] Patients with obesity are particularly at risk for fast oxygen desaturation after induction due to the detrimental effects of the increase in central fat distribution.[6,7]

The 4th National Audit Project (NAP4) of the Royal College of Anaesthetists found that, in major airway events, obesity was over-represented two-fold and class III obesity was over-represented four-fold compared with the general population. [8]

In comparison to the general population, it is currently unknown what percentage of patients undergoing elective surgery are obese. Hence, we undertook this study to identify the proportion of obesity in an elective surgical population compared with the general population as well as to identify major and minor airway events in the obese and non-obese elective patient groups.

MATERIALS AND METHODS

We undertook this non-randomized clinical trial at NMCH, Jamuhar, a tertiary care teaching hospital for a period of 6 months. The study included all adult patients from 18 to 60 years of age, undergoing elective surgery who required general anesthesia. Exclusion criteria were: any patients undergoing ophthalmic or obstetric surgery, or those undergoing general anesthesia as a rescue technique for

failed regional or sedation. The patient's personal information was kept anonymous.

The WHO definition of obesity is termed as class I=BMI ≥ 30 kg.m^2, class II=BMI ≥ 35 kg.m^2 and class III=BMI ≥ 40 kg.m^2. But due to the genetic tendency of Indians towards abdominal obesity and its associated risk of related lifestyle diseases, guidelines for the diagnosis of obesity for the Indian population have been published in JAPI 2009 according to which obesity is termed as Class I=BMI ≥ 25 kg.m^2, and Class II=BMI ≥ 30 kg.m^2. [9]

Specific data included the choice of supraglottic airway device (SAD), direct laryngoscopy, and occurrence of an airway event. Major airway events were defined as unrecognized oesophageal intubation; a 'cannot intubate cannot ventilate' emergency; the need for unplanned reintubation or cricothyroidotomy; or respiratory arrest. Minor airway events were defined as: desaturation to SpO2 < 90%; failed mask ventilation; aspiration; airway trauma and difficult intubation; or recognized oesophageal intubation. [10]

Data were collected for all patients in the pre-anesthetic check-up room (PAC room), operating theatre, and post-anesthesia unit on a pre-structured proforma by the primary investigator. Data were recorded concurrently during or immediately following the patient care. All the data were analyzed using SPSS software version 26.

RESULTS

The study included 100 patients who underwent elective surgery in total. Out of them, 14 were between the ages of 18-29, 21 were between the ages of 30-39, 31 were between the ages of 40-49, and 34 were between the ages of 50-60. There were 54 men and 46 women in the study's sample. Table 1 describes the baseline characteristics of the research population.

Among the study population, 30% of the patients were obese out of which, 21% had class I obesity (BMI ≥ 25 kg.m^2), and 9% had class II obesity (BMI ≥ 30 kg.m^2). This was much higher than the prevalence of obesity in the general Indian population. [2]

A total of 15 airway events were recorded. There were only two serious airway events, both of which involved the non-obese patient. Table 2 and Figure 1 provide summaries of the airway event occurrences.

Overall, airway events were significantly higher in obese patients, for which the p-value is 0.0072 (chi-square test). While for non-obese to class I obesity p-value is 0.17 (chi-square test), and for class I to class II p-value is 0.06 (Fisher exact test). Data suggests that obesity was associated with significantly higher airway events.

