

HEART RATE VARIABILITY AFTER SEPTOPLASTY SIMULATION IN RATS USING DIFFERENT SCHEMES OF GENERAL ANESTHESIA

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ВАРИАБЕЛЬНОСТЬ СЕРДЕЧНОГО РИТМА ПОСЛЕ МОДЕЛИРОВАНИЯ СЕПТОПЛАСТИКИ У КРЫС С ИСПОЛЬЗОВАНИЕМ РАЗЛИЧНЫХ СХЕМ ОБЩЕЙ АНЕСТЕЗИИ

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Abstract: Aims: to evaluate the heart rate variability after simulation of septoplasty in rats under various general anesthesia schemes. The study was carried out on 24 sexually mature outbred male rats weighing 185-250 g. In group 1, phthorothane was used for anesthesia and in group 2, zoletil was used. The operation was performed by 2-sided zigzag scarification of the nasal septum mucosa. Interpreted 30-second fragments of records ECG without artifacts. Isolation of a 30 second fragment took place in the Biopac Student Lab 4.1 software. After that, the parameters of spectral analysis were calculated in the Kubios HRV program. The spectral component of heart rate variability was assessed using the Wilcoxon test for connected samples. The use of phthorothane is preferable and gives a more pronounced increase in the tone of the parasympathetic division of the ANS, in comparison with zoletil. This helps to reduce stress-related hyperactivation of the sympathetic nervous system in the postoperative period.

Keywords: HRV, rats, septoplasty, anesthesia, ECG, autonomic nervous system, stress.

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Резюме: Цель: оценить вариабельность сердечного ритма после моделирования септопластики у крыс при различных схемах общей анестезии. Исследование проведено на 24 половозрелых беспородных крысах-самцах массой 185-250 г. В 1-й группе для анестезии использовали фторотан, во 2-й — золетил. Операцию выполняли путем двусторонней зигзагообразной скарификации слизистой оболочки носовой перегородки. Интерпретировались 30-секундные фрагменты записей ЭКГ без артефактов. Выделение 30-секундного фрагмента происходило в программе Biopac Student Lab 4.1. После этого в программе Kubios HRV были рассчитаны параметры спектрального анализа ВСР. Спектральную составляющую вариабельности сердечного ритма оценивали с помощью теста Вилкоксона для связанных выборок. Применение фторотана является предпочтительным и дает более выраженное повышение тонуса парасимпатического отдела ВНС, по сравнению с золетилом. Это способствует уменьшению связанной со стрессом гиперактивации симпатической нервной системы в послеоперационном периоде.

Ключевые слова: ВСР, крысы, септопластика, наркоз, ЭКГ, вегетативная нервная система, стресс.

Introduction. Septoplasty is a powerful surgical stressor [1-3]. After surgical interventions in the nasal cavity in the body of animals, stress reactions occur [4-6], due to an increase in predominantly nociceptive impulses that occur at the site of injury [7, 8].

Aims: to evaluate the heart rate variability after simulation of septoplasty in rats under various general anesthesia schemes.

Materials and methods. The study was carried out on 24 sexually mature outbred male rats weighing 185-250 g. To assess the state of the autonomic nervous system (ANS), an analysis of heart rate variability (HRV) was carried out in rats before surgery (control data) and on the second, fourth and sixth days after surgery. All rats were divided into two groups of 12 animals each. In group 1, phthorothane was used for anesthesia and in group 2, zoletil was used. The operation was performed by 2-sided zigzag scarification of the nasal septum mucosa. Interpreted 30-second fragments of records containing an average of 189 RR intervals without artifacts. Isolation of a 30 second fragment took place in the Biopac Student Lab 4.1 software. After that, the parameters of spectral analysis were calculated in the Kubios HRV program. The spectral component of heart rate variability was assessed using the Wilcoxon test for connected samples.

Results. In both groups, STD RR increased slightly (group 1 (5.12 ± 0.56 ms) ($p > 0.05$); group 2 (5.27 ± 0.57 ms) ($p > 0.05$)). day STD RR increased in group 1 (6.38 ± 0.74 ms) ($p < 0.01$), while in group 2 it decreased (4.0 ± 0.39 ms) ($p < 0.01$), compared with control (4.76 ± 0.5). On the sixth day in both groups, STD RR returned to preoperative values (4.32 ± 0.77 ms and 4.31 ± 0.72 ms, respectively) ($p > 0.05$). On the second day, Mean HR increased in groups 1 and 2 (411.35 ± 9.89 bpm and 411.23 ± 10.32 bpm, respectively) ($p < 0.001$). On the fourth day, Mean HR in group 2 increased (423.04 ± 11.56 beats / min) ($p < 0.001$), and in group 1 Mean HR decreased, but still remained above the control (396.88 ± 11.02 beats / min) ($p < 0.01$). On day 6, Mean HR in both groups increased (428.11 ± 12.31 bpm and 437.95 ± 10.81 bpm, respectively) ($p < 0.05$). On the second day after surgery, RMSSD increased in group 1 (5.28 ± 0.7 ms) ($p < 0.001$), while in group 2 RMSSD decreased (3.36 ± 0.35 ms) ($p < 0, 05$). On the fourth day, positive dynamics was noted in group 1 (6.59 ± 0.65 ms) ($p < 0.05$), and in group 2, negative dynamics of changes in RMSSD (2.73 ± 0.25 ms) ($p < 0.001$). In group 1, on the sixth day, RMSSD decreased (5.25 ± 0.77 ms) ($p < 0.05$), and in group 2, RMSSD decreased (3.41 ± 0.69 ms) ($p < 0.01$), reaching the values before the surgery.

Discussion. Experimental work on the nasal septum in rats is carried out to study the effect on the surrounding tissues of grafts replacing the cartilage of

the septum, new methods of hemostasis and prevention of postoperative nosebleeds, in order to develop manual skills of the surgeon [9, 10, 11], etc.

Despite these facts, the simulation of septoplasty in small rodents, as classical experimental animals, on a non-deviated nasal septum can show the role of traumatic as well as surgical damage in the manifestation of stress reactions. In previous studies, we have shown that surgical damage to the nasal septum provokes an anxiety state [5] and a depression-like state [4]. It was also found that a side effect of such traumatization is sensory deprivation of the olfactory analyzer, which, in turn, can cause changes in the cytoarchitectonics of the hippocampus [12, 13].

Conclusions. The use of phthorothane is preferable and gives a more pronounced increase in the tone of the parasympathetic division of the ANS, in comparison with zoletil. This helps to reduce stress-related hyperactivation of the sympathetic nervous system in the postoperative period.

Conflict of interest. The authors declare no conflict interest.

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