Effect of laparoscopic cholecystectomy on the liver function and immune function

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Objective: To explore the effect of laparoscopic cholecystectomy (LC) on the liver function and immune function. Methods: A total of 110 patients who were admitted in our hospital from December, 2014 to December, 2015 for cholecystectomy were included in the study and divided into the observation group and the control group according to different operation methods. The patients in the observation group were given LC, while the patients in the control group were given open cholecystectomy (OC). The morning fasting venous blood 1 d before operation, 1 d and 7 d after operation was extracted to determine the levels of serum immune globulin IgA, IgG, IgM, and liver function indexes TBIL, ALT, AST, and GGT. The changes of immune globulin and liver function in the two groups were observed and compared. Results: The levels of IgA, IgG, and IgM 1 d after operation in the two groups were significantly reduced when compared with 1 d before operation, and the levels of various indicators 7 d after operation were recovered to the levels 1 d before operation. The comparison of various indicators at the same timing points after operation between the two groups was not statistically significant. The levels of TBIL, ALT, AST, and GGT 1 d after operation in the two groups were significantly elevated when compared with 1 d before operation, and the levels of various indicators 7 d after operation were recovered to the levels 1 d before operation. The recovery degree in the observation group was significantly superior to that in the control group. Conclusions: LC has a small effect on the immune function and liver function, with a rapid postoperative recovery, obviously reflecting the superiority of minimal invasiveness, which is safe and reliable; therefore, it deserves to be widely recommended in the clinic.

1. Introduction

Cholecystectomy is a common operation in the general surgery department. Gallbladder stone, gallbladder polyps, acute and chronic cholecystitis are mainly involved in the gallbladder diseases, among which gallbladder stone is a main reason for cholecystectomy[1]. An acute attack of gallbladder diseases will induce severe abdominal pain, nausea, and vomiting, so that cholecystectomy is often required in the clinic to reach the goal of thorough cure. Currently, open cholecystectomy (OC) and laparoscopic cholecystectomy (LC) are mainly adopted in the treatment of gallbladder diseases in the clinic. Due to small trauma, rapid postoperative recovery, minimal reduction of the effect brought by the operation trauma, and the best therapeutic effect, LC is widely applied in the clinic[2,3]. It is reported that OC and LC have a certain effect on the immune and liver functions. In order to explore the effect of different cholecystectomy methods on the immune function and liver function, the clinical materials of patients who were admitted in our hospital from December, 2014 to December, 2015 for cholecystectomy were analyzed.

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2. Materials and methods

2.1. General materials

A total of 110 patients who were admitted in our hospital from December, 2014 to December, 2015 for cholecystectomy were included in the study and divided into the observation group (LC) and the control group (OC) according to different operation methods with 55 cases in each group, among which in the observation group, 21 were male, and 34 were female; aged from 25 to 62 years old, with an average age of (48.5±11.7) years old; 28 had gallbladder stone, 13 had chronic cholecystitis, and 14 had gallbladder polyps; in the control group, 23 were male, and 32 were female; aged from 24 to 63 years old, with an average age of (47.7±12.2) years old; 27 had gallbladder stone, 16 had chronic cholecystitis, and 12 had gallbladder polyps. The comparison of the general materials between the two groups was not statistically significant (P>0.05).

2.2. Inclusion and exclusion criteria

Inclusion criteria: (1) those who were in accordance with the diagnostic criteria of gallbladder related diseases; (2) those who had signed the informed consents. Exclusion criteria: (1) those who were merged with chronic liver disease, abnormal liver function, severe infection, and dysimmunity disease; (2) those who were performed with ERCP before operation; (3) those who were accompanied by jaundice, common bile duct stones, or hepatolithiasis; (4) those who were pregnant or at the lactation period.

2.3. Methods

The operation was performed with tracheal intubation under general anesthesia. The patients in the observation group were performed with LC. CO2 was used to establish pneumoperitoneum with air pressure from 12 to 15 mmHg. The three-hole method or four-hole method laparoscope was used for operation. The surrounding tissues were separated. The anatomy of Calot triangle was performed. The cystic artery and cystic duct were occluded and separated. The gallbladder was peeled off and removed. The electrocoagulation knife was used for hemostasis. The patients in the control group were performed with OC. Under the right upper quadrant costal margin, an incision was made. The corresponding tissues were separated to expose the surgical field. The anatomy of Calot triangle was performed. The cystic artery and cystic duct were occluded and separated and the gallbladder was removed. A routine drainage was performed after operation, and antibiotics were applied for infection prevention.