Table 1: Baseline characteristics

	Total	Non-obese	Class I obesity	Class II obesity
Overall	100	70	21	9
Age				
18-29 years	14	9	4	1
30-39 years	21	12	6	3
40-49 years	31	22	6	3
50-60 years	34	27	5	2
Sex				
Male	54	37	12	5
Female	46	33	9	4
Surgical department				
General surgery	32	21	7	4
Gynecology	30	19	8	3
Orthopedic	24	18	4	2
Neurosurgery	6	5	1	0
ENT	8	7	1	0

Table 2: Summary of recorded airway events

	Total	Non-obese	Class I obesity	Class II obesity
Total patients	100	70	21	9
Minor events				
Desaturation (SpO_2<90%)	3	0	1 (4.76%)	2 (22.22%)
Difficult intubation	4	2 (2.85%)	1 (4.76%)	1 (11.11%)
Airway trauma	4	2 (2.85%)	1 (4.76%)	1 (11.11%)
Recognized esophageal intubation	2	0	1 (4.76%)	1 (11.11%)
Major events				
Unplanned reintubation	1	1 (1.42%)	0	0
Respiratory arrest	1	1 (1.42%)	0	0
Total events	15	6 (8.57%)	4 (19.04%)	5 (55.55%)

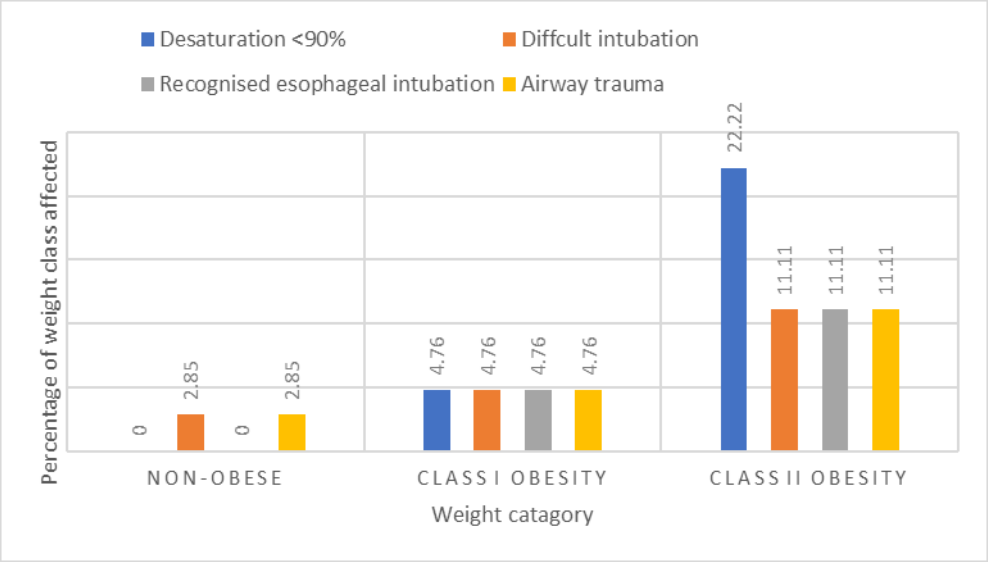

Figure 1: Summary of airway events

Airway event rates increased with BMI: 8.57% (6/70) in non-obese, 19.04% (4/21) in class I obesity, and 55.55% (5/9) in class II obesity.

When compared to non-obese patients, using SAD in obese patients were substantially more likely to experience airway events, p-value = 0.06 (Chi-square test). Table 3 provides a summary of airway events with different airway devices used in the different weight classes.

Table 3: Summary of airway events by airway device used and weight class

Airway device	Event type	Total	Non-obese	Class I obesity	Class II obesity
First generation SAD	None	5	2	2	1
	Desaturation	1	0	0	1
	SAD problem	1	0	1	0
Second generation SAD	None	9	6	2	1
	Desaturation	1	0	0	1
	SAD problem	1	0	0	1
Direct laryngoscopy	None	71	58	12	1
	Desaturation	1	0	1	0
	Difficult intubation	4	2	1	1
	Airway trauma	4	2	1	1
	Recognized esophageal intubation	2	0	1	1

However, in any weight class, there was no statistically significant difference between using a first-generation device or a second-generation device in terms of airway events, p-value = 0.51 (Fisher exact test). At the same time, there was also no statistically significant difference in the number of airway events between the various obesity classifications within the obese group, p-value = 0.26 (Fisher exact test).

