RESEARCH ARTICLE

Airway management in bariatric surgery patients, our experience in Qatar: A prospective observational cohort study

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ABSTRACT

Background: Obesity has always been considered a criterion of difficult airway management, and many authors have tackled this subject. We are presenting our experience in airway management in obese patients undergoing bariatric surgery in Qatar and comparing the results with previous studies.

Objective: The primary objective of this study was to explore the relationship between difficult mask ventilation and difficult intubation. The secondary objective was to identify other factors that may play a role in either difficulty such as gender, associated comorbidities, and the skill and experience of anesthetists.

Design: This study was a prospective observational cohort study.

Sample: A total of 401 patients were selected for various elective bariatric surgery in Hamad General Hospital, including 130 males and 271 females with an average body mass index(BMI) of 46.03 kg m^{-2}.

Results: We used Pearson Chi-Square and Yates corrected Chi-square statistical tests in our statistical analysis. Neck circumference had a p value of 0.001 in both genders. The male gender had a p value of 0.052 and 0.012 in mask ventilation and difficult intubation, respectively. The Mallampati score had a p value of 0.56 and 0.006 in mask ventilation and intubation, respectively. In general, neck circumference, Mallampati score, gender, obstructive sleep apnea, and diabetes mellitus had greater negative effects on airway management than BMI alone.

Conclusion: It was hard to intubate 25% of patients who had difficult mask ventilation (DMV). All DMV and 20 out of 23 of difficult intubation patients were

in the high BMI group ($\geq$ 40). Neck circumference, Mallampati score, and male gender were major independent factors; however, other factors, such as obstructive sleep apnea, and diabetes mellitus, should be kept in mind as additional risks.

Keywords: bariatric surgery, difficult intubation, difficult mask ventilation

1. INTRODUCTION

Managing the airway in obese patients, in general, is considered a challenge to many anesthetists. In this segment of patients, the literature is inconclusive regarding the difficulties in airway management that may result in hypoxia and death.[1–3] In other articles, the validity of obesity and even the history of obstructive sleep apnea in patient airway management were questioned.[4–6] Therefore, the criteria for difficult airway management (mask ventilation and intubation) in obese patients remain unresolved.

To elaborate more, we see that in the Fourth National Audit Project (NAP4), it was reported that obesity was the major cause of airway complications in 40% of airway-related adverse events.[1] The same was claimed by Kheterpal et al., that obese neck anatomy, a history of sleep apnea, a history of snoring, and BMI of 30 kg m^2 or greater were identified as independent predictors of difficult airway.[2] Juvin et al., concluded that that difficult intubation is more common among obese than non-obese patients.[3] However, in other studies the above-mentioned conclusions were challenged as in Collins et al., claimed that when the anesthesiologist is prepared there is no evidence that obesity per se is a risk factor for difficult laryngoscopy and tracheal intubation.[4] Lundstrøm et al., in their analysis of 91,332 patients scheduled for direct laryngoscopy found that high BMI is a weak but statistically significant predictor of difficult and failed intubation.[5] In 180 morbidly obese patients selected for bariatric procedures with their airway managed in ramping position and with the incidence of 68% had obstructive airway disease. Neligan et al., found in morbidly obese patients there was no relationship between the presence and severity of obstructive sleep apnea, BMI, or neck circumference and difficulty of intubation or laryngoscopy grade.[6] Only a Mallampati score of 3 or 4 or male gender predicted difficult intubation.

In Hamad Medical Corporation, obese patients have historically undergone various types of surgeries, with only sporadic comments from anesthetists on airway management. However, since the establishment of a dedicated bariatric and metabolic surgery team and with a plethora of articles in the medical press focusing on difficult airway management in obese patients in the context of the above contradicting conclusions, we decided to conduct this prospective study to contribute our experience in this field. Our study aims to shed some light on the airway management in this category of patients and present it to readers from the anesthesia specialty for further encouragement of more studies, as the number of obese patients undergoing various types of surgeries in the adult and children populations is growing.

Our primary aim was to determine the relationship between difficult mask ventilation (DMV) and difficult intubation (DI). Our secondary objective was to identify other factors that may play a role in either of these difficulties, such as sex, associated comorbidities, and the skill and experience of anesthetists. The skill and experience of anaesthetists, in particular, has received little attention in the literature to date.

