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Original research

The role of fast-track surgery in pancreaticoduodenectomy: A retrospective cohort study of 635 consecutive resections

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HIGHLIGHTS

- Compared with other abdominal operations, pancreaticoduodenectomy (PD) has higher mortality because of serious complications.
- Fast-track surgery (FTS) methods can reduce the risk of complications and shorten the medical expenses.
- FTS technology could be used safely in patients whom underwent abdominal operations such as PD.

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ABSTRACT

Background: Pancreaticoduodenectomy (PD) is one of the most difficult and dangerous operations in general surgery. This study used the concept of fast-track surgery (FTS) technique, which involves pain control, early enteral nutrition and other measures during the preoperative period, to evaluate the rate of complications and shorter hospitalization.

Methods: This retrospective, observational study was conducted between January 2009 and January 2013. A total of 635 patients underwent PD in the Department of Pancreatic Surgery at ChangHai Hospital (Shanghai, China). 325 patients had FTS and 310 patients received the traditional pathway of treatment. The incidence of postoperative complications, the serum albumin level, expenses, postoperative hospitalization, and readmission rates were compared.

Results: There were no significant differences in the blood transfusion volume, nasogastric intubation, and readmission rates ($p > 0.05$). However, the FTS group had less postoperative hospitalization, fewer expenses and a lower incidence of postoperative complications compared with the control group ($p<0.05$).

Conclusion: Pancreaticoduodenectomy can be further optimized by the use of FTS methods, which can reduce the incidence of in hospital postoperative complications and expenses without increasing the risk of readmission.

1. Introduction

Fast-track surgery (FTS) is a concept initially described by Dr. Henrik Kehlet in 2001 [1,2]. This technique involves pain control, early enteral nutrition, and minimally invasive surgical access to reduce the perioperative stress response, decrease hospitalization and increase patient satisfaction and safety after discharge [2]. Following the development of the anesthetic and nursing technique, this concept has been widely used in thoracic, orthopedic, gynecologic and colon surgery [3,4]. However, its role in pancreaticoduodenectomy (PD) is still controversial.

PD is a technically difficult and delicate operation, which has been performed with increasing frequency for both benign and malignant diseases of the periampullary region in recent decades [5]. Postoperative complications, such as pancreatic fistula, biliary fistula, intra-abdominal abscess, and delayed gastric emptying (DGE), are common. Despite advances in medical therapy (e.g. utilization of somatostatin) and improved surgical techniques over the past decade, PD has high perioperative mortality with a reported frequency ranging from 3% to 5% [6–8]. Some studies have showed the benefit of early enteral nutrition in the recovery of PD [9]. We aimed to evaluate the safety and outcome of a protocol of

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enhanced recovery after PD in a tertiary care hospital with the biggest volume pancreatic surgery unit in China.

2. Subjects and methods

2.1. Patients and grouping criteria

From January 2009 to January 2013, 712 patients received a PD operation at the Department of Pancreatic Surgery, ChangHai Hospital, Second Military Medical University (SMMU, China). Among them, 635 consecutive, eligible patients underwent PD or pylorus-preserving pancreaticoduodenectomy (PPPD) for diseases of the pancreatic head, ampulla, and distal common bile duct. All participants were adults between the ages of 18 and 83 years (median 52 years). The exclusion criteria were as follows: (1) distant metastases; (2) locally unresectable tumours' (arterial involvement or combined serious inflammation). All patients gave written informed consent before surgery. This study was approved by the Shanghai Changhai Hospital Ethics Committee (SCHEC). All patient records was anonymized and de-identified prior to analysis. Over the study period, 310 patients followed the traditional pathway in the first 2 years and were classified as the control group. From January 2011 to January 2013, 325 patients underwent PD or PPPD (FTS group) after the protocol for the FTS technique was introduced into our department.

2.2. Surgical techniques

All patients underwent the standard preoperative examinations, including cardiorespiratory function assessment, serum biochemical detection, and contrast-enhanced upper-abdominal computed tomography (CT). During the operation, the inhaled anesthetic sevoflurane was used in every case. The operative strategy depended on the scope of the tumor and involvement of vessels, and the clearance of lymph nodes was finished in both groups. All operations were performed by 3 surgeons with expertise involving the pancreas, with each performing over 100 pancreas surgeries/year. The end of the gastric tube was put in the distant 20 cm of the output loop, and ascites were drained by celiac double cannula which passed through the Winslow's foramen and behind the portal vein. The elderly and/or patients with heavy blood loss were treated in the intensive care unit (ICU) after the operation.

