Research Article

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Anesthesia for obese patients: experience of the Moulay Ismail Military Hospital in Meknes

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Abstract

Obesity is a major public health problem and has become one of the most common co-morbidities in anesthesia. Consequently, anesthesiologists are increasingly confronted with the perioperative management of obese patients, which is characterized by its impact on all major body functions. An understanding of the pathophysiology and complications in this specific group of patients allows for safer and more effective care, as obesity constitutes a high risk for perioperative complications.

This work is a descriptive and analytical study conducted at the Department of Anesthesiology of the Moulay Ismail Military Hospital in Meknes over a 10-month period in 2025.

We collected epidemiological data, main medical history and risk factors, anomalies revealed during clinical examination and perioperative complementary tests, anesthetic particularities, perioperative complications and their management, and ultimately the operational strategy.

The main objectives of this study are to determine the prevalence of this patient population in the hospital's anesthesiology practice, to highlight the difficulties and complications encountered in their perioperative management, to report the specific features of this category of patients in light of recent literature data, and to evaluate our management in accordance with the recommendations of scientific societies.

Keywords: Obesity, Anesthesia, Surgery, Body Mass Index.

I. Introduction:

Obesity is a major public health problem: more than one billion people live with obesity, and its prevalence is increasing in almost all countries. The prevalence of overweight is 31% in the region [1]. Driven by an epidemiological demographic trend and the severe complications associated with it, obesity inevitably brings an increasing number of patients into the intensive care unit [2].

Obese patients may require surgical intervention; consequently, anesthesiologists are frequently faced with the challenge of effectively managing obese patients who present with distinct pathophysiological features and associated comorbidities[3].

The objective of this work is to evaluate the perioperative anesthetic management of obese patients undergoing surgery in the central operating theater of the Moulay Ismail Military Hospital in Meknes.
The core research questions focus on the specificities of the perioperative anesthetic management of obese subjects within our institution and its compliance with international recommendations from scientific societies.

II. Materials and Methods:

(1) Study design:

This is a descriptive and analytical cross-sectional study with retrospective recruitment, conducted over a 10-month period, evaluating the perioperative anesthetic management of obese patients undergoing surgery in the central operating theater of the Moulay Ismail Military Hospital in Meknes.

(2) Study location:

The central operating theater of the Department of Anesthesiology and Intensive Care at the HMMI Military Hospital in Meknes, from April 1 to January 31, 2025. The facility comprises 8 operating rooms covering the following surgical specialties:

- ENT surgery
- Ophthalmic surgery
- Visceral surgery
- Neurosurgery
- Orthopedic and trauma surgery
- Urological surgery
- Vascular surgery
- Thoracic surgery
- Stomatology and maxillofacial surgery
- Plastic surgery
- Gynecological surgery
- Interventional gastroenterology (ERCP)

(3) Study materials:

To conduct this study, a data collection sheet (Appendix 1) was designed to gather data from pre-anesthetic consultation records, patient medical files, intraoperative anesthesia monitoring sheets, and intensive care unit monitoring sheets. Data were expressed as frequencies, percentages, and means.

(4) Study population:

A series of 50 adult obese patients who underwent a pre-anesthetic consultation was enrolled.

(5) Inclusion Criteria:

Included in our study were all adult patients with BMI >30 kg/m^2 and pediatric subjects with a BMI IMC>97eme percentile on the growth chart, whether known to be obese or diagnosed incidentally during the pre-anesthetic consultation, who underwent elective surgery during the study period.

(6) Exclusion criteria:

Patients not recognized as obese with a BMI< 30 kg/m^2 $ in adults and a BMI< 97eme percentile on the growth chart in pediatric subjects, or those not identified as obese following the pre-anesthetic consultation, as well as patients operated on in the emergency operating theater or managed for bariatric surgery.

(7) Data collection and analysis:

Quantitative techniques were applied, encompassing:

- Verification of the collected data.
- Presentation of data using charts and graphs.
- Statistical evaluation of the data (using Excel).
- Commentary and interpretation of the evaluation data to draw conclusions

(8) Ethical considerations:

Authorization for data collection was obtained from the Health Service Inspectorate of the Royal Armed Forces (number 8101/EMG/ISS) in Rabat on April 18, 2025. Other ethical aspects were also taken into consideration: respect for the anonymity of study participants, respect for the confidentiality of results.

III. Results:

During the study period, 3,200 surgical procedures were performed in the central operating theater of the HMMI.

We collected 50 procedures involving patients with a BMI > 30 kg/m^2 on the growth chart for the pediatric population who met our inclusion criteria, representing an incidence rate of 1.56%.

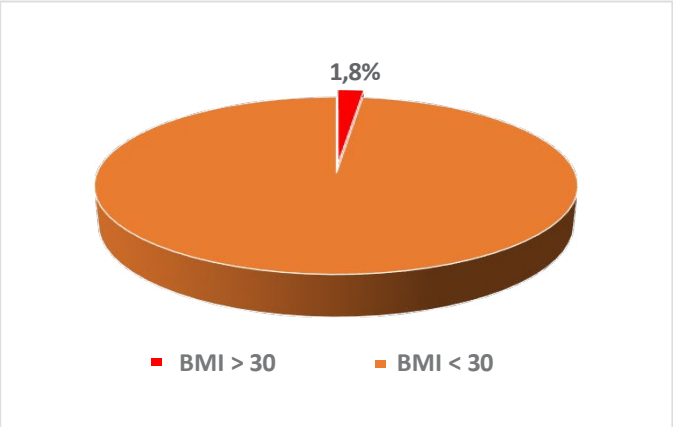

Figure 1: Prevalence of obese patients during our study period

Patient age ranged from 14 to 70 years, with a mean of 39.15 years. The predominant age group was 40 to 60 years, comprising 15 patients (44% of cases). We noted a clear female predominance in our study, with 29 females (59.7%) and 11 males (41%), resulting in a male-to-female sex ratio of 0.61.