2. METHODS

Following the approval of Hamad Medical Corporation's Ethical and Medical Research Committee (MRC) and obtaining a consent waiver (Ref. MRC/678/2014) dated April 24, 2014, the study was considered "exempt" as we were not deviating from standard anesthesia techniques. A prospective observational cohort study was conducted from April 2014 to November 2015.

The number of patients recruited was 401, including 130 males and 271 females, and all were scheduled for elective bariatric procedures. We had initially selected 404 patients; but, after considering body mass index (BMI), we decided to exclude three patients with a BMI under 30. We also excluded patients undergoing emergency procedures.

The patient ages ranged between 18 and 78 years. The bariatric surgeries performed were primarily laparoscopic procedures for sleeve gastrectomy (347 patients) and Roux-en-Y gastric bypass procedure (41 patients). Other procedures (13 patients) included laparoscopic cholecystectomy, repair of hiatus hernia, and removal of a gastric

band. The procedures were performed under the care of the bariatric surgical team.

The patients were grouped into three categories according to their BMI, based on the World Health Organization classification of obesity:[7] Group I (30 – 34.99), Group II (35 – 39.99), and Group III (>40). Data collection, which was compiled in a Microsoft Excel spreadsheet, included demographic factors, the type of surgery, comorbidities, preoperative assessment, intra-operative airway management, airway-related complications, and immediate postoperative outcome with comments.

Patient assessment was performed and documented by a senior anesthetist, typically in the preoperative anesthesia clinic, with an emphasis on airway evaluation, gastroesophageal reflux, and hiatus hernia. Optimizing the patient's general condition, especially those with uncontrolled diabetes mellitus and/or hypertension, was considered. Other assessments included the American Society of Anesthesiologists (ASA) classification, demographic data, BMI, mouth opening, thyromental distance, neck circumference, and Mallampati classification.

Patients were reevaluated the night before surgery. Most of these evaluations were conducted by an anesthesia consultant. Additional support from the surgical intensive care unit was arranged in advance for those patients at risk of experiencing obstructive sleep apnea (OSA) or with multiple comorbidities.

Han and Cormack-Lehane (C-L) grading were considered in the classifications of difficulties in mask ventilation and tracheal intubation, respectively.[8,9] In addition, the number of attempts and the use of other intubation tools were considered. OSA patients were identified through a STOP-Bang questionnaire before surgery.[10] As there is no consensus of critical neck circumference measurement for airway assessment, we considered ≥ 44 cm, measured at the cricoid level, as the cutoff point.[11 – 13]

Besides their regular morning medication, patients were not usually given any sedative premedication. However, the option of premedication was discussed with the patients. Patients were reassessed preoperatively in the holding area of the operating theater, and all concerns were noted.

Once patient sign-in and identification procedures were completed, the patient was connected to the monitors. ECG leads, pulse oximetry, noninvasive BP, and bispectral index (BIS) were applied, and their baseline values were recorded. Whether to establish invasive BP and a second cannula was determined on a case-by-case basis according to the procedure type and patient comorbidities. Other equipment for airway management (videolaryngoscope), including Gum-elastic bougie (GEB), were kept ready.

At Hamad General Hospital, and other hospitals of Hamad Medical Corporation, we follow the Society for Obesity and Bariatric Anaesthesia single-sheet guidelines for OSA stratification, preoxygenation, doses of medications, and ramping positioning of the patient during induction and recovery.[14]

The principle induction agent was propofol 2 mg kg^{-1}, preceded by 2% lidocaine (60 – 100 mg). Etomidate was used as an alternative if there were any concerns with using propofol, or if dictated by the patient's comorbidities, further doses of propofol were given if required. This was followed by an analgesic dose of ketamine (0.5 mg kg^{-1}), fentanyl 2 mcg kg^{-1}, and a muscle relaxant (cistracurium or rocuronium).

Once the patient was asleep, mask ventilation was attempted, and efforts were made to observe chest movement and end-tidal CO_2. If mask ventilation was suboptimal, an oropharyngeal airway was inserted; this would be followed by a muscle relaxant. Previously, we used Cistracrium 0.15 mg kg^{-1}, but since the advent of Sugammadex, rocuronium has become the drug of choice. In 12 patients with grade-3 mask ventilation, a muscle relaxant was given immediately after difficulty was determined, which helped to ease ventilation.

