

FEATURES OF ANESTHESIA AND ANALGESIA IN SURGICAL TREATMENT OF PATIENTS WITH MORBID OBESITY

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ABSTRACT

Morbid obesity is a significant pathological condition that considerably complicates anesthesia and analgesia during surgical treatment. Patients in this category exhibit pronounced anatomical and physiological changes, such as reduced functional residual lung capacity, increased airway resistance, cardiovascular disorders, and a higher likelihood of gastroesophageal reflux, all of which significantly elevate the risks of perioperative complications.

This article presents current data on key aspects of preoperative preparation, including risk stratification and patient optimization. It discusses the specific features of selecting and applying induction and maintenance anesthesia methods, considering altered pharmacokinetics and pharmacodynamics. Particular attention is given to intraoperative monitoring, including respiratory function and hemodynamic management, and the use of regional analgesia techniques.

The importance of a multidisciplinary approach to perioperative management of morbidly obese patients is emphasized, aimed at minimizing complications and improving the efficacy of anesthetic support. The findings can help improve clinical outcomes in this patient category.

Keywords: Morbid obesity, anesthesia, analgesia, perioperative preparation, pharmacokinetics, regional analgesia, intraoperative monitoring, respiratory function, multidisciplinary approach, surgical treatment.

INTRODUCTION

Morbid obesity, characterized by a body mass index (BMI) of ≥ 40 kg/m² or ≥ 35 kg/m² in the presence of comorbidities, represents a global healthcare challenge. Anesthetic management of patients with this pathology requires consideration of numerous factors, including changes in anatomical and physiological parameters, pharmacokinetics, and pharmacodynamics of drugs, as well as the high risk of perioperative complications. This article reviews key aspects of anesthesia and analgesia in morbidly obese patients.

Global Operative-Anesthetic Risks in Morbid Obesity Surgery

The risks can be grouped as follows:

1. "Difficult" airways.
2. Pulmonary issues.
3. Increased risk of aspiration.
4. Altered pharmacokinetics of anesthetic drugs.
5. Surgical technical challenges.
6. Increased risk of bleeding.

Obesity and Pharmacokinetics

- 1. Absorption:** Unpredictable with intramuscular and subcutaneous drug administration.
- 2. Volume of Distribution (Vd):** Increased, especially for lipophilic drugs.
- 3. Metabolism:** Phases 1 and 2 of hepatic elimination are unchanged or enhanced. Metabolism may reduce with fatty liver, cirrhosis, intra-abdominal hypertension syndrome, reduced cardiac output, and hepatic blood flow.
- 4. Excretion:** Renal blood flow, glomerular filtration rate, secretion, and clearance are increased. Renal dysfunction or acute kidney injury may develop, requiring extracorporeal therapy under conditions of intra-abdominal hypertension and severe rhabdomyolysis.

Preoperative Preparation

Preoperative preparation involves a thorough assessment of the patient's functional state with a focus on respiratory and cardiovascular systems. Key considerations include:

1. Respiratory System: Obese patients often exhibit hypoventilation, reduced functional residual lung capacity, and obstructive sleep apnea syndrome (OSAS). Spirometry and, if needed, polysomnography are essential.

2. Cardiovascular System: Hypertension, heart failure, and ischemic heart disease are prevalent, necessitating echocardiography and stress testing.

3. Gastrointestinal Risks: Increased aspiration risk requires premedication with proton pump inhibitors and prokinetics.

Minimal premedication is advised to avoid respiratory depression. Patient education on deep breathing techniques and positioning to reduce hypoxemia risk is emphasized. Premedication typically includes atropine 0.1% at 0.004-0.008 mg/kg, fentanyl at 0.8-1.2 µg/kg, and diazepam at 0.08-0.12 mg/kg.

Induction and Maintenance of Anesthesia

Induction of anesthesia in morbidly obese patients involves challenges, including airway patency and tracheal intubation difficulties.

Induction Methods:

- Use of short half-life drugs like propofol, mivacurium, or atracurium, considering altered pharmacokinetics.
- Videolaryngoscopy to facilitate intubation.

