

# The Application of Enhanced Recovery after Surgery on Pancreaticoduodenectomy

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**Abstract.** enhanced recovery after surgery was firstly proposed by Danish surgeon Kehlet in 2001. It can reduce stress and trauma as well as postoperative complications and accelerate rehabilitation of patients with preoperative, intraoperative and postoperative application of a series of effective measures based on evidence-based medicine. Its philosophy conforms to modern biology-psychology-social medical model and medical ethics standards while relieving patients' pain, reducing costs and shortening hospitalization time. Its contents can be summarized as: (1) preoperative propaganda and education; (2) effective anesthesia and analgesia; (3) accurate surgical operation; (4) postoperative rehabilitation. With the proposal and gradual recognition of ERAS concept, it has been well applied in the surgeries of gastrointestinal tract, thyroid, breast, urinary system, etc. Corresponding diagnosis standards have been summarized. Especially in the colorectal surgery, the application effect is the most significant. But the concept of ERAS still has great controversy in surgical fields because of complicated operation, great trauma, various complications such as liver surgery and pancreatic operation, so it has not been widely recognized.

## 1 Instruction

The PD involves pancreas, biliary tract, stomach, duodenum, jejunum and many other organs. Not only the tumor needs excision, but pancreatic anastomosis, bilioenteric anastomosis and gastrointestinal anastomosis are required for the reconstruction of the digestive tract, so PD is the most difficult surgical method with great trauma in the field of general surgery. Literature reports that the incidence of postoperative complications of PD reaches 48% [1], such as pancreatic fistula, biliary fistula, bleeding, delayed gastric emptying, incision infection, abdominal infection, stress ulcer, MODS, etc. Abroad treatment centers of general surgery, which applied ERAS concept to pancreatic operation earlier, reported its curative effects. The results of the retrospective study on 41 pancreatic-operation patients from 2005 to 2011 of the University of Melbourne showed: the LOS after surgery and the total LOS of the 20 cases in the ERAS group was significantly lower than the 21 patients in the traditional treatment group ( $P < 0.05$ ); but 3 patients in the ERAS group returned to the hospital due to stomachache while no patients in the traditional treatment group returned [2]. The results of the retrospective study of ERAS application on 82 PD patients of Deoliveira et al. [3] showed: the LOS after surgery and the total LOS were 9d and 11d respectively and the rate of readmission was 14.6%. In this group, the overall incidence of postoperative complication was 47.6%; as for the patients placed with abdominal drainage tube, the incidence of pancreatic fistula was 8.5%. However, the majority of the ERAS clinical researches related with pancreatic surgery are monocentric retrospective researches, so there lacks a unified evaluation system. Meanwhile, the ERAS scheme they apply in the pancreatic surgery usually refers to the pancreatic surgeon. There is no unified scheme aiming at pancreatic disease and pancreatic surgery accepted by most of the pancreatic surgeon. In 2011, ESPEN and ASMEN conducted a systematic review on high-quality random clinical study, cohort study of large samples and META analysis of ERAS after PD. They classified relevant treatment measures and summarized different recommended levels [4]. According to the statistical results and combining the clinical working experience of our department, the application of ERAS on PD is discussed here.

## 2 Preoperative Treatment Scheme

With the application of ERAS on gastrointestinal surgery, clinical practice, evidence-based medicine, preoperative propaganda and education and smoking cessation is confirmed by clinical practice and evidence-based medicine; routine mechanical bowel preparation and long fasting before operation is unnecessary; liquid diet containing glucose 2h before anesthesia is one of the reliable measures. It can reduce trauma and stress stimulation, having positive influence on rapid recovery of patient, so it is widely accepted in practice. Meanwhile, it is also applicable to pancreatic operation and other surgical operations. Preoperative jaundice-reducing treatment before PD surgery is controversial. The results of META analysis of PD perioperative treatment shows: preoperative biliary drainage will not reduce postoperative mortality; on the contrary, it increases the incidence of complications related to drainage [5]. According to our previous clinical experience, we believe preoperative biliary drainage should not serve as the preoperative preparation but should be applied to specific patients. Regarding the patients whose total bilirubin is greater than 171  $\mu\text{mol/L}$  with severe malnutrition or cholangitis, we can consider to conduct preoperative biliary drainage.

### 3 Intraoperative Treatment Scheme

Compared with relatively normative and mature intraoperative treatment scheme of gastrointestinal surgery, the complexity of PD leads to its slow progress in the aspect of minimally invasive, so it is still necessary to shorten surgery time and reduce operative stress so as to achieve greater progress.

(1) Prophylactic reference of antibiotics: single dose of prophylactic antibiotics is used 30 minutes before operation. If the operation time exceeds 3 hours or the bleeding volume is greater than 1500 ml, we can add a dose (according to the half-life of the drug).

