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EFFECT OF PERIOPERATIVE ADMINISTRATION OF LIDOCAINE ON THE RATE OF ELIMINATION OF ENTERIC FAILURE IN PATIENTS AFTER PANCREATO-DUODENAL RESECTION

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Ключові слова: *внутрішньовенне введення лідокаїну, кишкова непрохідність, ентеральна недостатність.*

Ключевые слова: *внутривенное введение лидокаина, кишечная непроходимость, энтеральная недостаточность.*

Key words: *intravenous infusion of lidocaine, ileus, enteral failure.*

Наведено порівняння впливу періопераційного внутрішньовенного введення лідокаїну з епідуральним введенням маркаїну на швидкість усунення ентеральної недостатності. Показана безпека введення лідокаїну внутрішньовенно та доведена його здатність усувати ентеральну недостатність.

Представлено сравнение влияния внутривенного периоперационного введения лидокаина с эпидуральным введением маркаина на скорость устранения энтеральной недостаточности. Показана безопасность введения лидокаина внутривенно и доказана его способность эффективно устранять энтеральную недостаточность.

This article compares the effects of perioperative intravenous administration of lidocaine with epidural administration of marcaine on the rate of elimination of enteric failure. This article outlines the safety of administration of intravenous lidocaine and proves its ability to effectively relieve enteric failure.

Postoperative ileus is a serious concern among surgical patients. The usage of epidural anesthesia and analgesia in combination with local anesthetics can reduce the duration of ileus [1, 2], but its mechanism of action remains unclear. A significant amount of anesthetic is systemically absorbed during epidural administration [3].

The aim of this study was to investigate the effect of intravenous administration of lidocaine on the rate of elimination of enteric failure in patients undergoing abdominal surgery in comparison with its epidural administration.

RESEARCH DESIGN

The study included 44 patients who underwent pancreato-duodenal resection. Patients were divided into two groups depending on the method of perioperative administration of the local anesthetic. Demographic data of the patients are shown in *Table 1*.

Table 1

Demographic data of patients of the first and second groups

Group Indicator	3-O (N = 22)	3-P (N = 22)
Age, in years	43 ± 12.2	
	43 ± 16.2	43 ± 7.7
Sex	M-25, F-19	
Male	13	10
Female	6	7
Body Mass Index (BMI), $kg \cdot m^{-2}$	26 ± 1.27	
	26 ± 1.38	26 ± 1.11

* - P <0.05 when comparing the main group with the comparison group

The main group included patients who received lidocaine by continuous intravenous infusion during surgery followed by i.v. lidocaine 3 days postoperatively. Infusion of lidocaine was started with a bolus of 1.5 $mg \cdot kg^{-1}$ to prevent intubation stress and was maintained constantly at 1 $mg \cdot kg^{-1} \cdot h^{-1}$. Intraoperatively, in the event of bleeding, the dose of lidocaine was either reduced to 0.5 $mg \cdot kg^{-1}$ or was totally discontinued.

The second group of patients received 15 mg of 0.125% marcaine, epidurally every 3 hours in the postoperative period. Preoperatively, these patients received 80 mg lidocaine by bolus administration after the epidural catheter was inserted.

Anesthesiological management of patients of both groups was identical and included total intravenous anesthesia with mechanical ventilation.

The indices observed were the influence of anesthetics on hemodynamics in the perioperative period and the rate of recovery of peristalsis for 3 postoperative days.

RESEARCH METHODS

Comprehensive laboratory investigations were performed on all patients immediately upon admission and at the key stages of treatment till the 3rd post-operative day. Key indices of the study were recorded at hospitalization, during the key stages of treatment and at the end of surgery, at 1, 6, 12 and 24 hours, and the 2nd and 3rd post-operative day) using the following methods.

Monitoring of hemodynamics and oxygen saturation of the arterial blood was performed using the apparatus «UTAS - UM-300». The calculations were performed using a series of values obtained every 1 - 2 hours daily and at 1, 6 and 12 hours. Central hemodynamics were rated using the parameters of the "Modified Stars" formula [4]. Study of oxygenation and hemodynamics were carried out concurrently. Blood gases were determined using the apparatus ABL 800 FLEX (Radiometr, Denmark).

The content of O_2 in arterial blood (CaO_2) was calculated by the formula: [5] $CaO_2 = 1.34 \cdot Hb \cdot SaO_2$, $ml \cdot l^{-1}$ where SaO_2 is saturation of oxygen in arterial blood and 1.34 – Gyufners constant. The content of O_2 in venous blood (CvO_2) was calculated by the formula [6]: $CvO_2 = CaO_2 - avO_2$, $ml \cdot l^{-1}$.

The calculation of VO_2 in $ml \cdot kg^{-1} \cdot min^{-1}$ was carried out by [7]. DO_2 was determined by the formula [8]: $DO_2 = CaO_2 \cdot CI$, $ml \cdot min^{-1}$.

Intestinal failure was assessed by the rate of recovery of peristalsis and the volume of residue derived from nasogastric and nasoenteral tubes and the volume of vomiting.

All investigated parameters were compared between the main and the comparison groups.

