

1 Comparison of the Effect of Intraoperative 1 mg/kg/h and 2 mg/kg/h IV Lidocaine 2 Infusion on Postoperative Pain and Nausea-Vomiting in Laparoscopic Gastric 3 Bypass Surgery

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6 **Objective:** To relieve postoperative pain and nausea and vomiting, various drugs and
7 methods, including intraoperative IV lidocaine infusion in different surgeries. However, the
8 exact same dose has not yet been determined. The purpose of this study was to evaluate and
9 compare the effect of intraoperative 1 mg/kg/h and 2 mg/kg/h IV lidocaine infusion on
10 postoperative pain and nausea-vomiting in laparoscopic gastric bypass surgery.

11 **Methods:** This clinical trial study was performed on patients undergoing laparoscopic
12 gastric bypass surgery in Rasoul-e-Akram Hospital, Iran. Patients were randomly assigned
13 into two groups (1 mg/kg/h lidocaine) and (2 mg/kg/h lidocaine). Postoperative pain and
14 nausea and vomiting were evaluated at times 0, 30 min, 1 h, 6 h, 12 h and 24 h after surgery.
15 Data was analyzed using statistical tests and SPSS 22.

16 **Results:** There was no significant difference in the effect of intraoperative 1 mg/kg/h and 2
17 mg/kg/h IV lidocaine infusion on static and dynamic pain and nausea-vomiting, agitation,
18 systolic BP, diastolic BP, pulse rate and postoperative administration of pethidine in
19 laparoscopic gastric bypass ($P>0.05$).

20 **Conclusion:** Based on results of this study, administration of low dose lidocaine (1 mg/kg/h)
21 can be considered as an appropriate dose of IV lidocaine infusion in order to control
22 postoperative pain and nausea and vomiting in laparoscopic gastric bypass surgery.

23 **Keywords:** lidocaine, pain, nausea-vomiting, gastric bypass

24 1. Introduction

25 In post-operative time, it is important to control and reduce postoperative pain and nausea-
26 vomiting (1). Different drugs and methods are used to relieve postoperative pain and nausea
27 and vomiting in different surgeries (2). One of these methods, which has been studied on
28 numerous occasions, is intraoperative intravenous (IV) lidocaine infusion undergone in a
29 wide range of surgical procedures such as laparotomy, laparoscopy, gynecological surgery,
30 orthopedics, etc., and has a positive effect in most cases in reducing postoperative pain and
31 nausea-vomiting (3). Considering the pharmacological effects of IV lidocaine, which has
32 both anti-inflammatory and anti-analgesic effects (protein receptor inhibitor G and NMDA),
33 lidocaine has been used to relieve postoperative pain (4). According to numerous studies on
34 various surgical procedures, intraoperative IV lidocaine infusion has been shown to reduce
35 postoperative pain and nausea and vomiting (5-14). Although the exact same dosage is still
36 unknown, the conducted studies have used 1-2 mg/kg/h dosages. In a double-blind clinical

37 trial on 41 patients undergoing microdistomy in two groups receiving 1.5 mg/kg/h lidocaine
38 infusion and normal saline infusion as placebo, Kim et al (2014) concluded that fentanyl
39 administration and postoperative pain intensity were significantly lower in the lidocaine
40 group except 48 hours after surgery. Total fentanyl administration, hospital stay and
41 satisfaction were significantly lower in lidocaine group than placebo group. Finally,
42 intraoperative systemic infusion of lidocaine reduces pain level during microdistomy surgery
43 (6). According to the studies, this study tends to evaluate and compare the effect of
44 intraoperative 1 mg/kg/h and 2 mg/kg/h IV lidocaine infusion on postoperative pain and
45 nausea-vomiting in laparoscopic gastric bypass to determine a more suitable and effective
46 dosage.

