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The use of dexmedetomidine in endoscopic surgical procedures of the nasal cavity in children

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Keypoints

Dexmedetomidine is widely used in cardiac surgery, neurosurgery, gynecology and dentistry. However, there is not enough experience in using it in otorhinolaryngology.

Abstract

Introduction

In recent years, dexmedetomidine has come to the forefront in pediatric anesthesiology. In recent years, this drug has begun to be widely used in surgical interventions of the nasal cavity in children. Surgical interventions in the nasal cavity are classified as low-traumatic and low-volume operations, but they are accompanied by fairly intense pain. Dexmedetomidine is widely used in cardiac surgery, neurosurgery, gynecology and dentistry. However, there is not enough experience in using it in otorhinolaryngology. Purpose of the study: Optimization of anesthesia during endoscopic surgical interventions in the nasal cavity in children.

Material and Methods

In the period from 2022 to 2024, 106 planned endoscopic surgical operations of the nasal cavity were performed in patients aged 10-15 years under local anesthesia and with so-called conscious sedation at the AMU surgical clinic. Patients were randomized into 2 groups: main (n=53) and control (n=53). Patients in the main and control groups underwent septoplasty surgery. Patients in the main group received dexmedetomidine as sedation, and midazolam was used as sedation in the control group.

Results

In the main group, the average consumption of fentanyl was 50 ± 20 mcg, while in the control group its consumption was 100 ± 25 mcg. The consumption of local anesthetic in the main group ranged from 3.0 to 6.0 ml depending on the operation, while in the control group it ranged from 4.0 to 8.0 ml. During intraoperative pain assessment on the BPS-NI pain scale, patients in the main group scored 3-4 points, and in the control group 4-10 points, respectively

Conclusion

Intraoperative sedation with dexmedetomidine in combination with local anesthesia can be recommended as an alternative to general anesthesia for endoscopic nasal surgery.

Keywords

Dexmedetomidine, conscious sedation, endoscopic surgical interventions in the nasal cavity

Introduction

In recent years, dexmedetomidine has come to the forefront in pediatric anesthesiology. Dexmedetomidine is not only an effective anesthetic and analgesic, but also responds to problems found in pediatric anesthesia, the need for "opioid sparing" or multimodal anesthesia. In recent years, this drug has begun to be widely used in surgical interventions of the nasal cavity in children.

Surgical interventions in the nasal cavity are classified as low-traumatic and low-volume operations, but they are accompanied by fairly intense pain. The anatomy of the nasal cavity is extremely complex and the possibilities for hemostasis are very limited. The close proximity of intracranial structures and blood vessels requires a “dry surgical area” and adequate anesthesia. The possibility of adequate contact with the patient, who is conscious during the operation, allows the surgeon to carry out the intervention with better anatomical orientation and achieve optimal local anesthesia. When anesthetizing this area, the anesthesiologist has to take into account the generality of the surgical field, the difficulty of visual control of the patient's face, the local use of adrenaline, the high risk of aspiration and postoperative nausea, vomiting, difficulty or impossibility of the patient's nasal breathing in the perioperative period. To provide anesthesia for the vast majority of surgical interventions in the nasal area, combined anesthesia is possible, based on the use of local infiltration anesthesia and controlled sedation. This type of anesthesia causes less physiological stress than general anesthesia. For these surgical procedures, dexmedetomidine is an ideal drug for conscious sedation, providing the desired level of sedation without respiratory depression and with a minimum of hemodynamic disturbances. According to the Ramsay sedation scale, an adequate degree of sedation can be considered 3-4 (3 - the patient is dozing, opens his eyes to a call, 4 - dozes, opens his eyes in response to physical stimulation).

The agonistic effect of dexmedetomidine on α2-adrenergic receptors of the sympathetic ganglia modulates the release of catecholamines, which leads to a sympatholytic effect and, consequently, bradycardia and hypotension. Thus, at low concentrations of dexmedetomidine, central sympatholytic effects predominate, causing a decrease in heart rate and blood pressure. When higher doses are used, peripheral vasoconstriction predominates, leading to an increase in total vascular resistance and blood pressure with a subsequent decrease in heart rate. The controllability of the hemodynamic effect of the drug allows for good “visibility” of the surgical field. The mechanism of the sedative effect of dexmedetomidine, associated with the adrenergic pathway of cortical activation, explains the lack of significant suppression of respiratory function. Therefore, there is no respiratory depression with dexmedetomidine. The effect of dexmedetomidine on α2 - adrenergic receptors of the locus coeruleus of the brain stem leads to a disruption of adrenergic transmission along the ascending nerve fibers in the ventrolateral preoptic nucleus of the thalamus, which in turn leads to activation of the GABA-ergic inhibition of the tuberomammillary nucleus emanating from this nucleus. As a result, the severity of histamine-mediated activation of the cortex decreases. It is through this system that the mechanism of natural slow sleep is realized. Therefore, the effects of dexmedetomidine closely match the natural human sleep mechanism. Dexmedetomidine is widely used in cardiac surgery, neurosurgery, gynecology and dentistry. However, there is not enough experience in using it in otorhinolaryngology.

Purpose of the study: Optimization of anesthesia during endoscopic surgical interventions in the nasal cavity in children.

Material and methods

In the period from 2022 to 2024, 106 planned endoscopic surgical operations of the nasal cavity were performed in patients aged 10-15 years under local anesthesia and with so-called conscious sedation at the AMU surgical clinic. Patients were randomized into 2 groups: main (n=53) and control (n=53). Patients in the main and control groups underwent septoplasty surgery. Patients in the main group received dexmedetomidine as sedation, and midazolam was used as sedation in the control group. There were no significant differences between groups in baseline characteristics. The criteria for including patients in the study were:

- absence of inflammatory diseases;
- consent of the patients' parents for surgical intervention under local anesthesia with sedation with dexmedetomidine.