After ventilating with O_2, air, and Sevoflurane for two to three minutes, and once the patient was relaxed, the intubation of the trachea was attempted with a Macintosh laryngoscope blade 4. Anesthesia was maintained using Sevoflurane, air, and oxygen. Tracheal intubation was performed by either a specialist or a resident (third- or fourth-year residency). If they failed in their first attempt, a second chance was usually given; rarely was a third chance given, and, in most cases, the consultant took over immediately.

At the end of the procedure, a muscle relaxant was reversed with either neostigmine and glycopyrrolate, or Sugammadex. Neuromuscular transmission monitoring was used whenever feasible. After extubation criteria were established, patients were transferred to the post-anaesthesia care unit with an oxygen mask and pulse oximetry in a head-up

position. Admission to the surgical intensive care unit was determined by a combined decision of the anesthetist and the surgeon.

All steps in the induction and the airway management were documented according to grades by Han's mask ventilation score. The difficulty in intubation was recorded by the Cormack-Lehane (C-L) laryngeal view. Finally, the number of attempts and the use of adjuncts, such as videolaryngoscopy or GEB, were documented.

2.1. Statistical analysis

Descriptive statistics was used to summarize demographic, anthropometric, airway management, clinical, and other related characteristics of the participants. The normally distributed data and results were reported as means and standard deviations; the remaining results were reported as medians and interquartile ranges. Categorical data were summarized using frequencies and percentages.

Associations between two or more qualitative variables—such as gender, age, BMI groups, comorbidities, and airway management characteristics—with outcome variables (difficult and easy mask ventilation) were assessed using the Chi-square (χ^2) test and/or Fisher Exact test as appropriate. Quantitative data between the two independent groups were analyzed using an unpaired

Table 1. Association of demographic, anthropometric and airway management characteristics with difficult mask ventilation.

Variable	Easy Mask Ventilation n (%)	Difficult Mask Ventilation n (%)	P-value*
Age group			
<55 years	347 (96.9%)	11 (3.1%)	0.786
≥55 years	42 (97.7%)	1 (2.3%)	
Gender			
Male	123 (94.6%)	7 (5.4%)	0.052
Female	266 (98.2%)	5 (1.8%)	
BMI			
30 to 34.99	13 (100%)	0 (0%)	0.778
35 to 39.99	77 (98.7%)	1 (1.3%)	
>40	299 (96.5%)	11 (3.5%)	
Mouth Opening			
≤ 4 cm	55 (98.2%)	1 (1.8%)	0.568
> 4 cm	334 (96.8%)	11 (3.2%)	
Thyromental Distance			
<7 cm	94 (95.9)	4 (4.1%)	0.467
≥7 cm	295 (97.4%)	8 (2.6%)	
Neck Circumference			
≥44 cm	157 (93.5%)	11 (6.5%)	<0.001
<44 cm	232 (99.6%)	1 (0.4%)	
Mallampati Score			
1	62 (98.4%)	1 (1.6%)	0.562
2	232 (97.9%)	5 (2.1%)	
3	90 (94.7%)	5 (5.3%)	
4	5 (83.3%)	1 (16.7%)	
OSA			
Yes	11 (91.7%)	1 (8.3%)	0.270
No	378 (97.2%)	11 (2.8%)	
DM			
Yes	88 (96.7%)	3 (3.3%)	0.846
No	301 (97.1%)	9 (2.9%)	

*Pearson Chi-Square and Yates corrected Chi-square statistical tests.

't' or Mann–Whitney U test as appropriate. The relationship between difficult mask ventilation (DMV) and demographic, anthropometric, and airway management characteristics were estimated by deriving odds ratios (ORs) from a logistic regression model.

Univariate and multivariate logistic regression methods were applied to assess the predictive values of each predictor or risk factors of DMV. Results were presented and reported as an OR and associated 95% confidence interval (CI). All p values presented were two-tailed, and $p < 0.05$ were considered statistically significant. All statistical analyses were conducted using statistical packages SPSS 23.0 (IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.) and Epi-info (Centers for Disease Control and Prevention, Atlanta, GA) software.