47 **2. Materials and Methods**

48 This study was a randomized clinical trial. The studied population included elective patients
49 who were candidate for laparoscopic gastric bypass referred to Rasoul-e-Akram Hospital
50 since June 2014 to March 2015. Sampling method was convenient sampling. Sample size was
51 determined using Cohen table with 80% statistical power, 0.05 alpha and 0.9 accuracy (21
52 subjects in each group). This study was a randomized clinical trial. Block randomization was
53 done in quadrilateral blocks. This study was performed on 42 elective patients who were
54 candidate for laparoscopic gastric bypass referred to Rasoul-e-Akram Hospital since June
55 2014 to March 2015. After obtaining consent and qualifying patients for inclusion and
56 exclusion, 41 patients were assigned into 2 groups of 21 patients (A and B) in 4 blocks. After
57 entering the operating room, standardized monitoring (ECG-POM-NIBP-Etco2) and insertion
58 of two 20G IV catheters and 3 cc/kg crystalloid serum infusion were performed for all
59 patients. Then, 3 mcg/kg fentanyl based on TBW and 0.02 mcg/kg midazolam based on TBW
60 were administered as premedication for all patients. For induction, all patients received 5
61 mg/kg thiopental sodium based on TBW followed by 0.2 mg/kg atracurium based on IBW
62 and 1.5 mcg/kg bolus lidocaine based on IBW for general anesthesia. After intubation of the
63 patients, all of them received 1.2 mac isoflurane followed by 0.03 mg/kg atracurium every 30
64 minutes and 50 mcg fentanyl every 40 minutes as maintenance. From the beginning of
65 surgery, group A received 1 mg/kg/h IV lidocaine infusion and group B received 2 mg/kg/h
66 IV lidocaine infusion by the pump until the end of surgery for a maximum of 4 hours. After
67 the end of surgery and discontinuation of all drugs, patients were placed in reserve by 0.04
68 mg/kg nisosigine and 0.02 mg/kg atropine and extubation was done; patients were transferred

69 to PACU (recovery). The time to enter recovery was set at $t=0$; for 24 h, patients were
70 monitored for pain based on numerical rating score (0-10), static and dynamic nausea-
71 vomiting, blood pressure (BP), heart rate and agitation in predicted times in the recovery or
72 surgery wards.

73 Finally, pain level was recorded in two A and B groups based on numerical rating score (0-
74 10) at times 0, 30 min, 1 h, 6 h, 12 h, and 24 h after surgery.

75 Pain level was recorded in two A and B groups based on numerical rating score (0-10) at
76 times 0, 30 min, 1 h, 6 h, 12 h, and 24 h after surgery. Static and dynamic nausea-vomiting
77 was recorded in two A and B groups at times 0, 30 min, 1 h, 6 h, 12 h, and 24 h after surgery.
78 Agitation was recorded in two A and B groups at times 0, 30 min, 1 h, 6 h, 12 h, and 24 h
79 after surgery. Systolic BP, diastolic BP and heart rate were recorded in 2 groups A and B at
80 times 0, 30 min, and 1 h after surgery.

81 Finally, data was analyzed by SPSS software version 22. In the analytical step, Kolmogorov-
82 Sminov test was used for determining normality of quantitative values. Then, independent T-
83 test or Mann-Whitney U-test were used for comparing the quantitative variables of two
84 groups A and B. Chi-square test (Z) was used to compare the qualitative variables. Repeated
85 measure ANOVA or Friedman test was used to check and compare the changes.

86 **3. Results**

87 In this study, 42 patients who were referred to surgery ward of the Rasoul-e-Akram Hospital
88 in 2016 and underwent laparoscopic elective gastric bypass were enrolled in the study. In
89 group A, 21 patients (50%) received intraoperative 1 mg/kg/h IV lidocaine infusion; in group
90 B, 21 patients (50%) received intraoperative 2 mg/kg/h IV lidocaine infusion.

91 **3.1. Determining and Comparing Pain in Two Groups A and B Based on Numerical Rating** 92 **Score at Times 0, 30 min, 1 h, 6 h, 12 h and 24 h after Laparoscopic Gastric Bypass**

93 In order to compare the pain level in 2 groups A and B based on numerical rating score at
94 times 0, 30 min, 1 h, 6 h, 12 h, and 24 h after laparoscopic gastric bypass, the Mann-Whitney
95 U-test was used. Friedman test was used for comparison at times 0, 30 min, 1 h, 6 h, 12 h and
96 24 h after laparoscopic gastric bypass in each of the two groups A and B (separately).
97 Descriptive features and comparison of pain levels are summarized in Table 1.

