Paediatric endoscopic dilatation of congenital intraluminal duodenal diverticulum or Congenital Duodenal Web (CDW)

Courtesy of Pr Mike Thomson, Sheffield Children's Hospital, UK

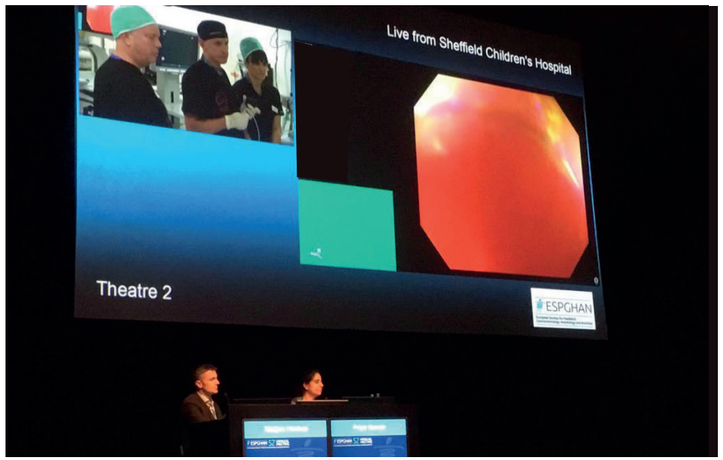

Fig. 1 Radiographic barium meal showing intact fundoplication and CDW

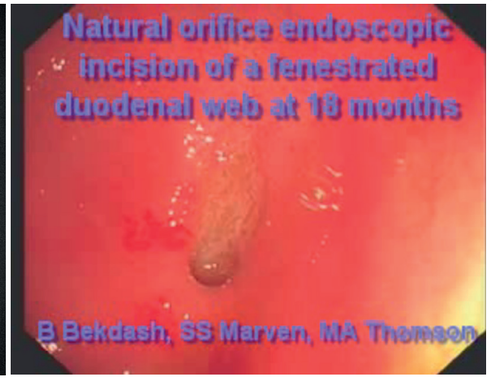

Fig. 2 Endoscopic image of CDW of patient at age 18 months

During its 2019 annual meeeting, the European Society for Paediatric Gastroenterology, Hepatology And Nutrition (ESPGHAN) organised for the first time, live endoscopy classes to promote and support specialists training on paediatric endoscopic techniques.
Pr Mike Thomson, Paediatric Gastroenterologist and Interventional Endoscopist, showcased a live endoscopic dilatation of CDW, from a theatre in the International Academy for paediatric endoscopy training, Sheffield Children's Hospital.

Patient History

A 4-year-old male patient, with a history of chronic Gastroesophageal Reflux Disease (GERD) was admitted for gastroenterology assessment. At the age of 10 months old, the patient had been treated for tracheal-oesophageal fistula (TOF) through a fundoplication procedure, done under endoscopy, but limited at time of surgery to the oesophagus and stomach. CDW was also diagnosticated at age 18 months and the patient was put under surveillance (see Fig. 2).
Despite maximum medical therapy, cow's milk exclusion and a repeat fundoplication, the patient continued to vomit forcefully and had significant weight loss, weighing only 15 kg on consultation.
Barium meal (Upper Gastro Intestinal contrast study) images revealed an intact fundoplication (see Fig. 1). Further upper gastrointestinal (UGI) endoscopy identified CDW as the most probable root cause of the vomiting.
It was decided to perform endoscopic balloon dilatation of the web to restore digestive pathway.

Clinical Challenge

Although, endoscopic balloon dilatation of the web in paediatric cases is only documented for a few patients worldwide, the Paediatric Gastroenterologist team of Sheffield Children's Hospital is trained on this technique of surgery and has performed several cases. Due to its minimally invasive technique, it was then determined to be the preferred treatment for the patient. Balloon dilatation produces tearing of the mucosa of the obstruction. Recovery time of this 'incision less' procedure is reduced, allowing the patient to come back to natural food ingestion much faster.
The surgical oesophago-gastroduodenoscopy (OGD) technique for paediatric patients is taking into account the small anatomical dimension and sharp anatomical angulations of children. For example, the oesophagus of a newborn is about 10 cm in length and about 0.5 cm in diameter. It requires small duodenoscopes and tools.
The fluoroscopic imaging challenge of the procedure is to provide contrast and image resolution at the lowest radiation dose possible, and lowest iodine concentration possible.