3. RESULTS

3.1. Difficult mask ventilation:

The total number of patients with DMV was 12 out of 401 (3%), including seven males compared with five females ($p = 0.052$) (OR 3.03; 95% CI 0.94, 9.73). Only neck circumference (NC) showed a statistically significant result ($p < 0.001$) for those of ≥ 44 cm NC (OR 16.26, CI 2.08, 127.17). Other variables—age, diabetes, and high-grade MMP—did not show any statistically significant results. However, there is a tendency for DMV in patients with OSA (OR 3.12, CI 0.37, 26.37), and BMI ≥ 40 (unadjusted OR 3.34, 95% CI for OR 0.43, 26.37, $p = 0.249$) (Tables 1, 2).

3.2. Difficult intubation:

There was a total of 23 patients who had their trachea intubated with difficulty (5.73%). Of these patients,

Table 2. Potential predictors for difficult mask ventilation: Logistic regression analysis.

	Unadjusted Odds ratio (OR)	95% CI for OR	P-value
Age group			
≥ 55 years	1.0 (reference)		
< 55 years	1.33	0.17, 10.57	0.787
Gender			
Female	1.0 (reference)		
Male	3.03	0.94, 9.73	0.063
BMI Group			
BMI < 40	1.0 (reference)		
BMI ≥ 40	3.34	0.43, 26.37	0.249
Mouth Opening			
≤ 4 cm	1.0 (reference)		
> 4 cm	1.81	0.23, 14.31	0.573
Thyromental Distance			
≥ 7 cm	1.0 (reference)		
< 7 cm	1.57	0.46, 5.33	0.470
Neck Circumference			
< 44 cm	1.0 (reference)		
≥ 44 cm	16.26	2.08, 127.17	0.008
Mallampati Score			
1	1.0 (reference)		
2	1.34	0.15, 11.65	0.793
3	3.44	0.39, 30.21	0.264
4	12.40	0.67, 229.39	0.091
OSA			
No	1.0 (reference)		
Yes	3.12	0.37, 26.37	0.295
DM			
No	1.0 (reference)		
Yes	1.14	0.30, 4.30	0.847

18 had their airway managed with a bougie, and two patients with predicted difficult intubation (DI) had videolaryngoscopy. Male sex and NC make intubation difficult ($p = 0.012$) with OR 2.90, CI 1.24, 6.80, ($p = 0.001$) and OR 4.26, CI 1.64, 11.05, respectively. The MMP score was a definite cause of difficulty ($p = 0.006$) and in grade 3 (OR 9.83, CI 1.25, 77.16), and grade 2 (OR 2.45, CI 0.30, 19.69) which showed a significant increase in difficulty with the higher grade.

In general, the BMI did not show a statistically significant effect on intubation ($p = 0.765$). However, in the BMI ≥ 40 group, 20 out of 23 (86.9%) patients experienced DI. Diabetics and OSA patients pose some difficulty in intubation (Tables 3, 4).

Of note, 25% of DMV patients were also difficult to intubate (Table 5).

3.3. Anesthetists' experience:

The airway management of 70.6% of the patients was performed by consultants. Consultants managed the difficult cases more often (2.12%). No patient had suffered from hypoxia, airway trauma, or delayed extubation. Two of the patients admitted to ICU were intubated for reasons other than their airway.

3.4. C–L view in relation to airway assessment and other variables

BMI has a weak relation to the C–L view; 149 of 191 (78%) patients of BMI ≥ 40 had a view of grade I,

Table 3. Association of demographic, anthropometric and airway management characteristics with difficult intubation.

Variable	Easy Intubation n (%)	Difficult Intubation n (%)	P-value*
Age group			
<55 years	338 (94.4%)	20 (5.6%)	0.711
≥55 years	40 (93%)	3 (7%)	
Gender			
Male	117 (90%)	13 (10%)	0.012
Female	261 (96.3%)	10 (3.7%)	
BMI			
30 to 34.99	13 (100%)	0 (0%)	0.765
35 to 39.99	75 (96.2%)	3 (3.8%)	
≥40	290 (93.5%)	20 (6.5%)	
Mouth Opening			
≤4 cm	53 (94.6%)	3 (5.4%)	0.896
>4 cm	325 (94.2%)	20 (5.8%)	
Thyromental Distance			
<6 cm	92 (93.9%)	6 (6.1%)	0.850
≥6 cm	286 (94.4%)	17 (5.6%)	
Neck Circumference			
≥44 cm	151 (89.9%)	17 (10.1%)	0.001
<44 cm	227 (97.4%)	6 (2.6%)	
Mallampati Score			
1	62 (98.4%)	1 (1.6%)	0.006
2	228 (96.2%)	9 (3.8%)	
3	82 (86.3%)	13 (13.7%)	
4	6 (100%)	0 (0%)	
OSA			
Yes	10 (83.3%)	2 (16.7%)	0.098
No	368 (94.6%)	21 (5.4%)	
DM			
Yes	82 (90.1%)	9 (9.9%)	0.053
No	296 (95.5%)	14 (4.5%)	