All patients had a consultation with a pediatrician before surgery. The following indicators were assessed intraoperatively:

- amount of opioids and local anesthetic;
- level of pain according to the behavioral pain scale (BPS-NI);
- hemodynamic parameters (BP and HR);
- respiration depth and frequency, SpO2;
- depth of sedation according to the Ramsay scale;
- intensity of bleeding;
- quality of surgical visibility;
- the surgeon's satisfaction with the result of the intervention performed;
- duration of surgery.

In the postoperative period the following was assessed:

- pain level using the Numerical Rating Scale (NRS);
- short duration when removing tampons from the nose;
- patient satisfaction;
- surgeon satisfaction.

The Ramsay scale was used to assess the adequacy of sedation with a target level of 3-4. Patient and surgeon satisfaction was assessed after surgery using a 5-point satisfaction scale. When using dexmedetomidine, the loading dose was 0.4-0.8 mcg/kg body weight over 10 minutes, followed by maintenance administration of the drug at a dose of 0.2-0.4 mcg/kg/hour. The drug was administered intravenously using a Braun syringe infusion pump dosing device. In the control group, midazolam was administered intravenously for sedation at a rate of 0.2 mg/kg. The operations were performed under local infiltration anesthesia using Jetocain 4.0-8.0 ml and to achieve an adequate level of pain relief, a combination of the sedative drug midazolam or dexmedetomidine with the opioid fentanyl was carried out at a dose of 1 mcg/kg in the main group and 2-3 mcg/kg in control group. Additional hemostasis was provided by the application of adrenaline. After completion of the operation, anterior tamponade with sponge tampons was performed.

Results

In the main group, the average consumption of fentanyl was 50 ± 20 mcg, while in the control group its consumption was 100 ± 25 mcg. The consumption of local anesthetic in the main group ranged from 3.0 to 6.0 ml depending on the operation, while in the control group it ranged from 4.0 to 8.0 ml. During intraoperative pain assessment on the BPS-NI pain scale, patients in the main group scored 3-4 points, and in the control group 4-10 points, respectively (Table 1).

Item	Description	Score	Main group, score	Control group, score
Facial expression	Relaxed	1	1	
	Partially tightened (e.g. brow lowering)	2		2
	Fully tightened (e.g. eyeled closing)	3		3
	Grimacing	4		4
Upper limb movements	No movement	1	1	1
	Partially bent	2		2
	Fully bent with finger flexion	3		3
	Permanently retracted	4		
Vocalization	There is no pain vocalization	1	1	1
	Moans ≤3 times/min and ≤3 s	2	2	2
	Moans >3 times/min or >3 s	3		3
	Shouts of “Oh, oh!” or holding your breath >3	4		
Total			3-4	4-10

Table 1. Intraoperative pain assessment on BPS-NI (Behavioral Pain Scale of Non-Intubated Patient) scale

Hemodynamic parameters in both groups are presented in Table 2.

Parameters	Main group	Control group	Significance of differences P
BP mmHg	98±10,62	132,8±16,87	0,034
Heart rate, min	60	82	0,08

Table 2. Hemodynamic parameters (m±δ). p<0.05 – significantly significant differences between two independent groups; p>0.05 – no significant differences between two independent groups.

In both groups, oxygen saturation (SpO2) remained at 98-99%. In the main group, there was a significant decrease in blood pressure, the average heart rate changed towards bradycardia in the group with dexmedetomidine, but no significant differences were obtained (p = 0.06), and only one patient in this group required the administration of atropine. Taking into account hemodynamic parameters, in the main group a smaller amount of adrenaline was required for hemostasis. The depth of sedation when assessed on the Ramsay scale in the main group reached 3-4 points. The level of intraoperative sedation in the control group was no more than 1-2 points. It is also necessary to note the differences in the duration of sedation in patients of both groups. For dexmedetomidine, the duration of sedation was an additional 1.2 ± 0.5 hours after the end of surgery. In patients in the control group, postoperative sedation was either absent or lasted only 0.5 hours. Bleeding was assessed by the state of the surgical field and the occurrence of intraoperative bleeding of varying intensity. In the main group of patients, no intraoperative bleeding was observed; the surgical field was assessed as dry and well visualized. Good surgical visibility ensures the success of the operation. In the main group, against the background of hemodynamic indicators and an almost “bloodless” operating field, the surgeon’s satisfaction was rated higher than in the control group. Also, low bleeding intensity and good surgical visibility in the main group significantly reduced the operation time. In the postoperative period, all patients of the main group noted good health and mood. In the control group, only 8 patients were satisfied with the anesthesia. Of interest was the fact that 15 patients in the control group reported pain and discomfort. According to the Numerical Rating Scale (NRS), the average pain perception score in the group of patients with discomfort was lower (1.15±0.83) than in patients in the control group (4.32±1.24, p<0.001). In both groups of patients, tampons were removed one day after surgery. In the main group of patients, in no case was there bleeding that required tamponade, and in the control group, tamponade was performed in 2 patients.

Thus, an analysis of the study results showed that the surgeon’s satisfaction during the operation and the patient’s comfort in the main group were higher compared to the control group.

Conclusion

1. Intraoperative sedation with dexmedetomidine in combination with local anesthesia can be recommended as an alternative to general anesthesia for endoscopic nasal surgery.
2. Without causing respiratory depression, dexmedetomidine creates a favorable hemodynamic profile without causing tachycardia, which, when used with smaller doses of the local anesthetic Zhetocaine, helps reduce the dose of the narcotic analgesic fentanyl by 3-4 times and thereby ensures good tolerability of the drug by patients, allowing no time delay their postoperative recovery, as well as safe anesthesia.

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