



Comparison between laparoscopic surgery and laparotomy for the treatment of acute ruptured ectopic pregnancy

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ABSTRACT

Objective: To study the stress reaction after laparoscopic surgery and laparotomy for the treatment of acute ruptured ectopic pregnancy.

Methods: 68 patients with acute ruptured ectopic pregnancy who received emergency surgical treatment in Pangang Group General Hospital between July 2013 and September 2016 were selected and analyzed retrospectively, including 29 patients with laparoscopic surgery and 39 patients with laparotomy who were included in the laparoscopy group and laparotomy group respectively. Before operation as well as 1d and 3d after operation, serum was collected to detect biochemical indexes and stress hormones.

Results: 1d and 3d after operation, serum Alb, AST, ALT, BUN, Scr and UA levels were not significantly different between laparoscopy group and laparotomy group ($P > 0.05$); serum NE (149.65 ± 17.58 vs. 186.61 ± 23.52 , 162.32 ± 20.15 vs. 295.86 ± 28.97 pg/ml), E (135.28 ± 19.85 vs. 179.55 ± 22.52 , 152.11 ± 18.52 vs. 231.38 ± 29.58 pg/ml), ACTH (3.88 ± 0.49 vs. 5.12 ± 0.82 , 4.39 ± 0.52 vs. 6.58 ± 0.92 pmol/L), Cor (177.64 ± 20.12 vs. 224.59 ± 35.55 , 185.21 ± 22.12 vs. 289.45 ± 41.28 ng/ml), Ins (12.21 ± 1.86 vs. 17.58 ± 2.52 , 18.95 ± 2.68 vs. 27.61 ± 4.12 IU/mL), PRA (1.65 ± 0.25 vs. 2.18 ± 0.35 , 1.73 ± 0.21 vs. 2.55 ± 0.47 ng/ml), AngII (44.12 ± 7.64 vs. 59.63 ± 7.92 , 52.27 ± 7.95 vs. 76.12 ± 9.35 pg/ml) and ALD (155.22 ± 19.76 vs. 205.62 ± 24.52 , 189.10 ± 22.58 vs. 316.85 ± 42.85 pg/ml) levels of laparoscopy group were significantly lower than those of laparotomy group ($P < 0.05$).

Conclusions: Laparoscopic surgery for acute ruptured ectopic pregnancy causes less adrenal stress reaction and RAAS system stress reaction, and the overall level of trauma is lower than that of laparotomy.

1. Introduction

Both laparotomy and laparoscopic surgery are the common surgical methods for the clinical treatment of acute ruptured ectopic pregnancy. Laparotomy operation is simple, can clearly reveal operation field, and is currently the most widely used way of ectopic pregnancy emergency surgery[1-2]. Laparoscopic surgery

is the operation method rising in recent years, the endoscopic equipment enables surgical operation under minimally invasive condition, the vision is clearer and the operation is more delicate, it can choose oviduct excision or embryo removal retaining oviduct, and it is suitable for women at childbearing age and with fertility requirements[3-4]. At present, more and more domestic and foreign scholars have adopted laparoscopic surgery for acute ruptured ectopic pregnancy and achieved positive effect, but there is no report about the stress response caused by the trauma after acute ruptured ectopic pregnancy. In the following study, the stress reaction after laparoscopic surgery and laparotomy for the treatment of acute ruptured ectopic pregnancy was analyzed.

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2. Subjects and methods

2.1 Research subjects

68 patients with acute ruptured ectopic pregnancy who received emergency surgical treatment in Pangang Group General Hospital between July 2013 and September 2016 were selected, and the inclusion criteria: (1) diagnosed with ectopic pregnancy after blood β -hCH, urine pregnancy test and vaginal ultrasound; (2) admitted to hospital for acute abdominal pain, with nonthrombogenic blood after posterior vaginal fornix puncture, and complying with the ruptured ectopic pregnancy; (3) accepting emergency operation; (4) with complete medical treatment. The medical records of 68 patients were reviewed, and there were 29 patients with laparoscopic surgery and 39 patients with laparotomy who were included in the laparoscopy group and laparotomy group respectively.