*Pearson Chi-Square and Yates corrected Chi-square statistical tests.

Table 4. Potential predictors for difficult intubation: Univariate logistic regression analysis.

	Unadjusted Odds ratio (OR)	95% CI for OR	*P*-value
Age Group			
≥55 years	1.27	0.36, 4.46	0.712
<55 years	1.0 (reference)		
Gender			
Male	2.90	1.24, 6.80	0.014
Female	1.0 (reference)		
BMI Group			
BMI ≥40	2.05	0.60, 7.07	0.254
BMI <40	1.0 (reference)		
Mouth Opening			
>4 cm	1.08	0.31, 3.79	0.896
≤4 cm	1.0 (reference)		
Thyromental Distance			
<7 cm	1.10	0.42, 2.87	0.850
≥7 cm	1.0 (reference)		
Neck Circumference			
≥44 cm	4.26	1.64, 11.05	0.003
<44 cm	1.0 (reference)		
Mallampati Score			
1	1.0 (reference)		
2	2.45	0.30, 19.69	0.400
3	9.83	1.25, 77.16	0.030
4	–	–	–
OSA			
Yes	3.51	0.72, 17.03	0.120
NO	1.0 (reference)		
DM			
Yes	2.32	0.97, 5.55	0.059
NO	1.0 (reference)		

and 153 of 180 (85%) had a view of grade II. The MMP scoring showed conflicting results; grade III had a good correlation with the view, but not with other grades.

NC, diabetes mellitus (DM), and OSA all have a nonstatistically significant correlation with the C–L view. However, there is a definite tendency toward a worse view (grade III) and, subsequently, more difficulty in intubation (Figures 1, 2).

4. DISCUSSION

Bariatric surgery (gastric banding) was the first and only kind of procedure conducted in Hamad General Hospital. In February 2011, the bariatric (metabolic) surgery and anesthesia unit was officially formed. The team mainly performs laparoscopic sleeve gastrectomy, gastric bypass surgeries, and other related procedures.

In Qatar, 70% of the population is either overweight or obese. According to 2016 statistics, nearly 16.7% are diabetics and these figures are increasing. These results reflect a serious health problem, both locally and globally.[15–17]

Airway management in obese patients remains a challenge to anesthetists. The literature contains an overabundance of controversial data on whether high BMI and associated changes, such as OSA and NC, are conclusive causes of airway difficulties.[3–6] However, in the Fourth National Audit Project of the Royal College of Anaesthetists, they reported that obesity was the major cause of airway complications in 40% of airway-related adverse events.[1]

There is also a lack of consensus regarding DMV in obese patients. In general, the incidence of DMV varies. A recent robust report showed that the combined DMV and DI overall incidence in the general

Table 5. Relationship between mask ventilation and intubation and other variables.

BMI group	Mask ventilation grade	Intubation grade view	Number of attempts	Intubation management	Neck circumference (cm)	Mallampati score
3	3	3	3	NONE	44	3
3	3	3	1	NONE	45	2
3	3	3	3	GEB	44	3
3	3	3	1	GEB	46	2
3	3	2	1	NONE	44	3
3	3	2	1	NONE	47	2
3	3	1	1	NONE	49.5	1
3	3	2	1	NONE	47	2
3	3	1	1	NONE	48	4
3	3	2	1	NONE	45	3
3	3	2	1	NONE	40	2
2	3	2	1	NONE	45	3

BMI group 3: ≥ 40
BMI group 2: 30–39.9
GEB: Gum–elastic bougie.

