Intrahepatic bile duct stone is a common type of cholelithiasis. Liver resection is the main surgical method in clinical treatment of intrahepatic bile duct stone. Its purpose is to remove the lesion, take out the stone completely and restore drainage while maximally reserve healthy liver tissue. Intrahepatic bile duct stones are mostly in strictly periodic distribution along bile duct bundle. Therefore, liver resection scope should be in unit of liver segments, complete excision of lesions of bile duct and corresponding liver. Open liver resection is the conventional method, but it will cause more traumas and is not conducive to postoperative recovery. Laparoscopic liver resection is a minimally invasive surgery developed in recent years. Through the use of video cameras, it can obtain clear vision and achieve precise operation \(^{10}\). In the following research, curative effect of laparoscopic liver resection in treating intrahepatic bile duct stone and its influence on serum indexes were analyzed.

1. Materials and methods

1.1 Subjects

80 cases of intrahepatic bile duct stone patients treated in our hospital from May 2013 to August 2014 were enrolled. They received liver resection and were randomly divided into the observation group who received laparoscopic liver resection and the control group who received open liver resection. Then serum was collected to detect inflammatory indexes, stress indexes, liver injury molecule and pain signal molecule contents. Results: (1) inflammatory stress response degree: compared with the control group, serum NF-kB, IL-17, IL-23, Cor, NE and E contents of the observation group were lower; (2) liver injury index: compared with the control group, serum TB, α-GST, PNP, OCT, GLDH and Arg I contents of the observation group were lower; (3) pain signal molecules: compared with the control group, serum mRNA contents of JAK2, STAT3, STAT5, JNK and MCP-1 of the observation group were lower. Conclusion: laparoscopic liver resection is helpful to reduce inflammatory stress response, control liver tissue injury and inhibit activation of pain signal pathway; it’s an ideal surgical method in treating intrahepatic bile duct stone.
1.2 Surgical methods

The observation group received laparoscopic liver resection. 6-hole method was adopted for surgery, which was as follows: placing 30° laparoscopic probe at 1.0cm under navel; choosing crossing points of horizontal lines that were 4 cm above middle of the right and left clavicle and navel as main operative hole and vice operative hole; choosing crossing points of left and right rib front lines and lower rib edges as assistant operative holes; placing portal triad clamping device at 2cm under xiphoid. During operation, hepatic round ligament, left triangular ligament, falciform ligament and left coronary ligament were first transected. Second hepatic portal was separated after lifting the liver. After selective portal blood occlusion, corresponding liver was then cut off. For resection of left lateral lobe of the liver, surface liver parenchyma at the left edge of hepatic round ligament was cut off, blood vessels to the left lateral lobe were separated and clipped, and then bile duct of the left lateral lobe was cut off with ultrasonic knife; for resection of left half liver, at first, portal door was first reduced, Glisson sheath of left half liver was separated with right angle clamp and clipped, and then liver tissue was cut off. The control group received open liver resection.

1.3 Sample collecting and testing methods

1.3.1 Serum collecting methods

At the end of surgery, 5 ml of peripheral blood was collected, standing for 10min at room temperature and centrifuged. Upper level of serum was taken and transferred into 1.5ml centrifuge tube and stored at -80°C.

1.3.2 Testing indexes and methods

Automatic biochemical analyzer was used to test TB content; ELISA was used to test contents of inflammatory response indexes NF-κB, IL-17, IL-23 as well as stress response indexes Cor, NE and E; analysis of t test results showed that serum NF-κB, IL-17, IL-23, Cor, NE and E contents of the observation group were lower than those of the control group. Differences had statistical significance (P<0.05).

2. Results

2.1 Inflammatory stress response

Surgical trauma will cause inflammatory response and stress response. At the end of surgery, serum indexes were collected and then ELISA was used to detect contents of inflammatory response indexes NF-kB, IL-17, IL-23 as well as stress response indexes Cor, NE and E; analysis of t test results showed that serum NF-kB, IL-17, IL-23, Cor, NE and E contents of the observation group were lower than those of the control group. Differences had statistical significance (P<0.05).

