Management of Maple Syrup Urine Disease in the Peri-operative Period

Abstract:
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Abstract
Maple syrup urine disease (MSUD) has an incidence of 1:125,000 newborns in Ireland. Patients, when fasting, or in a catabolic state build up toxic metabolites leading to progressive neurological dysfunction. We describe the necessary peri-operative management of a patient with MSUD who developed symptomatic gallstones requiring a laparoscopic cholecystectomy.

Introduction
Maple syrup urine disease (MSUD) is an autosomally recessive inherited metabolic disorder. It is caused by a deficiency of the branched-chain alpha-keto-acid-dehydrogenase complex leading to a build up of the branched-chain amino acids (leucine, isoleucine, and valine). The main toxic amino acid, leucine, and its metabolites build up in the blood, cerebrospinal fluid, and urine, resulting in a characteristic sweet smelling urine. This can lead to acute and chronic brain dysfunction. The concentration of plasma branched chain amino acids (BCAAs) can be controlled and optimised to acceptable levels by restricting the patients’ dietary protein intake and supplementing with an amino acid mixture free of leucine, isoleucine, and valine. However, in catabolic states, such as fasting, vomiting, or diarrhoea, muscle proteins release amino acids leading to an accumulation of leucine, its metabolites and ketoacids. Neurotoxic levels, particularly of leucine, may accumulate within hours, leading to confusion, ataxia, seizure activity, and potential cerebral oedema. Thus, it is imperative that these patients are not subjected to a prolonged period of fasting or catabolic states. We report a case of a woman with MSUD who developed recurrent attacks of biliary colic and cholecystitis, requiring a cholecystectomy and describe her complex peri-operative management.

Case Report
A 22-year-old girl with MSUD presented to the Emergency Department (ED) with epigastric pain and vomiting. She had previously been admitted to the intensive care unit due to complications of MSUD while suffering from a viral illness. On examination she was tender and Murphy’s sign positive. Having contacted the National Centre for Inherited Metabolic Disorders, an infusion of 0.9% Sodium Chloride + 10% Dextrose + Potassium Chloride 2mmol/kg/day and Intralipid 20% 2g/kg/day was started. An abdominal ultrasound showed multiple gallstones (Figure 1). She was treated with intravenous antibiotics. Her liver function tests were elevated and an MRCP showed two large gallstones in her gallbladder and a normal calibre common bile duct (Figure 2). Her symptoms resolved and she was discharged home. She returned to the ED twice the following week with biliary colic and vomiting. An elective cholecystectomy was planned and advice regarding her peri-operative management was obtained from the National Centre for Inherited Metabolic Disorders.

An infusion of 0.9% Sodium Chloride + 10% Dextrose + Potassium Chloride 2mmol/kg/day and a separate infusion of Intralipid 20% 2g/kg/day was required to prevent a build-up of neurotoxic levels of leucine and were started at midnight prior to surgery and continued until usual MSUD diet resumed post-operatively. Induction of anaesthesia was with Propofol, Atracurium and Fentanyl. The reversal agents Neostigmine and Glycopyrrolate were used. Her pre-operative infusions of saline/ dextrose/ potassium and intralipids were continued throughout her surgery. An uneventful 4 port laparoscopic cholecystectomy was performed. The cystic duct and artery were ligated and divided in the standard fashion, prior to removal of the gallbladder through the epigastric port site. On the first post-operative day she remained on the saline/ dextrose/ potassium and intralipid infusions. Serum branched chain amino acid levels were monitored daily perioperatively and remained stable. Oral diet was recommenced and she was discharged home on the second post-operative day. Histology revealed chronic cholecystitis, cholelithiasis and cholesterosis.

Discussion
The incidence of MSUD worldwide is approximately 1:185,000 newborns, while in Ireland it is more common at 1:125,000 newborns . If these patients require surgery or present with an acute illness, it is imperative, in order to avoid metabolic decompensation, that plasma BCAAs are within target ranges, and dehydration and acidosis corrected. Lipid infusion provides calories without causing over hydration and haemodilution, preventing cerebral oedema and death which has been reported previously in catabolic states . This should be done under the advisement of metabolic specialists. Our patient had previously been admitted to the intensive care unit while suffering from a mild viral illness and so was at risk of metabolic decompensation with each acute presentation of biliary sepsis and with elective surgery. No single anaesthetic agent is advocated but Ketamine is a good choice due to its anti-convulsant properties . Our patient received Propofol Atracurium and Fentanyl and had an uneventful peri-operative course.

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References

