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IMPACT OF METABOLIC SYNDROME ON ANESTHESIA COURSE AND PERIOPERATIVE OUTCOMES IN SURGICAL PATIENTS

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Abstract

Metabolic syndrome is one of the most significant risk factors for perioperative complications in patients undergoing anesthesia. The combination of abdominal obesity, insulin resistance, arterial hypertension, and dyslipidemia creates an adverse metabolic background that significantly affects the pharmacokinetics and pharmacodynamics of anesthetic agents, hemodynamic stability, and the incidence of postoperative complications.

The aim of this study was to analyze the impact of metabolic syndrome on the course of anesthesia, intraoperative hemodynamic stability, and early postoperative outcomes. Particular attention was given to cardiovascular responses to anesthetic agents, the need for vasoactive support, and the risk of metabolic and respiratory complications.

It was shown that patients with metabolic syndrome more frequently experience intraoperative hypotension, reduced responsiveness to vasopressors, and more pronounced impairment of tissue perfusion. In addition, an increased risk of postoperative insulin resistance, hyperglycemia, and delayed recovery of consciousness was observed. The findings emphasize the need for an individualized anesthetic approach considering the patient's metabolic status.

Keywords

metabolic syndrome, anesthesia, insulin resistance, obesity, intraoperative hypotension, anesthetic pharmacodynamics, hemodynamic instability, perioperative risk, vasopressors, postoperative complications, critical care, anesthetic management

INTRODUCTION

Metabolic syndrome is a cluster of interrelated metabolic disorders, including abdominal obesity, insulin resistance, arterial hypertension, and dyslipidemia. Its prevalence continues to increase, making it a major public health issue, including in anesthesiology and intensive care medicine.

Patients with metabolic syndrome belong to a high perioperative risk group. Disturbances in carbohydrate and lipid metabolism, endothelial dysfunction, and

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chronic systemic inflammation reduce cardiovascular adaptive capacity and alter responses to anesthetic agents. This manifests as hemodynamic instability, increased susceptibility to hypoxia, and altered requirements for vasoactive and fluid therapy.

Of particular importance is the influence of metabolic syndrome on the pharmacokinetics and pharmacodynamics of anesthetic drugs. These patients demonstrate altered distribution volumes for lipophilic agents, delayed metabolism, and unpredictable clinical responses to standard dosing. This necessitates careful preoperative assessment and individualized anesthetic management.

The aim of the study was to evaluate the impact of metabolic syndrome on the course of anesthesia, intraoperative hemodynamic parameters, and early postoperative outcomes in surgical patients.

MATERIALS AND METHODS

A prospective study included 110 patients undergoing elective and emergency surgical procedures under general anesthesia. All patients were divided into two groups:

- Group I — patients with metabolic syndrome (n = 55)
- Group II — patients without metabolic syndrome (n = 55)

Metabolic syndrome was diagnosed according to the International Diabetes Federation (IDF) criteria, including abdominal obesity combined with at least two additional components (hyperglycemia, arterial hypertension, hypertriglyceridemia, or reduced HDL levels).

The following parameters were assessed:

- mean arterial pressure (MAP)
- frequency of intraoperative hypotension episodes
- requirement for vasopressor support
- perioperative blood glucose levels
- doses of anesthetic agents and muscle relaxants
- time to emergence from anesthesia
- incidence of early postoperative complications

Monitoring was performed using standard intraoperative methods (non-invasive and invasive blood pressure measurement, ECG, pulse oximetry, capnography, and urine output monitoring).

Statistical analysis was performed using Student's t-test and the χ^2 test. Differences were considered statistically significant at $p < 0.05$.

RESULTS

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The study demonstrated that patients with metabolic syndrome (MS) exhibit more pronounced hemodynamic instability during anesthesia, increased need for vasopressor support, and slower recovery after anesthesia. In addition, this group of patients more frequently experienced episodes of intraoperative hypotension and hyperglycemia.

Table 1. Intraoperative hemodynamic parameters

Parameter	MS (+) (n=55)	MS (−) (n=55)	p
MAP, mmHg	68.4 ± 7.1	74.2 ± 6.3	<0.01
Hypotensive episodes, n (%)	31 (56.4%)	14 (25.5%)	<0.01
Vasopressor requirement, n (%)	28 (50.9%)	12 (21.8%)	<0.01

Patients with metabolic syndrome demonstrated significantly reduced blood pressure stability and a higher frequency of vasopressor use.

Table 2. Perioperative metabolic parameters

Parameter	MS (+) (n=55)	MS (−) (n=55)	p
Fasting glucose, mmol/L	7.8 ± 1.6	5.4 ± 1.1	<0.001
Intraoperative hyperglycemia, n (%)	33 (60.0%)	10 (18.2%)	<0.001
Insulin resistance (HOMA-IR)	4.9 ± 1.3	2.6 ± 0.8	<0.001

A significant increase in blood glucose levels and marked insulin resistance were observed in patients with metabolic syndrome, contributing to impaired adaptation to surgical stress.

Table 3. Postoperative recovery parameters

Parameter	MS (+) (n=55)	MS (−) (n=55)	p
Time to awakening, min	24.6 ± 6.8	17.3 ± 5.2	<0.01
Postoperative complications, n (%)	19 (34.5%)	8 (14.5%)	<0.05
Length of hospital stay, days	8.7 ± 2.1	6.3 ± 1.8	<0.01

Patients with metabolic syndrome showed delayed recovery of consciousness, higher complication rates, and prolonged hospitalization.

CONCLUSIONS

1. Metabolic syndrome is associated with increased intraoperative hemodynamic instability.
2. Patients with MS more frequently experience hypotensive episodes and require greater vasopressor support.
3. Disturbances in carbohydrate metabolism and insulin resistance intensify the surgical stress response.
4. Metabolic syndrome increases postoperative complication rates and delays recovery from anesthesia.
5. Patients with MS require an individualized anesthetic approach and enhanced perioperative monitoring.

CONCLUSION

Metabolic syndrome is a significant perioperative risk factor that exerts a multidimensional impact on the course of anesthesia and postoperative recovery. Patients with MS demonstrate pronounced hemodynamic instability, impaired glucose metabolism, and delayed recovery after surgical procedures.

The findings confirm the need for perioperative risk stratification in patients with metabolic syndrome during preoperative assessment. Individualization of anesthetic management, early correction of metabolic disorders, and intensified monitoring can reduce complication rates and improve clinical outcomes.

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