Dexamethasone combined with hydromorphone preemptive analgesia alleviates pain and complications after jaw cyst enucleation: a randomized controlled trial

Wang Zhou  
Zhejiang Provincial People's Hospital (Affiliated People's Hospital, Hangzhou Medical College)

Fan Liu  
Changxing People's Hospital of Chongming District

Junbiao Fang  
Zhejiang Provincial People's Hospital (Affiliated People's Hospital, Hangzhou Medical College)

Lianghui Han (✉️ h909593@163.com)  
Changxing People's Hospital of Chongming District

Research Article

Keywords: dexamethasone, jaw cyst, postoperative analgesia, facial swelling, trismus

Posted Date: August 1st, 2022

DOI: https://doi.org/10.21203/rs.3.rs-1843771/v1

License: © This work is licensed under a Creative Commons Attribution 4.0 International License. Read Full License
Abstract

Background

Dexamethasone is widely used in the prevention of postoperative complications in oral surgery and strengthening the analgesic effect after anesthesia, but the efficacy is controversial, and the relationship between postoperative complications and pain is still unclear. The purpose of this study was to evaluate the analgesic effect of dexamethasone in the treatment of jaw cyst and to explore the relationship between postoperative complications and pain.

Methods

We conducted a prospective, randomized, double-blind clinical trial. 120 patients were divided into two groups, dexamethasone group (group D) and control group (Group C). All patients were given 0.02mg/kg of hydromorphone to relieve pain in advance at 10 minutes before the beginning of operation. Meanwhile, dexamethasone was injected 0.2mg/kg intravenously in group D and normal saline was injected in group C. The primary endpoint was pain intensity at 2h, 6h, 12h, 24h and 48h after surgery. The secondary endpoints were the incidence and extent of complications after surgery, including facial swelling and trismus.

Results

Compared with group C, the VAS scores at rest at 2, 6, 12 and 24 h after surgery and during mobilization at 2h, 6h, 12h, 24h and 48h after surgery in group D were significantly lower (P < 0.05). The degree of facial swelling and trismus in group D at 12, 24 and 48 h after surgery was significantly lower than that in group C (P < 0.05), but there was no difference at 6 hours after operation (P > 0.05). The C-reactive protein (CRP) level at 24 h after operation in group D was lower than group C (P < 0.05), but there was no significant difference in blood glucose concentration between the two groups (P > 0.05).

Conclusion

Dexamethasone can reduce the degree of facial swelling and trismus after jaw cyst surgery by inhibiting the production of inflammation, which alleviated the postoperative pain of patients significantly. In addition, it did not increase the risk of hyperglycemia.

Trial registration:

This study was registered with the Chinese Clinical Trial Registry on May 07, 2020 (URL: http://www.chictr.org.cn/showproj.aspx?proj=53344). Registry number: ChiCTR2000032693). Registered
Background

Enucleation of jaw cyst is one of the most common oral surgery operations [1]. Due to the need to damage the soft tissues of the oral cavity and remove bone tissue, there is a strong degree of postoperative inflammation, often accompanied by moderate or severe pain, oedema and trismus, which increases the pain and discomfort of patients [2]. The demand for a comfortable postoperative recovery and a rapid return to daily activities has increased the importance of controlling postoperative inflammation, especially pain and swelling, which also make oral surgery be considered a good model and the gold standard in pain studies [3].

To alleviate the associated postoperative discomfort, Preemptive analgesia techniques are widely used in all types of surgery. Preemptive analgesia refers to taking certain measures to prevent central or peripheral nerve sensitisation and to reduce or eliminate pain caused by an injury before the injurious stimulus acts on the body. As mentioned by Woolf and Chong [4]: simple changes in the timing of therapeutic interventions can have a profound and beneficial effect on postoperative pain. In clinical practice, hydromorphone hydrochloride, a typical new semi-synthetic opioid, has been used extensively with good curative effect for preemptive analgesia in clinical anaesthesia [5].

In oral surgery, dexamethasone is often used to prevent postoperative complications [6], while in anaesthesia it is also commonly used as an adjunct to anaesthetic analgesia, to enhance the effect and duration of postoperative analgesia and to reduce the use of postoperative analgesic drugs [7, 8]. However, their efficacy is controversial and uncertain, and even fewer studies have reported on the relationship between postoperative complications and pain. We believe that postoperative swelling and difficulty in opening the mouth are directly proportional to pain after oral surgery, therefore, this study will evaluate the efficacy of dexamethasone in postoperative analgesia and prevention of postoperative complications in jaw cyst surgery and explore the relationship between the facts.

