OPINION

The future developments in endoscopy

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Abstract

Gastrointestinal endoscopy has seen great changes over recent years, and the future seems bright. Looking forward, some advances in technology can be predicted, but the current financial climate may limit their widespread adoption. Increasing subspecialisation with continuing service development and quality assurance are likely to form the basis of the major changes over the next 5 years. Increasing juxtaposition between laparoscopic and endoscopic procedures presents the most exciting opportunities over the 10-year timeframe. This article extrapolates current trends to try to predict the different possibilities for endoscopy over the next decade.

Introduction

Gastrointestinal (GI) endoscopy is a rapidly expanding and advancing field that makes any attempt to predict the future difficult. This article is the opinion of just two individuals, and in our effort to gaze into a crystal ball, we will undoubtedly get some things wrong. We have therefore examined what recent changes have occurred and tried to extrapolate them out into the future. We have also considered the long-term impact of the current financial and economic climate. It is yet unclear what effect a prolonged recession may have on healthcare services, but we speculate that the emphasis in the National Health Service (NHS) is likely to be on improving basic things rather than advanced technology. We have therefore chosen a selection of topics based on their potential clinical impact, likelihood of occurring and personal preference. We apologise for any unintentional exclusions or obvious omissions made by us.

Subspecialisation

One of the most important, although possibly least obvious, changes is that endoscopy is becoming more widely recognised

as a subspecialty in and of itself. This is now reflected in the training of gastroenterologists, with the new UK 2010 curriculum supporting a subspecialist module in advanced endoscopy. There is increasing appreciation that it is impossible for one individual to be an expert in all aspects of endoscopy. There is a developing divergence between upper GI, lower GI, small bowel and hepatobiliary endoscopic practice, with many high-level practitioners subspecialising in only one. This is reflected in our article, in which we have tried to make predictions in each of these domains, but with the recognition that it will not be possible to cover all the different aspects of endoscopic practice.

Technology

In each area of endoscopy, there has been some technological change over the last 5–10 years. Miniaturisation has allowed the development of scopes enabling diagnostic and therapeutic cholangioscopy. Wireless capsule and balloon-assisted technology can now permit endoscopic investigation and treatment within the small bowel, a historical 'black-hole' within gastroenterology. Improvements in optics and screen resolution now allow imaging of the bowel in high definition, alongside a number of different technologies for selective optical imaging. These have the potential to improve our ability to distinguish pathology without recourse to histopathology, and therefore, give better clinical outcomes and more streamlined clinical care with an overall cost saving.

Clinical quality

However, the main recent changes have been in the service provision and quality assurance arenas. This was prompted by a growing recognition of the wide variability in performance initially for colonoscopy, and backed up by audit data

demonstrating poor clinical outcomes and deficiencies in almost all aspects of training.^{1,2} Driven by the desire to implement a national bowel cancer screening service, the application of rigorous quality standards were aimed at improving the clinical outcomes and patient experience for endoscopy as a whole. The UK global rating scale³ has been one of the huge success stories of recent years, enabling units to obtain funding to rectify deficiencies in their service, demonstrate improvements in performance figures and establish evidence of improvements to clinical outcomes on both a unit and national basis (2011 national colonoscopy audit, unpublished data). Key performance indicators (KPIs) have been reasonably identifiable for colonoscopy, using completion, adenoma detection and complication rates. The UK bowel cancer screening service has implemented monitoring of these KPIs in a rigorous fashion and recent publications have demonstrated excellent clinical outcomes.⁴

Deficiencies in clinical service provision have been identified in other areas such as endoscopic retrograde cholangiopancreatography (ERCP)⁵ and management of acute GI bleeding.^{6,7} The Joint Advisory Group for GI endoscopy is currently developing specific KPIs and assessment tools to allow accurate measurement of these and other aspects of GI endoscopy. A validated directly observed polypectomy score has now been implemented to allow training and assessment of polypectomy.^{8,9} This process is set to continue, with assessment of haemostatic techniques used for management of GI bleeding planned as the next target area. These initiatives have also prompted greater awareness of the non-technical skills and safety culture that need to be addressed within endoscopy.¹⁰ The adoption of the WHO checklist as an effective safety measure to prevent surgical error has clear parallels in endoscopy, and work is underway to translate these concepts to both diagnostic and therapeutic endoscopy.

Access to such quality data is of increasing interest to providers and professional organisations, and also to patients and their advocates. In the UK, revalidation will provide a powerful driver for this. The Dr Foster website already provides information on diagnostic gastroscopy standards, and public access to data is likely to become the de facto standard for all risky interventional procedures such as endoscopic mucosal resection (EMR), endoscopic submucosal dissection, ERCP and endoscopic ultrasound (EUS)-guided drainage procedures. In endoscopy, there are already a number of web-based initiatives that allow individual endoscopists to collate their own quality data, including the ERCP quality network^{11,12} and GIQuIC.¹³ The salient feature of these systems is that key anonymised data on each case are uploaded to a central website and automatically analysed to provide an individual 'report card'. Benchmark comparisons can also be made with the average of all other contributors without identifying

them individually. The current critical missing link is easy extraction of data from endoscopy electronic reporting tools. We anticipate that this will be solved in the 5-year timeframe, and the use of such registries will become routine.