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99
100**Table 1: descriptive features and comparison of pain level in two groups A and B based on numerical rating score at times 0, 30 min, 1 h, 6 h, 12 h and 24 h after laparoscopic gastric bypass**

Time	Group		Test statistic	p-value
	A (mean \pm SD)	B (mean \pm SD)		
0	1.67 \pm 1.01	1.71 \pm 0.78	0.014	0.989
30 min	2.67 \pm 0.73	2.67 \pm 0.65	0.139	0.889
1 h	3.29 \pm 0.84	3.19 \pm 0.98	0.346	0.729
6 h	5.71 \pm 0.9	5.57 \pm 1.2	0.898	0.369
12 h	4.86 \pm 0.96	4.71 \pm 0.95	0.404	0.687
24 h	3.95 \pm 1.39	3.81 \pm 1.03	0.199	0.842

101 Based on the results of Table 1, there was no significant difference between pain levels of
 102 patients in 2 groups A and B based on numerical rating score at times 0, 30 min, 1 h, 6 h, 12
 103 h, and 24 h after laparoscopic gastric bypass ($P>0.05$). There was a significant difference
 104 between pain levels of patients based on numerical rating score at times 0, 30 min, 1 h, 6 h,
 105 12 h, and 24 h after laparoscopic gastric bypass in group A ($P<0.001$, $X^2=94.18$). There was a
 106 significant difference between pain levels of patients based on numerical rating score at times
 107 0, 30 min, 1 h, 6 h, 12 h, and 24 h after laparoscopic gastric bypass in group B ($P<0.001$,
 108 $X^2=88.29$).

109 **3.2. Determining and Comparing Static Nausea-Vomiting in Two Groups A and B at Times 0,** 110 **30 min, 1 h, 6 h, 12 h and 24 h after Laparoscopic Gastric Bypass**

111 In order to compare static nausea-vomiting levels in 2 groups A and B after laparoscopic
 112 gastric bypass, Z-test was used. Friedman test was used for comparison at times 0, 30 min, 1
 113 h, 6 h, 12 h and 24 h after laparoscopic gastric bypass in each of the two groups A and B
 114 (separately). Frequency values and nausea-vomiting comparison are summarized in Table 2.

115 **Table 2: descriptive features and comparison of static nausea-vomiting levels in two groups A and B after**
 116 **laparoscopic gastric bypass**

Time	Group		Test statistic	p-value
	A (N, %)	B (N, %)		
0	2 (9.5%)	5 (23.8%)	1.26	0.896
30 min	4 (19%)	3 (14.3%)	0.4	0.655
1 h	0 (0%)	1 (4.8%)	0.22	0.587
6 h	0 (0%)	0 (0%)	0	0.5
12 h	0 (0%)	0 (0%)	0	0.5
24 h	0 (0%)	0 (0%)	0	0.5

117 Based on the results of Table 2, there was no significant difference between static nausea-
 118 vomiting levels of patients in 2 groups A and B at times 0, 30 min, 1 h, 6 h, 12 h, and 24 h
 119 after laparoscopic gastric bypass ($P>0.05$). There was a significant difference between static
 120 nausea-vomiting levels of patients at times 0, 30 min, 1 h, 6 h, 12 h, and 24 h after
 121 laparoscopic gastric bypass in group A ($P=0.01$, $X^2=15$). There was a significant difference

122 between static nausea-vomiting levels of patients at times 0, 30 min, 1 h, 6 h, 12 h, and 24 h
123 after laparoscopic gastric bypass in group B ($P=0.008$, $X^2=15.73$).

124 **3.3. Determining and Comparing Dynamic Nausea-Vomiting in Two Groups A and B at Times**
125 **0, 30 min, 1 h, 6 h, 12 h and 24 h after Laparoscopic Gastric Bypass**

126 In order to compare dynamic nausea-vomiting levels in 2 groups A and B after laparoscopic
127 gastric bypass, Z-test was used. Friedman test was used for comparison at times 0, 30 min, 1
128 h, 6 h, 12 h and 24 h after laparoscopic gastric bypass in each of the two groups A and B
129 (separately). Frequency values and nausea-vomiting comparison are summarized in Table 3.

130 **Table 3: descriptive features and comparison of dynamic nausea-vomiting levels in two groups A and B after**
131 **laparoscopic gastric bypass**

Time	Group		Test statistic	p-value
	A (N, %)	B (N, %)		
0	8 (38.1%)	6 (28.6%)	0.65	0.742
30 min	14 (66.7%)	11 (52.4%)	0.95	0.828
1 h	5 (23.8%)	5 (23.8%)	0	0.5
6 h	0 (0%)	0 (0%)	0	0.5
12 h	0 (0%)	0 (0%)	0	0.5
24 h	0 (0%)	0 (0%)	0	0.5

