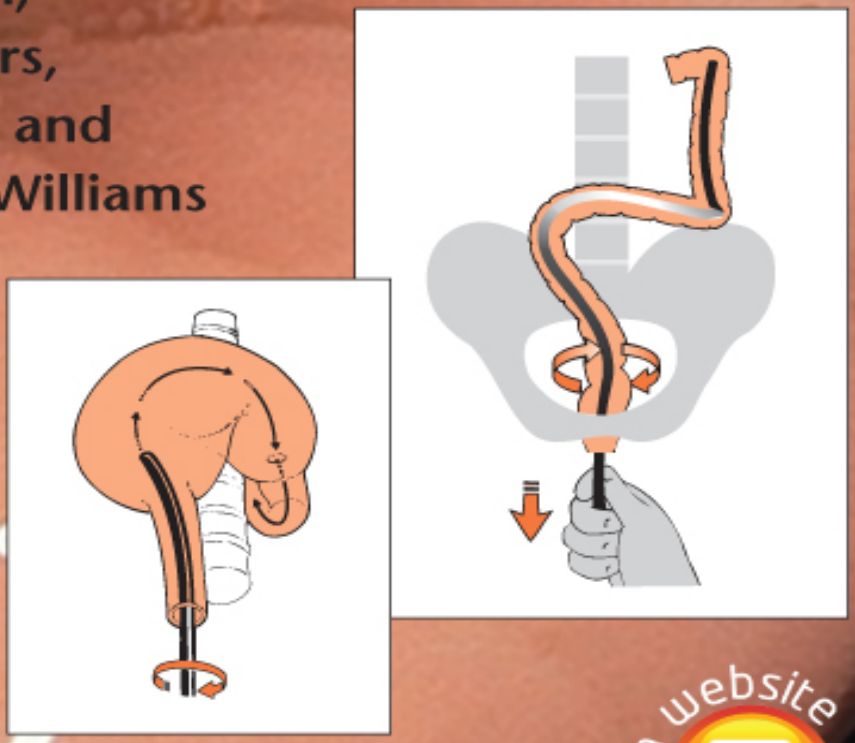
COTTON AND WILLIAMS'

Practical Gastrointestinal Endoscopy

The Fundamentals

SEVENTH EDITION

Adam Haycock,
Jonathan Cohen,
Brian P. Saunders,
Peter B. Cotton and
Christopher B. Williams



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Adam Haycock MBBS BSc(hons) MRCP MD FHEA
Consultant Physician and Gastroenterologist
Honorary Senior Lecturer
Imperial College; *and*
Endoscopy Training Lead
Wolfson Unit for Endoscopy
St Mark's Hospital for Colorectal and Intestinal Disorders
London, UK

Jonathan Cohen MD FASGE FACG
Clinical Professor of Medicine
Division of Gastroenterology
New York University School of Medicine
New York, USA

Brian P Saunders MD FRCP
Consultant Gastroenterologist
St Mark's Hospital for Colorectal and Intestinal Disorders; *and*
Adjunct Professor of Endoscopy
Imperial College
London, UK

Peter B Cotton MD FRCP FRCS
Professor of Medicine
Digestive Disease Center
Medical University of South Carolina
Charleston, South Carolina, USA

Christopher B Williams BM FRCP FRCS
Honorary Physician
Wolfson Unit for Endoscopy
St Mark's Hospital for Colorectal and Intestinal Disorders
London, UK

Videos supplied by Stephen Preston
Multimedia Consultant
St Mark's Hospital for Colorectal and Intestinal Disorders
London, UK

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The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK

111 River Street, Hoboken, NJ 07030-5774, USA

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Preface to the Seventh Edition

Gastrointestinal endoscopy continues to evolve and has seen a steady increase in demand, complexity, and innovation in what it is possible to do with an endoscope. It is now the undoubted investigation of choice for the GI tract, although there is no room for complacency. Parallel improvements in imaging capabilities such as MRCP and CT colonography are now impacting on the "diagnostic" endoscopy workload, and much of the current emphasis is on advancing endoluminal, transluminal, and hybrid therapeutic techniques.

The ongoing adoption of national bowel cancer screening programs has driven up standards for endoscopists across the board. Increasing recognition of the importance of identifying even small, subtle premalignant dysplastic lesions and the ability to provide complex therapeutic intervention in both the upper and lower GI tract has made the learning process even more lengthy and difficult for those new to the field. Accordingly, the "fundamentals" no longer refers solely to basic or simple procedures, if indeed it ever did. In this era of increasing complexity of endoscopy and increasing attention to quality performance, the fundamental skills that constitute the foundation of all endoscopic practice have never been more important to master.