Compared with the traditional dissection performed using the endotherm knife in the control group, the FTS patients accepted the new electro-surgery technique such as ultrasound knife and LigaSure™ to dissect and stop bleeding during the operation. Moreover, absorbable suture and nasal-jejunum nutrient canal were used in the FTS group. These measures may reduce the residual foreign matter and simplify the procedure of enteral nutrition after surgery.

2.3. Protocol for early recovery after PD

Pain control is one of the most important aspects of the FTS technique. The FTS group received continuous infusion of bupivacaine 0.125% with fentanyl 2 μg/mL at a rate of 4–6 mL/h until day 5 via the thoracic epidural catheter (T7–T9 level).

In the terms of nutrition after operation, the FTS patients followed a strict feeding plan: (1) drink 100–150 mL water after 6 h (2) infusion of enteral nutritional emulsion (EN) (TPF-D, Fresenius Kabi Deutschland GmbH Co., Germany) via nasogastric tube within 24 h; we increased the amounts by 500 mL (liquid diet, 24–48 h), 1000 mL (semifluid diet, 48–72 h) and 1500 mL (regular diet, 72 h–96 h), then we removed the nasogastric tube. In some patients which cannot tolerate EN as a result of vomiting or abdominal distension, we reduced or stopped the EN infusion. In contrast, patients in the control group received total parenteral nutrition (TPN) and the gastric tube was removed when the patients could take a semifluid diet. The control group fasted for about 72 h after the operation. The TPN solutions were prepared by a clinical pharmacist under aseptic conditions and adjusted to the weight of each patient. The amino acids, fat emulsion and dextrose mixture with electrolytes, vitamins and trace elements were administered via a central venous catheter (CVC).

Furthermore, all patients were encouraged to exercise in the bed to prevent deep vein thrombosis (DVT) and pulmonary embolism (PE). We removed the celiac double cannula when the drainage was below 5 mL/day, and patients were discharged when they regained a normal diet and could perform daily activities.

2.4. Outcomes

We followed up all patients by telephone and mail until 3 months after discharge. The outcome measures included the occurrence of major complications and readmission within 30 days after hospital discharge. Three types of measurement were carried out, including laboratory tests, perioperative condition and complication assessment. The laboratory tests assessed serum albumin (ALB), C-reactive protein (CRP), transferrin (TF) and peritoneal fluid amylase (PFA). Perioperative condition contains blood transfusion volume, days of indwelling gastric intubation, anal exhaust/defecation time, postoperative hospitalization, readmission within 30 days after discharge and complications after PD included pancreatic fistula, biliary fistula, chylous fistula, DGE, ileus, intra-abdominal hemorrhage, gastrointestinal bleed, intra-abdominal abscess, pneumonia and wound infection. The definition of pancreatic fistula was any measurable drain fluid on or after postoperative day 3 with amylase values greater than three times the serum levels, as proposed by the International Study Group on Pancreatic Fistula (ISGPF) [10]. DGE was likewise defined as the inability to return to a standard diet by postoperative week 1 or prolonged nasogastric suction as described by the International Study Group of Pancreatic Surgery (ISGPS) [11].

2.5. Statistical analysis

SPSS 17.0 software (SPSS, Chicago, IL, USA) was used for statistical analyses. Categorical variables were analyzed using the Chi-

Table 1
Clinical characteristics and pathology results.

	FTS group, % (n = 325)	Control group, % (n = 310)	*p* value
Gender			
Male	59.7%	59.4%	0.498
Female	40.3%	40.6%	
Age at surgery (y)	56.96 ± 11.50	57.05 ± 12.30	0.928
Operation			
PD	13.5%	24.5%	0.072
PPPD	77.2%	66.1%	
Pathology			
Benign	19.7%	21.0%	0.690
Malignant	80.3%	79.0%	
Albumin (g/L)			
Preoperative	33.12 ± 3.45	32.98 ± 4.12	0.065
Postoperative	33.65 ± 3.23	33.11 ± 4.01	0.071
C-reactive protein (mg/L)			
Preoperative	8.15 ± 2.02	7.69 ± 2.65	0.059
Postoperative	29.80 ± 15.24	33.56 ± 18.33	0.077
Transferrin (g/L)			
Preoperative	2.33 ± 0.23	2.27 ± 0.21	0.068
Postoperative	2.31 ± 0.12	2.23 ± 0.19	0.071

FTS, fast-track surgery; PD, pancreaticoduodenectomy; PPPD, pylorus-preserving pancreaticoduodenectomy.