Nutrition 32 (2016) 309–314

Contents lists available at ScienceDirect

Nutrition

journal homepage: www.nutritionjrnl.com

Applied nutritional investigation

Feasibility of jejunal enteral nutrition for patients with severe duodenal injuries

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ARTICLE INFO

Article history:
Received 19 June 2015
Accepted 26 August 2015

Keywords:
Enteral nutrition
Parenteral nutrition
Trauma
Duodenal injury
Critical illness

ABSTRACT

Objective: The aim of this study was to evaluate the feasibility of enteral nutrition (EN) for critically ill trauma patients with severe traumatic duodenal injuries who received placement of concurrent decompressing and feeding jejunostomies.

Methods: Adult patients admitted to the trauma intensive care unit from January 2010 to December 2013, given concurrent afferent decompressing and efferent feeding jejunostomies for severe duodenal injury and provided EN or parenteral nutrition (PN), were retrospectively evaluated. Enteral feeding intolerance was defined as an increase in the decompressing jejunostomy drainage volume output, worsening abdominal distension, or cramping/pain unrelated to surgical incisions. Patients who failed initial EN were transitioned to PN.

Results: Twenty-six patients were enrolled. Of the 24 patients given EN within the first 2 wk posthospitalization, 18 (75%) failed EN within 2 ± 2 d of initiating EN. EN was discontinued when increases were seen in decompressing jejunostomy drainage volume output (n = 11) and output with abdominal pain and/or distension (n = 6), or abdominal pain/distension was seen without an increase in output (n = 1). Jejunostomy drainage volume output increased from 474 ± 425 mL/d to 1168 ± 725 mL/d ($P < 0.001$) during EN intolerance. More patients with blunt intestinal injury than those with penetrating injuries (75% versus 15%, respectively; $P = 0.035$) tolerated EN. Patients initially given PN (n = 13) received more calories ($P < 0.005$) and protein ($P < 0.001$) than those given initial EN (n = 13).

Conclusion: The majority of patients with severe duodenal injuries and concurrent decompressing/feeding tube jejunostomies failed initial EN therapy.

Introduction

The importance of early enteral nutrition (EN) in reducing infectious complications and improving mortality for critically ill surgical and trauma patients is well established and recommended by current guidelines [1–5]. Early EN has been proven superior for reducing infectious complications compared with early parenteral nutrition (PN) when given to patients with major abdominal trauma [2,6,7]. As a result, early EN is given to critically ill patients with traumatic injuries whenever possible.

Duodenal injuries are associated with high rates of morbidity and mortality, especially when the injury is in combination with pancreatic injury [8,9]. However, traumatic duodenal injury occurs infrequently due to its protected retroperitoneal location. Patients enrolled in this study required placement of a nasogastric or orogastric tube, retrograde (afferent) decompressing jejunostomy, and antegrade (efferent) feeding jejunostomy in addition to provision of EN or PN. Unfortunately, little is known regarding EN management for these patients. Our anecdotal practice observations provided the opinion that the provision of EN for these patients was associated with a high rate of feeding intolerance. The purpose of this study was to evaluate the feasibility of EN for patients with severe duodenal injuries and concurrent decompressing and feeding jejunostomies.

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http://dx.doi.org/10.1016/j.nut.2015.08.026
0899-9007/

Materials and methods

Patient selection

Adult critically ill patients, age ≥18 y, admitted to the intensive care units (ICUs) of the Presley Trauma Center of Regional One Health in Memphis, Tennessee, with a severe traumatic injury to the duodenum or proximal jejunum at or near the ligament of Treitz with placement of concurrent decompressing and feeding jejunostomies were eligible for the study. Patients were referred to the Nutrition Support Service for EN or PN. Study candidates were retrospectively identified from the Nutrition Support Service monitoring records from January 2010 to December 2013. The patients' electronic medical and Nutrition Support Service records were reviewed for data retrieval. Injury Severity Score (ISS) [10], Abbreviated Injury Scale (AIS)-Abdomen [11], survival, ventilator days, hospital length of stay (LOS), and ICU LOS were retrieved from the trauma registry of Regional One Health. The assignment of the American Association for the Surgery of Trauma (AAST) duodenal injury score [12] was determined based on a consensus of participating attending surgeons from the institution for a different study.

The study was approved and conducted in accordance with guidelines established by the University of Tennessee Health Science Center Institutional Review Board and Regional One Health Office of Medical Research. Because all measurements were performed as part of routine clinical care of the patients and because confidentiality procedures for the patients were maintained, the requirement for written informed consent was waived.

Surgical procedures

At our institution, usual surgical management for patients with AAST grade I duodenal injury is primary repair of the lesion. Patients with AAST grade II or III injury and selected grade IV duodenal injuries receive a primary repair of the intestinal lesion with placement of a decompressing naso or oro-gastric tube, retrograde (afferent) decompressing jejunostomy, and antegrade (efferent) feeding jejunostomy [13]. Other grade IV wounds are managed via repair and duodenal exclusion. A 14- to 16-French red rubber catheter is used for both jejunostomies. Each catheter is introduced into the jejunum through separate enterostomies and is secured using a Witzel technique. The proximal (afferent) decompressing tube is placed distal to the duodenal injury and left open to gravity for drainage. The distal (efferent) jejunostomy tube is used for continuous enteral feeding. A schematic representation for management of severe duodenal injuries with placement of decompressing gastric and jejunostomy tubes with a feeding jejunostomy is provided in Figure 1.