2.2 Operation methods

Both groups of patients underwent surgery under general anesthesia. Laparotomy group received lower abdominal transverse incision to expose the ruptured oviduct and then decide the salpingectomy or tubal embryo transfer according to actual condition. Laparoscopic group received infra-umbilical piercing and CO₂ filling to establish pneumoperitoneum, the pressure was maintained between 12-15mmHg, then the a 10 mm transverse incision was made at umbilical level, Trocar was imbedded for abdominal exploration, then 0.5-1.0cm incision was made in left and right McBurney's points to imbed surgical instruments, expose the ruptured oviduct and then decide the surgical method according to actual condition, and the method was the same as that of laparotomy group. After the operation was completed, the abdominal cavity was flushed, drainage was imbedded, and incisions were sutured.

2.3 Serum index detection methods

Before operation as well as 1d and 3d after operation, 5-8ml cubital venous peripheral blood was collected and centrifuged to separate serum, the automatic biochemical analyzer was used to detect albumin (Alb), aspartate aminotransferase (AST), alanine aminotransferase (ALT), blood urea nitrogen (BUN), serum creatinine (Scr) and uric acid (UA) levels, and enzyme-linked immunosorbent assay kits were used to determine epinephrine (E), norepinephrine (NE), adrenocorticotrophic hormone (ACTH), cortisol (Cor), insulin (Ins), renin (PRA), angiotensin II (AngII) and aldosterone (ALD) levels.

2.4 Statistical methods

SPSS20.0 software was used to input and analyze data, measurement data analysis between two groups was by t test and

$P < 0.05$ indicated statistical significance in differences.

3. Results

3.1 General information

Laparoscopy group included 29 cases, they were (25.46 \pm 4.22) years old, the duration of amenorrhea was (13.89 \pm 1.93), and the abdominal bleeding volume was (144.51 \pm 18.65)ml; laparotomy group included 39 cases, they were (24.97 \pm 4.51) years old, the duration of amenorrhea was (14.11 \pm 1.88), and the abdominal bleeding volume was (141.98 \pm 17.95)ml. The two groups of patients were not significantly different in age, duration of amenorrhea and abdominal bleeding volume ($P < 0.05$).

Table 1

Comparison of general information between two groups of patients (\pm s)

Parameters	Laparoscopy group (n=29)	Laparotomy group (n=39)	P
Age (years old)	25.46 \pm 4.22	24.97 \pm 4.51	>0.05
Duration of amenorrhea (weeks)	13.89 \pm 1.93	14.11 \pm 1.88	>0.05
Abdominal bleeding volume (ml)	144.51 \pm 18.65	141.98 \pm 17.95	>0.05

Table 2

Comparison of serum biochemical indexes between two groups of patients before and after operation (\pm s)

Parameters	Laparoscopy group (n=29)	Laparotomy group (n=39)	P
Alb(mg/L)			
Before operation	64.29 \pm 7.82	65.12 \pm 9.24	>0.05
1d after operation	62.89 \pm 8.21	64.02 \pm 8.79	>0.05
3d after operation	63.77 \pm 9.12	64.89 \pm 9.52	>0.05
AST(U/L)			
Before operation	19.28 \pm 2.85	19.85 \pm 2.57	>0.05
1d after operation	20.11 \pm 2.77	20.11 \pm 3.08	>0.05
3d after operation	19.92 \pm 2.44	20.32 \pm 3.28	>0.05
ALT(U/L)			
Before operation	23.51 \pm 3.68	23.77 \pm 4.28	>0.05
1d after operation	22.98 \pm 3.42	23.21 \pm 4.09	>0.05
3d after operation	23.77 \pm 4.12	23.55 \pm 4.52	>0.05
BUN(mmol/L)			
Before operation	7.57 \pm 0.83	7.71 \pm 0.94	>0.05
1d after operation	7.81 \pm 0.94	7.82 \pm 1.02	>0.05
3d after operation	7.92 \pm 0.89	7.88 \pm 0.91	>0.05
Scr(μ mol/L)			
Before operation	83.11 \pm 9.35	82.94 \pm 10.24	>0.05
1d after operation	84.18 \pm 9.75	83.57 \pm 9.37	>0.05
3d after operation	82.89 \pm 9.14	83.11 \pm 9.14	>0.05
UA(μ mol/L)			
Before operation	329.56 \pm 47.82	332.12 \pm 48.95	>0.05
1d after operation	334.21 \pm 49.21	331.93 \pm 46.57	>0.05
3d after operation	336.42 \pm 50.29	334.28 \pm 42.39	>0.05

3.2 Biochemical indexes

Before operation as well as 1d and 3d after operation, analysis of the serum biochemical indexes Alb, AST, ALT, BUN, Scr and UA levels between two groups of patients was as follows: before operation as well as 1d and 3d after operation, serum Alb, AST, ALT, BUN, Scr and UA levels were not significantly different between laparoscopy group and laparotomy group ($P > 0.05$).