Methods

Ethics Approval, Registration and Patient Selection

This is a prospective, randomised, double-blind study taking place at Nantong University Hospital and Zhejiang Provincial People's Hospital from May 2020 to April 2021. The study was approved by the Ethics Committee of the Affiliated Hospital of Nantong University (ethical approval number: 2019-K094) and registration was completed with the China Clinical Trials Centre (registration number: ChiCTR2000032693). Written informed consent was obtained from all participants before the conduct of this study. This trial was conducted in accordance with the Declaration of Helsinki. And this manuscript adheres to the Consolidated Standards of Reporting Trials (CONSORT) guidelines.
A total of 120 American Society of Anesthesiologists (ASA) Class I-II surgical patients between the ages of 16 and 65 years were recruited for this study, and the procedure was performed under general anesthesia with nasal intubation for maxillary cyst excision, and the maxillary cysts were all less than 5 cm in diameter. Participants without recent hepatic or renal insufficiency, severe allergic or hypersensitivity reactions to relevant drugs, cardiovascular or neurological disease, pregnant women or patients with airway difficulties, obesity and those taking opioids were excluded. We randomised 120 patients into groups D (dexamethasone group) and C (control group) using a random number table and the results of the randomisation grouping were sealed in opaque envelopes until the pretreatment drugs were prepared. Neither the patients nor the anaesthetists involved in the study were aware of the results of the random grouping.

**Study Procedures**

All patients did not receive any preoperative treatment and were monitored in the operating room for non-invasive blood pressure (BP), Electrocardiogram (ECG), peripheral oxygen saturation and electroencephalographic bispectral index (BIS). Each patient was induced with sufentanil 0.3 µg.kg⁻¹, propofol 2-2.5 mg.kg⁻¹ and cis-atracurium 0.2 mg.kg⁻¹. Anesthesia was maintained by a combination of static inhalation, 1.0% sevoflurane by inhalation in all patients, and intravenous infusion of remifentanil 6-12 µg/(kg. h) and isoproterenol 3-5 mg /(kg. h), adjusted according to hemodynamic parameters. During surgery, PETCO2 and BIS values were maintained at 35-45 mmHg (1 mmHg = 0.133 kPa) and 45-55 respectively. 10 min before the start of surgery, all patients were given intravenous hydromorphone 0.02 mg/kg for preemptive analgesia, meanwhile, patients in group D received intravenous dexamethasone 0.2 mg/kg and patients in group C received intravenous equal doses of saline.

**Outcome Measures**

The primary indicators for this study were to evaluate the pain intensity, including the resting pain and activity pain in the 48h postoperative period. Secondary indicators included assessing the facial swelling and restricted mouth opening of the patients in the 48h postoperative period, and monitoring the patients’ adverse effects, such as changes in blood glucose. Another anaesthetist, who was unaware of the intervention, performed the outcome assessment.

**VAS (Visual Analogue Scale) Pain Scale**: A 10cm horizontal line is drawn across the top of the paper, with 0 at one end of the line indicating no pain, 10 at the other end indicating extreme pain, and the middle section indicating varying degrees of pain. The patient is asked to mark a mark on the horizontal line to indicate the degree of pain according to his or her self-perception, and the length is measured.

**Facial swelling grading**, reference and improvement of Daniel Lim [9] study method, specific approach: first measure the distance from the corner of the mouth to the earlobe on the extraction side (a), the distance from the earlobe to the mandibular angle (b) and the distance from the external canthus to the mandibular angle (c) respectively (Figure 1), calculate the facial measurement distance $X = [(a + b)/2 + c]/2$, and then calculate the facial swelling percentage, the calculation formula is [postoperative facial
measurement distance (X1) - pre-operative facial measurement distance (X0)] / pre-operative facial measurement distance (X0) × 100%. The facial swelling was assessed according to the facial swelling percentage, and the criteria were: Grade 0, swelling area ≤ 3%; Grade I, swelling area 3% to 6%; Grade II, swelling area 6% to 12%; Grade III, swelling area ≥ 12%.