Statistical analysis of the results was performed using the application package "Microsoft Excel 2003" and "STATISTICA® for Windows 6.0" (№ AXXR12D833214FAN5). Determination of the parameters of distribution was carried out using either the Lilliefor's or the Shapiro-Wilks tests. In «normal» distribution, the data was presented as mean ± standard error of the mean (M ± m). The null hypothesis was rejected as the p-value was below 0.05 (indicating statistical significance). To assess discrepancies among the selected variables, we used the "Student's t-test" for paired variables and the "t-test" for independent variables. Pearson's χ^2 and McNemar's criteria were used for comparison of discrete variables.

RESULTS AND DISCUSSION

In all patients at the time of admission, the intensity of cardio-

Table 2

Cardiac index, transport and exchange components of oxygenation

	Group	At Admission	Operatively			1 Hour	6 Hours	1st Day	2nd Day	3rd Day
			Initial stage	Key stage	Final stage					
CI	Main	3.7 ±0.29	3.5 ±0.28	3.22 ±0.25*	3.35 ±0.24	3.35 ±0.31	3.65 ±0.27	3.49 ±0.32	3.1 ±0.25*	3.45 ±0.24
CI	Comparison	3.66 ±0.17	3.95 ±0.27	3.88 ±0.34	3.70 ±0.34	3.55 ±0.22	3.27 ±0.19*	3.12 ±0.21	2.86 ±0.27	2.9 ±0.18
DO_2	Main	674 ±55	614 ±53	564 ±45*	588 ±45	590 ±43	640 ±40	545 ±38*	458 ±39*	508 ±31*
DO_2	Comparison	691 ±47	638 ±54*	627 ±61*	590 ±54*	547 ±40 *	514 ±41*#	483 ±42 *	469 ±39*	409 ±19* #
VO_2	Main	157 ±17	149 ±9.7	138 ±9.08*	143 ±13	144 ±10	155 ±8.5	149 ±9.64	132 ±9.41*	148 ±10.93
VO_2	Comparison	155 ±6.3	167 ±10	164 ±13	157 ±13	151 ±8.5	141 ±7.2*	151 ±8.2	156 ±10	143 ±6.8

* - P <0.05 when comparing different stages within the same group; # - P <0.05 when comparing the main group with the comparison group

vascular function was at the upper limit of normal (CI – 3.70 ± 0.29 $l \cdot min^{-1} \cdot m^{-2}$).

Intraoperative infusion of lidocaine reduced the hyperdynamic circulatory response to surgical trauma, indicated by a decrease of CI on average by 23% (p <0.05) in relation with patients of the comparison group. Additional signs of intraoperative stress activation were not monitored. Perioperative infusion of lidocaine and its continuation in the postoperative period contributed to a normodynamic circulation in the immediate postoperative period one hour after the operation (CI–3.35 ± 0.31 $l \cdot min^{-1} \cdot m^{-2}$). In addition, during the key stage of the operation, additional disturbances of the exchange component of oxygenation (VO_2 –138 ± 9.08 $ml \cdot min^{-1} \cdot m^{-2}$) did not occur and the reduction in the transport component (DO_2 – 564 ± 45 $ml \cdot min^{-1} \cdot m^{-2}$) did not exceed 10%.

In the early postoperative period, the indicators of transport and exchange components of oxygenation in the main group of patients were within the reference range and remained stable till the end of the study.

At the same time in the comparison group, DO_2 was 13-20% (p<0.05) lower than the main group till the end of the study, which indicates the stressed state of oxygenation in the comparison group that was a consequence of hypodynamic circulation in this group of patients.

All patients of both the groups had enteric failure from the first postoperative day, as evidenced by the presence of more than 200 ml of fluid remaining in the stomach of all patients and the absence of peristalsis (*Table 3*).

Table 3

Indicators of intestinal failure

	Group	1st day	2nd day	3rd day
Fluid in stomach (vomit), ml	Main	388 ± 39	255 ± 22	120 ± 27
	Comparison	387 ± 47	240 ± 19	183 ± 28
Active peristalsis, number of patients	Main	0	7	18
	Comparison	0	10	16

* - P<0.05 when comparing the main group with the comparison group

Restoration of peristaltic activity in patients of both groups occurred simultaneously and was noted in 32% of the main group patients and 45% of patients in the comparison group. At the same time, enteric failure was present in 100% of patients of both groups, as evidenced by the volume of retained fluid in the stomach on an average of more than 200 ml. On postoperative day 3, peristalsis appeared in 82% and 73% of patients of the main and comparison groups respectively. There were no statistically significant changes between both groups.

Thus, intravenous infusion of lidocaine in the main group of patients did not result in adverse hemodynamic effects, limiting the stress response of the circulatory system to surgical trauma and preventing hypodynamic blood circulation in the postoperative period, which was observed in patients of the comparison group. This led to an equivalent rate of restoration of intestinal activity in patients of both groups, but the expression of hypodynamic circulation in patients of the main group was less pronounced due to the earlier restoration of the oxygen regimen.

CONCLUSIONS

Perioperative administration of lidocaine at 1 $mg \cdot kg^{-1} \cdot hr^{-1}$ does not affect hemodynamics and can be used intraoperatively.

The rate of recovery of peristalsis upon intravenous administration of lidocaine is comparable with that of epidural administration of marcaine.

I.V administration of lidocaine may be recommended for eliminating enteric failure (and restoring intestinal activity) in patients after pancreatodudodenal resection.

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