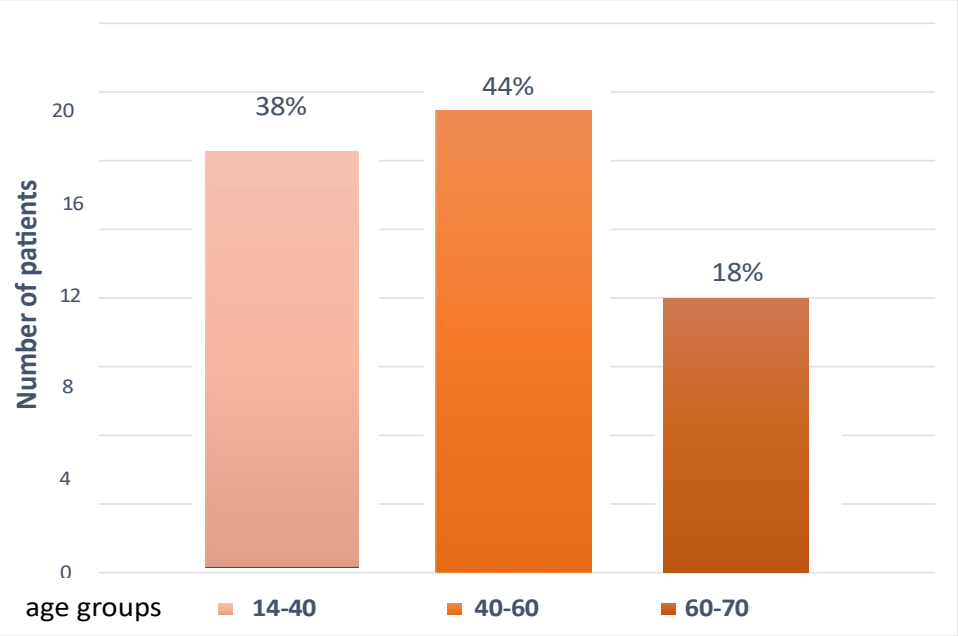

Figure 2: Distribution of patients according to age groups.

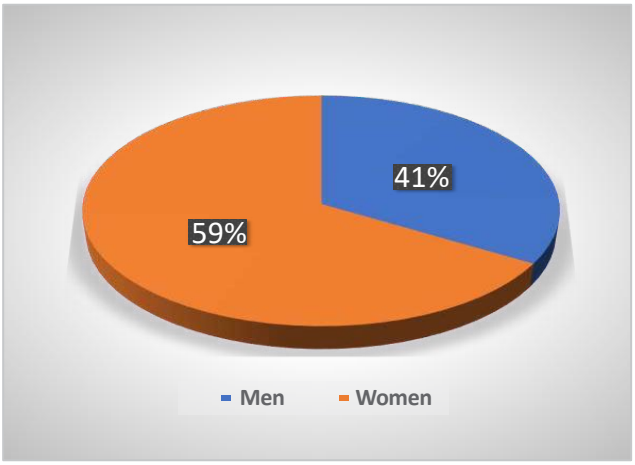

Figure 3: Distribution of patients according to sex.

Patient BMI ranged between 31.1 kg/m^2 and 45 kg/m^2, with a mean of 36.08 kg/m^2. The predominant BMI category was 30 to 34.9 kg/m^2, accounting for 22 patients (44% of cases).

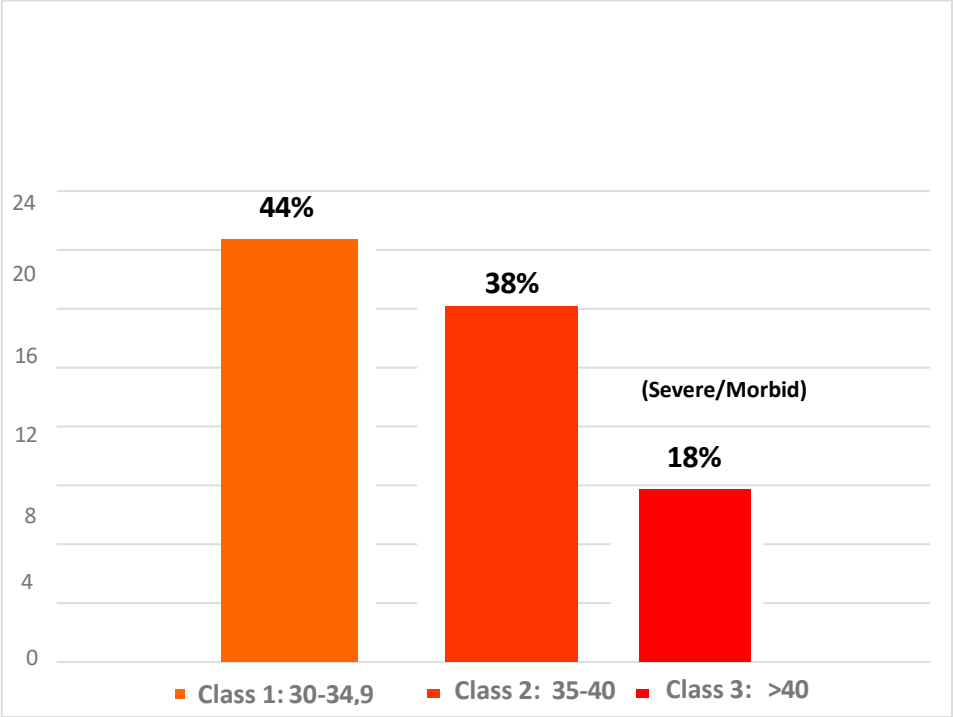

Figure 4: Distribution of patients in our series according to BMI

We found that 24 patients (47%) admitted to the operating theater had specific underlying medical conditions, while no prior history was reported in 18 patients. Dyslipidemia was the most frequently reported comorbidity, present in 21 patients (41.1%). Obstructive sleep apnea (OSA) was suspected or diagnosed in 30% of our series (15 patients). Seven patients were known hypertensives on regular oral antihypertensive treatment and well-controlled. However, hypertension was discovered incidentally during the pre-anesthetic consultation in 3 patients, bringing the total number of hypertensive patients in our series to 13 (26.4%). Diabetes mellitus was found in 12 patients (23.5%), and joint problems were reported in 13 patients (26%). Three patients had coronary artery disease, including one case related to ischemic heart disease sequelae and one case of stable angina, representing 5.8% of cases.

