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Cost-analysis of nutrition support in patients with severe acute pancreatitis

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Abstract

Purpose – The purpose of this research was to assess the preferred route of nutrition support (enteral versus parenteral) for treatment of severe acute pancreatitis in the acute care setting. Further, in cases when enteral nutrition is the preferred route, is nasal-bridling a lower-morbidity and cost-effective method?

Design/methodology/approach – A retrospective review of pre-existing data from an 870-bed hospital system. Medical records were reviewed via an online database system ($n = 25$ patients) with severe acute pancreatitis. Length of stay and cost were analyzed.

Findings – More patients received TPN versus the nasal-jejunal (post-pyloric) tube feeds group. No significant relationship was found between total cost and number of co-morbidities or between either of the two treatment groups. However, a medium to large effect size was shown which could indicate a significant relationship in a larger sample size.

Originality/value – The findings of this research add to the literature already available and will be of interest to those who specialize in this area.

Keywords Pancreatitis, Nutrition, Nasal bridle, Parenteral nutrition, Enteral nutrition, Patients, Health care, United States of America

Paper type Research paper

Introduction

Severe acute pancreatitis is an inflammatory condition that is caused by the activation of specific enzymes in the acinar cells of the pancreas, which results in inflammation of the pancreas and neighboring tissues (Siow, 2008). Pancreatitis is usually associated with increased alcohol consumption and gallstones (Gardner *et al.*, 2008). The remaining causes are usually related to trauma, drugs, and post-endoscopic retrograde cholangiopancreatography (post-ERCP) (Gardner *et al.*, 2008). The signs and symptoms for pancreatitis include severe sudden epigastric pain radiating to the back, nausea, vomiting, diarrhea, loss of appetite, fever/chills, shock, hemodynamic instability, lack of bowel sounds, possibly a pseudocyst mass and steatorrhea

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(Ioannidis, 2008). Treatment is limited and controversial since the disease is poorly understood (Siow, 2008).

Mild acute pancreatitis makes up about 75 percent to 85 percent of all cases and is associated with a low mortality rate compared to severe acute pancreatitis cases (Lugli *et al.*, 2007). Mild pancreatitis first presents as edema of the gland with minimal or no organ dysfunction (Khokhar and Seidner, 2004). Increased protein breakdown and increased oxygen deficits from the blood are the acute inflammatory responses of severe acute pancreatitis, which then results in vital organ dysfunction (Lugli *et al.*, 2007). Patients with mild pancreatitis can often be managed solely with intravenous hydration (Ioannidis *et al.*, 2008). Approximately 15 percent-20 percent of patients presenting with acute pancreatitis are classified as having severe disease with pancreatic necrosis/pseudocysts (McClave *et al.*, 2006). Multi-organ system failure and the presence of pseudocysts are among the most common indicators of severe disease (Forsmark, 2007). In approximately 25 percent-50 percent of severe acute pancreatitis cases length of stay is usually greater than one month and is associated with multiple organ failure and infection which can lead to increased morbidity and mortality (Russell, 2004). Upon admission to the hospital, severe acute pancreatitis patients often present with malnutrition (Lugli *et al.*, 2007). Patients with severe acute pancreatitis have elevated nutritional needs due to increased energy expenditure and catabolism.

