experience and the available data to date, we believe that CsA treatment should be considered as a last medical resort to prevent medical abortion in fulminant UC during pregnancy.

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## Effect of MRCP introduction on ERCP practice: are there implications for service and training?

Training is an increasingly relevant issue in the UK.[1] The structure of postgraduate medical training is undergoing significant change at present, with attempts to streamline and shorten duration. Modernising medical careers (MMC) marks a major reform in postgraduate medical education.[2]

Endoscopic retrograde cholangiopancreatography (ERCP) requires considerable training to perform effectively and safely.[3] Competency has been based on total procedure numbers performed by trainees. Consensus suggests 180–200 diagnostic/therapeutic ERCPs are required to obtain competence within a training facility with sufficient case volume for viable training opportunities.[2] Selective cannulation of the bile duct has been used as a benchmark for technical success.[4] Moreover, multivariate analyses find case volume to independently predict ERCP related complications.[5–8]

''Diagnostic'' ERCP should rarely be required with the increasing accessibility to newer imaging modalities. Magnetic resonance cholangiopancreatography (MRCP) has been found to be of equivalent diagnostic utility as ERCP. Such developments may reduce ERCP case volume and potentially increase procedure complexity with implications for service and training. Few studies have reported potential changes to ERCP practice following MRCP introduction.

To test our hypothesis that MRCP introduction may produce quantitative and qualitative changes to existing ERCP practice, we assessed 542 consecutive ERCPs during a 28 month period from November 2001 to February 2004 from a prospective database. The effect of MRCP introduction on ERCP practice was assessed 14 months after the addition of MRCP facilities to our unit and compared with the 14 month period prior to MRCP introduction.

Pre-MRCP introduction, 310 ERCPs (298 with complete data) were performed and 232 were performed in the post-MRCP period. Indications for ERCP were categorised by clinical, biochemical, and ultrasound (USS) findings and the likelihood of therapeutic intervention for each indication assessed before and after MRCP introduction. Failed cannulation was defined by the inability to cannulate the papilla and opacify the required duct.

The ERCP indication profile changed little following MRCP introduction (fig 1). A 25%

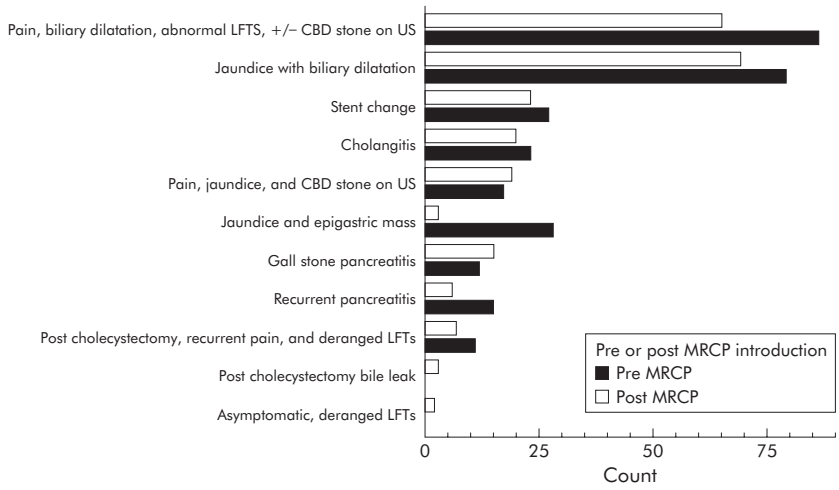


**Figure 1** Indications for endoscopic retrograde cholangiopancreatography (ERCP) in pre-magnetic resonance cholangiopancreatography (MRCP) and post-MRCP introduction periods. CBD, common bile duct; LTFS, liver function tests.