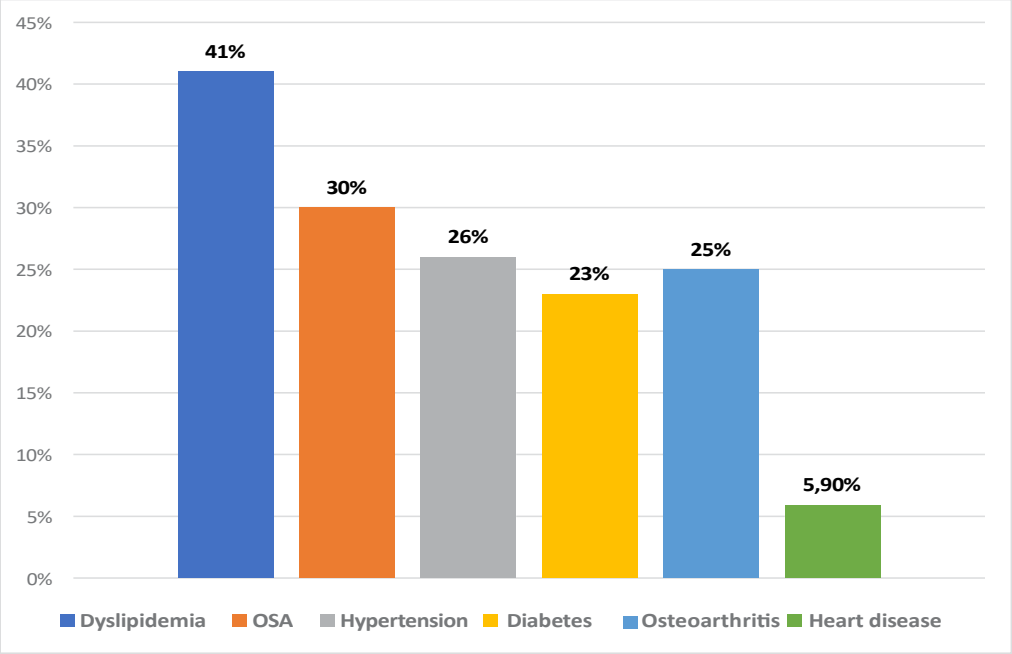

Figure 6: Comorbidities associated with obesity in our series

The majority of surgical procedures performed in overweight subjects involved visceral and orthopedic surgery, accounting for 28 patients (55.8%), while 12 patients underwent gynecological surgery (23.5%) (see Figure 7).

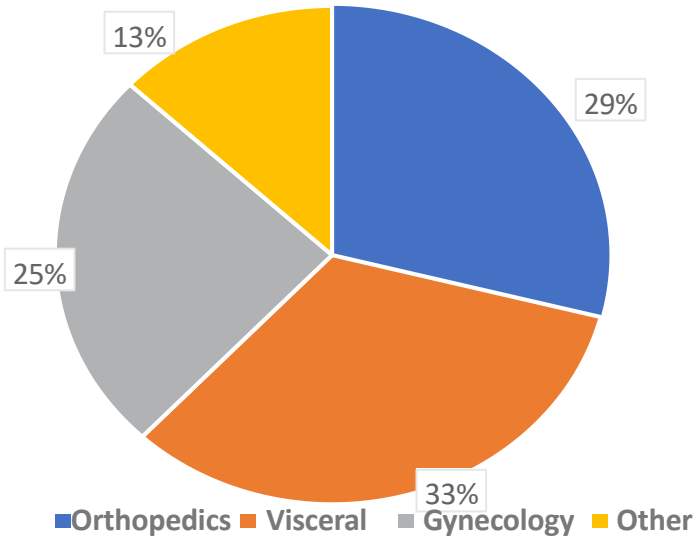

Figure 7: Partition of patients using the type of intervention

General considerations:
Medical history included one case of prior catheter-based stent placement, 6 cases of active smoking, 2 cases of chronic alcoholism, and 7 cases of prior spinal anesthesia for cesarean delivery, all uneventful with straightforward postoperative recovery.

General condition was preserved in all patients. A total of 82% of patients had good peripheral venous access, whereas venous access was difficult in 9 patients.

Preoperative risk evaluation (ASA score) allowed the classification of patients into two groups: ASA I and ASA II, accounting for 47% (24 cases) and 53% (26 cases), respectively. Complete blood count, coagulation profiles, serum ionograms, and renal function tests were normal in all patients.

Airway assessment:
Assessment of the upper airways for predictors of difficult ventilation and/or intubation revealed no history of prior difficult intubation. Mouth opening was normal, and the thyromental distance was normal (>6,5 cm) in all patients. Regarding dental status, 3 patients were edentulous; there were no cases of mandibular protrusion or macroglossia. Cervical spine mobility was limited in 3 patients. One case of a pharyngeal abscess was anticipated to carry a risk of difficult intubation/ventilation.

Mallampati score distribution was as follows: Mallampati I in 14 patients (26.6%), Mallampati II in 16 patients (32.3%), Mallampati III in 12 patients (23.5%), and Mallampati IV in 8 patients (14.7%).

Respiratory assessment:
Dyspnea was identified in 25 cases (50% of patients) of NYHA class I dyspnea, 20 cases (40% of patients) of NYHA class II dyspnea, and 5 cases of NYHA class III dyspnea. 13 cases were strongly suspected of obstructive sleep apnea (based on patient and family interviews), and 3 cases had confirmed obstructive sleep apnea hypopnea syndrome (OSAHS). Furthermore, the STOP-Bang score (a predictive score for sleep apnea) was not systematically performed or mentioned in the medical records. Chest radiography was normal in all patients, and pulmonary function testing was not indicated for our patients.