The traditional treatment for acute pancreatitis has been fasting in order to avoid pancreatic stimulation; however, that strategy has been proven not to be effective in patients with severe pancreatitis due to the delay of providing nutrition support (Lugli *et al.*, 2007). Parenteral nutrition was once thought to be the standard in providing nutrition to these patients (McClave *et al.*, 2006). Several disadvantages of parenteral nutrition have been identified which include catheter-related sepsis, gut atrophy resulting in possible bacterial translocation, catheter embolism, and hyperglycemia (Lugli *et al.*, 2007). Recently, there has been a shift in the management away from total parenteral nutrition (TPN) to early, post-pyloric enteral feeding placed beyond the beyond the ligament of treitz in the jejunum (Gardner, 2008). The advantages of enteral feeding are more physiological and prevent gut mucosal atrophy and are free from the complications associated with TPN (Martindale *et al.*, 2008). Enteral nutrition used to be disputed because of the invasive placement of the feeding tube and the thought that enteral nutrition caused diarrhea (Lugli *et al.*, 2007). Gastric enteral feedings have been shown to be associated with delayed gastric emptying and increased risk for aspiration, thus evidence to feed post-pylorically (Marik and Zaloga, 2003). One current preventable disadvantage of feeding post-pylorically is the associated risk of proximal migration or recoiling of the nasojejunal tube back into the stomach, which can cause stomach contents to stimulate the release of pancreatic enzymes (Jabbar and McClave, 2005). Overall, enteral nutrition appears to be clinically beneficial because it encourages the rapid return of normal gut function and reduces the cytokine-generated stress response that occurs during an acute episode of pancreatitis (Alsolaiman *et al.*, 2002). Thus, enteral nutrition is preferred because it is more cost-effective than parenteral nutrition and results in fewer complications (Russell, 2004). Parenteral nutrition should be initiated only in patients with severe pancreatitis disease who do not tolerate enteral feeding or in those whom nutritional goals cannot be reached secondary to an obstruction of the ileus.

Nutrition support is critical in patients with severe acute pancreatitis, thus the basis becomes identifying the most appropriate route for enteral nutrition (DeLegge, 2007). When appropriate, placement of a jejunal feeding tube beyond the ligament of Treitz should be trialed (Jabbar and McClave, 2005). Incorrect placement of the jejunal feeding tube, accidental removal, and proximal migration of the tube can contribute to a delay in providing optimal nutrition (Ioannidis *et al.*, 2008). Usually, it is possible to place a nasal jejunal tube within three to five days by which time it is possible to make a diagnosis of severe or mild pancreatitis and assess for an ileus (Eatock, 2005). Unfortunately, the common procedure to place tubes into the jejunum to deliver nutrition is not always clear (Greene *et al.*, 2000). The procedure is time consuming, and utilizes hospital resources including serial x-rays, transportation of critically ill patients to fluoroscopy and uses multiple pharmacological agents (Sedar and Janczyk, 2008).

However, radiological placement of post-pyloric feeding tubes has a high success rate and rarely involves major technique related problems (Thurley *et al.*, 2008). Since placement of these tubes is costly and time sensitive to the radiology technician, having to replace nasojejunal tubes is an expensive significant disadvantage (Heuschkel and Duggan, 2008). Dislodgements also reduce the amount of enteral nutrition received thus resulting in lower caloric intake due to increased wait time to have the tube replaced.

This in turn, adds to decreased clinician productivity because clinicians have to re-do the same procedure multiple times as well as an increase in potential complications (Sedar and Janczyk, 2008). Trained professionals such as registered dietitians are learning to place post-pyloric tubes at the bedside, which should further reduce cost (Jimenez and Ramage, 2004). Seder and Jancyzk investigated if routine bridling of nasoenteric feeding tubes in the intensive care unit is a low-morbidity, cost-effective method of decreasing tube dislodgement. Data showed that implementing the nasal bridle resulted in a reduced unintentional dislodgement rate from 32.6 percent to 6.5 percent. There also was a $4,000 reported cost saving along with a huge reduction in staff time required for tube replacements, radiation exposure (x-rays and fluoroscopy), and sedation requirements (Sedar and Janczyk, 2008). Most of the time naso-jejunal tubes can be placed successfully but a high percentage of avoidable complications occur in the hospital setting such as blockages or misplacement of the tube, thus proving the value of bridling (Jukes and Smithies, 2001).

The clinical challenge is how to provide adequate nutrition to these patients while preserving gut function, inhibiting pancreatic stimulation, and reducing the risk of septic and metabolic complications associated with nutrition support. Overall, post-pyloric enteral feeding with nasal bridling seems to be the optimal route of nutrition support in patients with severe acute pancreatitis (Seder and Jancyzk, 2008). However, some hospitals may not consistently implement feeding patients with severe acute pancreatitis post-pylorically due to the lack of perceived resources in placing and replacing NJ tubes and physician support in changing current practice patterns (Greenwood *et al.*, 2004). If NJ tubes are placed and secured with a nasal bridle then length of stay and total hospitals costs should decrease. The purpose of this study was to assess if hospitals recommend enteral nutrition more often than parenteral nutrition for patients with severe acute pancreatitis.