132 Based on the results of Table 3, there was no significant difference between dynamic nausea-
133 vomiting levels of patients in 2 groups A and B at times 0, 30 min, 1 h, 6 h, 12 h, and 24 h
134 after laparoscopic gastric bypass ($P>0.05$). There was a significant difference between
135 dynamic nausea-vomiting levels of patients at times 0, 30 min, 1 h, 6 h, 12 h, and 24 h after
136 laparoscopic gastric bypass in group A ($P=0.001$, $X^2=45$). There was a significant difference
137 between dynamic nausea-vomiting levels of patients at times 0, 30 min, 1 h, 6 h, 12 h, and 24
138 h after laparoscopic gastric bypass in group B ($P=0.001$, $X^2=33.77$).

139 **3.4. Determining and Comparing Agitation in Two Groups A and B at Times 0, 30 min and 1 h**
140 **after Surgery**

141 In order to compare agitation levels in 2 groups A and B after laparoscopic gastric bypass, Z-
142 test was used. Friedman test was used for comparison at times 0, 30 min and 1 h after surgery
143 in each of the two groups A and B (separately). Frequency values and agitation comparison
144 are summarized in Table 4.

145 **Table 4: descriptive features and comparison of agitation levels in two groups A and B after laparoscopic gastric**
146 **bypass**

Time	Group		Test statistic	p-value
	A (N, %)	B (N, %)		
0	6 (28.6%)	5 (23.8%)	0.35	0.636
30 min	5 (23.8%)	6 (28.6%)	0.35	0.636
1 h	1 (4.8%)	1 (4.8%)	0	0.5

147 Based on the results of Table 4, there was no significant difference between agitation levels
 148 of patients in 2 groups A and B at times 0, 30 min and 1 h after laparoscopic gastric bypass
 149 ($P>0.05$). There was no significant difference between agitation levels of patients at times 0,
 150 30 min and 1 h after laparoscopic gastric bypass in group A ($P=0.072$, $X^2=5.25$). There was
 151 no significant difference between agitation levels of patients at times 0, 30 min and 1 h after
 152 laparoscopic gastric bypass in group B ($P=0.097$, $X^2=4.66$).

153 **3.5. Determining and Comparing Systolic BP in Two Groups A and B at Times 0, 30 min and 1** 154 **h after Laparoscopic Gastric Bypass**

155 In order to compare systolic BP levels in 2 groups A and B at times 0, 30 min and 1 h after
 156 laparoscopic gastric bypass, independent t-test and Mann-Whitney U-test were used.
 157 Friedman test and repeated measure test were used for comparison of systolic BP levels at
 158 times 0, 30 min and 1 h after laparoscopic gastric bypass in each of the two groups A and B
 159 (separately). Descriptive features and comparison of systolic BP are summarized in Table 5.

160 **Table 5: descriptive features and comparison of systolic BP levels in two groups A and B at times 0, 30 min and 1 h**
 161 **after laparoscopic gastric bypass**

Time	Group		Test statistic	p-value
	A (mean \pm SD)	B (mean \pm SD)		
0	141.76 \pm 13.68	141.9 \pm 14.92	0.032	0.974
30 min	139.33 \pm 13.13	139.43 \pm 15.27	0.025	0.98
1 h	134.05 \pm 11.38	136.48 \pm 10.42	0.768	0.477

162 Based on the results of Table 5, there was no significant difference between systolic BP
 163 levels of patients in 2 groups A and B at times 0, 30 min and 1 h after laparoscopic gastric
 164 bypass ($P>0.05$). There was a significant difference between systolic BP levels of patients at
 165 times 0, 30 min and 1 h after laparoscopic gastric bypass in group A ($P<0.001$, $X^2=27.71$).
 166 There was a significant difference between systolic BP levels of patients at times 0, 30 min
 167 and 1 h after laparoscopic gastric bypass in group B ($P=0.012$, $X^2=5.59$).

168 **3.6. Determining and Comparing Diastolic BP in Two Groups A and B at Times 0, 30 min and 1** 169 **h after Laparoscopic Gastric Bypass**

170 In order to compare diastolic BP levels in 2 groups A and B at times 0, 30 min and 1 h after
 171 laparoscopic gastric bypass, independent t-test was used. Repeated measure test was used for
 172 comparison of diastolic BP levels at times 0, 30 min and 1 h after laparoscopic gastric bypass
 173 in each of the two groups A and B (separately). Descriptive features and comparison of
 174 diastolic BP are summarized in Table 6.