**Table 1** Indication and therapeutic intervention

| Indication | Therapeutic intervention | Pre-MRCP (n = ) | Post-MRCP (n = ) | OR (95% CI) |
|---|---|---|---|---|
| Pain, biliary dilatation, abnormal LFTs ± CBD stone on USS | Yes | 31 | 40 | 2.92 (1.43–5.97) |
| | No | 43 | 19 | |
| Jaundice with biliary dilatation | Yes | 70 | 44 | 0.53 (0.13–1.98) |
| | No | 4 | 5 | |
| Stent change | Yes | 27 | 23 | N/A |
| | No | 0 | 0 | |
| Cholangitis | Yes | 20 | 15 | 0.25 (0.02–2.65) |
| | No | 1 | 3 | |
| Pain, jaundice, and CBD stone | Yes | 12 | 18 | 3.00 (0.24–36.9) |
| | No | 2 | 1 | |
| Jaundice with epigastric mass | Yes | 12 | 1 | 0.93 (0.82–1.07) |
| | No | 13 | 2 | |
| Gall stone pancreatitis | Yes | 8 | 9 | 0.84 (0.14–4.97) |
| | No | 3 | 4 | |
| Recurrent pancreatitis | Yes | 3 | 3 | 5.50 ( 0.61–49.5) |
| | No | 11 | 2 | |
| Post cholecystectomy, recurrent pain, and deranged LFTs | Yes | 6 | 5 | 1.67 (0.21–13.2) |
| | No | 4 | 2 | |
| Post cholecystectomy bile leak | Yes | 0 | 2 | N/A |
| | No | 0 | 1 | |
| Asymptomatic with deranged LFTs | Yes | 0 | 0 | N/A |
| | No | 0 | 2 | |

MRCP, magnetic resonance cholangiopancreatography; CBD, common bile duct; LTFS, liver function tests; USS, ultrasound; N/A not applicable; OR (95% CI), odds ratio (95% confidence interval).

reduction in total ERCP numbers was found in the post-MRCP period and the monthly mean number of ERCPs performed was reduced from 22 to 17 per month.

Cannulation failure rates pre-MRCP and post-MRCP were 8.7% (26 ERCPs) and 14.2% (33 ERCPs), respectively. Pre-MRCP introduction, 191 of 272 (70%) successful cannulations were with therapeutic intent. Post-MRCP introduction, 163 of 232 (81%) successful cannulations were with therapeutic intent. Significant increases in the proportion of therapeutic procedures (odds ratio (OR) 1.74 (95% confidence interval (CI) 1.13–2.69); $p = 0.012$) and failed cannulations (OR 1.74 (95% CI 1.005–2.99); $p = 0.046$) were therefore identified. No significant associations existed between each ERCP indication and failed cannulation. Changes in therapeutic intervention following MRCP introduction for each indication are highlighted in table 1.

We have encountered alterations in ERCP practice following MRCP introduction with fewer, potentially more complex, procedures being performed. Subset analysis found change only in the group with pain, biliary dilatation, with abnormal LFTs ± CBD stone on USS, potentially reflecting improved identification of duct stones by MRCP. Objective assessment of technical difficulty was not easy, as both trainees and trainers were both involved in performing ERCPs and no validated criteria to assess ERCP difficulty were available during the study period.

MRCP introduction has an impact on ERCP practice. ERCP services and training may require redirection towards fewer but more complex procedures. These changes may necessitate a reduction in the number of cases performed on a list, may result in fewer trainees embarking on ERCP training and, as endoscopy centres require threshold numbers of cases to ensure competency in technique and adequacy of training, may reduce the number of centres able to offer viable training opportunities.

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## A novel method to determine small intestinal barrier function in human neonates in vivo

Mucin 2 (MUC2) is the structural component of the protective mucus layer of the gastrointestinal tract, and is secreted by goblet cells.[1] MUC2 is a glycoprotein that contains high amounts of threonine and proline residues.[2 3] Recently, we showed that almost 90% of dietary threonine is utilised by the intestine of piglets in first pass.[4] This high visceral threonine requirement presumably reflects the high synthesis rate of MUC2. In this context, threonine might be of critical nutritional importance in maintaining good intestinal barrier function. Neonates with impaired gut function following bowel resection require adequate gut adaptation and recovery of intestinal barrier function to avoid the consequences of malabsorption of dietary nutrients and pathogenic bacterial insults. We therefore used a tracer method to study the role of dietary threonine in intestinal MUC2 synthesis and to calculate the fractional synthetic rate (FSR) of small intestinal MUC2 in human neonates as a parameter for intestinal barrier function.

