Comparison of the trauma degree after retroperitoneoscopy and percutaneous nephtoscopy treatment of complicated upper ureteral calculi

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ABSTRACT

Objective: To compare the trauma degree after retroperitoneoscopy and percutaneous nephtoscopy treatment of complicated upper ureteral calculi. Methods: A total of 82 cases of patients with complicated upper ureteral calculi who received surgical treatment in our hospital from July 2013 to January 2015 were included for study. According to the different surgical methods, included subjects were randomly divided into observation group 41 cases and control group 41 cases. Control group received percutaneous nephtoscopy treatment, observation group received retroperitoneoscopy treatment, and then differences in early postoperative coagulation indicators, blood glucose and insulin levels, stress protein levels as well as PI3K/Akt and p38MAPK signaling pathway expression were compared between two groups. Results: Early postoperative PLCR, PDW, APTT and D-D values of observation group were lower than those of control group while Ca²⁺ value was higher than that of control group; early postoperative GLU, fasting lactate, fasting lactate/pyruvic acid and HOMA-IR values of observation group were lower than those of control group while HOMA-β value was higher than that of control group; early postoperative HSP70, DNA ligase 1, JAB1 and ATF4 expression levels of observation group were higher than those of control group while β-tubulin and IFT1 expression levels were lower than those of control group; early postoperative p38MAPK mRNA and protein expression levels of observation group were lower than those of control group while PI3K and Akt mRNA and protein expression levels were higher than those of control group. Conclusion: Retroperitoneoscopy treatment of patients with complicated upper ureteral calculi causes less injury to patients and less effect on internal environment, and helps to patients’ early postoperative rehabilitation.

1. Introduction

Percutaneous nephrolithotomy (PCNL) and retroperitoneal laparoscopic ureterolithotomy (RLU) are the common methods of the clinical treatment of complicated ureteral calculi, and the advantages and disadvantages of the two in the treatment have been controversial. Complicated ureteral calculi are mostly complicated with distal inflammatory polyp, stenosis and ureteral distortion etc., so the operation is difficult. PCNL is with longer ureteroscope, and can be smoothly sent into the upper ureter[1,2]. In RLU operation, posterior peritoneal space will directly decide whether the operation is smooth or not, the operator needs to use fingers to artificially push open the fascia and expand the peritoneal space during operation, the process is relatively complex but the surgical trauma is small, and the probability of completely removing calculi is high. In the research, the trauma degree after retroperitoneoscopy and percutaneous nephtoscopy treatment of complicated upper ureteral calculi was mainly compared, hereby reported as follows.
2. Information and methods

2.1 General information

A total of 82 cases of patients with complicated upper ureteral calculi who received surgical treatment in our hospital from July 2013 to January 2015 were included for study. According to the different surgical methods, included subjects were randomly divided into observation group 41 cases and control group 41 cases. Control group included 22 male cases and 19 female cases, they were 30-69 years old and the average was (49.82±8.55) years; observation group included 23 male cases and 18 female cases, they were 32-68 years old and the average was (48.76±8.36) years. Differences in baseline information were not significant between two groups, \( P > 0.05 \).

2.2 Surgical methods

Control group received percutaneous nephrolithotomy (PCNL) treatment, specifically as follows: patients took bladder lithotomy position, F5 ureter was retrograde inserted from affected side and catheter was indwelled. Patients changed to prone position and then the waist was elevated, puncturing through 11 or 12 costal inferior margin into target calyces guided by ultrasound, placing guide wire after urine came out and expanding percutaneous renal channel. Ureteroscope was placed, then the joint of pelvis and ureter was found, the sheath was sent into the upper ureter and the location of stone, holmium laser optical fiber was placed, the stones were broken, cleaned and removed, double J tube was indwelled, sheath was removed and T tube was sutured and fixed.

Observation group received retroperitoneal laparoscopic ureterolithotomy (RLU) treatment, specifically as follows: patients lay on the uninjured side, a longitudinal incision (1.5 to 2.0 cm) was made in costal inferior margin 2 cm, long curved pliers were used to open muscle layer and lumbodorsal fascia, the index finger was used to push open the peritoneum and expand the retroperitoneum, homemade balloon was placed and 500 mL gas was injected, trocar with diameter of 10 mm was embedded in 2 cm under the costal margin and sacral spinal muscular outer margin. Laparoscope and related equipment were embedded, perirenal fascia was opened, lateral vertebral fascia was incised, the ureter was found and ureteral calculi segment was freed. Ureter above the stone was clamped, and the hook was used to split the ureter and remove the calculi. Double J tube was embedded after operation, and 3-0 absorbable suture line was used to seam ureteral incision, and retroperitoneal drainage tube was indwelled.

2.3 Observation indexes

Early postoperative coagulation indicators: platelet-large cell ratio (PLCR), platelet distribution width (PDW), activated partial thromboplastin time (APTT), D-dimer (D-D) and Ca\(^{2+}\).