Methods

Subjects

A total of 25 subjects were recruited via a survey. All subjects were patients at one of the seven hospitals in a large city in North Carolina between February 2008 and December 2008. Online medical records became available in February 2008, which allowed for identifying appropriate candidates by primary admitting diagnoses.

Overall, 52 subjects were pooled via the online search that were admitted between February 2008 and December 2008 with a diagnosis of acute pancreatitis and had a length of stay greater than ten days; however, 28 of these subjects did not meet the inclusion criteria. Each chart was reviewed for diagnosis of severe rather than an acute form of pancreatitis. This was determined by length of stay, type of nutrition ordered, and multiple complications. Inclusion criteria included 18 years of age or older, a confirmed acute pancreatitis diagnosis, a nutrition support physician order or greater than five days without any form of nutrition. Exclusion criteria included pregnancy/lactation, less than 18 years of age, and patients with a confirmed diagnosis of severe acute pancreatitis that did receive an oral diet within the first five days of admission. This study was exempt from IRB approval because the study design was a retrospective review of medical records without identifying information about the given patient.

Measures

Medical records of the subjects were reviewed within a four-week period. All HIPPA regulations were followed. Physician orders, history/physical and progress notes of online medical charts were thoroughly reviewed. The number of days each patient remained nothing by mouth (npo) prior to some form of nutritional support initiation and the type of nutrition support that was ordered were included on the researcher developed survey instrument. Complication status post total parenteral nutrition or nasal-jejunal feedings were evaluated and recorded via nutrition assessments included in each of the charts by a registered dietitian. A daily nutrition support of $\sim$25 kcal/kg per admit weight or average versus adjusted weight and 1.5-2.0 g/kg protein per IBW was standard in all patients.

Patients were assigned to a treatment group depending on the type of nutrition treatment perceived to treat the diagnosis of severe acute pancreatitis. Total cost was evaluated between both treatment groups. The TPN treatment groups' cost included: price of PICC line insertion, labs that were drawn on a bi-weekly basis pertaining to nutrition, cost of TPN formula, and general cost of daily hospital stay depending on length of stay per individual patient. The nasal-jejunal tube feed treatment groups' cost included: price to place NJ tube by radiology, general formula cost per day, and general cost of daily hospital stay depending on length of stay per individual patient. Comorbidities were also assessed, and included patient reported history of heart disease, diabetes, alcohol/drug use, hepatitis, eating disorders, history of pancreatitis, depression, as well as use of mediations, smoking, and BMI if classified as overweight or obese.

Data collection

All data were obtained from patient charts through online documentation computer software system, Chartview/SoftMed. Various ethnic cultures and races were included in this study.

Statistics

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 17.02. The probability level for significance was set at $p < 0.05$. Two independent-samples t tests were performed for both total cost and co-morbidities for both treatment groups (total parenteral nutrition and nasal-jejunal tube feeds). A Pearson correlation was also performed between total cost and co-morbidities.

Results

A total of 24 subjects were included in the final analysis. Data from one subject was excluded because they received both TPN and nasal-jejunal tube feedings. The average length of stay for the subjects included was 16.5 days. Overall, 14 patients remained npo for five or more days; ten patients received nasal-jejunal feeds compared to 14 patients who received TPN. The four patients that received nasal-jejunal feeds had nasal-jejunal tubes displaced by the patient and the tubes had to be replaced; two of the tubes had to be replaced more than once. This process took up to two days each time a tube was replaced. Thus, 44 percent of the time tubes were displaced which hindered the ability to maximize nutrition intake while waiting on replacement.

Various qualitative factors were recorded for each subject. The study included ten females and 14 males. The median age of all subjects was 46 years of age. Of the subjects, nine were African American and 15 were Caucasian; 15 had a history of alcohol/drug abuse and ten subjects had a history of pancreatitis. An overall number of 18 subjects were smokers or had a history of smoking. Body mass index (BMI) was recorded. Of the subjects, 18 had a BMI of 25 kg/m2 or greater, indicating overweight/obese. Pseudocysts were present in approximately one-third of the subjects selected.