175
176**Table 6: descriptive features and comparison of diastolic BP levels in two groups A and B at times 0, 30 min and 1 h after laparoscopic gastric bypass**

Time	Group		Test statistic	p-value
	A (mean \pm SD)	B (mean \pm SD)		
0	91.24 \pm 8.24	93.05 \pm 9.71	0.651	0.519
30 min	89.57 \pm 9.3	91.19 \pm 11.27	0.508	0.615
1 h	86.24 \pm 9.54	89.14 \pm 7.35	1.18	0.245

177 Based on the results of Table 6, there was no significant difference between diastolic BP
 178 levels of patients in 2 groups A and B at times 0, 30 min and 1 h after laparoscopic gastric
 179 bypass ($P > 0.05$). There was a significant difference between diastolic BP levels of patients at
 180 times 0, 30 min and 1 h after laparoscopic gastric bypass in group A ($P < 0.001$, $X^2 = 58.94$).
 181 There was a significant difference between diastolic BP levels of patients at times 0, 30 min
 182 and 1 h after laparoscopic gastric bypass in group B ($P = 0.001$, $X^2 = 11.38$).

183 3.7. Determining and Comparing Heart Rate in Two Groups A and B at Times 0, 30 min and 1 184 h after Laparoscopic Gastric Bypass

185 In order to compare heart rate in 2 groups A and B at times 0, 30 min and 1 h after
 186 laparoscopic gastric bypass, independent t-test and Mann-Whitney test were used. Repeated
 187 measure test and Friedman test were used for comparison of heart rate at times 0, 30 min and
 188 1 h after laparoscopic gastric bypass in each of the two groups A and B (separately).
 189 Descriptive features and comparison of heart rate are summarized in Table 7.

190
191**Table 7: descriptive features and comparison of heart rate in two groups A and B at times 0, 30 min and 1 h after laparoscopic gastric bypass**

Time	Group		Test statistic	p-value
	A (mean \pm SD)	B (mean \pm SD)		
0	93.05 \pm 7.32	96.86 \pm 6.64	1.76	0.085
30 min	90.29 \pm 6.66	92.86 \pm 8.31	1.26	0.207
1 h	86.43 \pm 6.47	88 \pm 7.44	0.9	0.364

192 Based on the results of Table 7, there was no significant difference between heart rate of
 193 patients in 2 groups A and B at times 0, 30 min and 1 h after laparoscopic gastric bypass
 194 ($P > 0.05$). There was a significant difference between heart rate of patients at times 0, 30 min
 195 and 1 h after laparoscopic gastric bypass in group A ($P < 0.001$, $X^2 = 28.5$). There was a
 196 significant difference between heart rate of patients at times 0, 30 min and 1 h after
 197 laparoscopic gastric bypass in group B ($P = 0.001$, $X^2 = 67.43$).

198 **3.8. Determining and Comparing the First, Second and Third Pethidine Administrations in Two**
 199 **Groups A and B after Laparoscopic Gastric Bypass**

200 In order to compare the first, second and third pethidine administrations in 2 groups A and B
 201 after laparoscopic gastric bypass, Z-test was used. Frequency values and comparison of the
 202 first, second and third pethidine administrations in groups A and B after laparoscopic gastric
 203 bypass are summarized in Table 8.

204 **Table 8: descriptive features and comparison of the first, second and third pethidine administrations in two groups A**
 205 **and B after laparoscopic gastric bypass**

Time	Group		Test statistic	p-value
	A (N, %)	B (N, %)		
1 st	6 (28.6%)	11 (52.3%)	1.61	0.053
2 nd	12 (57.1%)	8 (38%)	1.26	0.103
3 rd	3 (14.3%)	1 (4.8%)	1.06	0.144

206 Based on the results of Table 8, there was no significant difference between the first, second
 207 and third pethidine administrations in 2 groups A and B after laparoscopic gastric bypass
 208 ($P>0.05$).