The facial swelling was assessed according to the facial swelling percentage, and the criteria were: Grade 0, swelling area ≤ 3%; Grade I, swelling area 3% to 6%; Grade II, swelling area 6% to 12%; Grade III, swelling area ≥ 12%.

**Grading criteria for trismus:** The distance between the incisal margins of the maxillary and mandibular central incisors is measured with vernier calipers. Grade 0, spacing > 2.5 cm; Grade I, spacing 2-2.5 cm; Grade II, spacing 1-2 cm; Grade III, spacing < 1 cm.

**Sample size**

The sample size estimation was based according to the activity pain intensity 24 hours after operation. Our preliminary study found that the mean VAS of the group C and the group D were 4.55 ± 0.98 and 3.90 ± 0.74 (10 patients each group). A power analysis was done with the use of G* Power 3.1.9.7 software and an effect size of d = 0.75 was calculated. According to the Cohen criteria (0.1 = small effect size, 0.3 = medium effect size, 0.5 = large effect size), this is a large effect size [10]. A sample size of 48 per group to achieve a power of 95% and a type I error of 5%. To compensate for the possibility of dropout, we eventually recruited a total of 120 patients.

**Statistical analyses**

All statistical analyses were performed with SPSS version 20. The Shapiro-Wilk test was applied to assess the normality of the data. To verify the homogeneity of variance, a Levene test was conducted. Quantitative variables were presented as the mean ± standard deviation (SD) or mean with 95% confidence intervals and nonparametric data as a median and interquartile range (IQR). The statistical significance of differences between groups was analysed using the independent t-test. Analysis of Mann-Whitney U test was used to analyse and adjust the baseline characteristics if there were statistically significant differences and possibility of covariance of baseline characteristics. Categorical variables were expressed as number (proportion) and analysed by Pearson $\chi^2$ test or Fisher exact test, such as ASA classifications, gender, facial swelling and mouth opening level. All figures were plotted with Graphpad prism 6.0 statistical software. A statistically significant difference was determined at a P value < 0.05.

**Results**

**Patient Characteristics**

A total of 150 patients were recruited for this study. However, 30 patients were excluded due to failure to meet the inclusion criteria or patient refusal (Fig. 2). The demographic data and ASA status were
compared among the two groups. We found no statistically significant differences in the demographic data among the two groups (p > 0.05; Table 1).

Flow diagram describing the 150 (120) subjects who completed the study protocol.

Table 1
Demographic Data and Surgery-Related Information

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group D (n = 58)</th>
<th>Group C (n = 62)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender, M/F (cases)</td>
<td>29/29</td>
<td>28/34</td>
<td>0.72</td>
</tr>
<tr>
<td>Age (years)</td>
<td>41.64 ± 14.66</td>
<td>41.60 ± 14.94</td>
<td>0.99</td>
</tr>
<tr>
<td>BMI (kg/m^2)</td>
<td>21.46 ± 2.31</td>
<td>21.45 ± 2.37</td>
<td>0.98</td>
</tr>
<tr>
<td>ASA status (/)</td>
<td>46/12</td>
<td>51/11</td>
<td>0.82</td>
</tr>
<tr>
<td>Duration of surgery(min)</td>
<td>39.88 ± 9.25</td>
<td>41.81 ± 9.96</td>
<td>0.28</td>
</tr>
<tr>
<td>Duration of anaesthesia(min)</td>
<td>53.55 ± 10.86</td>
<td>55.47 ± 11.23</td>
<td>0.35</td>
</tr>
<tr>
<td>Total sufentanil dosage(ug)</td>
<td>20.03 ± 2.19</td>
<td>20.50 ± 2.01</td>
<td>0.23</td>
</tr>
<tr>
<td>Total remifentanil dosage(ug)</td>
<td>520.31 ± 95.44</td>
<td>541.48 ± 108.96</td>
<td>0.26</td>
</tr>
</tbody>
</table>

Values are expressed as mean ± SD or number of patients

**Abbreviations:** BMI, body mass index; Group D, dexamethasone group; Group C, control group.

**Postoperative pain intensity**

Patients in group D had significantly lower resting pain scores than group C at 2h, 6h, 12h and 24h postoperatively (p<0.05), however, there was no difference between the two groups at 48h postoperatively (Figure 3A). We then tested the VAS score during mobilization under the maximum mouth opening in both groups at the time course and showed that group D was significantly lower than group C (p<0.05, Figure 3B).