DISCUSSION

This cross-sectional study found that the incidence of obesity is significantly higher in the elective surgical population compared with the general population (30% vs. 23.5%).[2]

In our study, minor airway events were relatively common (n=14), whereas major airway events were uncommon (n=2). Among non-obese individuals, 5.7% experienced minor airway events compared to 30% of obese patients for which the p-value is 0.07 (chi-square test). Additionally, the frequency of minor airway events increased exponentially with increasing obesity class with 19.04% in class 1 and 55.55% in class 2, respectively. Even though mild airway events by themselves might not endanger a patient, they could jeopardize their condition if precautions aren't taken

to prevent them. Hence, although these events are 'minor' the high frequency of these airway events with obesity warrants ensuring that mitigating strategies are available.

The most common minor airway events were difficult intubation and airway trauma. Both difficult intubation and airway trauma were present in 2.85% (n=2/70) of non-obese patients compared with 6.66% (n=2/30) of obese patients, for which the p-value was 0.18 (chi-square test). Our findings are in contrast with findings by Shaw M, Waiting J, Barraclough L, et al, where the most common airway event was oxygen desaturation <90% which was present in 4% of the obese patients. [10]

Difficult intubation remained a common event, occurring in 4 of 71 intubations (5.63%). Difficult intubation did not increase significantly with obesity, occurring in 2.85% (n=2/70) of non-obese patients compared with 6.66% (n=2/30) of obese patients for which the p-value was 0.11 (chi-square test). These findings are comparable to findings by Saasouh W, where a statistically significant association between weight class and difficult intubation was not shown. [11] Our study findings are similar to the findings by Lavi et al who found that patients with obesity tend to have higher Intubation Difficulty Score (IDS) than non-obese patients. [12] This is likely due to the presence of more oropharyngeal tissue fat in patients with obesity, which makes it more difficult to view the airway.

In a study conducted by Kheterpal S et al it was found that of almost half a million cases of airway management, a BMI of >30 kg/m^2 was associated with both difficult mask ventilation and difficult intubation, implying an increased risk of a potential catastrophic "cannot-ventilate-cannot-intubate-situation" [13]

The second most common minor airway event was desaturation <90%, which was not present in non-obese patients and was 10% (n=3/30) in obese patients for which the p-value is 0.04. (Fisher exact test). These findings are comparable to findings by Mantaga S, Thanakiattiwibun C, Rojanapithayakorn, et al. where oxygen desaturation below 90% was observed in 5.6% of the patients. [14]

The results of our study would support current advice from NAP4 [8] and the Society of Bariatric Anaesthesia [15] that SADs should only be used in "highly selected patients." Similarly, first-generation SADs are avoided in these guidelines, especially for obese patients. Our study findings are comparable to findings by Cheon et al who found that in patients anesthetized using laryngeal mask airways, the overall incidence of intra-operative ventilatory complications, increased 2 folds when the patient's BMI was greater than 30 kg/m^2. They concluded that the incidence of intraoperative complications is equally proportional to the higher BMI of the patient (p-value = 0.0008) [16]

Even though in our analysis second-generation SADs were more commonly used than first-generation SADs, the use of second-generation devices was not significantly associated with a decrease in SAD problems in any weight class for which the p-value is 0.51 (Fisher exact test). However, given that only 9 patients with class 2 obesity were included in this study, it is difficult to conclude complication rates between devices in the higher weight classes.

CONCLUSION

Obesity is more prevalent in the elective surgical population compared with the general population. According to our study, obese patients experience minor incidents more frequently than non-obese patients. Increased incidence of difficult intubation, airway damage, and desaturation have all been linked to obesity. Given the increasing proportion of obesity and the fact that obese patients constitute a higher proportion of elective surgical patients than the general population, anaesthetists should be prepared for an increased incidence of such events and should prepare for mitigating strategies to prevent these from becoming major complications.

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