Five years from now—2017

Upper GI endoscopy

There are likely to be two areas in upper GI endoscopy that will alter significantly in the next 5 years. The first is optimising the management of upper GI bleeding. Upper GI bleeding is common and has a high rate of mortality, but current provision of services is patchy, often inadequately resourced, and generally considered to be unsustainable. A toolkit has therefore been developed outlining different service models that can be adopted to achieve high standards of care.¹⁴ Local smaller hospitals can realistically be expected to optimise management of patients within normal working hours, but are likely to require liaison with larger acute hospitals to provide out-of-hours cover either by a 'hub-and-spoke' model or by sharing resources across trusts. These models will probably necessitate the development of formalised upper GI bleed networks, which will need close involvement of commissioning agencies. It is likely that individuals will have to become accredited for management of GI bleeding in the same way that is now standard for diagnostic endoscopy and polypectomy. The development of validated assessment tools for haemostatic skills is already underway. Training paradigms may have to change, as ad hoc on-the-job experience may not result in competency in these skills. Mandatory attendance at therapeutic courses and simulated emergency scenario training will probably become part of the accreditation process. Reduction in regional variation will be difficult to achieve, but the clinical imperative is clear. With more financial incentives demanded by the adoption of Commissioning for Quality and Innovation (CQUINS) across the NHS, we feel that these models of care will become a reality within the next 5 years, with measurable benefits to patient care.

The second main development is likely to be the more widespread adoption of new techniques for diagnosis and management of dysplasia and early cancer in the upper GI tract. Adoption of systematic biopsy protocols and advances in endoscopic treatments such as EMR, radiofrequency ablation, photodynamic therapy and cryotherapy have resulted in a radical shift from surgical to endoscopic management for pre-malignant conditions such as Barrett's oesophagus.¹⁵ Although there are still some questions regarding efficacy and durability, the potential benefits of avoiding surgery are clear, and more endoscopists will undoubtedly become familiar with these techniques.

Lower GI endoscopy

As a result of changes to the UK bowel cancer screening programme and national awareness campaigns, there

is predicted to be an increased demand of over 100% for colonoscopy and sigmoidoscopy over the next 3–5 years. There are several new innovations with the potential to improve productivity in diagnostic colonoscopy. Devices such as ShapeLock (USGI Medical, San Clemente, California, USA) are designed to help endoscopists navigate through a tortuous bowel. Self-propelled colonoscopes such as Aer-o-Scope (GI View, Israel) could be used to reduce the endoscopist's involvement in intubation. Regardless, increased numbers of procedures will inevitably result in a greater incidence of treatable pathology. Many colonoscopists lack the training, skills and/or experience to deal with difficult or complex lesions, and often refer surgery lesions that can be dealt with endoscopically by highly skilled colonoscopists expert in complex EMR/endoscopic submucosal dissection techniques. Standards are being developed to help determine which polyps can be dealt with by non-experts, and which should be referred to tertiary centres for a specialist therapeutic endoscopic opinion. As with specialist surgery, only a few colonoscopists are likely to be needed or be able to provide a high-quality specialist referral service with sufficient numbers to maintain and improve their skills. Many colonoscopists already make referrals to their local experts on an ad hoc, case-by-case basis, and it is likely that regional networks and referral pathways will become formalised to provide a comprehensive streamlined service.¹⁶

The increasing uptake of high-definition scopes and incorporation of new optical techniques, such as narrow-band imaging and colour enhancement, will undoubtedly change our management of small colonic polyps. These have already been shown to allow experienced endoscopists to make an optical diagnosis in vivo, and distinguish between adenomatous and hyperplastic polyps.¹⁷ A short training intervention can allow non-experts to attain acceptable sensitivity and specificity,¹⁸ allowing routine adoption of a 'resect and discard' strategy. This could permit polypectomy and determination of future surveillance intervals without recourse to histopathology, improving efficiency and decreasing costs.¹⁹

Endoscopic retrograde cholangiopancreatography

Incremental improvements in wire, catheter and balloon technology are expected to potentially improve ductal access and procedural success. Prophylactic pancreatic duct stenting^{20–21} to reduce the severity and frequency of post-procedure pancreatitis in high-risk patients will be more widely used. Large balloon sphincteroplasty (following a small sphincterotomy) is likely to be more widely adopted with trial data becoming available in order to more clearly delineate its role. Fully covered removable metal stents will be used more widely for benign indication²² and in preference to plastic stents in operable patients who require preoperative drainage. The Evaluating the Predictors

and Interventions of Sphincter of Oddi Dysfunction (EPISOD) trial²³ investigating the role of sphincter of Oddi Manometry in type 3 Sphincter of Oddi dysfunction (SOD) will report in the next few years, and should clarify this controversial area. Single-operator cholangioscopy has had a new lease of life via the Boston Scientific SpyGlass system.^{24–25} The breakthrough to be expected in the next 5 years will be the introduction of a robust single-operator video scope with full angulation, irrigation and biopsy ability. However, this is likely to remain a tool used primarily in tertiary units as an adjunct in the diagnosis of indeterminate strictures and to deliver therapy (Electrohydraulic or laser lithotripsy) to large stones.