population is 0.4%, and the prediction of impossible DMV is 0.15%, while a previous study found that the overall incidence of DMV was 1.4%.[2,18–19] However, there are conflicting reports of DMV in obese patients study; some findings indicate that BMI is not an important factor in determining DMV, while others state that BMI > 50 is the predictor of DMV.[20–21]

In the literature surveyed, there was no consensus as to whether (or what measure of) BMI is associated with DMV.[12,22–23] This was, in part, the motivation for our research. In our prospective study, we found that DMV in obese patients (BMI ≥ 30) was approximately 3%, in comparison with what was reported in another study as 14%.[13]
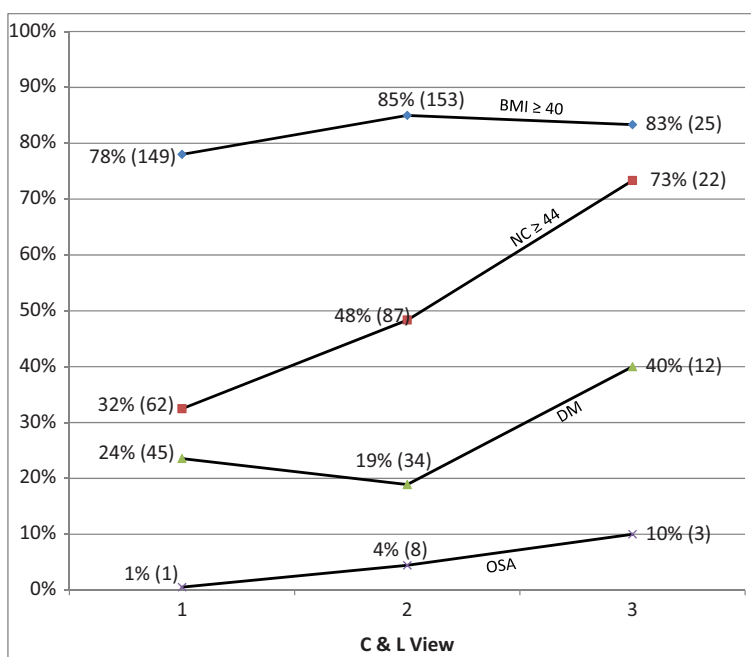

Figure 1. Relationship between body mass index, neck circumference, diabetes mellitus and obstructive sleep apnea with Cormack-Lehane view.
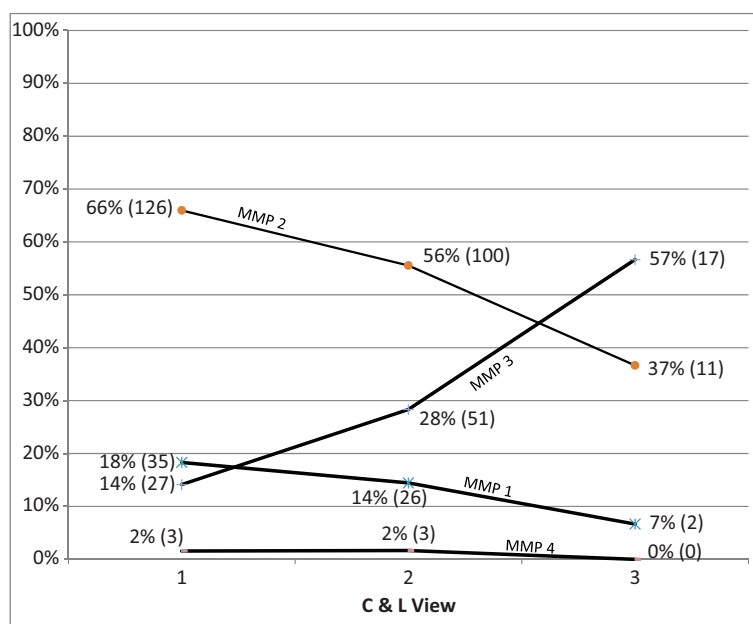
Figure 2. Relationship between Mallampati grade and Cormack-Lehane view.

Reports on the relationship between DMV and DI in obese patients were scarce in the literature, and thus the association between DMV and DI is unclear.[24] However, all reports surveyed showed that, in the general population, there is a significant increase in the rate of DI after DMV occurs, with variable percentages.[23,25] In a different study, most DMV patients were easily intubated.[2]

In our study, only 25% of DMV patients were difficult to intubate. From the results obtained, it can be seen that NC ≥ 44 constitutes 11 out of 12 patients. MMP scores of 3 and 4 accounted for half the patients (6/12), all of which were in BMI group 3 (≥ 40) (Table 5).