Solution

Fluoroscopic imaging guidance was performed with the OEC One C-arm set to continuous standard fluoroscopy and paediatric configuration (addition of a 3.5 mm equivalent aluminium filter and removal of the anti-scatter grid). The additional filtration permits to harden the X-ray beam, and the removal of attenuating anti-scatter grid allows the C-arm to set up a lower technique (kV, mA), maintaining image quality while managing radiation dose for paediatric anatomy.
The laser aimers were turned on during the procedure to aid proper centering, avoiding extra positioning shots. Following ALARA best practices, the radiographer kept the image intensifier as close to the patient as possible. It was possible to complete the full procedure avoiding the use of the magnification mode which has a higher dose rate. The Cine run of final control of des-obstruction pathway was selectively recorded post acquisition using the Cine Save function instead of re-acquiring the sequence (which requires additional dose and contrast media). All of these imaging techniques were carefully applied to manage the radiation exposure throughout the procedure.

Procedure

The procedure was performed under local anaesthesia.
Cannulation of the stenosis was done under endoscopic guidance. The balloon was introduced in the natural orifice to accomplish the dilatation under fluoroscopic imaging guidance as illustrated by Fig. 3, 4 and 5.

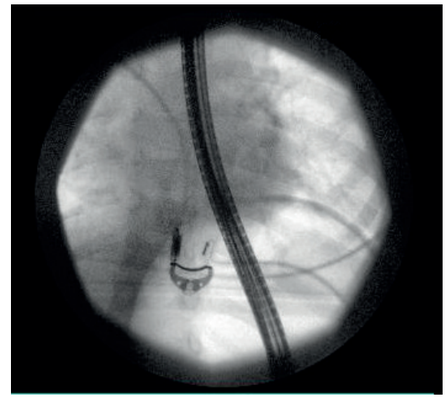

Fig. 3 Fluoroscopic image showing correct insertion of duodenoscope in the patient's stomach

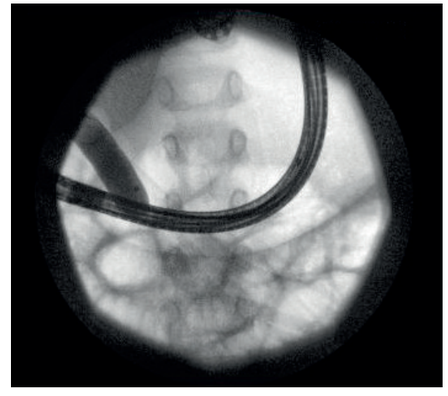

Fig. 4 Fluoroscopic image showing balloon dilatation at stenosis level

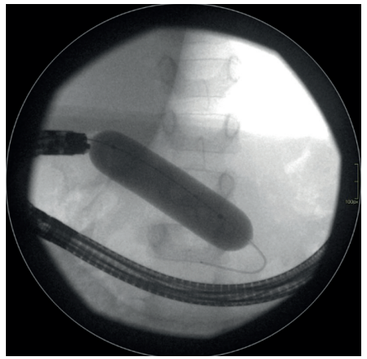

Fig. 5 Fluorosocopic image of balloon dilatation showing no "waist" or residual stenosis

Final fluoroscopic image of balloon dilatation showed no 'pinch' or 'waist' in the balloon resulting from resistance during inflation, indicating proper tearing of mucosa at stenosis level.
Final control of pathway restoration after balloon dilation was done under fluoroscopic imaging, using Iodine contrast media diluted at 50% (see Fig. 6).

Conclusion

The procedure allowed enlargement of the original orifice from 1mm to a of 10 mm in diameter.
Total procedure time was 20 mn.
Total fluoroscopy time was 10 mn and cumulated DAP was 83 mGy.cm².
The objectives of reducing procedure duration and re-establishing gastric pathway were reached.
The patient came back to normal nutrition without vomiting the day following the procedure.

