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Review Article

Impact of perioperative fluid administration on early outcomes after pancreatoduodenectomy: A meta-analysis

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A B S T R A C T

Background: Pancreatoduodenectomy (PD) remains a technically challenging surgical procedure with morbidity rates ranging between 30 and 50%. It is suggested that the liberal use of fluids is associated with a poor perioperative outcome. This review examines the impact of fluid administration on outcomes after PD.
Methods: A literature search was conducted using the MEDLINE, EMBASE and PubMed database (June 1966–June 2016). Studies identified were appraised with standard selection criteria. Data points were extracted and meta-analysis was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).
Results: Eleven studies, seven retrospective trials and four randomized control trials comprising 2842 patients were included. Seven studies were meta-analyzed. There was no difference in length of hospital stay ($P = 0.25$), pancreas specific complications ($P = 0.20$), pulmonary ($P = 0.58$), cardiovascular ($P = 0.75$), gastrointestinal ($P = 0.49$), hepatobiliary ($P = 0.53$), urogenital ($P = 0.42$), wound complication ($P = 0.79$), reoperation rate ($P = 0.69$), overall morbidity ($P = 0.18$), major morbidity ($P = 0.91$), 30-day mortality ($P = 0.07$) and 90-day mortality ($P = 0.58$) in low or high fluid groups.
Conclusion: The current available data fails to demonstrate an association between the amount of perioperative intravenous fluid administration and postoperative complications in patients undergoing PD.

1. Introduction

Although the perioperative mortality of pancreatoduodenectomy (PD) has declined in the last 10 years, it remains a technically challenging surgical procedure associated with morbidity rate ranging between 30 and 50% [1–3]. The complications include anastomotic leak, pancreatic fistula, wound infection and delayed gastric emptying. Low volume center, advanced age, extended resection, higher preoperative serum bilirubin level as well as a soft pancreatic texture have been associated with the aforementioned complications [4].

Owing to the long operative time, substantial evaporative fluid losses occur, compounded by the catabolic postoperative state of reduced oral intake and third-space losses, this results in a negative fluid balance [5,6]. Hence, it is not uncommon for patients to receive large volume of fluids intra- and post-operatively to replace this fluid deficit. More recently, it is recognized that over zealous resuscitation is associated with a negative clinical outcome. Tissue oedema from intravenous fluids leads to pulmonary, cardiac and gastrointestinal dysfunctions as well as impaired wound healing [6]. Randomized trials in colorectal surgery suggests that restricting fluid administration in the perioperative period reduces the incidence of anastomotic leaks, delayed gastric emptying, as well as cardiac and pulmonary complications [7,8]. It also facilitates an

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early return of gastrointestinal function [9].

The aim of this study was to investigate the impact of perioperative fluid administration on perioperative outcomes after pancreatoduodenectomy through a systematic review of published data in the literature to establish evidence-based clinical practice.

2. Methods

2.1. Search strategy

Literature search was conducted using the MEDLINE, EMBASE and PubMed databases (June 1966–June 2016). The search was limited to English language articles and to humans. The search terms used were “pancreaticoduodenectomy” or “pancreatoduodenectomy” AND “fluid”.

2.2. Selection criteria

The selection criteria were: all studies > 20 patients comparing different fluid regimens. The inclusion criteria of minimum of n > 20 was made to improve the strength of the systematic review. The level of evidence (I-III) of included studies was graded according to that described by the U.S. Preventive Services Task Force.

2.3. Data extraction and critical appraisal

The studies were independently and critically assessed using a standard protocol two authors (YH and TCC) using a standard protocol. Discrepancies between the reviewers were resolved by discussion and consensus Data extracted include the methodology, quality criteria, and endpoints addressed in the study. Surgical complications were graded based on the Clavien-Dindo Classification (CDC). (Grade I: no treatment; Grade II: medications only; Grade III: surgical, endoscopic or radiological intervention; Grade IV: life-threatening complications requiring ICU admission). Major complications were defined as CDC grade $\geq$ 3. The complications were categorised to facilitate reporting of endpoints. Complications that include anastomotic leak, fistula, abscess, intraabdominal collections and haemorrhage were classified as pancreas-related complication. Pleural effusions, pulmonary embolisms and pneumonitis were classified as pulmonary complications. Arrhythmia, deep vein thrombosis, vascular thrombosis, myocardial infarction, cardiac arrest and cerebrovascular accident were classified as cardiovascular complications. Delayed gastric emptying, ileus, large bowel obstruction, diarrhea, gastrointestinal tract bleeding and anastomotic leak were classified as gastrointestinal complications. Bile leak and liver infarction were classified as hepatobiliary complications. Mortality rate was further studied at 30 days, 60 days and 90 days.