Blood glucose and insulin change: fasting blood glucose (GLU), fasting lactate, fasting lactate/pyruvic acid, insulin resistance index (HOMA-IR) and insulin secretion index (HOMA-\( \beta \)).

Stress-related proteins: 70S heat shock protein (HSP70), \( \beta \)-tubulin, DNA ligase, IFIT1, JAB1 and endoplasmic reticulum stress-related protein activating transcription factor 4 (ATF4).

PI3K/Akt and p38MAPK signaling pathways: peripheral blood was obtained from patients, and western-blot and RT-PCR were used to detect the mRNA and protein expression levels of p38MAPK, PI3K and Akt in it.

2.4 Statistical methods

Data obtained in the research was analyzed by SPSS 23.0 software, measurement data was in terms of Mean ± SD, comparison between two groups was by \( t \) test, and \( P < 0.05 \) was set as the standard of statistical significance in differences.

3. Results

3.1 Blood coagulation indicators

Surgical trauma can make the patient in a state of abnormal blood coagulation, and severe cases may result in the occurrence of postoperative bleeding. Early postoperative detection of patients'
blood coagulation-related indicators is the reliability index to judge the treatment outcome, and results showed that early postoperative PLCR, PDW, APTT and D-D values of observation group were lower than those of control group while Ca2+ value was higher than that of control group ($P<0.05$), shown in Table 1.

### 3.2 Blood glucose and insulin levels

There are varying degrees of stress damage in patients after surgical treatment, glycogen decomposition decreases and insulin resistance occurs under stress, and there is obstacle in the maintenance of normal blood glucose level. Similar coagulation indexes, blood glucose and insulin levels in surgical patients can reflect the surgical trauma and operation effect to a certain extent, and specific results were as follows: early postoperative GLU, fasting lactate, fasting lactate/pyruvic acid and HOMA-IR values of observation group were lower than those of control group while HOMA-β value was higher than that of control group ($P<0.05$), shown in Table 2.

### 3.3 Stress protein levels

There may be abnormal expression of a series of related proteins in stress process, which causes histocyte dysfunction, and thus affects homeostasis. Detection of the expression levels of trauma-associated proteins HSP70, DNA ligase [Ⅰ], JAB1 and others showed that early postoperative HSP70, DNA ligase [Ⅰ], JAB1 and ATF4 expression levels of observation group were higher than those of control group while β-tubulin and IFIT1 expression levels were lower than those of control group ($P<0.05$), shown in Table 3.

### 3.4 PI3K/Akt and p38MAPK signaling pathways

Surgical trauma and stress can regulate multiple abnormal signal pathways, which contributes to the changes of downstream functional factor expression levels, and is an important approach to regulate cell injury and apoptosis. PI3K/Akt and p38MAPK signaling pathways play an important role in the process of surgical trauma, and PI3K, Akt and p38MAPK are their downstream factors. The detection of postoperative PI3K, Akt and p38MAPK expression levels of two groups showed that early postoperative p38MAPK mRNA and protein expression levels of observation group were lower than those of control group while PI3K and Akt mRNA and protein expression levels were higher than those of control group ($P<0.05$), shown in Table 4.

### 4. Discussion

The treatment of upper ureteral calculi has been a clinical difficulty, and especially for complicated upper ureteral calculi patients with distal ureteral stenosis, polypus and tortuousness, etc, the choice of surgical approach will directly determine treatment outcome. Both percutaneous nephrolithotomy (PCNL) and retroperitoneal laparoscopic ureterolithotomy (RLU) are the minimally invasive methods to treat complicated upper ureteral calculi, but PCNL needs...
artificially established percutaneous renal channel, and there is the risk of bleeding during and after operation\[3,4\]. RLU may remove the stones all at once, it is with small trauma, less bleeding and rapid postoperative recovery, and so it is widely welcomed by clinical physicians and patients. Given that the treatment of complicated upper ureteral calculi is difficult, reducing the surgical trauma is one of the most effective measures to improve the effect of treatment, patients with complicated upper ureteral calculi were selected as the research subjects in the research, and the trauma degree after retroperitoneoscopy and percutaneous nephrostomy treatment of complicated upper ureteral calculi was compared, which would be specifically studied from coagulation indexes, blood glucose and insulin levels, stress protein levels, PI3K/Akt and p38MAPK signal pathway expression and other aspects.

