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Risk factors of gastroparesis syndrome after abdominal non-gastroduodenal operation and its prevention

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ABSTRACT

Objective: To investigate risk factors of gastroparesis syndrome (PGS) after abdominal non-gastroduodenal operation and its prevention. **Methods:** Clinical data of 22 patients with PGS after abdominal non-gastroduodenal operation was analyzed retrospectively, and compared with the patients of non-PGS after abdominal non-gastroduodenal operation during the same time. The possible influencing factors of PGS were analyzed by single factor analysis and logistic regression analysis. **Results:** All 13 selected factors related with PGS, including age, disease category (benign and malignant), operation time, intraoperative blood loss, postoperative analgesic pump, postoperative enteral nutrition time, postoperative parenteral nutrition time, perioperative blood glucose level, perioperative nutrition status (anaemia or lower proteinemia), pylorus obstruction before surgery, intra-abdominal infection after surgery, and spiritual factor were related with PGS. The statistical analysis showed that the difference was statistical significant ($P < 0.05$), and gender had no correlation with PGS ($P > 0.05$); non-conditional multivariate analysis showed that malignant tumor, perioperative nutrition status, pylorus obstruction, operation time, blood loss, intra-abdominal infection after surgery, and mental factor were significant related with PGS as dependent variable and related risk factors in single factor analysis as independent variables ($P < 0.05$). **Conclusions:** PGS is a result of multiple factors, and among these factors, malignant tumor, poor nutrition status, pylorus obstruction before surgery, longer operation-time, more blood loss, intra-abdominal infection after surgery, and mental factor are major risk factors of PGS.

1. Introduction

Postoperative gastroparesis syndrome (PGS) is an early common complication after abdominal operation. It mainly occurs in after gastroduodenal operation, but also occurs in non-gastroduodenal operation and is a functional disease with characteristic of gastric motility disorder and non-mechanical obstruction of gastric outlet. The incidence of PGS is increasing with expanding operation and delaying operation-time. It has been reported that the PGS incidence after pancreaticoduodenectomy reached to 20%–50%[1].

Although more cases related with PGS after post subtotal gastrectomy were reported, relatively less cases about PGS after abdominal non-gastroduodenal operation were reported. This study aims to explore risk factors related with PGS.

2. Materials and methods

2.1. Clinical data

A total of 24 PGS cases after abdominal non-gastroduodenal operation were selected, including 15 male and 9 female, aged from 38 to 79 years old; the average age was (56.8±3.5) years old, and included 10 cases with radical resection of colon carcinoma, 3 cases with cholangio-intestinal anastomosis of high bile duct carcinoma, 5 cases

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with radical resection of rectal carcinoma (Dixon), 1 case with resection of total colorectal polyps by laparoscopy, 3 cases with right hemihepatectomy of liver cancer, 2 cases with resection of intestine stromal tumor. The inclusive criteria was as following[2]: the amount of decompressed gastric drainage (more than 600–800 mL/d) and duration (more than 10/d); gastroscope or gastrointestinal image showing non-mechanical obstruction of gastric outlet; gastrointestinal peristalsis decreasing or disappearing; non-underlying diseases leading gastroparesis, such as scleroderma, diabetes mellitus, hypothyroidism, pancreatitis and other connective tissue diseases; without drugs influencing contractility of gastroduodenal smooth muscle, such as morphine, atropine, anisodamine and so on; no significant disturbances of water-electrolyte and acid-base significantly.

2.2. Research method

Patients were divided into observation group and non-PGS patients and control group. The differences between two groups were compared and statistically analyzed, including age, gender, disease category (benign and malignant), operation time, intraoperative blood loss, postoperative analgesic pump, postoperative enteral nutrition time, postoperative parenteral nutrition time, perioperative blood glucose level, perioperative nutrition status (anaemia or lower proteinemia), pylorus obstruction before surgery, intra-abdominal infection after surgery, and spiritual factor (fear, over stress, apprehension and pessimism in the perioperative period).

2.3. Statistic analysis

All measurement data was expressed as mean±SD. Difference between two groups was analyzed by *t*-test and χ^2 -test. Then, risk factors were analyzed diversely by one-factor test and non-conditional logistic regression analysis. The differences were considered to be significant at $P < 0.05$.

3. Results

3.1. Single factor analysis

Table 1 showed 13 selected factors possibly related with PGS, including age, disease category, operation time, intraoperative blood loss, postoperative analgesic pump, postoperative enteral nutrition time, postoperative parenteral nutrition time, perioperative blood glucose level, perioperative nutrition status (anaemia or lower proteinemia), pylorus obstruction before surgery, intra-abdominal infection after surgery, and spiritual factor were related with PGS. The differences had statistical significance ($P < 0.05$); Gender had no relation with PGS ($P > 0.05$). So age, malignant tumor, anaemia or lower proteinemia, pylorus obstruction before surgery, operation time, intraoperative blood loss, intra-abdominal infection after surgery, postoperative analgesic pump, postoperative enteral

nutrition time, postoperative parenteral nutrition, postoperative hyperglycemia and bad mood in the perioperative period were risk factors of PGS.

Table 1

Comparative analysis of the factors related to PGS between two groups.