Cardiovascular assessment:
There was one case of stable angina treated with stent placement 4 years prior, 9 cases of moderate hypertension under treatment, and elevated blood pressure measurements in 5 patients (normal in the others). Electrocardiography (ECG) revealed one case of inferior ST-segment elevation, 5 cases with signs of left ventricular hypertrophy (LVH), 2 cases of incomplete right bundle branch block (RBBB), 36 cases of incomplete left bundle branch block (LBBB), and 36 normal ECGs. Three coronary artery disease patients required specialized consultation for preoperative therapeutic adjustment.

Anesthetic Management:
No premedication was reported in the anesthetic records, and preoperative fasting rules were strictly observed (> 6 hours). Peripheral venous access proved impossible in 4 cases, requiring central venous catheterization. Pre-oxygenation was performed in all patients in the head-up (proclive) position for a minimum duration of 3 minutes.

Regarding airway management (Figure 8), among the 29 cases

under general anesthesia, there were 10 cases of difficult intubation (20% of patients) and 3 cases of impossible intubation (5% of patients). Standard intubation using a Macintosh laryngoscope was performed in 22 patients. Two patients underwent awake fiberoptic intubation, 2 patients were intubated using a video-laryngoscope, and 3 intubations were facilitated with an Eschmann stylet. One patient with a pharyngeal abscess complicated by necrotizing fasciitis, in whom ventilation and intubation were impossible, secured an airway via emergency tracheostomy. Dental breakage involving the upper incisors complicated intubation in one of our patients.

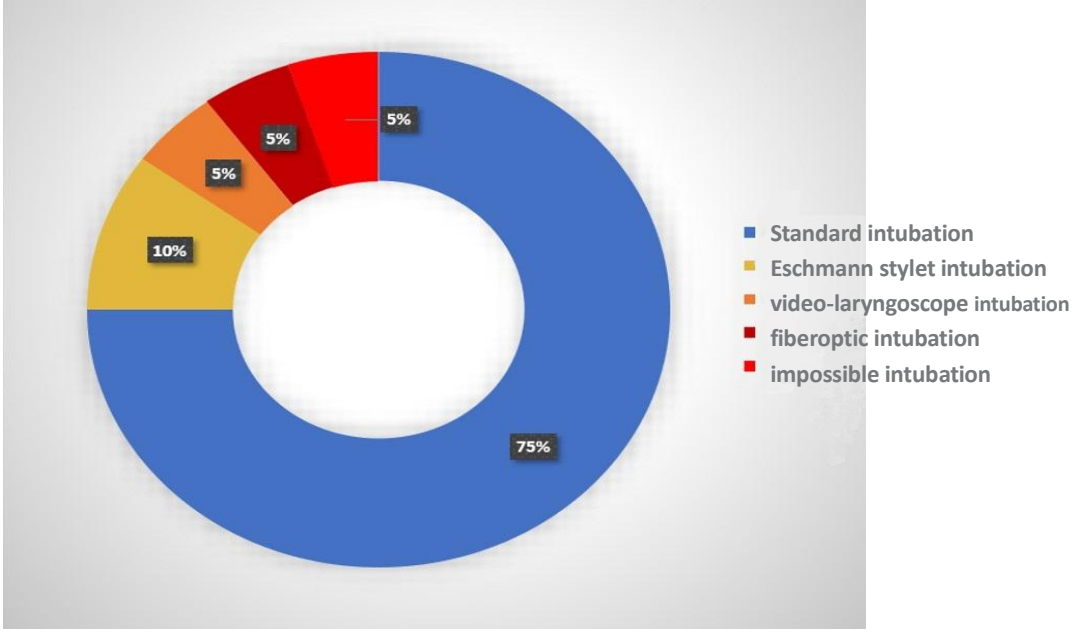

Figure 8: Airway management of the 29 patients.

Perioperative monitoring was standard, including non-invasive blood pressure (NIBP), oxygen saturation, ECG, and capnography for intubated patients. Additional monitoring (invasive blood pressure) was performed in a single case.

General anesthesia was the most common technique used for obese subjects in our study, performed in 29 patients (58%), while regional anesthesia was used in 21 patients (42%). Patients benefited from peripheral nerve blocks and/or epidural analgesia, particularly in orthopedic and/or gynecological surgery (Figure 9).

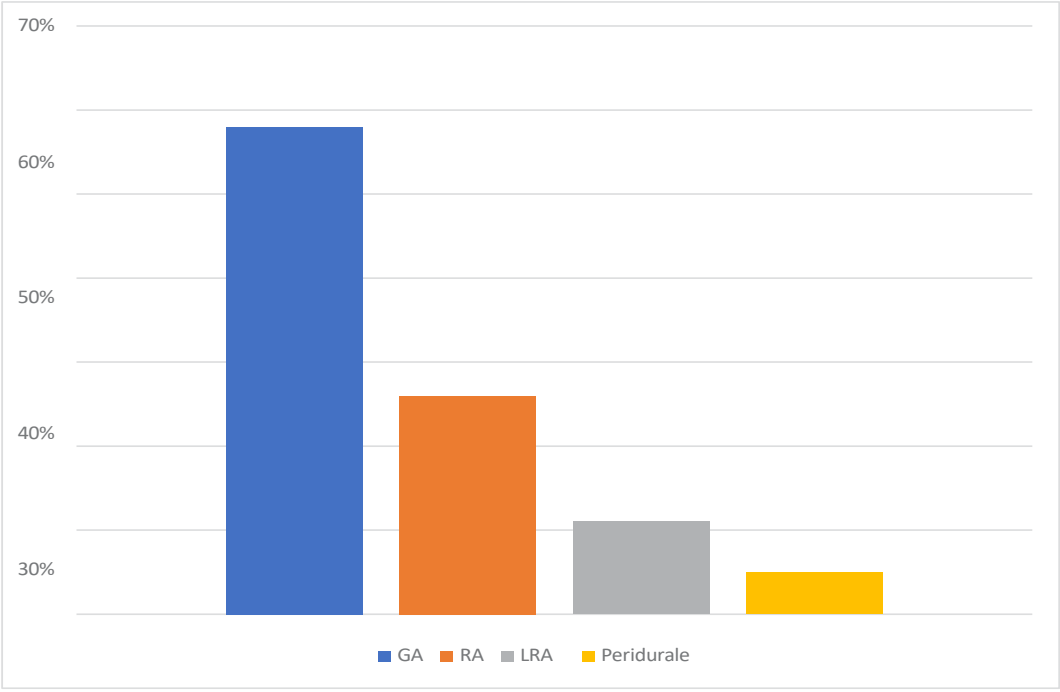

Figure 9: Distribution of patients in our series according to the anesthetic technique.