**Facial swelling and trismus**

Almost all patients had different degrees of facial swelling and limited mouth opening after surgery. Compared to Group C, patients in Group D had significantly less swelling of the face and less restricted mouth opening at 12h, 24h and 48h postoperatively (p<0.05; Table 2 and Table 3). But there was no significant difference between the two groups at 6 hours after surgery (p>0.05).

Table 2 Incidence of postoperative facial swelling in two groups
Values are expressed as number of patients (%).

**Abbreviations:** Group D, dexamethasone group; Group C, control group.

**Table 3** Incidence of postoperative restriction of mouth opening in two groups

<table>
<thead>
<tr>
<th></th>
<th>6h post-op</th>
<th>12h post-op</th>
<th>24h post-op</th>
<th>48h post-op</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group D</strong> (n = 58)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 0</td>
<td>45%77.6%</td>
<td>21%36.2%</td>
<td>2%1.7%</td>
<td>1%1.7%</td>
</tr>
<tr>
<td>Level 1</td>
<td>13%22.4%</td>
<td>31%53.4%</td>
<td>43%74.1%</td>
<td>35%60.3%</td>
</tr>
<tr>
<td>Level 2</td>
<td>0%0.0%</td>
<td>6%10.3%</td>
<td>12%20.7%</td>
<td>19%32.8%</td>
</tr>
<tr>
<td>Level 3</td>
<td>0%0.0%</td>
<td>0%0.0%</td>
<td>1%1.7%</td>
<td>3%5.2%</td>
</tr>
<tr>
<td><strong>Group C</strong> (n = 62)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 0</td>
<td>39%62.9%</td>
<td>5%8.1%</td>
<td>0%0.0%</td>
<td>0%0.0%</td>
</tr>
<tr>
<td>Level 1</td>
<td>23%37.1%</td>
<td>44%71.0%</td>
<td>19%30.6%</td>
<td>14%22.6%</td>
</tr>
<tr>
<td>Level 2</td>
<td>0%0.0%</td>
<td>12%19.4%</td>
<td>38%61.3%</td>
<td>34%54.8%</td>
</tr>
<tr>
<td>Level 3</td>
<td>0%0.0%</td>
<td>1%1.6%</td>
<td>5%8.1%</td>
<td>14%22.6%</td>
</tr>
<tr>
<td><strong>P-value</strong></td>
<td>0.079</td>
<td>0.001</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

CRP and blood glucose
The level of CRP after surgery was significantly higher than preoperation in both groups. There was no difference in the preoperative CRP concentration between the two groups, but after 24 hours after surgery, the median and interquartile range of CRP concentration in group D [15.6 (10.0-26.0)] was significantly lower than in group C [25.3 (11.9-38.9)] (p=0.012; Figure 4A).

Compared with the preoperative measures, the postoperative blood glucose concentrations of both groups showed a significant increase and were statistically different (group D: 6.08±1.42 mmol/l VS 4.93±0.61 mmol/l, P= 0.000; group C: 5.91±1.37 mmol/l VS 4.89±0.65 mmol/l, P= 0.000). But there was no difference in the blood glucose concentration between the two groups before and after surgery (p>0.05; Figure 4B).

Discussion

This study showed that preoperative intravenous dexamethasone significantly enhanced the analgesic effect of hydromorphone postoperatively and tremendously alleviated postoperative pain, which is consistent with previous studies [11]. Despite the relatively large number of such studies and conclusive results [12, 13], the mechanisms by which dexamethasone reduces postoperative pain remain uncertain, including immunosuppression [14], reduction of endotoxin levels [15] or gene regulation [16, 17], but most studies suggest that it is inextricably linked to its powerful anti-inflammatory effects [18, 19]. It was well known that microglia and various inflammatory factors which secreted played an important role in the generation and development of pain [20], and dexamethasone could alleviate pain by inhibit the activation and morphological changes of microglia from 0.5h after tissue injury [21]. As our results showed, the pain intensity in the treatment group decreased significantly from 2h after operation (Figure 3A and Figure 3B).