3.3 Endocrine stress hormones

Before operation as well as 1d and 3d after operation, analysis of serum endocrine stress hormones NE, E, ACTH, Cor, INS, PRA, AngII and ALD between two groups of patients was as follows: before operation, serum NE, E, ACTH, Cor, INS, PRA, AngII and ALD levels were not significantly different between laparoscopy group and laparotomy group (P>0.05); 1d and 3d after operation, serum NE (149.65±17.58 vs. 186.61±23.52, 162.32±20.15 vs. 295.86±28.97 pg/ml), E (135.28±19.85 vs. 179.55±22.52, 152.11±18.52 vs. 231.38±29.58 pg/ml), ACTH (3.88±0.49 vs. 5.12±0.82, 4.39±0.52 vs. 6.58±0.92 pmol/L), Cor (177.64±20.12 vs. 224.59±35.55, 185.21±22.12 vs. 289.45±41.28 ng/ml), Ins (12.21±1.86 vs. 17.58±2.52, 18.95±2.68 vs. 27.61±4.12 IU/mL), PRA (1.65±0.25 vs. 2.18±0.35, 1.73±0.21 vs. 2.55±0.47ng/ml), AngII (44.12±7.64 vs. 59.63±7.92, 52.27±7.95 vs. 76.12±9.35 pg/ml) and ALD (155.22±19.76 vs. 205.62±24.52, 189.10±22.58 vs. 316.85±42.85 pg/ml) levels of laparoscopy group were significantly lower than those of laparotomy group. Differences in serum NE, E, ACTH, Cor, INS, PRA, AngII and ALD levels were significantly significant between two groups of patients 1d and 3d after operation (P<0.05).

Table 3

Comparison of serum endocrine stress hormones between two groups of patients before and after operation (±s)

Parameters	Laparoscopy group(n=29)	Laparotomy P group(n=39)	P
NE(pg/ml)			
Before operation	126.93±19.32	128.15±17.58	>0.05
1d after operation	149.65±17.58	186.61±23.52	<0.05
3d after operation	162.32±20.15	295.86±28.97	<0.05
E(pg/ml)			
Before operation	102.52±14.85	104.11±16.42	>0.05
1d after operation	135.28±19.85	179.55±22.52	<0.05
3d after operation	152.11±18.52	231.38±29.58	<0.05
ACTH(pmol/L)			
Before operation	2.95±0.41	3.01±0.39	>0.05
1d after operation	3.88±0.49	5.12±0.82	<0.05
3d after operation	4.39±0.52	6.58±0.92	<0.05
Cor(ng/ml)			
Before operation	152.38±18.75	155.42±19.12	>0.05
1d after operation	177.64±20.12	224.59±35.55	<0.05
3d after operation	185.21±22.12	289.45±41.28	<0.05
Ins(IU/ml)			
Before operation	8.29±1.02	8.51±1.06	>0.05
1d after operation	12.21±1.86	17.58±2.52	<0.05
3d after operation	18.95±2.68	27.61±4.12	<0.05
PRA(ng/ml)			
Before operation	1.35±0.22	1.39±0.19	>0.05
1d after operation	1.65±0.25	2.18±0.35	<0.05
3d after operation	1.73±0.21	2.55±0.47	<0.05
AngII(pg/ml)			
Before operation	30.25±5.58	30.94±4.95	>0.05
1d after operation	44.12±7.64	59.63±7.92	<0.05
3d after operation	52.27±7.95	76.12±9.35	<0.05
ALD(pg/ml)			
Before operation	126.27±17.65	127.15±15.62	>0.05
1d after operation	155.22±19.76	205.62±24.52	<0.05
3d after operation	189.10±22.58	316.85±42.85	<0.05