Postoperative Course:
A total of 82.3% of procedures (41 cases) were uneventful (Figure 10). The main complications were desaturation in 3 patients (5.8% of cases), arterial hypotension (3 cases), a hypertensive surge (1 patient), and favorable bradycardia in one case.

All 29 intubated patients in our series were extubated immediately postoperatively on the operating table once they were reversal-ready (decurarized), conscious, and normothermic. Multimodal analgesia—consisting of paracetamol at 15 mg/kg of ideal body weight plus a single 40 mg dose of nefopam—was predominantly prescribed in 76% of our patients, while 24% received paracetamol alone. In 85% of cases, recovery following general anesthesia was uneventful; the proclive position was maintained, and patients were transferred to the post-anesthesia care unit (PACU) for close monitoring. However, respiratory distress was reported in 5 cases (one of whom was transferred to the intensive care unit for further management), and 6 patients experienced postoperative nausea and vomiting. Patients who received regional and peripheral nerve blocks experienced no postoperative anesthetic complications.

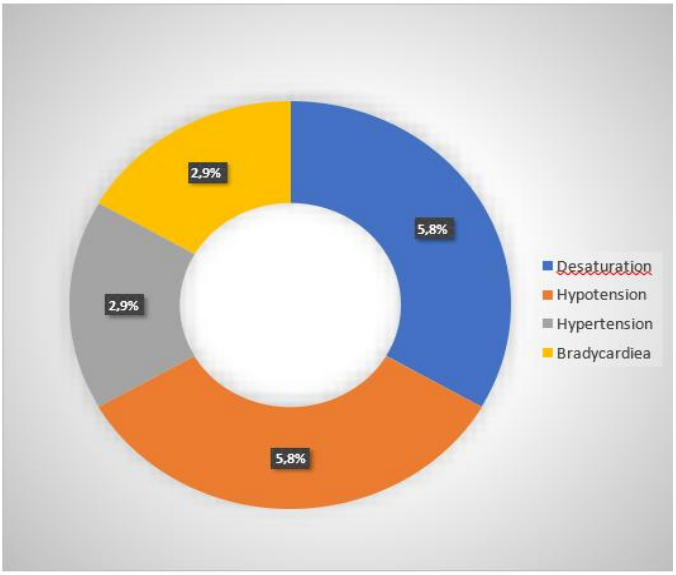

Figure 10: Distribution of intraoperative incidents in our series

Delayed postoperative complications in our series included:
- 8 operated patients (14.7% of cases) developed surgical site (parietal) infections.
- Postoperative peritonitis on day 2 in a 64-year-old female operated on for cholecystitis associated with multi-lithiasic gallbladder; her management consisted of exploratory laparotomy with peritoneal lavage and ICU admission for close monitoring, with a fatal outcome.
- A 68-year-old male orthopedic trauma patient, operated on for femoral neck fracture stabilization via centromedullary nailing, presented with massive pulmonary embolism on day 14 postoperatively.

Evolution progressed to death from multiple organ failure in both fatal cases.

IV. Discussion: 34

LObesity is a major public health problem worldwide due to lifestyle changes, and surgery for obese patients has increased accordingly in recent years [4]. Obesity is associated with comorbidities such as hypertension, diabetes, coronary artery disease, dyslipidemia, obstructive sleep apnea, asthma, osteoarthritis, and others [5–7]. Consequently, it is essential for intensivists to adapt to this new population, which constitutes an ever-growing share of their patients. In Morocco, according to the results of the National Anthropometric Survey (ENA), 10.3 million adult Moroccans are obese and 3.6 million adults suffer from severe obesity [8]. These data must be updated given the age of the study, and this figure will certainly be revised upward due to the socioeconomic changes Morocco is experiencing, changes in dietary habits, the development of transportation means, and industrialization, which have resulted in a significant reduction in physical activity levels, sedentary lifestyles, and substantial weight gains [1,9].

Anesthesia for the obese patient is not common practice in our facility (incidence of 1.56%), a population consisting primarily of women (59.7%), which agrees with results found in other series [1,10–12]. The majority of obese patients in our series were aged between 40 and 60 years (44%), which is close to large studies conducted by Craig M. Hales et al. [12,13] and Emmerich et al. [11]. Dyslipidemia was the major comorbidity in our study, followed by sleep apnea syndrome, arterial hypertension, and diabetes, which corresponds to frequent pathologies in this population [14–16].

The surgeries most frequently found in our hospital were visceral and trauma-orthopedic surgery, perhaps related

to the high frequency of hepatic and biliary pathologies, primarily driven by cholesterol supersaturation of bile, impaired gallbladder emptying, and rapid weight loss [17–21], and osteoarthritis in this population [22,23].

Patient information in our series, given that surgery in the obese is high-risk surgery and following the recommendations of the French National Authority for Health (HAS), is important to better sensitize patients to the most frequent anesthetic risks [24].

There was a correlation between predictive factors for difficult ventilation and/or intubation sought during the pre-anesthesia consultation and cases of difficult intubation (one case of pharyngeal abscess), and Mallampati IV score was found in 14.7% of patients versus 20% of difficult intubation in the field [25]. Measurement of neck circumference was not part of the management parameters during the pre-anesthesia consultation in our facility, yet it allows for predicting difficult intubation with high fidelity [25–27]. No pulmonary function testing was requested for our patients given the absence of formal indication in accordance with current recommendations [28,29].