Interestingly, our study found no difference in postoperative pain intensity between two groups at 48h postoperatively, which may be related to the status of pain at that time (Figure 3A), as the pain was so mild in both groups at the time that it was difficult for dexamethasone to show its effect in them. We then measured the pain scores in both groups with maximum mouth opening and we found a significant reduction in pain in group D. This finding provides ample evidence that postoperative pain intensity after excision of cyst of jaw is closely related to post-operative oral and facial complications.

Facial swelling and trismus are common postoperative complications of oral surgery. The external manifestations of swelling and difficulty in opening the mouth of the face are due to increased capillary permeability caused by persistent postoperative inflammation, which in turn leads to tissue and cellular oedema. A mate analysis by Falci [6] showed that dexamethasone had better prevention of postoperative complications than NSAIDs and was more effective than methylprednisolone in treating postoperative swelling and trismus. It was also in agreement with the results of our study (Table 2, Table 3), that patients in the dexamethasone group had more mild facial swelling and trismus than the control group from12h after the surgery, and the differences between the two groups became more pronounced when the time reaches 24 hours and 48 hours after operation (p<0.001). A research from Korea had found that
the time point of maximum facial swelling appearance after oral surgery is in the 2.25 ± 0.19 days postoperative [22], so we could not find a significant difference between the two groups at 6 hours after surgery as the time was too early to appear the difference.

C-reactive protein (CRP) was a sensitive index and marker reflecting various infectious and non-infectious systemic inflammation. In the study of knee arthritis and osteoarthritis models, it was found that the level of serum CRP was not only related to the development and prognosis of the disease, but also positively correlated with pain intensity [23, 24]. We further measured serum CRP concentrations in both groups and found that patients in the dexamethasone group had significantly lower CRP levels compared to the control group (Figure 4A), a result that is consistent with the findings of Tammachote [25] and Kim [26], both of which demonstrate the great role of dexamethasone in inhibiting the production of postoperative inflammatory factors and the development of inflammation. Therefore, we believe that due to the development of postoperative inflammation forming facial swelling, which in turn further causes symptoms such as trismus, and these symptoms exacerbate the patient's post-operative pain and discomfort, but the process that is well suppressed by dexamethasone, as the development of post-operative inflammation and complications are inhibited, thus further reducing the development of postoperative pain.

The application of glucocorticoids was generally considered to bring side effects such as hyperglycemia and delayed surgical wound healing [27]. The results of our last study suggested that blood glucose concentrations were risen with different extent in both groups at 24h after the operation, but there was no statistical difference between patients in the dexamethasone group and the control group (Figure 4B), as a result, we consider more the occurrence of a stressful increase in blood glucose which was associated with surgery and anesthesia in the particular situation rather than the effect of dexamethasone [28, 29], which is consistent with the opinions of many research findings in domestic and international [30-32]. Therefore, we believe that there is evidence to support that perioperative intravenous treatment with 0.2 mg/kg dexamethasone is safe in the surgery.

A limitation of our study is that we were unable to observe the patients' postoperative complications for a longer time due to the patients' hospitalization period, that made us uncertain about the clinical efficacy of dexamethasone for a prolonged time for postoperative complications after scrapieotomy for jaw cysts. To improve and perfect the experiment and research, the next step of the study will be to set up regular post-operative follow-ups to prolong the observation of the development of postoperative complications in patients to get the best and most accurate clinical data.

**Conclusions**

The mechanism of dexamethasone in preemptive analgesia may had multiple modes of action and there was no definite conclusion at present, but we believe that inflammation played an important role in the occurrence of postoperative pain in the perioperative period of oral surgery, dexamethasone could reduce the degree of facial swelling and trismus after the operation of curettage of jaw cyst by inhibiting
inflammation to alleviate postoperative pain enormously, and had an excellent and safe efficacy in the clinical practice.

**Abbreviations**

VAS: Visual analogue scale; ASA: American Society of Anesthesiologist; BP: Blood pressure; ECG: Electrocardiogram; BIS: Bispectral index; SD: standard deviation; IQR: interquartile range; CRP: C-reactive protein

**Declarations**

**Acknowledgments**

Not applicable.

**Authors’ contributions**

ZW and HLH designed and conducted the study and drafted and revised the manuscript. LF contributed to data collection. FJB performed the statistical analysis for the study. ZW and HLH prepared the manuscript. All authors read and approved the final manuscript.