2.2 Liver injury indexes

Surgical operation of liver resection will cause liver tissue injury. Therefore, serum biochemical indexes related to liver injury were tested. At the end of surgery, both groups’ serum specimen was collected. ELISA was used to test contents of liver injury indexes TB, -GST, PNP, OCT, GLDH and Arg I; after t test, it was found that TB, -GST, PNP, OCT, GLDH and Arg I contents of the observation group were lower than those of the control group. Differences had statistical significance (P<0.05).

2.3 Pain signal pathway

Surgical trauma will cause postoperative pain. JAK-STAT and JNK-MCP1 are main signal pathways that mediate pain response. Therefore, fluorescence quantitative PCR was used to test serum pain-related signal molecule contents. T test analysis showed that mRNA contents of JAK2, STAT3, STAT5, JNK and MCP-1 of the observation group were lower than those of the control group. Differences had statistical significance (P<0.05).

| Table 1: Comparison of both groups’ inflammatory indexes and stress indexes |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                 | NF-kB(ng/L)     | IL-17(ng/L)     | IL-23(ng/L)     | Cor(ng/ml)      | E(ng/ml)        | NE(ng/ml)       |
| The observation group | 29.14±3.31      | 75.52±9.34      | 132.27±18.29    | 144.41±18.21    | 121.31±14.95    | 92.29±11.14     |
| The control group   | 48.32±6.25      | 128.14±18.65    | 229.54±32.14    | 227.29±34.41    | 198.24±23.23    | 154.13±22.43    |
| P                 | <0.05           | <0.05           | <0.05           | <0.05           | <0.05           | <0.05           |

| Table 2: Comparison of both groups’ liver injury indexes |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                 | TB(μmol/L)      | -GST(mU/L)      | PNP(U/L)        | OCT(U/L)        | GLDH(U/L)       | Arg I(U/L)      |
| The observation group | 3.18±0.44      | 174.52±22.32    | 14.58±1.85      | 2.13±0.32       | 0.84±0.09       | 3.74±0.52       |
| The control group   | 5.34±0.71      | 256.69±31.85    | 21.45±2.81      | 2.92±0.40       | 1.42±0.17       | 5.59±0.74       |
| T                 | 7.020           | 6.484           | 6.818           | 5.293           | 8.198           | 7.581           |
| P                 | <0.05           | <0.05           | <0.05           | <0.05           | <0.05           | <0.05           |
inflammatory cell activation and inflammatory factor recruitment and IL-23 are pro-inflammatory factors which can participate in can regulate expressions of multiple inflammatory factors; IL-17 and IL-23, etc. NF-kB is an important nuclear transcription factor which inflammatory response, including NF-kB as well as IL-17 and IL-23, etc. NF-kB is an important nuclear transcription factor which can regulate expressions of multiple inflammatory factors; IL-17 and IL-23 are pro-inflammatory factors which can participate in inflammatory cell activation and inflammatory factor recruitment. Stress responses are the activation of adrenal medulla and cortex, and the release of relevant hormones into blood. Cor is an important hormone released by adrenal cortex and it is very important to the body’s resistance to noxious stimulation; E and NE are released by adrenal medulla and they can mediate hemodynamic fluctuations. The research analyzed both groups’ serum inflammatory stress indexes at first and results showed that compared with the control group, serum NF-kB, IL-17, IL-23, Cor, NE and E contents of the observation group were lower, which indicated that laparoscopic liver resection was helpful to reduce inflammatory response and stress response caused by surgical operation.