Screening for obstructive sleep apnea syndrome was a priority during the pre-anesthesia consultation of these patients, relying essentially on the questioning of the patient and their family, constituting a factor in favor of difficult intubation [30,31]. The subjects in our series suffering from OSA were not followed and were mostly diagnosed recently or fortuitously during the pre-anesthesia consultation. Their management requires the initiation of continuous positive airway pressure (CPAP) 2 to 4 weeks before the procedure; although its practice proves effective, it was not implemented during our experience [31,32].

The electrocardiogram (ECG) systematically performed revealed electrical abnormalities for which 2 patients required a specialized consultation, which aligns with international recommendations given the frequency of cardiovascular pathologies in this population. Cardiovascular evaluation remains an unavoidable step in our practice for evaluating perioperative cardiovascular risk, nevertheless, cardiovascular explorations were not requested systematically [33–35].

In our series, our diabetic patients had correct fasting blood glucose levels and HbA1c rates below 7% before the procedure; the biological panels of all patients were normal [34].

The ASA score classifies patients according to their physical status (American Society of Anesthesiologists); half of the patients were at high risk, which joins previous conclusions concerning this high-risk pathology [1,2,12,13].

Premedication is an important part of preoperative management of all patients coming for surgery to alleviate complications like infections, gastrointestinal disturbances, postsurgical pain and anxiety. At least antacid and analgesic premedication should be considered, which was not mentioned in the medical records. However, medication adjustment was necessary for obese coronary patients and for patients under antihypertensive and hypoglycemic treatment [36–38]. Anxiolytics were not administered to avoid respiratory depression resulting from the use of sedatives [32].

Peripheral venous access proved impossible in 8% of cases, for which central venous catheterization was required, a fairly common occurrence in the obese patient [32,39,40].

Airway management is difficult in the obese patient (30% of cases undergoing general anesthesia and 20% of the overall workforce of our series), which implies sufficient preoxygenation, the preparation of a difficult intubation cart, and the presence of an experienced and numerous team [3,25,32,34].

The majority of patients underwent general anesthesia (58%), which may be due to the difficulty of performing locoregional anesthesia in this population, patient refusal, or the nature of the surgery. Given the difficulty of intubation generated by this category of patients, preoxygenation is indispensable for all our patients; it was performed in the head-up (proclive) position and for a minimum duration of 3 minutes [18,20,41]. Induction was performed using a rapid sequence and Sellick maneuver. This conduct was dictated by the significant risk of gastroesophageal reflux with the risk of aspiration.

Anesthetics used were: propofol as the hypnotic of choice in all patients. The available opioid is fentanyl. The muscle relaxant used was Rocuronium. Maintenance was ensured by halogenated agents (mostly sevoflurane over isoflurane). The calculation of ideal and corrected body weight is an entity often omitted in the management of our patients, whereas its adoption is part of the literature recommendations. Our team, conscious of the intra- and postoperative risk of anesthetic agents, favors close monitoring in the PACU.

Ventilation was performed in pressure-controlled mode, in a semi-closed circuit with a respiratory rate between 8 and 12 cycles/min and PEEP adjusted between 5 and 8 cm H2O. Tidal volume was set between 6 ml/kg and 10 ml/kg, and according to hemodynamic monitoring data. The ventilatory management of patients in our series for episodes of desaturation was mostly corrected by the almost systematic application of alveolar recruitment maneuvers whenever plateau pressures were below 30 cmH2O.

In our study, among cases with intraoperative desaturation, 2 cases were caused by bronchospasm. Switching to manual ventilation with 100% FiO2 and deepening anesthesia with endotracheal administration of a bronchodilator (Ventolin) and systemic corticosteroid administration was sufficient to restore normal saturation and correct the increase in pressures.

Monitoring included automated blood pressure measurement with a cuff, electrocardioscope, and pulse oximetry. Complementary monitoring (invasive pressure) was performed in a single case (depending on the intraoperative hemodynamic state), reflecting the rationalization of monitoring means. On the other hand, the non-availability of appropriately sized cuffs in our facility and the use of overly narrow cuffs overestimating blood pressure values were noted. In our study, 3 cases presented an intraoperative hypertensive peak; reinforcement of analgesia and administration of nicardipine were necessary to restore optimal blood pressure.

A significant rate of regional anesthesia was preferred and performed in 42% of patients given its advantages, notably the preservation of upper airways and the good analgesia it provides [36,41].

Special attention was paid by the anesthetic and surgical teams regarding contact zone in this population due to overweight, skin fragility, and associated comorbidities [3,34,42].

Neuromuscular blockade monitoring finds an unavoidable place in this category of patients, which will help reduce the incidence of residual neuromuscular blockade during extubation, particularly in the PACU. However, the absence of instrumental monitoring of neuromuscular blockade and/or reversal was noted. The clinical approach is routine. Otherwise, the literature highlights the interest of anticipating the risk of residual blockade by making Sugammadex—a rocuronium antagonist—immediately available for possible emergency use. This product is rarely available due to its cost.

The awakening of our patients took place without incidents in 85% of cases in the PACU; 15% of patients in our study presented respiratory complications, a frequent complication in these patients of multifactorial origin [38,42,43]. Indeed, 4 incidents of respiratory failure in the PACU, i.e., 8.8% of our patients, benefited from non-invasive ventilation (NIV) sessions for two hours, with a notion of worsening in one case who was reintubated and transferred to the ICU for management of postoperative ARDS.

Postoperative nausea and vomiting were also frequent in our study (12% of patients), probably related to gastroparesis in our diabetic patients [38].

Regarding surgical complications in our series, we recorded one case of postoperative peritonitis requiring surgical re-exploration via laparotomy, and 6 cases whose postoperative courses were marked by surgical site infection. Our series recorded two deaths, i.e., 4% of the patients in our study. The first death resulted from a massive pulmonary embolism 14 days after the procedure. The second death in our series was related to postoperative peritonitis, which evolved into multiorgan failure from septic shock.

Among the main problems encountered in the management of the obese patient in our study is the absence of specific material means dedicated to the management of the obese patient in the operating room, and the lack of expertise among paramedical personnel in managing the obese patient, who therefore cannot take appropriate steps to address problems encountered in this population. This requires collaboration between surgeons and anesthetists, who must take into consideration the pathophysiological particularities of this population category to ensure optimal management and avoid perioperative complications that frequently occur in this type of patient.