**Funding**

This work was supported by the National Key Research and Development Program of China (No. 2018YFC2001904) Research on strategies for the prediction, prevention and treatment of perioperative infection in elderly patients. The funding body played the roles in the design of the study and collection, analysis, and interpretation of data and in writing the manuscript.

**Availability of data and materials**

The datasets generated and/or analyzed during the current study are not publicly available due to the data has not been completely uploaded in the database but are available from the corresponding author on reasonable request.

**Ethics approval and consent to participate**

The study was approved by the Ethics Committee of the Affiliated Hospital of Nantong University (ethical approval number: 2019-K094) and registration was completed with the China Clinical Trials Centre (registration number: ChiCTR2000032693). Written informed consent was obtained from all participants before the conduct of this study.

**Consent for publication**

Informed consent from the subject for publication of all images and tables in the manuscript.
Competing interests

The authors have no conflicts of interest to declare.

References


Figures

Figure 1

Diagram of facial swelling measurement
(a) The distance from the corner of the mouth to the earlobe on the extraction side. (b) The distance from the earlobe to the mandibular angle. (c) The distance from the external canthus to the mandibular angle. Calculating the facial measurement distance (X) according to formula $X = [(a + b)/2 + c]/2$, the X value was taken as the average value of facial measurements in millimeters in three times. And then calculating the facial swelling percentage $= \frac{\text{postoperative facial measurement distance (X1)} - \text{pre-operative facial measurement distance (X0)}}{\text{pre-operative facial measurement distance (X0)}} \times 100\%$.

**Figure 2**

CONSORT diagram of patients recruitment
Figure 3

Comparison of postoperative VAS scores between the two groups

Values were expressed as mean with 95% confidence intervals and analyzed using the independent t-test.

A The VAS score at rest in the two groups of patients during postoperative period. The degree of postoperative pain intensity reached the maximum at 6 hours after operation, and then decreased slowly as time goes on. Patients in group D had significantly lower resting pain scores than group C at 2h (1.52±0.97 vs 2.52±0.93), 6h (1.85±1.09 vs 2.69±0.91), 12h (1.69±1.01 vs 2.44±0.88) and 24h (1.47±1.04 vs 1.84±0.95) postoperatively (p<0.05), however, there was no difference between the two groups at 48h (1.27±1.04 vs 1.41±1.08) postoperatively. B The VAS score during mobilization in the two groups of patients during postoperative period. The degree of postoperative pain intensity reached the maximum at 6 hours after operation, and then decreased slowly as time goes on. Patients in group D had significantly lower pain scores than group C (p<0.05) at 2h (4.08±1.03 vs 4.92±1.06), 6h (4.34±1.16 vs 5.20±1.13), 12h (4.17±1.31 vs 4.89±1.05), 24h (3.99±1.07 vs 4.81±1.03) and 48h (3.82±1.16 vs 4.24±1.06) postoperatively.

Note: Compared with group C, *p<0.05.

Abbreviations: VAS = Visual Analogue Scale; Group D, dexamethasone group; Group C, control group.
Comparison of CRP and blood glucose concentration between two groups

A Comparison of CRP concentration between two groups. Values were expressed as median and interquartile range and analyzed using Mann-Whitney U test. There was no difference in the preoperative CRP concentration between the two groups (group D [0.70 (0.30-2.10)] vs group C [0.75 (0.10-1.50)], P=0.706), the CRP concentration after 24 hours after surgery in group D [15.6 (10.0-25.9)] was significantly lower than in group C [25.3 (12.0-38.5)] (p=0.012). B Comparison of blood glucose concentration between two groups. Values are expressed as mean ± SD and analyzed using the independent t-test. Compared with the preoperative measures, the postoperative blood glucose concentrations of both groups showed a significant increase and were statistically different (group D: 6.08±1.42 mmol/l VS 4.93±0.61 mmol/l, P= 0.000; group C: 5.91±1.37 mmol/l VS 4.89±0.65 mmol/l, P= 0.000). But there was no difference in the blood glucose concentration between the two groups in preoperation [group D (4.93±0.61) vs group C (4.89±0.65), P=0.742] and after surgery [group D (6.08±1.42) vs group C (5.91±1.37), P=0.513].

Note: Compared with group C, *p<0.05; CRP = C-reactive protein