4. Discussion

Emergency surgery is the first choice for treatment of acute ruptured ectopic pregnancy, and according to the ectopic pregnancy site and disease condition, the salpingectomy or the surgery retaining the oviduct can be selected. Acute ruptured ectopic pregnancy can cause a large amount of bleeding and blood volume loss, which will affect the blood perfusion of liver, kidney and other important organs and increase the risk of viscera function damage[5-6]. In clinical practice, the timely emergency operation can avoid further development of bleeding and ensure the safety of the patient's life. Laparotomy and laparoscopic surgery are the common ways of operation for acute ruptured ectopic pregnancy, the former is with simple operation, but large trauma[7], and the latter is with small trauma and delicate operation, and can furthest meet the requirements of the childbearing age women to retain fertility[8-9]. In the above study, the changes of the important viscera function after laparotomy and laparoscopic surgery treatment of acute ruptured ectopic pregnancy were analyzed at first, and the comparison of biochemical indicators between two groups of patients before and after surgery showed that before operation as well as 1d and 3d after operation, serum Alb, AST, ALT, BUN, Scr and UA levels were not significantly different between laparoscopy group and laparotomy group. Thus it confirms that no matter laparotomy or laparoscopic surgery, the timely emergency surgery will not cause obvious liver and kidney function impairment in patients with acute ruptured ectopic pregnancy.

Laparoscopic surgery is not only beneficial to retaining the fertility childbearing-age patients with ectopic pregnancy, but can also reduce the surgical trauma and the stress reaction caused by trauma. Operation trauma is a strong stressor that can significantly activate the body's stress response and cause the abnormal synthesis and secretion of a variety of endocrine hormones[10-11]. Adrenal gland is the endocrine gland that plays an important role in the process of stress reactio, the hormones secreted by adrenal medulla and cortex are closely related to the activation of stress reaction[12]. Adrenal medullary secretion function is associated with the excitability of sympathetic nervous system, and the stress reaction caused by trauma could increase the excitability of sympathetic nervous system, which causes the massive release of NE and E and leads to vasoconstriction and myocardial contractility enhancement[13-14]; the adrenocortical secretion function is regulated by HPA axis, hypothalamus signal peptide acts on pituitary gland and stimulate the synthesis and release of ACTH, ACTH acts on adrenal cortex and causes massively secretion of Cor, and the Cor can on the one hand, enhance the ability of the body to endure trauma[15], and on the other hand promote glycogen decomposition and elevate blood sugar levels, and also stimulate the compensatory secretion of insulin[16-17]. In the study, analysis of the contents of adrenal gland-related endocrine hormones showed that serum NE, E, ACTH, Cor and INS levels of laparoscopic group 1d and 3d after surgery were significantly lower than those of laparotomy group. This means that

laparoscopic surgery treatment of acute ruptured ectopic pregnancy causes fewer traumas than laparotomy, and the postoperative adrenal gland-related stress reaction activation is lighter.

The activation of the body's stress response is not only related to the change of the adrenal cortex and medulla function, but also closely related to the renin - angiotensin - aldosterone (RAAS) system activity. The stress response caused by surgical trauma can directly activate RAAS system, and the pathological condition of massive blood volume loss in patients with ruptured ectopic pregnancy will also increase the compensatory activity of RAAS system[18]. Renin synthesis and secretion is the first step of RAAS system activation, blood volume loss and vasoconstriction will both stimulate renin release, renin splits the angiotensinogen into angiotensin I, and the angiotensin I is further transformed into AngII further under the action of angiotensin converting enzyme. AngII is an important vasoactive substance that can not only cause vasoconstriction and guarantee the blood perfusion of vital organs, but can also stimulate the secretion of ALD, lead to sodium and water retention and increase compensatory blood volume[19-20]. In order to further clarify the differences in trauma after laparoscopic surgery and laparotomy treatment of acute ruptured ectopic pregnancy, serum RAAS system stress hormone contents were analyzed in the study, and the results showed that serum PRA, AngII and ALD levels of laparoscopic group 1d and 3d after surgery were significantly lower than those of laparotomy group. It further shows that laparoscopic surgery treatment of acute ruptured ectopic pregnancy causes fewer traumas than laparotomy, and the postoperative RAAS system stress reaction activation is lighter.

To sum up, it is believed that laparoscopic surgery for emergency treatment of acute ruptured ectopic pregnancy causes lower overall trauma degree than laparotomy, and laparoscopic surgery helps reduce the degree of postoperative adrenal stress reaction and RAAS system stress reaction.

Conflict of interest statement

The authors report no conflict of interest.

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