V. Limitations:

Our study has several limitations that should be taken into account when interpreting the results:
It is a single-center study, conducted in one bloc central, which restricts the applicability of the conclusions to other clinical situations. Furthermore, even if the sample size (50 patients) is acceptable, it remains too small to perform detailed analyses according to clinical or pathological subgroups.

In addition, the lack of a personalized assessment for each patient makes it impossible to verify whether certain specific complications are linked to the terrain, the surgery, the anesthetic management or the postoperative care in the surgical department.

Finally, it would also be advisable for each medical institution to conduct a study tailored to its context, over a longer period with a larger sample, which will allow a better approach to this population in our context of a developing country.

VI. Conclusion:

Obesity, which is growing rapidly worldwide, is increasingly encountered in anesthesia. However, it is a situation that associates significant comorbidities, and the obese patient presents an increased anesthetic risk for several reasons. First, from a respiratory standpoint, difficulties are encountered in ventilating and controlling the upper airways. Furthermore, the higher frequency of gastroesophageal reflux in obese individuals increases their risk of aspiration during anesthetic induction. Sleep apnea syndrome sometimes complicates the postoperative period. An adaptation to the physiology of the obese patient is necessary in the choice of drugs and their dosage. It is also possible to observe an increased risk of infection, particularly respiratory, and slower wound healing, as it is known that despite the absence of hypoxia, tissue oxygenation is often insufficient in obese patients for optimal healing. Finally, an increased thromboembolic risk is noted.

A preoperative evaluation focused on the complications of excess weight should enable an adapted perioperative strategy. Preoperatively, certain dangerous situations associated with obesity must be mitigated, in particular sleep apnea syndrome managed beforehand with continuous

positive airway pressure, gastroesophageal reflux prevented by antihistamines, and patient positioning carried out with particular care in the head-up (proclive) position.

Both anesthetic techniques carry risks, but when possible, locoregional anesthesia is more appealing. On the other hand, if general anesthesia is required, the technique must include rapid sequence induction using drugs with a rapid onset and short duration of action, taking into account their volume of distribution and elimination half-life, along with proper ventilation. Postoperative epidural analgesia provides superior quality, and thromboembolic prevention with low-molecular-weight heparin is necessary.

The anesthetic team of the Moulay Ismail Military Hospital is aware of the risks and the challenge represented by the anesthetic management of this category of patients. Nevertheless, this work has helped highlight our shortcomings in managing these patients, particularly the need to acquire certain monitoring tools and apply specific recommendations dictated by scientific societies.

➢ **Consent for publication:**

1. The authors declare that they have no competing interests regarding the publication of this paper.
2. All authors of the manuscript have read and agreed to its content and are accountable for all aspects of the accuracy and integrity of the manuscript.

➢ **Ethical Approval and Consent to participate:**

Not applicable.

➢ **Competing interests:**

The authors declare the absence of any conflict of interest.

➢ **Funding**

Not applicable.

References

1. Phelps NH, Singleton RK, Zhou B, Heap RA, Mishra A, Bennett JE, et al. Worldwide trends in underweight and obesity from 1990 to 2022: a pooled analysis of 3663 population-representative studies with 222 million children, adolescents, and adults. The Lancet. 2024;403(10431):1027–1050.
2. Obesity: Health consequences of being overweight. https://www.who.int/news-room/questions-and-answers/item/obesity-health-consequences-of-being-overweight. Accessed 23 July 2026.
3. Seyni-Boureima R, Zhang Z, Antoine MMLK, Antoine-Frank CD. A review on the anesthetic management of obese patients undergoing surgery. BMC Anesthesiol. 2022;22:98.
4. Heterogeneous contributions of change in population distribution of body mass index to change in obesity and underweight. eLife.10:e60060.
5. Kim S-H, Sutherland ER, Gelfand EW. Is there a link between obesity and asthma? Allergy Asthma Immunol Res. 2014;6(3):189–195.
6. Ahmed SK, Mohammed RA. Obesity: Prevalence, causes, consequences, management, preventive strategies and future research directions. Metabolism Open. 2025;27:100375.
7. CDC. Consequences of Obesity. Obesity. 2026. https://www.cdc.gov/obesity/php/about/consequences.html. Accessed 26 July 2026.
8. Gauthier C. Les Cahiers du Plan N° 43 - Mars / Avril 2013. Site institutionnel du Haut-Commissariat au Plan du Royaume du Maroc. https://www.hcp.ma/Les-Cahiers-du-Plan-N-43-Mars-Avril-2013_a1248.html. Accessed 26 July 2026.
9. NCD Risk Factor Collaboration (NCD-RisC). Diminishing benefits of urban living for children and adolescents' growth and development. Nature. 2023;615(7954):874–883.
10. Cooper AJ, Gupta SR, Moustafa AF, Chao AM. Sex/Gender Differences in Obesity Prevalence, Comorbidities, and Treatment. Curr Obes Rep. 2021;10(4):458–466.
11. Emmerich SD, DMV, Fryar CD, MSPH, Stierman B, MD, et al. Produits - Fiches d'information - Numéro 508 - Septembre 2024. 2024. doi:10.15620/cdc/159281.
12. Hales CM, Carroll MD, Fryar CD, Ogden CL. Prevalence of Obesity Among Adults and Youth: United States, 2015-2016. NCHS Data Brief. 2017;(288):1–8.
13. Hales CM, Carroll MD, Fryar CD, Ogden CL. Prevalence of Obesity and Severe Obesity Among Adults: United States, 2017-2018. NCHS Data Brief. 2020;(360):1–8.
14. Feingold KR. Obesity and Dyslipidemia. In: Feingold KR, Adler RA, Ahmed SF, Anawalt B, Blackman MR, Chrousos G et al., editors. Endotext. 2000. South Dartmouth (MA). MDText.com, Inc. http://www.ncbi.nlm.nih.gov/books/NBK305895/. Accessed 26 July 2026.
15. Bays HE, Kirkpatrick CF, Maki KC, Toth PP, Morgan RT, Tondt J, et al. Obesity, dyslipidemia, and cardiovascular disease: A joint expert review from the Obesity Medicine Association and the National Lipid Association 2024. Journal of Clinical Lipidology. 2024;18(3):e320–e350.
16. Vekic J, Stefanovic A, Zeljkovic A. Obesity and Dyslipidemia: A Review of Current Evidence. Curr Obes Rep. 2023;12(3):207–222.
17. Chan W-K, Chuah K-H, Rajaram RB, Lim L-L, Ratnasingam J, Vethakkan SR. Metabolic Dysfunction-Associated Steatotic Liver Disease (MASLD): A State-of-the-Art Review. J Obes Metab Syndr. 2023;32(3):197–213.
18. Mori K, Akiyama Y, Tanaka M, Sato T, Endo K, Hosaka I, et al. Deciphering metabolic dysfunction-associated steatotic liver disease: insights from predictive modeling and clustering analysis. J Gastroenterol Hepatol. 2024;39(7):1382–1393.
19. Zahra N. Link of obesity and gallstones formation risk. AOWMC. 2019;9(5):118–120.
20. Parra-Landazury NM, Cordova-Gallardo J, Méndez-Sánchez N. Obesity and Gallstones. Visc Med. 2021;37(5):394–402.
21. Banut D, Banut C. Obesity as a Risk Factor for Biliary Lithiasis - Clinical Study. Applied Medical Informatics. 2009;24(1, 2):53–58.
22. Nedunchezhiyan U, Varughese I, Sun AR, Wu X,