In line with the last edition, we have limited this book to the most common diagnostic and therapeutic "upper" and "lower" GI procedures, reserving more advanced techniques such as ERCP and EUS for others to cover. What is new to this edition is acknowledgement of the enormous impact of the Internet and electronic "e-learning." This edition is supported by a selection of online multimedia images and

clips, which are signposted in the text and referenced at the end of each chapter. To allow for greater use of mobile platforms, each chapter has been reconfigured into a more easily digestible “bite-sized” chunk with its own key learning points and searchable keywords. Multiple-choice questions (MCQs) are also available online to allow self-assessment and consolidate learning.

We also formally acknowledge with this edition what has been common parlance for years—that this book is “Cotton and Williams′” fundamentals of gastrointestinal endoscopy, sharing personal opinions, tips, and tricks gained over many years. Although this is the last edition in which these two pioneering authors will actively participate, this textbook will remain a practical guide squarely based on their practice and principles. It has been our privilege to work with them to produce this edition, and we are honored to have been asked to sustain this important effort in the future.

Practical Gastrointestinal Endoscopy: The Fundamentals aims to complement rather than replace more evidence-based recommendations and guidelines produced by national societies. It remains focused on helping those in the first few years of experience to move more quickly up the learning curve toward competency. We hope that it will inspire trainees to attain the levels of excellence represented by those individuals from whom the book takes its name.

Adam Haycock
Jonathan Cohen
Brian P Saunders

Preface to the First Edition

This book is concerned with endoscopic techniques and says little about their clinical relevance. It does so unashamedly because no comparable manual was available at the time of its conception and because the explosive growth of endoscopy has far outstripped facilities for individual training in endoscopic technique. For the same reason we have made no mention of rigid endoscopes (oesophagoscopes, sigmoidoscopes and laparoscopes) which rightly remain popular tools in gastroenterology, nor have we discussed the great potential of the flexible endoscope in gastrointestinal research.

Our concentration on techniques should not be taken to denote a lack of interest in results and real indications. As gastroenterologists we believe that procedures can only be useful if they improve our clinical management; clever techniques are not indicated simply because they are possible, and some endoscopic procedures will become obsolete with improvements in less invasive methods. Indeed we are moving into a self-critical phase in which the main interest in gastrointestinal endoscopy is in the assessment of its real role and cost-effectiveness.

Gastrointestinal endoscopy should be only one of the tools of specialists trained in gastrointestinal disease—whether they are primarily physicians, surgeons or radiologists. Only with broad training and knowledge is it possible to place obscure endoscopic findings in their relevant clinical perspective, to make realistic judgements in the selection of complex investigations from different disciplines, and to balance the benefits and risks of new therapeutic applications. Some specialists will become more expert and committed than others, but we do not favour the

widespread development of pure endoscopists or of endoscopy as a sub-specialty.

Skilful endoscopy can often provide a definitive diagnosis and lead quickly to correct management, which may save patients from months or years of unnecessary illness or anxiety. We hope that this little book may help to make that process easier and safer.

April 1979
P.B.C., C.B.W.

Acknowledgments

The authors are grateful to the dedicated collaborators who have embellished or enabled the production of this book.

The skills of Steve Preston (steveprestonmultimedia@gmail.com) produced the web videos and imagery. The artistry and great patience of David Gardner (davidgardner@cytanet.com.cy) has allowed upgrading of the drawings and figures in this edition and several previous ones. At Wiley publishers, the guidance of Oliver Walter, backed by Rebecca Huxley's formidable editorial talents, has made the production process almost enjoyable.

The authors also wish to register indebtedness to their respective life-partners (Cori, Sarah, Annie, Marion and Christina) for their unending support—despite intrusions into personal and family time.

About the Companion Website

This book is accompanied by a website:

www.wiley.com/go/cottonwilliams/practicalgastroenterology

The website includes:

- 37 videos showing procedures described in the book
- All videos are referenced in the text where you see this logo 
- A clinical photo imagebank, consisting of an equivalent clinical photo for selected line illustrations
- An interactive “check your understanding” question bank (MCQs) to test main learning points in each chapter

CHAPTER 1

The Endoscopy Unit, Staff, and Management

 Most endoscopists, and especially beginners, focus on the individual procedures and have little appreciation of the extensive infrastructure that is now necessary for efficient and safe activity. From humble beginnings in adapted single rooms, most of us are lucky enough now to work in large units with multiple procedure rooms full of complex electronic equipment, with additional space dedicated to preparation, recovery, and reporting.

Endoscopy is a team activity, requiring the collaborative talents of many people with different backgrounds and training. It is difficult to overstate the importance of appropriate facilities and adequate professional support staff, to maintain patient comfort and safety, and to optimize clinical outcomes.

Endoscopy procedures can be performed almost anywhere when necessary (e.g. in an intensive care unit), but the vast majority take place in purpose-designed “endoscopy units.”

Endoscopy units

Details of endoscopy unit design are beyond the scope of this book, but certain principles should be stated.

There are two types of unit. Private clinics (called ambulatory surgical centers in the USA) deal mainly with healthy (or relatively healthy) outpatients, and should

resemble cheerful modern dental suites. Hospital units have to provide a safe environment for managing sick inpatients, and also more complex procedures with a therapeutic focus, such as endoscopic retrograde cholangiopancreatography (ERCP). The more sophisticated units resemble operating suites. Units that serve both functions should be designed to separate the patient flows as far as possible.