Maintenance of Anesthesia:

- Inhalation Anesthetics: Sevoflurane and desflurane are preferred due to minimal impact on respiratory function.
- Total Intravenous Anesthesia (TIVA): Fentanyl-based TIVA may be an alternative due to its rapid metabolic elimination.

Monitoring includes capnography, oxygen saturation control, invasive arterial pressure measurement, and cardiac output monitoring.

Postoperative Analgesia

Effective postoperative pain management is crucial for recovery. Recommended approaches include:

- 1. Regional Analgesia:** Epidural or spinal anesthesia reduces systemic opioid requirements and minimizes respiratory complications.
- 2. Multimodal Analgesia:** Combining NSAIDs, paracetamol, and local anesthetics reduces opioid dosage.
- 3. Respiratory Function Control:** Non-invasive ventilation methods and careful monitoring prevent hypoventilation.

Features of the Multidisciplinary Approach

Management of morbidly obese patients requires close collaboration among surgeons, anesthesiologists, intensivists, and postoperative rehabilitation specialists. Key objectives include:

- Minimizing perioperative complications.
- Optimizing drug selection based on individual patient characteristics.
- Ensuring early mobilization and prevention of thromboembolic complications.

Study Findings

The study included 40 patients (ages 25-50, ASA III-IV) with morbid obesity (BMI 41-89 kg/m²) undergoing bariatric surgery. Patients were divided into two groups based on anesthesia methods:

1. Group 1: 20 patients underwent combined anesthesia with high thoracic epidural blockade and low-dose sevoflurane inhalation.
2. Group 2: 20 patients received standardized balanced endotracheal anesthesia.

Tab 1 Characteristics of Patients:

Indicator	group 1	group 2
Age, years	39±4,2	35±8,4
Gender (m/f)	6/14	5/15
Body weight, kg (M±SD)	137,5±39,1	140±26,9
Height, cm (M±SD)	164,5±7,5	169,5±7,5
Body mass index (BMI), kg/m ² (M±SD)	51±12,9	52±10,3
ASA III, %	80%	80%
ASA IV, %	20%	20%
Arterial hypertension,%	93,4%	93,4%
Operation duration, min (M±SD)	65±22,6	62±24,2

- Similar average age, weight, and BMI across groups.
- Most patients underwent the first stage of surgical treatment—gastric banding and/or ileal bypass surgery (70% in both groups).

The second stage of treatment for morbid obesity - dermatolipectomy with abdominoplasty and/or hernia repair with hernia repair - was performed in 30% of patients in group 1; in the 2nd – 30% of patients.

Tab 2 Indicators of hemodynamics and gas exchange in the perioperative period.

Indicator/ stage	Before surgery		After 15 minutes		Middle operation		End of operation	
	1st group	2nd group	1st group	2nd group	1st group	2nd group	1st group	2nd group
BP system, mmHg	158 (150-165)	159 (140-160)	140 (130-140)*	130 (130-140)	120 (120-120)*	130 (120-140)	120 (110-130)*	130 (120-130)
BP diast, mmHg	100 (80-100)	100 (80-100)	80 (80-80)	80 (70-80)	80 (60-80)	70 (70-80)	80 (60-80)	70 (60-80)
Heart rate, min-1	83 (78-92)	82 (78-88)	83 (78-90)	81 (74-86)	80 (74-88)	80 (72-85)	82 (80-85)	80 (78-85)
SpO2,%	98 (96-100)	96 (96-100)	96 (96-99)	95 (94-97)	96 (96-100)	95 (95-97)	96 (96-100)	96 (95-97)
EtCO2, mmHg	39 (36-41)	37 (35-40)	39 (37-40)	38 (36-40)	40 (37-41)	38 (37-40)	40 (37-42)	39 (37-40)

Table 3: Indicators of acid-base balance in the perioperative period.