2.4. Observation indicators

The morning fasting venous blood 1 d before operation, 1 d and 7 d after operation was collected. The immunoturbidimetric assay was used to detect the levels of serum immunoglobulin IgA, IgG, and IgM. The full automatic blood cell analyzer was used to determine the levels of TBIL, ALT, AST, and GGT. The changes of immune globulin and liver function in the two groups were observed and compared.

2.5. Statistical analysis

SPSS 18.0 software was used for statistical analysis. The measurement data were expressed as mean ± SD, and t test was used. Chi-square test was used for the enumeration data. P<0.05 was regarded as statistically significant.

3. Results

3.1. Comparison of the immunoglobulin levels before and after operation in the two groups

The levels of IgA, IgG, and IgM 1 d after operation in the two groups were significantly reduced when compared with 1 d before operation, and the levels of various indicators 7 d after operation were recovered to the levels 1 d before operation (P<0.05). The comparison of various indicators at the same timing points after operation between the two groups was not statistically significant (P>0.05) (Table 1).

3.2. Comparison of the liver function before and after operation between the two groups

The levels of TBIL, ALT, AST, and GGT 1 d after operation in the two groups were significantly elevated when compared with

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<tr>
<th>Table 1. Comparison of the immunoglobulin levels before and after operation in the two groups (n=55).</th>
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<td>Groups</td>
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<tr>
<td>Control</td>
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</table>

*P>0.05 when compared with the control group; *P<0.05 when compared with 1 d before operation and 7 d after operation.
of pathogens after receiving the specific stimulation can synergize with stimulatory molecules to produce and secrete specific humoral immunity is mainly mediated by B cells which reported by Qu[8].

The effects of LC and OC on the immune function and liver function are therefore, widely applied in the gallbladder removal and small effect on the respiration, circulation, immunity, and rapid postoperative recovery, higher tolerance in the elder patients, surgery characterized by small incision, less damage to the tissues, operation were recovered to the levels 1 d before operation (P<0.05). The recovery degree in the observation group was significantly superior to that in the control group (P<0.05) (Table 2).

4. Discussion

OC is a mature surgical technique with a higher effectiveness and safety, but it can create a large trauma to the patients. Moreover, its tolerance is reducing with the increasing age, and the risk is correspondingly increased. LC is a kind of minimally invasive surgery characterized by small incision, less damage to the tissues, rapid postoperative recovery, higher tolerance in the elder patients, and small effect on the respiration, circulation, immunity, and stress; therefore, it is widely applied in the gallbladder removal[5,6]. Trauma and any outside bad stimulation can bring added burden to the body and affect the stable internal environment to cause liver function damage, body stress, and immune reaction[7]. The study of the effects of LC and OC on the immune function and liver function reported by Qu[8] shows that LC has a small effect on the immune function and liver function.

Under a normal condition, the concentration of immunoglobulin maintains a relatively constant level. Researches demonstrate that surgery can produce a dual effect of excessive consumption and synthesis inhibition to the immunoglobulin, and the reduced degree is associated with the severity degree of trauma[9]. The specific humoral immunity is mainly mediated by B cells which can synnergy with stimulatory molecules to produce and secrete the specific immunoglobulin and are involved in the elimination of pathogens after receiving the specific stimulation[10]. IgG is synthesized by the spleen and plasma cells. When the body receiving the outside antigenic stimulation, IgG firstly combines with the antigen to form the antigen complex which can integrate with the macrophages to promote the phagocytosis and regulation, protect and maintain the normal physiological function, and reduce the damage of stimulation to the body. IgA is an important factor for protecting the body mucous membrane. When the stimulation antigens invade the skin and intestinal mucosa, IgA can secrete the antibodies to eliminate the antigens. IgM mainly plays a role in the humoral immunity, possessing strong sterilization, phagocytosis, and bacteriolyis function, can activate the complements and regulate the phagocytosis, and promote the phagocytosis by complement mediation[11,12]. It is reported that the operation wound can create a stress reaction and cause immune dysfunction, resulting in general immune reaction inhibition, among which the specific immunity alteration is obviously associated with the trauma degree[13].