(2) Intraoperative insulation: avoiding hypothermy during the operation can reduce the incidence of postoperative incision and the complications of cardiopulmonary system [6]. The measures adopted include rising the indoor temperature of the operating room, warming infusion liquid in advance, washing abdominal cavity with warm saline, covering insulation blanket during and after operation, avoiding unnecessary body exposure, etc.

(3) Controlling stress and reducing trauma: the guideline mentions epidural analgesia during operation: compared with opioid drugs of intravenous application, epidural analgesia in the middle part of the chest has good analgesia with less respiratory depression [7]. But it requires the recognition and cooperation of the anesthetist. As for the laparoscopic surgery, in the gall bladder, stomach, colon and rectum surgeries, endoscopic surgery can significantly relieve the trauma and stress of patients and enhance recovery comparing with laparotomy. But PD not only requires tumor separation and excision around important blood vessels after peritoneum, but also requires complicated digestive tract reconstruction. It has higher requirements of the experience, operation level and endurance of doctors as well as the endoscope instrument. An operation usually takes seven to eight hours. Long-time anesthesia itself increases the stress and trauma of patients, which goes against the concept of ERAS. In clinical work, we regard "minimally invasive surgery" as a concept rather than an operation, so we don't insist on performing PD through endoscope, but reduce the trauma to patients by shortening the operation time, reducing intraoperative bleeding with gentle and careful operation.

### 4 Postoperative Treatment Scheme

In the postoperative ERAS treatment scheme of PD, the focus of the debate is the indwelling drainage tube, the indwelling time of the drainage tube and early-stage feeding of patients.

(1) Blood glucose control: the rising of blood glucose and insulin resistance after PD will lead to anastomotic fistula and other serious complications and rise perioperative mortality.

(2) Postoperative analgesia: establishing standardized painless wards with individualized, multi-mode and preventive analgesia, such as PCIA pump, epidural analgesia, NSAIDs analgesics so as to reduce or avoid systemic application of opioid drugs.

(3) Shortening service time of antibiotic after surgery. For postoperative patients of PD, we combine blood routine examination, C-reactive protein examination, procalcitonin examination as well as body temperature changes to monitor postoperative infection in our clinical work. Antibiotic is usually stopped when procalcitonin falls to 0.5 ng/ml.

(4) Restrictive fluid therapy: postoperative transfusion should follow the principle of transfusion according to demands in order to avoid tissue edema, microcirculation disturbance, hydrothorax, seroperitoneum, abnormality of cardiopulmonary function which will aggravate trauma and stress.

(5) Peritoneal drainage: pancreatic fistula is the most dangerous postoperative complications of PD. Part of the foreign research results show that the incidence of complications caused by postoperative indwelling abdominal drainage or not has no statistically significant difference [8]. However, as there is no completely unified diagnosis critical, the incidence of postoperative pancreatic fistula reported by different centers has great difference. The drainage tube is of great importance to postoperative observation and treatment of complications such as pancreatic fistula and severe bleeding. Our experience is to indwell a drainage tube at the sides of both pancreas-intestine anastomotic stoma and bilioenteric anastomosis stoma. The key point is that the drainage tube should be placed at a distance of 1-1.5 cm from the anastomotic stoma to avoid the injury of the anastomotic stoma in the process of tube drawing; in the meanwhile, if there are no complications such as anastomotic fistula or hemorrhage, the tubulization time should not exceed 5 days.

(6) Early-stage enteral nutrition: early-stage feeding can protect the barrier function of gastrointestinal mucosa and promote postoperative recovery of gastrointestinal functions. Our approach is to place the intestinal feeding tube 10-15 cm away from the gastrointestinal anastomotic stoma and provide small dose of enteral nutrition since the first or second day after operation. Through the retrospective analysis of 127 patients of PD in our department from 2006 to 2013, we draw a conclusion that early-stage enteral nutrition after PD can actively accelerate the recovery of digestive function after operation. The method is secure and effective for it not only promotes the recovery of patients' gastroenteric function but also avoids the adverse impact of food on anastomotic healing.

The study of ERAS, especially in the aspect of PD, started quite late. There are much controversy and few literature reports at home and abroad, but all the research results show its feasibility, security and effectiveness to some degree. European counterparts brought forward the application guide of ERAS in pancreatic operation, but in view of different national conditions, cultural background, ways of life and medical models, western standards cannot be adapted by Chinese patients completely, so blind imitation may have negative effect on patients' recovery and even lead to medical disputes on the contrary. But as practitioners of pancreas surgery, we should catch sight of the significance of ERAS in the development of modern surgery, make efforts to break old ideas and accept new things. In the pursuit of best prognosis and enhanced recovery, we should find an appropriate balance. Customizing ERAS scheme for different patients can truly push forward the cause and bring good news to patients.

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