Five neonates with bowel resection for necrotising enterocolitis were studied (gestational age 33 ± 1 weeks; four had an ileostomy and one had a jejunostomy). Four weeks postoperatively a continuous [U-$^{13}$C] threonine infusion was administered enterally by feeding tube over 12 hours (materials and methods are available as supporting material online on the *Gut* website at http://www.gutjnl.com/supplemental). Using triple CsCl density gradients, mucins were isolated from intestinal outflow fluid collected at three hour intervals over two days.[5] Mucin containing fractions had a buoyant density between 1.40 and 1.55 g/ml, were stained with periodic acid/Schiff's (PAS) reagent (fig 1A), had an apparent molecular weight of 550 kDa, and corresponded to a peak in the hexose assay (not shown). Western blot analysis using PMH1, a monoclonal antibody specific for MUC2, revealed that pooled PAS positive fractions (that is, fractions 13–15) contained MUC2 (fig 1B, three representative patients).[6] GC-IRMS analysis demonstrated the presence of the threonine tracer in MUC2 isolated from the intestinal outflow fluid (fig 1C), indicating that dietary threonine was incorporated into MUC2. Threonine enrichment rose linearly during threonine administration and gradually decreased after administration was stopped. Time to absorb threonine and incorporate threonine into MUC2, and subsequently to secrete threonine as part of MUC2 into the intestinal lumen, ranged from approximately six to 10 hours in patients with an ileostomy (table 1). In contrast, MUC2 secretion time for the single patient with a jejunostomy was less than three hours. The linear increase in [U-$^{13}$C] enrichment in MUC2 and the luminal [U-$^{13}$C] threonine precursor enrichment were used to calculate FSR (see *Gut* website at http://www.gutjnl.com/supplemental). FSR was 12.1–89.7% per day (table 1).

This is the first study which has determined small intestinal MUC2 synthesis in human neonates. FSR of mucosal proteins was 51%/day and 15–29%/day for human

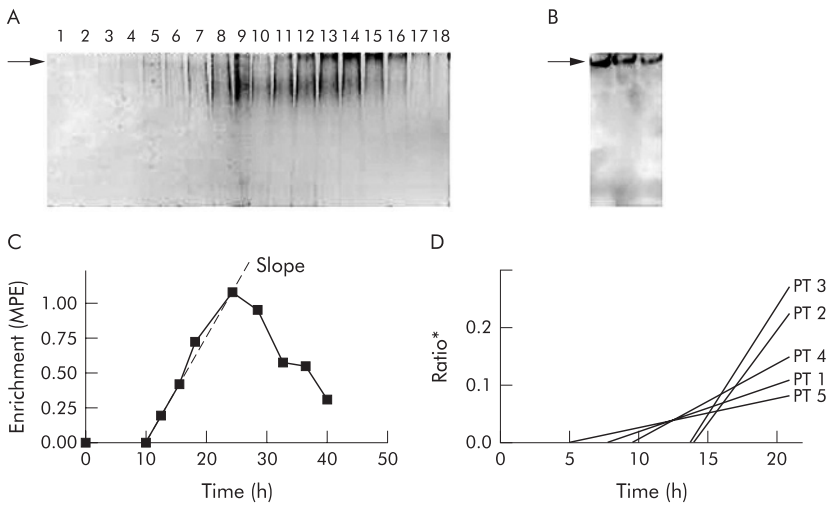


**Figure 1** Isolation and characterisation of human mucin 2 (MUC2) in intestinal outflow fluid. Fractions from the third CsCl density gradients were run on sodium dodecyl sulphate-polyacrylamide gels followed by periodic acid/Schiff's (PAS) staining (A). After the final CsCl density gradient, PAS positive fractions were pooled, subjected to western blot analysis, and identified as pure MUC2 (B, pooled fractions of three representative patients). Arrows indicate the positions of the PAS positive bands (A) and of MUC2 (B). (C) Threonine enrichment in purified MUC2 in one representative patient with an ileostomy (PT 4). (D) Ratio (*) of the slope of the linear increase in [U-$^{13}$C] threonine enrichment of purified MUC2 versus luminal [U-$^{13}$C] threonine precursor enrichment during the experiment for all patients. Fractional synthetic rate can be determined by multiplying the slope (ratio/$\Delta$t) by 24 hours and 100%.