Pr Thomson: "I really liked the large monitor that I can move easily closer to my sight, it saves me craning my neck to see the image"

Radiographer Chris Heafer: "The Cine Save function is brilliant and very useful. It saves dose by avoiding the need to rerun the fluoroscopy sequence,, and it is easy to use"

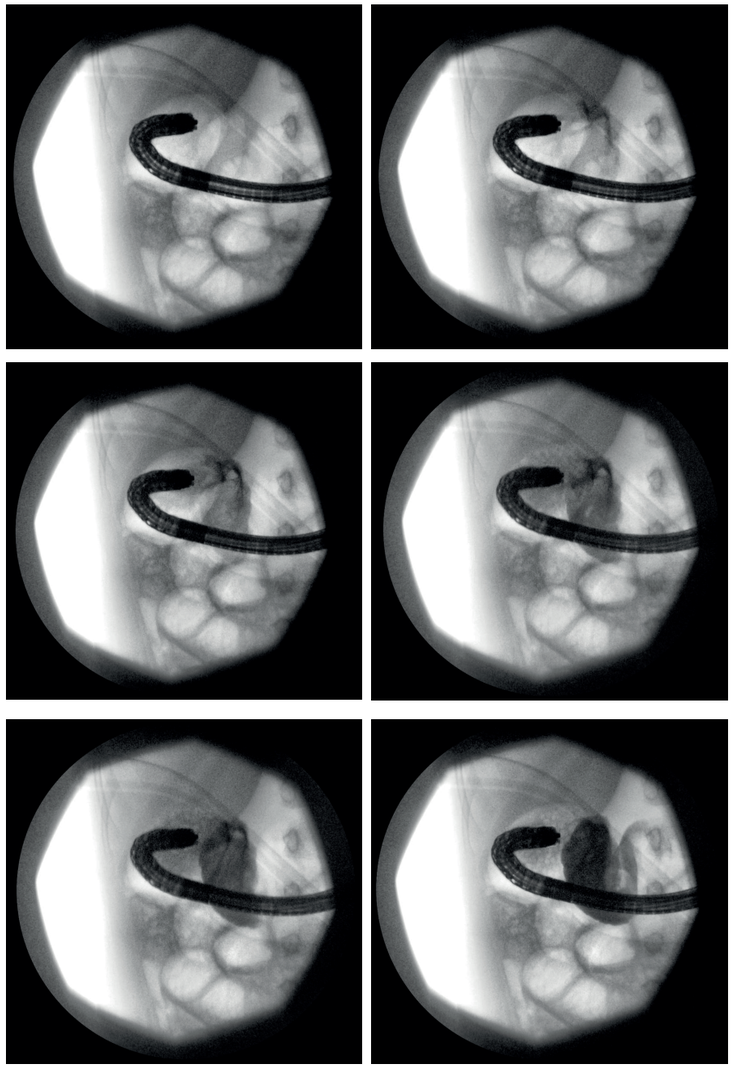

Fig. 6 Cine run series of images confirming des-obstruction and re-establishment of gastric pathway

Pr. Mike Thomson is a consultant Pediatric Gastroenterologist and Interventional Endoscopist – Honorary Reader in Pediatric Gastroenterology.

I trained in medicine in Aberdeen (Scotland), then I moved back to UK in Yorkshire to specialize in Pediatrics. I moved to Brisbane (Australia) to train more specifically in Paediatric gastroenterology at the Centre of Paediatric Gastroenterology, and completed my research for medical doctorate focusing on Nutrition and Energy expenditure in Cystic Fibrosis. I also trained in endoscopy, pediatric hepatology and pediatric nutrition. I was involved in their Pediatric Liver Transplant Program which is one of the finest in the world.

I returned to the UK to work for 2 years at the Birmingham Children's Liver Transplant Unit. After that, I accepted a position at the Royal Free Paediatric Gastroenterology Unit set up by Professor John Walker-Smith, one of the fathers of Paediatric Gastroenterology, for about 10 years.

For the last 15 years, I have been a Consultant Paediatric Gastroenterologist and Interventional Endoscopist at the Centre for Paediatric Gastroenterology of Sheffield Children's Hospital NHS Foundation Trust. I am also an Honorary Reader in Paediatric Gastroenterology Sheffield University Medical School.