3. Discussions

Open surgery is the most widely used method in clinical with relatively simple operation and lower requirement for medical devices. However, with wider resection and traction scope and larger amount of bleeding, it will cause more traumas to body functions and thus influence postoperative recovery process. Laparoscopic surgery is a gradually developed minimally invasive surgery and laparoscopic liver resection has been performed by scholars in recent years. The biggest advantage of laparoscopic surgery is minimally invasive. The use of video probes reduces the incidence and extent of intra-operative traction to local organizations. The most direct embodiment of the body suffering from surgical trauma is the activation of inflammatory stress response. Inflammatory factors and transcription factors are the most intuitive indicators that reflect inflammatory response, including NF-kB as well as IL-17 and IL-23, etc. NF-kB is an important nuclear transcription factor which can regulate expressions of multiple inflammatory factors; IL-17 and IL-23 are pro-inflammatory factors which can participate in inflammatory cell activation and inflammatory factor recruitment. Stress responses are the activation of adrenal medulla and cortex, and the release of relevant hormones into blood. Cor is an important hormone released by adrenal cortex and it is very important to the body’s resistance to noxious stimulation; E and NE are released by adrenal medulla and they can mediate hemodynamic fluctuations. The research analyzed both groups’ serum inflammatory stress indexes at first and results showed that compared with the control group, serum NF-kB, IL-17, IL-23, Cor, NE and E contents of the observation group were lower, which indicated that laparoscopic liver resection was helpful to reduce inflammatory response and stress response caused by surgical operation.

While cutting off corresponding liver segments of lesions of hepatic duct in liver resection surgery, there is a need to pull and squeeze adjacent normal liver tissue, resulting in liver tissue injury. Laparoscopic surgery is with clear vision and precise operation. It can reduce traction and squeeze of surgical operation to normal liver tissue and then ease the damage degree of normal live tissue. Studies have shown that many biochemical markers in serum can more sensitively reflect the damage degree of liver tissue, such as TB, α-GST, PNP, OCT, GLDH and Arg I. TB is a catabolism product of cholesterol in the liver and enters the intestine with the secretion of bile. Liver cell injury or intrahepatic bile duct blockage will cause abnormal bile acid metabolism or excretion, expression of which is elevated serum TB content. α-GST is a kind of drug metabolizing enzyme and located in the central cell of the liver lobule. It can reflect the damage of liver metabolism; PNP is located in liver sinusoidal endothelial cell, closely related to the degradation of ATP, and is the sensitive indicator that reflects liver sinusoidal endothelium injury; OCT and GLDH are enzymes that are largely expressed in hepatocyte mitochondrion, and are released into blood in injury or rupture of liver cell; Arg I is the enzyme distributed in liver nucleus and microsome and it can be used to reflect injury of nucleus and microsome. The research compared both groups’ liver injury indexes and found that compared with the control group, serum TB, α-GST, PNP, OCT, GLDH and Arg I contents of the observation group were lower, which indicated that laparoscopic liver resection was helpful to reduce normal liver tissue injury.

Pain caused by incision and wound is the most common postoperative concurrent change. Laparoscopic surgery reduces surgical incision and trauma, and certainly will help to alleviate postoperative pain at the same time. Modern basic medical studies have shown that the body’s pain reaction is mediated by complex signal pathways. Surgical trauma causes postoperative pain through different signal pathways. JAK-STAT signal pathway is composed of related receptors of tyrosine kinase, JAK and SAT. It plays a regulatory role in multiple systems and cells. JAK2, STAT3 and STAT5 are widely expressed in hippocampal neurons and glial cells, and are involved in occurrence of pain perception and neurodegenerative lesions. In the process of pain occurrence, expressions of multiple cytokines increase, which, through related receptors of tyrosine kinase, activates JAK2 and its downstream STAT3 and STAT5, causes large expressions of pain mediators such as ATP, prostaglandins, excitatory amino acids and nitric oxide, etc, and ultimately causes increased sensitivity to pain and occurrence of pain perception. JNK-MCP1 is an important signal pathway that is involved in neuropathic pain. C-Jun N-terminal kinase, i.e. JNK is a member of mitogen-activated protein kinase, i.e. MAPK family. Noxious stimulation can activate JNK, increase expression of monocyte chemoattractant protein 1, i.e. MCP-1 who belongs to chemokine family, acts on CCR2 in nervous system and causes ectopic impulses and occurrence of pain. The research analyzed pain-related signal molecule contents and found that serum JAK2,
STAT3, STAT5, JNK and MCP-1 contents of the observation group were lower than those of the control group, which indicated that laparoscopic liver resection was helpful to inhibit activation of pain signal pathway.

In conclusion, laparoscopic liver resection is helpful to reduce inflammatory stress response, control liver tissue injury and inhibit activation of pain signal pathway; it’s an ideal surgical method in treating intrahepatic bile duct stone.

References