Indicator	Before surgery		Main stage of surgery		After surgery		One day after the operation.	
	1st group	2nd group	1st group	2nd group	1st group	2nd group	1st group	2nd group
pH	7,37 (7,34;7,39)	7,37 (7,35;7,37)	7,35 (7,32;7,36)	7,35 (7,31; 7,35)	7,29 (7,24; 7,31)	7,29 (7,25; 7,32)	7,36 (7,33; 7,37)	7,36 (7,32; 7,37)
pCO2, mmHg	52,1 (47;55,2)	50,1 (44,5;52,6)	48,7 (43; 54,3)	45,2 (41,2; 51,2)	47,7 (40,5; 55)	49,7 (44,5; 52,9)	43,1 (39,2; 46,1)	41,9 (37,2; 51,8)
pO2, mmHg	29,9 (24,6; 33,7)	30,9 (25,67; 36,2)	42,8 (36,4; 48,1)	43,2 (37,6; 51,8)	36,7 (32,8; 40,2)	34,5 (28,3; 42,6)	34,6 (29,1; 43,2)	37,6 (25,6; 51,1)
HCO3, mol/L	25,9 (23,6; 26,4)	24,8 (23,7; 26,2)	23,7 (22,4; 24,6)	22,65 (21,2; 24,2)	20,1 (18,1; 22,6)	20,1 (18,9; 21,8)	21,7 (20,4; 23,5)	22,2 (20,5; 24,3)
Lactate, mol/L	1,35* (1;2,1)	1,1 (1,1;1,9)	1,35* (1,1;1,9)	1,6 (1,3;1,9)	1,65* (1,1;2,1)	1,8 (1,4;2,1)	1,4* (1,2;1,7)	1,85* (1,5;2,3)
Glucose, mol/L	5,8 (5,3;6,6)	5,25 (4,8;6,3)	6,2 (5,2;7,9)	6,8 (5,9;7,6)	7,15 (6,4;9,2)	7,25 (6,2;8,4)	6,25 (5,4;6,9)	6,3 (5,6;6,9)

Blood gas, acid-base balance and lactate parameters in the preoperative period in both groups were characterized by moderately pronounced hypercapnia, moderate respiratory acidosis compensated by moderate metabolic alkalosis.

In the course of the operation acid-base balance indices underwent changes associated with the accumulation of acidic components in the blood, which was reflected by a decrease in HCO3 level, depletion of blood buffer capacity and increase in lactate, statistically significantly expressed in group 2 patients, with subsequent normalization of these indices a day after the operation.

Table 3: Indicators characterizing early postoperative rehabilitation of patients

Indicator	1st group	2nd group
Eye opening, min	6 (4;8)*	29 (20;38)
Effective spontaneous breathing, min	7 (6;8)*	73,5 (45;130)
Extubation, min	9 (8;10)*	80 (50;140)
Pain level according to VAS, points	0-1	3-6
Bromage motor block level, degree	0	0

In group 1, spontaneous breathing was restored 6 minutes after the end of the operation and extubation was performed on the operating table in 9 (8;10) minutes, respectively, prolonged artificial ventilation was not required. At the same time, the level of postoperative pain on the operating table according to VAS was minimal 0-1 points. At high quality of sensory block, the level of motor block on the Bromage scale was equal to zero.

In group 2, postoperative rehabilitation of patients required prolonged artificial lung ventilation, as the recovery of spontaneous breathing came after 73.5 (45;130) minutes, extubation was possible only after 80 (50;140) minutes, with the level of postoperative pain 3-6 points on VAS.

CONCLUSION

1. Anesthesia for morbidly obese patients requires an individualized approach based on a deep understanding of anatomical and physiological characteristics and risks.
2. Modern methods of induction, maintenance, and multimodal analgesia combined with an effective multidisciplinary approach significantly improve surgical outcomes.
3. Multicomponent balanced endotracheal anesthesia is an effective method of anesthesiological support of patients with morbid obesity, but it does not allow early postoperative rehabilitation of patients and requires prolonged artificial ventilation.
4. Combined anesthesia based on ketamine, combined with thoracic epidural anesthesia with 0.2-0.5% nrapine solution, as well as inhalation of low doses of sevoflurane in the gas-drug mixture is the most effective technique of antinociceptive protection in surgical treatment of patients with morbid obesity of III-IV classes according to ASA, provides effective early postoperative rehabilitation of patients and high-quality postoperative analgesia.

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