

Abnormal liver function following total parenteral nutrition in a patient with short bowel syndrome

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Date accepted for publication 8 September 2008

Abstract

Total parenteral nutrition (TPN) is an essential means of maintaining nutrition in those who are unable to do so via an enteral route. However, long term TPN can pose potentially serious complications, in particular liver related damage. This article describes a case of abnormal liver function following total parenteral nutrition and discusses the methods of potentially reducing such complications.

Keywords

Total parenteral nutrition; steatosis; cholestasis; short bowel.

Introduction

After extensive resection of the small intestine the remaining bowel undergoes a significant adaptation response. Studies have demonstrated bowel adaptation occurs through epithelial hyperplasia, an increase in villous diameter, height and crypt depth within weeks to months of a resection^[1]. Total parenteral nutrition is the most important factor responsible for prolonging the lives of patients with small bowel syndrome^[2]. In the initial stages following resection, TPN should begin early to attain positive nitrogen balance and to prevent severe weight loss^[3].

Case report

A 37-year-old male was admitted to the Accident and Emergency Department following a stab wound to his abdominal wall. He underwent an emergency laparotomy which demonstrated a perforated small bowel. There was extensive necrosis of the jejunum and ileum and tight adhesions noted at the base of the small bowel mesentery. The majority of the small bowel was resected leaving 35 cm of small bowel in total (30 cm jejunum and 5 cm of terminal ileum). This was subsequently anastomosed to the remaining colon. In order to meet his daily nutritional requirements the patient was commenced on long term total parenteral nutrition. Following 3 weeks of TPN, routine blood investigations revealed the following: bilirubin 81 mmol/l, alkaline

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phosphatase 225 U/l, alanine aminotransferase 240 U/l, gamma glutamyl transferase 184 U/l and aspartate aminotransferase 151 U/l. A hepatitis and autoantibody screen was ordered which proved negative. In addition the patient underwent an abdominal ultrasound scan which revealed no obvious abnormalities.

Discussion

Total parenteral nutrition is not without its complications and long term TPN has been associated with catheter sepsis and liver impairment^[4]. Steatosis is the most common histological liver abnormality. Histological evaluation has revealed periportal fat accumulation that may extend into a panlobular or centrilobular distribution in certain cases^[5]. The following hepatobiliary disorders have been reported in adult patients on TPN^[7].

- Steatosis
- Steatohepatitis
- Cholestasis
- Fibrosis
- Micronodular cirrhosis
- Phospholipidosis
- Biliary sludge
- Cholelithiasis and its complications
- Acalculous cholecystitis

Short bowel syndrome, especially in cases with small bowel length less than 50 cm, increases the risk of TPN-associated liver disease and cholestasis^[6]. It is unclear whether it is the loss of bowel alone or the combination with TPN use that predisposes patients to developing hepatic cholestasis and fibrosis^[6]. This may be related to interruption of the enterohepatic circulation with subsequent abnormal bile acid metabolism^[7]. Clinical and animal studies suggest that TPN-related hepatic steatosis is primarily related to the effects of excess caloric intake, usually in the form of dextrose or glucose and impaired hepatic secretion of triglycerides. Increased hepatic fat deposition may begin with infusions of highly concentrated glucose and amino acids stimulating increased insulin secretion and lipogenesis. Mismatched carbohydrate:nitrogen ratios, such as in high-fat and low-protein solution, and inadequate amino acids may also play a role by impairing lipoprotein synthesis and triglyceride secretion^[8].

Management of TPN-induced liver dysfunction is dependent on a multitude of factors. These include the trialling of enteral nutrition, sepsis prevention, treatment of small bowel bacterial overgrowth, avoidance of overfeeding, optimization of lipid and amino acid emulsions, and prevention of choline, carnitine and taurine deficiency. In addition the use of ursodeoxycholic acid (UDCA) may provide some benefit. UDCA has been shown to improve liver function by promoting bile flow, displacing toxic bile acids, providing chemoprotective effects on hepatocytes, reducing intestinal translocation of endotoxins and bacteria, and enhancing endotoxin biliary excretion^[9].

A variety of hypotheses have been postulated with regard to TPN-induced liver failure. However, further research is needed to make such theories definitive. Numerous management regimes exist to combat such liver dysfunction. In cases where the small bowel length is less than 50 cm, TPN-associated liver disease and cholestasis are expected events and prevention therapy must be started together with TPN infusion. The incidence of TPN-related hepatobiliary complications has been reported to range from 20 to 75% in adults^[10]. Severe cholestasis induced by total parental nutrition, characterized by bile duct regeneration, portal inflammation, and fibrosis, has a rapid progression and can lead to cirrhosis in months^[11]. Continued research is therefore required in order to cast further light on therapeutic management.

Teaching point

In patients with short bowel syndrome the daily amount of calories to be infused must be personalized on the basis of measurable studies of the daily total energy expenditure and this should be monitored monthly. However, as with any form of medical management the risks and benefits must be weighed accordingly.

References

1. Schulzke JD, Schmitz H, Fromm M, Bentzel CJ, Riecken EO. Clinical models of intestinal adaptation. *Ann N Y Acad Sci* 1998; 859: 127-138.
2. Wu G-H, Wu Z-H, Wu Z-G. Effects of bowel rehabilitation and combined trophic therapy on intestinal adaptation in short bowel patients. *World J Gastroenterol* 2003; 9: 2601-4.
3. Platell CF, Coster J, McCauley RD, Hall JC. The management of patients with the short bowel syndrome. *World J Gastroenterol* 2002; 8: 13-20.
4. Howard L, Ashley C. Management of complications in patients receiving home parenteral nutrition. *Gastroenterology* 2003; 124: 1651-61.
5. Tulikoura I, Huikuri K. Morphological fatty changes and function of the liver, serum free fatty acids, and triglycerides during parenteral nutrition. *Scand J Gastroenterol* 1982; 17: 177-85.
6. Stanko RT, Nathan G, Mendelow H, Adibi SA. Development of hepatic cholestasis and fibrosis in patients with massive loss of intestine supported by prolonged parenteral nutrition. *Gastroenterology* 1987; 92: 197-202.
7. Quigley EM, Marsh MN, Shaffer JL, Markin RS. Hepatobiliary complications of total parenteral nutrition. *Gastroenterology* 1993; 104: 286-301.
8. Keim NL. Nutritional effectors of hepatic steatosis induced by parenteral nutrition in the rat. *JPEN* 1987; 11: 18-22.
9. Kowdley KV. Ursodeoxycholic acid therapy in hepatobiliary disease. *Am J Med* 2000; 108: 481-6.
10. Guglielmi FW, Boggio-Bertineta D, Federico A, *et al.* Total parenteral nutrition-related gastroenterological complications. *Dig Liver Dis* 2006; 38: 623-42.
11. Guglielmi FW, Regano N, Mazzuoli S, *et al.* Cholestasis induced by total parenteral nutrition. *Clin Liver Dis* 2008; 2: 97-110.