The results in the study showed that the levels of IgA, IgG, and IgM 1 d after operation in the two groups were significantly reduced when compared with 1 d before operation, and the levels of various indicators 7 d after operation were recovered to the levels 1 d before operation (P<0.05); the comparison of various indicators at the same timing points after operation between the two groups was not statistically significant (P>0.05), indicating that LC has a small effect on the humoral immunity, manifesting in a less reduced degree of immune function after operation and rapid postoperative recovery, which is no different with OC.

It is reported by Aniwar et al[14] that the levels of TBIL, ALT, AST, and GGT 1 d after OC and LC operations were elevated, and 5 d after operation were recovered to the levels 1 d before operation, suggesting that LC and OC have a certain effect on liver function.

The effect of OC on the liver function is mainly originating from the liver extrusion and traction during the operation, and the reduced blood circulation in the liver due to anesthesia and stress reaction[15]. CO2 pneumoperitoneum is required to be established for LC. CO2 pneumoperitoneum can reduce the blood flow of the portal vein and hepatic artery, which can alter the hepatic blood flow dynamics, thus affecting the liver function. The higher the pneumoperitoneum pressure is, the worse the hepatic circulation is, and the more serious the ischemia is, thus affecting the liver function. Moreover, with the increased pneumoperitoneum pressure, partial CO2 will enter the blood circulation, which can stimulate the production of endocrine hormone and aggravate the hepatic ischemia, thus leading to liver function damage[16]. Hemostasis with electrocoagulation knife can damage the local liver tissues and the extrahepatic bile duct, which is another reason for liver function injury, resulting in the elevation of transaminase after operation; therefore, electric knife operation should be reduced during the operation in order to reduce the extrahepatic bile duct thermoelectric effect and heat injury to the liver[17].

The results in the study showed that the levels of TBIL, ALT, AST, and GGT 1 d after operation in the two groups were significantly elevated when compared with 1 d before operation, and

<table>
<thead>
<tr>
<th>Groups</th>
<th>Time</th>
<th>TBIL (μmol/L)</th>
<th>ALT (U/L)</th>
<th>AST (U/L)</th>
<th>GGT (U/L)</th>
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<tbody>
<tr>
<td>Observation</td>
<td>1 d before operation</td>
<td>9.37±6.54</td>
<td>17.28±5.83</td>
<td>19.32±3.71</td>
<td>22.28±5.57</td>
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<td>1 d after operation</td>
<td>24.26±5.15*</td>
<td>34.71±5.25*</td>
<td>33.15±3.66*</td>
<td>48.59±7.58*</td>
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<td>7 d after operation</td>
<td>8.98±7.58*</td>
<td>16.73±4.78*</td>
<td>18.71±3.57*</td>
<td>23.24±6.55*</td>
</tr>
<tr>
<td>Control</td>
<td>1 d before operation</td>
<td>9.42±4.55</td>
<td>17.35±5.58</td>
<td>19.27±4.25</td>
<td>22.19±5.71</td>
</tr>
<tr>
<td></td>
<td>1 d after operation</td>
<td>29.84±5.31*</td>
<td>41.19±3.51*</td>
<td>41.47±4.05*</td>
<td>58.35±6.32*</td>
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<td></td>
<td>7 d after operation</td>
<td>9.69±5.47</td>
<td>18.75±5.74</td>
<td>21.31±2.17</td>
<td>24.07±4.65</td>
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</tbody>
</table>

*P<0.05 when compared with the control group; †P<0.05 when compared with 1 d before operation and 1 d after operation.

Comparison of the liver function before and after operation between the two groups (n=55).
the levels of various indicators 7d after operation were recovered to the levels 1 d before operation (P<0.05); the recovery degree in the observation group was significantly superior to that in the control group (P<0.05), indicating that OC and LC can damage the liver function to a different degree, but the effect by LC is less than that by OC; moreover, the various indicators are correspondingly recovered with the rehabilitation.

In conclusion, LC has a small effect on the immune function and liver function, with a rapid postoperative recovery, obviously reflecting the superiority of minimal invasiveness, which is safe and reliable; therefore, it deserves to be widely recommended in the clinic.

References