Factors	Observe group (n=22)	Control group (n=44)	<i>t</i>	χ^2	<i>P</i>
Sex (F/M)	12/10	27/17		4.21	0.371
Age	55.2±2.3	57.3±6.1	2.421		0.033
Disease category				15.52	0.000
Malignant diseases (n)	18	12			
Benign disease (n)	4	32			
Anaemia or lower proteinemia	11	5		16.44	0.000
Pylorus obstruction (n)	8	3		16.49	0.000
Operating time (h)	4.3±0.4	2.9±0.3	3.214		0.003
Blood loss during surgery (mL)	506.1±11.1	337.2±10.3	7.637		0.000
Intra-abdominal infection (n)	5	4		17.01	0.000
Postoperative analgesic pump (n)	10	9		16.87	0.000
Time of postoperative parenteral nutrition (d)	7.5±1.3	5.3±0.2	5.063		0.001
Starting time of enteral nutrition (d)	3.6±0.2	2.1±0.3	4.372		0.012
Postoperative glucose levels (mmol/L)	8.7±1.1	6.5±0.6	4.345		0.015
Mental factors (n)	14	11		17.31	0.000

3.2. Multivariate non-conditional logistic regression analysis

Table 2 showed that malignant tumor, perioperative nutrition status, pylorus obstruction before surgery, intra-abdominal infection after surgery, operation time, intraoperative blood loss, spiritual factors had statistical significance ($P < 0.05$). So, malignant tumor, anaemia or lower proteinemia, pylorus obstruction before surgery, intra-abdominal infection after surgery, operation time, intraoperative blood loss, spiritual factors were main risk factors of PGS.

Table 2

Multivariate non-conditions logistic regression analysis.

Factors	Parameter estimates	$OR=e^{\beta_i}$	χ^2	<i>P</i>
Malignant tumors	3.332	27.994	8.212	0.009
Nutrition status	3.569	35.481	17.425	0.000
Pylorus obstruction	3.873	48.086	13.345	0.000
Operation time	4.371	79.123	9.372	0.006
Intraoperative blood loss	3.183	24.119	7.241	0.025
Intra-abdominal infection	3.914	50.099	15.474	0.000
Mental factor	2.981	19.708	7.674	0.013

4. Discussion

PGS is an early common complication after upper abdominal surgery, especially which occurs mainly after gastroduodenal operation, and also occurs after non-gastroduodenal operation. Symptoms of PGS mainly includes postoperative bleeding, satiety, malaise, intractable hiccup, nausea vomiting (more gastric content, less bile) after meal, and temporary remission of symptoms after vomiting. The pathogenesis of PGS is not completely understood, which is considered to be related to many factors, such as operative procedure, mental factor, neural factor, anesthesia factor, underlying diseases, changes of diet structure, and so on[3]. The occurrence of PGS after abdominal non-gastroduodenal operation is correlated with the following reasons: Gastrointestinal inhibition sympathetic nervous system is activated after operation, which on the one hand, directly inhibited gastric motility, on the other hand, indirectly inhibited gastromyoelctrical activity and smooth muscle contraction and alleviated gastric emptying by catecholamine from sympathetic nerve endings preventing the release of acetylcholine[4]; Intraoperative and postoperative gastrointestinal decompression is not thorough, which leads gastro hyperinflation or full of anesthesia gas to directly inhibit gastrointestinal peristalsis. All these reasons cause delayed gastric emptying and the occurrence of PGS[5]; Patients with underlying diseases, such as anemia, hypoproteinemia, low immunity, and diabetes mellitus, may be likely to develop anastomotic edema, anastomotic sputum, anastomotic spasm, or output stenosis after operation which causes limitation of dyskinesia and delaying gastric emptying[6,7]; Anesthetics has inhibiting effect on gastrointestinal peristalsis. Some studies show that the occurrence of PGS has a higher incidence for especially postoperative analgesic pump[8]; Patients with anxiety and early-stage feeding of acid, fat, the diet with higher or lower osmotic pressure may have a correlation with the occurrence of PGS[9]. In summary, the occurrence of PGS is not a result of one factor and related with many factors.

One-factor analysis showed 13 factors possibly related with PGS, age, disease category, operation time, intraoperative blood loss, postoperative analgesic pump, postoperative enteral nutrition time, postoperative parenteral nutrition time, perioperative blood glucose level, perioperative nutrition status (anaemia or lower proteinemia), pylorus obstruction before surgery, intra-abdominal infection after surgery, and spiritual factor were related with PGS. The differences had statistical significance ($P < 0.05$), and gender had no relation with PGS ($P > 0.05$). So, age, malignant tumor, anaemia or lower proteinemia, pylorus obstruction before surgery, operation time, intraoperative blood loss, intra-abdominal infection after surgery, postoperative analgesic pump, postoperative enteral nutrition time, postoperative parenteral nutrition, postoperative hyperglycemia and bad

mood in the perioperative period were risk factors of PGS.

Furthermore, this study showed that malignant tumor, perioperative nutrition status, pylorus obstruction before surgery, intra-abdominal infection after surgery, operation time, intraoperative blood loss, and spiritual factors had statistical significance ($P < 0.05$). So, malignant tumor, anaemia or lower proteinemia, pylorus obstruction before surgery, intra-abdominal infection after surgery, more operation time, more intraoperative blood loss, and spiritual factors were main risk factors of PGS.

All the analysis shows that the occurrence of PGS is a result of multiple factors, and pseudomorph caused by interaction or interference of all factors may influence the judgment of the diseases. This study used logistic gradual regression model and overcame one-sidedness of one-factor analysis so that the results had significant representativeness and accuracy, but because of the limitation of inadequate samples and selection of risk factors possibly related, the study needs further more samples and including more variables that are possibly related to PGS in order to comprehensively and systematically investigate the pathogenesis and provide reference for clinical prevention and individual treatment.

Conflict of interest statement

We declare that we have no conflict of interest.

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