Endoscopic ultrasound

To date, the development of EUS in the UK has been somewhat haphazard and the training inconsistent. The recent British Society of Gastroenterology working party report²⁶ sets out a framework for training, service provision, commissioning and regulation. If adhered to, this should result in the development of a coherent and quality-focused service across the country over the next few years. Improvements in cross-sectional imaging including higher-resolution CT scanning, wider adoption of appropriate protocols and CT-positron emission tomography may result in a diminished role for EUS in the diagnosis and staging of upper GI and pancreaticobiliary malignancy. However, the role of EUS in tissue acquisition, complex intervention and therapy is likely to grow. Contrast EUS²⁷ and EUS elastography are the focus of intense development and research, currently, with advances particularly in quantification²⁸ likely in this timeframe. These techniques are likely to become more clinically relevant and more widely used over the next 5 years. The potential benefits range from targeted fine needle aspiration to improvements in the ability of EUS to discriminate between chronic pancreatitis and malignancy. Improvements in the quantification of contrast EUS may enable the assessment of tumour microvasculature with possible derivation of prognostic information such as predicting response to chemotherapy. The role of interventional EUS techniques such as EUS-guided necrosectomy,^{29–30} EUS-guided duct puncture and drainage,³¹ in comparison with radiological and surgical interventions, will become clearer. EUS-guided injection therapy for pancreatic neoplastic cysts³² and ductal adenocarcinoma³³ are likely to become therapeutic options in selected cases.

Small bowel

The development of wireless capsule endoscopy revolutionised our ability to diagnose problems within the small bowel, and is now considered a first-line investigation for suspected Crohn's disease, occult GI bleeding and surveillance of small bowel polypoid syndromes.³⁴ There are an increasing number of manufacturers, and the different versions of capsule

technology now incorporate high definition or 360° panoramic views (PillCam SB2, Given Imaging, Duluth, Georgia, USA; CapsoCam SB1, Capsovision, Saratoga, California, USA), and measurement of small bowel physiological parameters such as pH, temperature and pressure (SmartPill Capsule, SmartPill Corporation, Buffalo, New York, USA). The main change that is likely to occur as these become more ubiquitous is the development of better computer-aided detection algorithms to allow automated reading and diagnosis. This would drastically improve the efficiency of reading and reporting, which is currently the rate-limited step preventing their widespread use.

Balloon-assisted enteroscopy, either with double balloon or single balloon, now permits us to provide endoscopic therapy to pathology that once required open surgery, and is considered the gold standard for deep small bowel intubation.³⁵ A newcomer on the block is spiral enteroscopy, which is a less technically demanding technique and has had promising initial results.³⁶ A new power-assisted version has been developed which may make this technology even more attractive and allow more widespread adoption of small bowel enteroscopy.

10 years from now—2022

Looking farther into the future, some themes will clearly continue. Subspecialisation will increase, with clearer demarcation of procedures into those for all, those for some, and those for a few. Some of the service development changes we have outlined above may take longer than 5 years to implement, and, given the financial state of the NHS at present, 10 years may be a much more realistic timeframe.

Identifying other innovations and developments that may become possible over 10 years becomes less easy. The most obvious ‘hot-topic’ that we have yet to address is the blurring of laparoscopic and endoscopic techniques and technologies. The development of natural orifice transluminal endoscopic surgery and combined laparoscopic/endoscopic procedures continues. Although there are increasing reports of operations in humans,^{37,38} we have left these techniques firmly in the 10-year timeframe as the majority of work is still on animal models and there is a need to develop better therapeutic instruments such as stapling and suturing devices to make these techniques practical and feasible in routine practice. Advances in such technologies may make some purely endoscopic therapies possible, such as endoscopic resection of early node-negative colorectal cancer. To realise these possibilities, increasing liaison of endoscopy and laparoscopy is almost inevitable.

Further improvements to capsule technology have been speculated about for years. A directable, self-propelled and therapeutic non-invasive device permitting drug delivery and biopsy could revolutionise the diagnosis and management of intraluminal disease. There are many ideas and prototypes in development, but what will eventually become reality is, at the moment, anyone’s guess.

Conclusions

Speculating is a risky business, as many stockmarket investors will attest. We have therefore tried to focus on extrapolating out recent trends rather than giving full reign to our imagination. We believe that endoscopy has a bright future, with a clear progression towards better accountability and emphasis on quality. There is likely to be some technological development, particularly around therapeutic instruments and capsule technology, but financial considerations may limit widespread adoption of these. Large cultural shifts have already been made, thanks to national quality assurance programmes, but there are clearly more to come.

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