Total cost and co-morbidities were tested on each of the treatment variables. The overall mean for total cost was $19,964 with a standard deviation of $7,625. The lowest total cost was $10,321 and the highest total cost was $38,987. The overall mean for comorbidity was 3.75 ± 1.36. The range of co-morbidities was 0-6.

An independent-samples t-test was calculated comparing the mean co-morbidity score of subjects who received the TPN treatment to the mean co-morbidity score of subjects who received post-pyloric tube feedings. This test was calculated to determine if there was a co-morbidity difference between the two groups, which could ultimately affect cost. No significant difference was found ($t(22) = 1.40, p = 0.18$). The mean of the TPN ($m = 3.43, SD = 1.51$) was not significantly different from the mean of the postpyloric tube feeds group ($m = 4.20, SD = 1.03$). To further examine the possible influence of co-morbidities a Pearson correlation was calculated examining the relationship between total cost and co-morbidities. A weak correlation that was not significant was found ($r(22) = 0.02, p = 0.93$. Total cost and co-morbidities are not related.

Given that there were no significant co-morbidity differences between the TPN and tube feeds group and that co-morbidity was not related to total cost, the mean total costs for the TPN and tube feeds groups were compared using an independent samples t-test. No significant difference was found ($t(22) = 1.85, p = 0.08$). The mean of the TPN ($m = 22277.84, SD = 7983.04$) was not significantly different from the mean of the tube feeding group ($m = 16724.78, SD = 6048.13$). Although this difference was

not statistically significant, we did find that the effect size (d = 0.61) of the difference was between medium and large (Cohen, 1992). Therefore, the difference between the groups of $5,553.06 was a meaningful difference and the fact that it was not statistically significant was most likely due to the small sample size.

Discussion

Overall, parenteral nutrition tends to be ordered more often compared to enteral nutrition despite current literature recommendations. Patients are remaining NPO greater than five days before receiving nutrition. This indicates that hospitalized patients with severe pancreatitis are not receiving nutrition promptly, nor are they receiving the proper route of nutrition. Patients frequently dislodge nasal-jejunal tubes, which demonstrates a need for nasal bridles to secure these tubes thereby preventing tubes from having to be replaced. This is important so that patients receive sufficient nutrition to recover from disease and illness faster and reduce hospital length of stay and cost.

To help implement the ease and cost of placing NJ tubes in the hospital setting, there is a strong need for physician and radiologists support in placing post-pyloric tubes. The timeliness and cost of placing post-pyloric tubes are the underlying factors for why these tubes are not implemented. One way to increase NJ tubes placement would be to have fluoroscopy bedside placement along with insertion of nasal bridles simultaneously, which could be performed once a post-pyloric tube is ordered instead of the patient waiting for a radiology procedure room. The cost benefit to hospitals would include having a nutrition support dietitian trained to place NJ tubes and nasal bridles. This would decrease the demand on radiologists and therefore more trained professionals would be available to provide this simple and quick procedure. Practice guidelines would also be beneficial for patients with severe pancreatitis in hopes of increasing the number of post-pyloric tubes (enteral nutrition) ordered compared to total parenteral nutrition. More studies are needed to determine if there is a significant correlation between total cost and co-morbidities preferably with a larger sample size.

Several limitations were present in this study. One limitation was the small sample size, which could be one reason that a significant correlation was not shown between cost and length of stay, as well as between the number of co-morbidities and disease states. The medium to large effect size indicated that if the sample size were larger, a significant relationship between variables would have been shown. Thus, inferences from this data, that there was a positive relationship between co-morbidities and total cost. Another limitation was the lack of APACHE scores, which would have been more reliable in identifying subjects with severe pancreatitis. Also, tracking lab values such as lipase, amylase, and prealbumin would have shown which patients recovered from pancreatitis faster and more effectively. This information could have been used to compare which route of nutrition helped patients recover faster.

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