2.4. Statistical analysis

The systematic review and meta-analysis followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Descriptive analysis was performed to provide summative figures. A meta-analysis of the perioperative outcomes from comparative studies was undertaken with Review Manager (RevMan) v.5.3 (The Cochrane Collaboration, Nordic Cochrane Center, Copenhagen, 2014) and Comprehensive Meta-analysis version 2.0 for Windows (Biostat, Englewood, New Jersey, USA). For continuous data, mean and standard deviation (SD) were estimated from the available median and range using method described by Hozo et al. when they were not available [10]. The mean differences (MD) of the continuous data were calculated. Dichotomous data were pooled for events. Sample size of comparative groups, odds ratio (OR) and 95% confidence intervals (CI) were calculated. A random effects model was used to control for heterogeneity among studies [11]. Heterogeneity among studies was assessed by I^2 statistic including I^2 values up to 30%, to 60% and above 60% indicating low, moderate and high levels of heterogeneity. Its significance was assessed by Cochran's Q-test. Publication bias was assessed visually by funnel plots and statistically with the Egger regression model. A p-value of <0.05 was considered significant.

3. Results

3.1. Literature search

The systematic search identified 863 potentially eligible studies. Fig. 1 shows the review process that led to the final inclusion of eleven studies [4–6,12–19]. There were seven retrospective comparative studies and four randomized controlled trials [4–6,12–19]. Two studies compared fluids administered in patients who experienced postoperative complications with those who did not experience complications [12,13]; nine studies compared complication rates of a high and low volume fluid regimen [4–6,14–19]. Of the nine studies, two studies compared restrictive fluid regimen with standard management [14,16]. Five series compared complication rates associated with different fluid administration rates [4,6,15,17,19]. The remaining two studies adopted quartiles of fluid balance as comparison points [5,18] (Tables 1 and 2).

In the two studies that compared fluid balance in patients with postoperative complications, both studies demonstrated a higher mean fluid balance in patients with postoperative complications [12,13] (Table 2). One of these studies also showed a higher mean fluid balance in patients with major complications [13] (Table 2). In the two studies that assigned quartiles of fluid balance to compare complication rates, both studies reported a higher postoperative fluid balance being associated with higher rates of complications [5,18]. These four studies were precluded from further examination in the meta-analysis due to heterogeneity in outcome reporting

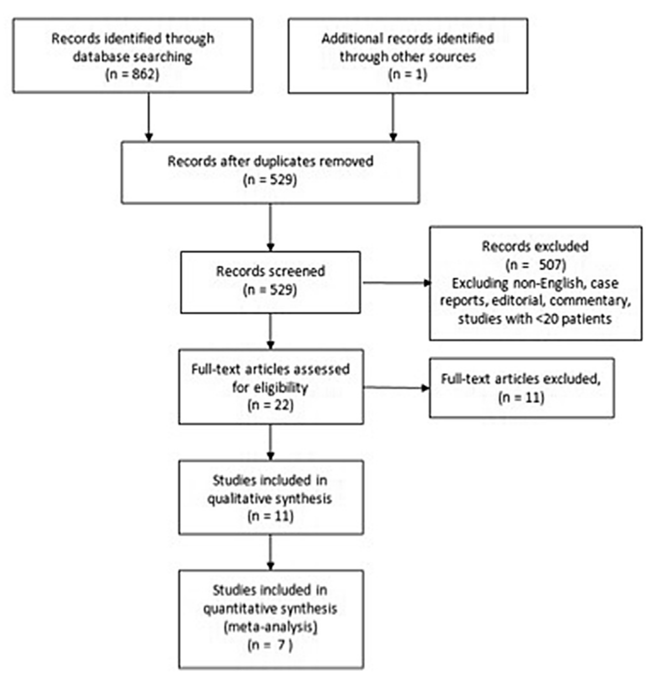

Fig. 1. PRISMA diagram.