Neck circumference has been widely reported to affect mask ventilation and intubation.[12,21,24,26] Studies have proved using ultrasound measurement that large NC, due to fat deposition in the anterior neck soft tissue, significantly contributes to both DMV and DI;[27] and yet, other authors have challenged this relationship.[6]

In our study, NC scored the highest statistically significant value in both DMV and DI. Other factors, such as OSA, BMI, and DM, showed a tendency to contribute to airway difficulties, but not in a statistically significant manner. However, most publications consistently confirm the incidence of difficult airway in cases of DM and OSA.[28–34]

The MMP and C-L view, without laryngeal pressure, showed a very strong correlation in the degree of difficulty in intubation ($p = 0.006$), but it was weak in mask ventilation grade. These findings confirmed those of a previous study, namely that MMP and NC significantly affect airway management.[26] Our findings echoed another study, which found that high-grade MMP affects the decision of airway management, in association with other factors.[35]

Notably, all reports agree that MMP is a poor single predictor of DI.[36,37] In addition to MMP, the new extended Mallampati score could likely help in identifying those patients with a difficult airway.[30,38] Other anatomical measures such as mouth opening, thyromental distance, and age failed to predict any difficulty in either mask ventilation, intubation grade, or even C-L view.

The skills and experience of the two dedicated anesthesia consultants were critical in managing the airway, evident in more than two-thirds of the cases. This factor was particularly important in managing difficult cases. In addition, the consultants' strict supervision of trainees and their timely intervention in cases of serious difficulty ensured the safety of the operating bariatric theater, with no complications to date.

Many reports have shown that the human factor plays a major role in airway management

outcomes.[39–40] Certainly, this decision is in accordance with the guidelines published by the Society for Obesity and Bariatric Anaesthesia and other societies.[14] Our study confirms the importance of the human factor, namely the involvement of skilled and experienced anesthetists in effective airway management.

The limitations of this study include its design as an observational study, not blinded nor controlled for legal constraints. The study also involved a small number of patients, with a female majority, and did not use the intubation difficulty scale score.

5. CONCLUSION

There is no clear consensus on whether BMI is the single predictive factor of a difficult airway or on what measure of BMI contributes to a difficult airway. We believe it is a misconception that BMI is the sole contributing factor of difficult airway management, as BMI does not consider the lean body mass and its associated mechanical changes. These changes include the percentage and distribution of adipose tissue, such as NC, occipital fat pad, and associated comorbidities of obesity, including OSA and DM, that would affect airway management.[12,26,27,34]

Many reports in the medical literature have identified a high BMI as a contributor to a difficult airway.[3,35,41–43] However, other authors have challenged this relationship.[5–6]

In this first of its kind study in the State of Qatar, we have shown that all DMV patients we observed and 20 out of 23 DI patients were in the high BMI group (≥ 40). In accordance with other studies, NC ≥ 44, MMP, and male gender were significant independent factors. However, other factors such as OSA and DM should be kept in mind as additional risks.

Given the lack of consensus surrounding BMI and a difficult airway, we, as physicians, should view obesity as a "syndrome" characterized by many "pathologies." This perspective requires us to consider the many factors that may

contribute to a difficult airway, rather than solely obesity or BMI.

Detailed preoperative airway assessment remains the key to success in airway management. Practices such as early use of videolaryngoscopy, the use of adjuncts, and request for assistance promote preparedness.

Finally, a key strength of our study was the experience of the anesthetists. The impact of their skill on the outcome also highlights the human factor as an important element of airway management.

COMPETING INTEREST

The authors of this study declined to declare any competing interests.

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AUTHORS' CONTRIBUTIONS

ARRV: concept and design of the study, data collection, revised the manuscript, interpretation, and provided critical feedback. Principal author

KNA: concept and design of the study, data collection, revised the manuscript, interpretation, and provided critical feedback.

MMMB: concept and design of the study, data collection, revised the manuscript, interpretation, and provided critical feedback.

JHF: data analysis, interpretation, wrote the manuscript, conducted meetings with authors and attained their approval, corresponding author.

All authors read and approved the final manuscript.

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