209 **4. Discussion**

210 According to the most important results of this study, there was no significant difference
 211 between the effect of intraoperative 1 mg/kg/h and 2 mg/kg/h IV lidocaine infusion on
 212 postoperative pain, static and dynamic nausea-vomiting, agitation, systolic BP, diastolic BP,
 213 heart rate and pethidine administration after laparoscopic gastric bypass. In both groups,
 214 intraoperative 1 mg/kg/h and 2 mg/kg/h IV lidocaine infusion significantly increased pain 6
 215 hours postoperatively and significantly decreased pain 24 hours postoperatively. Moreover,
 216 postoperative static and dynamic nausea-vomiting, agitation, systolic BP, diastolic BP and
 217 heart rate significantly decreased 0-24 hours after the surgery. Therefore, lidocaine seems to
 218 reduce postoperative pain and complications. However, high-dose and low-dose lidocaine has
 219 the same significant effect in reducing pain and complications after laparoscopic gastric
 220 bypass.

221 Postoperative pain not only causes physical and mental torment, but also increases the risk of
 222 side effects and delayed recovery. Therefore, it is important to eliminate emotional pain and
 223 stress to maintain comfortable recovery, reduce the incidence of postoperative cardiovascular
 224 complications and increase sooner discharge (15). It has been previously reported that
 225 preoperative IV lidocaine infusion can increase postoperative analgesic effects and accelerate
 226 early recovery; intraoperative continuous infusion can effectively prevent central hyperalgergy

227 through the pain pathway (16). Lidocaine has an insignificant opioid-sparing property in
228 patients undergoing various surgical procedures (17, 18). Several mechanisms have been
229 suggested to explain the insignificant opioid-sparing effect of preoperative lidocaine. First,
230 lidocaine has anti-inflammatory properties which can minimize the pain caused by surgical
231 inflammation (19, 20). Second, lidocaine also can directly block the pathways of pain
232 conducting sodium channels (21). Eventually, lidocaine can reduce the need for opioid drugs
233 or intraoperative volatile anesthetics, which may reduce the progression of postoperative pain
234 (22, 24).

235 Based on literature review, this study was the first study to compare the effects of two
236 different doses of lidocaine (1 mg/kg/h vs. 2 mg/kg/h IV infusion) on postoperative pain and
237 nausea-vomiting after laparoscopic gastric bypass. However, many studies have shown that
238 different doses of lidocaine infusion reduced postoperative pain level and side effects,
239 compared with placebo and other drugs. For example, Tikuišis et al (2014) studied 64
240 patients undergoing laparoscopic colon surgery and found that pain level significantly
241 decreased 24 h after the surgery in both rest and movement in 2 mg/kg/h lidocaine group
242 compared to placebo group. Moreover, there was no significant difference between
243 postoperative complications between the two groups (5). Through a meta-analysis, Ventham
244 et al. (2015) reviewed 40 clinical trials on comparing the effect of lidocaine infusion with
245 placebo or routine postoperative laparoscopic treatments and found that lidocaine
246 intervention reduced the pain score at rest in 2, 12 and 24 hours after surgery and reduced
247 nausea and vomiting (9). ... et al (2015) studied 226 patients undergoing laparoscopic
248 gynecological surgery and revealed that 1% lidocaine infusion was more effective on
249 postoperative pain than placebo (12). Terkawi et al (2016) found no significant difference in
250 pain scores between the two groups by follow-up of 216 patients after 2 days of abdominal
251 surgery in two groups of 1 mg/kg/h IV Lidocaine infusion and epidural analgesia. In
252 lidocaine group, episodes of hypotension and postoperative nausea and vomiting were less
253 frequent than placebo group (14).

254 In the above studies, pain and nausea-vomiting were not compared between two groups of 1
255 mg/kg/h and 2 mg/kg/h lidocaine; positive effect of lidocaine in reducing pain and nausea-
256 vomiting in most of these studies may be due to the fact that lidocaine has been compared
257 with opiate and placebo. Moreover, inconsistency of this study with some studies may be due
258 to differences in samples, design of studies, lidocaine doses and surgical site and procedures.

259 In the present study in which patients were carefully monitored for up to 24 hours after
260 surgery, although administration of high-dose lidocaine did not cause side effects after

261 surgery, administration of low doses, as high doses, reduced pain, nausea-vomiting and
262 agitation. Therefore, low doses of lidocaine (1 mg/kg/h), rather than high doses (2 mg/kg/h),
263 can be used as an appropriate dose of IV lidocaine infusion to control postoperative pain and
264 nausea-vomiting in laparoscopic gastric bypass.

265 **5. Conclusion**

266 Based on the results of this study, low doses of lidocaine (1 mg/kg/h), rather than high doses
267 (2 mg/kg/h), can be used as an appropriate dose of IV lidocaine infusion to control
268 postoperative pain and nausea-vomiting in laparoscopic gastric bypass.

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