Coagulation dysfunction caused by different degrees of trauma can cause multiple organ dysfunctions in patients, existing statistical data shows that 25%-35% of trauma patients may have postoperative blood coagulation dysfunction, and it is directly related to the case fatality rate of patients. At present, the state of early blood coagulation function in patients with trauma is receiving more and more attention, and early postoperative blood coagulation indexes of patients were also detected in the study\[5,6\]. Platelet-large cell ratio (PLCR), platelet distribution width (PDW), activated partial thromboplastin time (APTT), D-dimer (D-D) and Ca2+ are clinical common blood coagulation indexes, and the results showed that postoperative PLCR, PDW, APTT and D-D values of observation group were lower while Ca2+ value was higher. The main cause of blood coagulation dysfunction in patients with trauma is that endothelial cells, mononuclear cells and others contact with blood, induce TF generation in a short time, start the exogenous coagulation system, cause blood coagulation factor consumption, platelet aggregation as well as coagulation and fibrinolytic system imbalance. And in the results of this research, there was no obvious low coagulation state in retroperitoneoscopy group of patients, indicating that less surgical trauma could reduce the influence on the metabolism of FIB and make the blood coagulation dysfunction within the relatively compensatory scope\[7\].

Post-traumatic stress can cause elevated blood glucose levels, and in order to maintain blood glucose balance, cerebral center increases insulin secretion. Excessive insulin cannot be combined with insulin receptor in the cell membrane and can’t play the role of antagonizing glucagon, eventually leading to sharply elevated blood glucose levels in the circulating blood. Blood glucose level change and glycometabolism disorder mainly depend on the degree of insulin resistance and compensatory secretion level of insulin\[8,9\]. High blood glucose is also one of the important causes of the blood coagulation system function change, and can influence all phases of the blood coagulation system. In the research, the values of early postoperative blood glucose, insulin and other related indexes in circulating blood of patients were detected, and results showed that early postoperative GLU, fasting lactate, fasting lactate/pyruvic acid and HOMA-IR values of observation group were lower while HOMA-\(\beta\) value was higher. HOMA-IR and HOMA-\(\beta\) can be used as the reliable indexes to judge the outcome and prognosis of trauma patients\[10\]. Both increased lactate and pyruvic acid ratio and increased lactate level mark that histocyte oxidation process deteriorates and a variety of diseases reach end-stage. The above results indicated that laparoscopic operation brought less damage to patients and reduced blood glucose fluctuations and insulin compensatory dysfunction caused by stress.

Early after trauma, the body experiences ischemia, anoxia and reperfusion process, and under the effect of early immune inflammatory reaction and other factors, there can be stress reaction in patients, which induces increased transcription activity of certain genes, expresses and generates non-specific proteins, known as stress proteins (SRP)\[11\]. 70S heat shock protein (HSP70) is a highly conservative stress protein produced when an organism is under adverse environmental factors, is closely related to cell damage, and belongs to nonspecific cytoprotective protein. HSP70 can prevent protein aggregation, assist the damaged protein folding and protect polypeptide swimming to the ribosome. It has been confirmed that \(\beta\)-tubulin expression is up-regulated after nervous system trauma, and it is currently recognized early stress indicator that indicates the existence of trauma. DNA ligase \(V\), also called DNA ligase, can connect DNA 3’-OH terminal and 5’-P terminal, and make the two generate phosphate diester bond\[12,13\]. DNA ligase \(V\) expression increases in traumatic stress reaction, plays the role of tissue repair and can protect the body and reduce the degree of tissue damage. IFIT1 is protein produced by human cells through interferon induction, highly expressed IFIT1 has been found in burn patients, and it is considered to be closely related to glucocorticoids. IFIT1 combination with glucocorticoid can reduce transcriptional activity, reduce anti-inflammatory activity of glucocorticoid and lead to excessive inflammatory reaction. JAB1 can strengthen the transcriptional activation activity of glucocorticoid, and as JAB1 expression increases, glucocorticoids transcription activity increases. At present, it has been found that JAB1 has the effect of both regulating the inflammatory response and inhibiting the generation and release of cytokines. Endoplasmic reticulum stress-related protein activating transcription factor 4 (ATF4) is an important matter of PERK pathway, and its content is little in cells under physiological condition. In cases of endoplasmic reticulum stress, ATF4 translation increases and protein generation increases, making eIF2\(\alpha\) phosphorylate and restore protein synthesis, and maintaining the normal function of cells. Above research results showed that early postoperative HSP70, DNA ligase \(V\), JAB1 and
that p38MAPK plays an important role in traumatic disease. P38MAPK is involved in the generation of oxygen free radicals, peroxidase and so on in reperfusion injury, indicating that p38MAPK pathway is activated during the process of trauma, and the degree of trauma is positively correlated with p38MAPK expression levels increases significantly in patients with trauma, indicating that p38MAPK pathway is activated during the process of trauma, and the degree of trauma is positively correlated with p38MAPK activation degree. Above research results showed that postoperative p38MAPK mRNA and protein expression levels of observation group were lower while PI3K and Akt mRNA and protein expression levels were higher, indicated that retroperitoneoscopy treatment of complicated upper ureteral calculi caused less trauma to tissues and cells.

To sum up, it is concluded as follows: retroperitoneoscopy treatment of patients with complicated upper ureteral calculi causes less injury to patients and less effect on internal environment, helps to patients’ early postoperative rehabilitation, and is worth popularization and application in clinical practice in the future.

References