Crawford R, Prasadam I. Obesity, Inflammation, and Immune System in Osteoarthritis. Front Immunol. 2022;13:907750.
23. Yao Z, Qi W, Zhang H, Zhang Z, Liu L, Shao Y, et al. Down-regulated GAS6 impairs synovial macrophage efferocytosis and promotes obesity-associated osteoarthritis. Elife. 2023;12:e83069.
24. Belgacem B, Gerbaud L, Gonnu Levallois S. Les indicateurs d'une bonne anesthésie retenus par la HAS. Oxymag. 2018;31(158):8–11.
25. Brodsky JB, Lemmens HJM, Brock-Utne JG, Vierra M, Saidman LJ. Morbid obesity and tracheal intubation. Anesth Analg. 2002;94(3):732–736; table of contents.
26. Sheff SR, May MC, Carlisle SE, Kallies KJ, Mathiason MA, Kothari SN. Predictors of a difficult intubation in the bariatric patient: does preoperative body mass index matter? Surgery for Obesity and Related Diseases. 2013;9(3):344–349.
27. Brodsky JB, Lemmens HJM, Brock-Utne JG, Vierra M, Saidman LJ. Morbid obesity and tracheal intubation. Anesth Analg. 2002;94(3):732–736; table of contents.
28. Wood G. Quand et à qui prescrire des explorations fonctionnelles respiratoires dans un bilan préopératoire ? Progrès en Urologie - FMC. 2017;27(3):F54–F56.
29. 10.1016/s0246-0289(22)42102-5.CrossRef Listing of Deleted DOIs. 2000. doi:10.1016/s0246-0289(22)42102-5.
30. Myatt J, Haire K. Airway management in obese patients. Current Anaesthesia & Critical Care. 2010;21(1):9–15.
31. Campion S, Langeron O. Prise en charge périopératoire du syndrome d'apnée obstructive du sommeil de l'adulte. Le Praticien en Anesthésie Réanimation. 2012;16(5):271–276.
32. Adams JP, Murphy PG. Obesity in anaesthesia and intensive care. British Journal of Anaesthesia. 2000;85(1):91–108.
33. Wanahita N, Messerli FH, Bangalore S, Gami AS, Somers VK, Steinberg JS. Atrial fibrillation and obesity--results of a meta-analysis. Am Heart J. 2008;155(2):310–315.
34. Nightingale CE, Margarson MP, Shearer E, Redman JW, Lucas DN, Cousins JM, et al. Peri-operative management of the obese surgical patient 2015. Anaesthesia. 2015;70(7):859–876.
35. Lavie CJ, Milani RV, Ventura HO. Obesity and cardiovascular disease: risk factor, paradox, and impact of weight loss. J Am Coll Cardiol. 2009;53(21):1925–1932.
36. Nightingale CE, Margarson MP, Shearer E, Redman JW, Lucas DN, Cousins JM, et al. Peri-operative management of the obese surgical patient 2015. Anaesthesia. 2015;70(7):859–876.
37. Varbanova M, Maggard B, Lenhardt R. Preoperative preparation and premedication of bariatric surgical patient. Saudi J Anaesth. 2022;16(3):287–298.
38. Seyni-Boureima R, Zhang Z, Antoine MMLK, Antoine-Frank CD. A review on the anesthetic management of obese patients undergoing surgery. BMC Anesthesiol. 2022;22:98.
39. Clech C, Gonzalez F, Cohen Y. Prise en charge des patients obèses en réanimation: aspects techniques. Réanimation. 2006;15(6):445–448.
40. Nafiu OO, Burke C, Cowan A, Tutuo N, Maclean S, Tremper KK. Comparing peripheral venous access between obese and normal weight children. Paediatr Anaesth. 2010;20(2):172–176.
41. Nielsen KC, Guller U, Steele SM, Klein SM, Greengrass RA, Pietrobon R. Influence of obesity on surgical regional anesthesia in the ambulatory setting: an analysis of 9,038 blocks. Anesthesiology. 2005;102(1):181–187.
42. Carron M, Safaee Fakhr B, Iepparielloo G, Foletto M. Perioperative care of the obese patient. Br J Surg. 2020;107(2):e39–e55.
43. Hodgson LE, Murphy PB, Hart N. Respiratory management of the obese patient undergoing surgery. Journal of Thoracic Disease. 2015;7(5). doi:10.3978/j.issn.2072-1439.2015.03.08.