Nutrition therapy

In the present study, the route of initial nutrition therapy was determined by the attending trauma physician based on the extent of organ injuries; complications experienced during the operative procedure; amount of blood loss and fluid resuscitation; postoperative requirement for vasopressor therapy; or intestinal complications such as ileus, obstruction, anastomotic leak, or a fistula. The Nutrition Support Service managed the EN or PN. Patients were assigned energy and protein goals of 25 to 32 kcal/kg daily and 2 to 2.5 g/kg daily, respectively [14]. Preresuscitation body weight was used to determine target nutritional goals. EN-fed patients were given an enteral formula (1.3 kcal/mL, 78 g of protein/L) containing glutamine, arginine, dietary nucleotides, and ω-3 fatty acids [15] at an initial rate of 15 to 25 mL/h via the feeding jejunostomy. The feeding was increased by 15 to 25 mL/h daily until the goal rate was achieved or feeding intolerance observed. Additional liquid protein supplements were provided as needed to achieve goal intakes. Parenteral nutrition therapy was initiated at 25 to 40 mL/h at approximately one-third of the goal amount of macronutrients, fluid, and electrolytes and advanced daily over 3 d until the goal regimen was achieved. Energy intake was decreased, whereas protein intake was maintained for those who received a propofol infusion containing 10% lipid emulsion. We achieved this by eliminating lipid calories and decreasing glucose calories for PN and by reducing enteral feeding rate and addition of liquid protein supplements for those receiving EN. Blood glucose concentrations were maintained between 70 and 150 mg/dL [16,17].

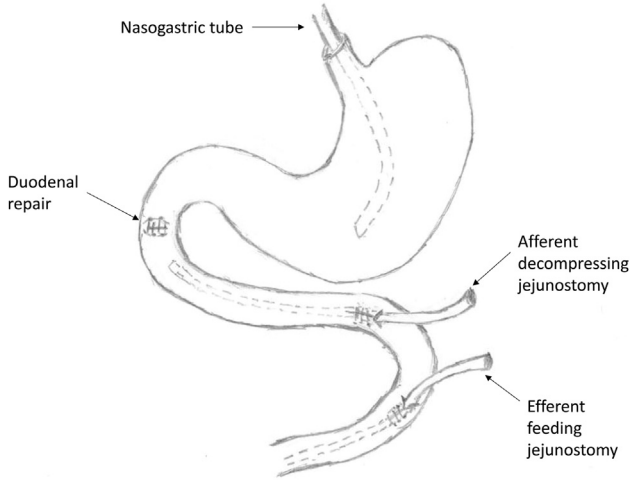

Fig. 1. The twin-tube jejunostomy procedure.

Enteral feeding intolerance was defined as approximately a >300 mL/d increase in the decompressing jejunostomy volume output or worsening abdominal distension, patient complaint of nonspecific signs or symptoms of bloating, or both; abdominal cramping, severe nausea, emesis, or abdominal pain not related to the surgical incision. Because objective criteria derived from studies regarding jejunal EN feeding intolerance for this unique population were lacking, we defined intolerance based on our anecdotal experience and that of others regarding antecedent signs and symptoms associated with reports of complications of intestinal ischemia and bowel necrosis following jejunal enteral feeding in critically ill surgical and trauma patients [18–22]. When enteral feeding intolerance occurred, EN was held and PN was initiated for those who received initial EN therapy. Once the signs and symptoms of enteral feeding intolerance abated, another trial of EN was cautiously reinitiated. PN was discontinued once enteral feeding tolerance was established. Those who failed EN while receiving initial PN therapy continued to receive PN until enteral feeding tolerance was achieved.

Measured and outcome variables

Serum laboratory tests were ordered either by the patient's primary service or the Nutrition Support Service and performed by the hospital laboratory as part of the patients' routine clinical care. Demographic, clinical outcomes, and nutrition data were collected. Patients who could communicate were interviewed daily for evidence of abdominal cramping, distension, bloating, nausea, or abdominal pain unrelated to the surgical incision. A physical exam of the abdomen was conducted daily. Nursing fluid intake and output records were reviewed for episodes of emesis, gastric and afferent drain volume output, bowel movements, and nutrition volume intake. Documentation of infectious and intestinal complications was obtained from the patient's electronic medical records and daily progress notes. Pneumonia was evident by clinical signs and symptoms and confirmed by bronchoalveolar lavage with the presence of $>10^5$ colony-forming units/mL. The number of days patients received antibiotic therapy was monitored; no effort was made to ascertain whether the therapy was empiric or therapeutic. A nitrogen balance determination was conducted for patients in the ICU while receiving EN or PN as previously described [14].

Statistical analysis

Data analysis was conducted using SigmaPlot for Windows, version 11.2 (Systat Software, Point Richmond, VA, USA). The data were evaluated for normality of the distribution by the Shapiro-Wilk test. Independent variables were compared by applying the *t* test for unpaired variables for normally distributed data or the Mann-Whitney *U*-test if not normally distributed. The *t* test for paired variables or Wilcoxon Signed Rank test was used for comparing pre- and post-variables. Two-way analysis of variance was used for assessing serial data with post hoc, pairwise comparison procedures by the Student-Newman-Keuls method. Nominal data were analyzed by χ^2 or Fisher Exact test. Continuous data were expressed as mean ± SD. The significance testing and reported probability values (*P*-value) were two-sided for all variables. A probability $P \leq 0.05$ was established as statistically significant.

Results

Patient characteristics

Twenty-six critically ill patients admitted to the trauma or surgical ICU with severe duodenal or proximal jejunal injuries at or near the ligament of Trietz, who had placement of concurrent decompressing and feeding jejunostomies, and referred to the Nutrition Support Service for EN or PN, were enrolled into the