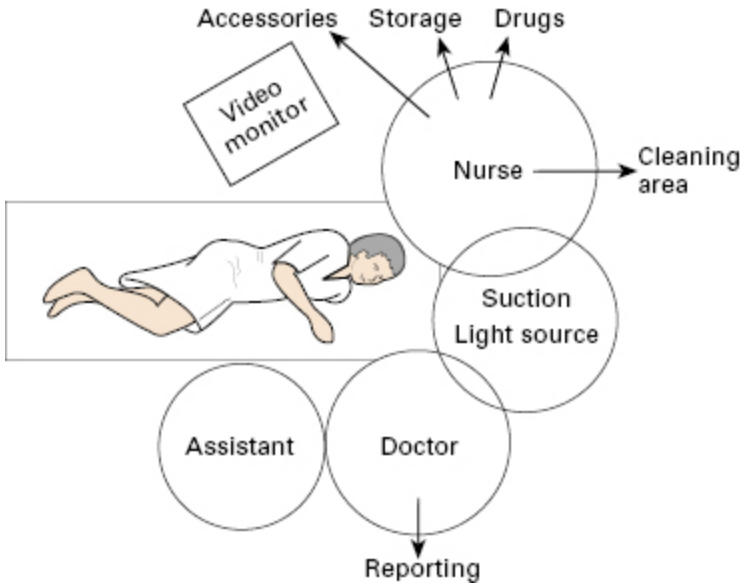
The modern unit has areas designed for many different functions. Like a hotel or an airport (or a Victorian household), the endoscopy unit should have a smart public face (“upstairs”), and a more functional back hall (“downstairs”). From the patient's perspective, the suite consists of areas devoted to reception, preparation, procedure, recovery, and discharge. Supporting these activities are many other “back hall” functions, which include scheduling, cleaning, preparation, maintenance and storage of equipment, reporting and archiving, and staff management.

Procedure rooms

The rooms used for endoscopy procedures should:

- ***not be cluttered or intimidating***. Most patients are not sedated when they enter, so it is better for the room to resemble a modern dental office, or kitchen, rather than an operating room.
- ***be large enough*** to allow a patient stretcher/trolley to be rotated on its axis, and to accommodate all of the equipment and staff (and any emergency team), but also compact enough for efficient function.
- ***be laid out with function in mind***, keeping nursing and doctor spheres of activity separate (Fig 1.1), and minimizing exposed trailing electrical cables and pipes (best by ceiling-mounted beams).

Fig 1.1 Functional planning—spheres of activity.



Each room should have:

- ***piped oxygen and suction*** (two lines);
- ***lighting planned*** to illuminate nursing activities but not dazzle the patient or endoscopist;
- ***video monitors placed conveniently*** for the endoscopist and assistants, but also allowing the patient to view, if wished;
- ***adequate counter space*** for accessories, with a large sink or receptacle for dirty equipment;
- ***storage space for equipment required on a daily basis***;
- ***systems of communication*** with the charge nurse desk, and emergency call;
- ***disposal systems*** for hazardous materials.

Patient preparation and recovery areas

Patients need a private place for initial preparation (undressing, safety checks, intravenous (IV) access), and a similar place in which to recover from any sedation or anesthesia. In some units these functions are separate, but can be combined to maximize flexibility. Many units have

simple curtained bays, but rooms with solid side walls and a movable front curtain are preferable. They should be large enough to accommodate at least two people other than the patient on the stretcher, and all of the necessary monitoring equipment.

The “prep-recovery bays” should be adjacent to a central nursing workstation. Like the bridge of a ship, it is where the nurse captain of the day controls and steers the whole operation, and from which recovering patients can be monitored.

All units should have at least one completely private room for sensitive interviews/consultations before and after procedures.

Equipment management and storage

There must be designated areas for endoscope and accessory reprocessing, and storage of medications and all equipment, including an emergency resuscitation cart. Many units also have fully equipped mobile carts to travel to other sites when needed.

Staff

Specially trained endoscopy assistants have many important functions. They:

- ***prepare patients*** for their procedures, physically and mentally;
- ***set up*** all necessary equipment;
- ***assist*** endoscopists during procedures;
- ***monitor*** patients' safety, sedation, and recovery;
- ***clean***, disinfect, and process equipment;
- ***maintain quality control***.

Most endoscopy assistants are trained nurses, but technicians and nursing aides also have roles (e.g. in

equipment processing). Large units need a variety of other staff, to handle reception, transport, reporting, and equipment management, including informatics.

Members of staff need places to store their clothes and valuables, and a break area for refreshments and meals.

Procedure reports

Usually, two reports are generated for each procedure—one by the nurses and one by the endoscopist.

Nurse's report

The nurse's report usually takes the form of a preprinted “flow sheet,” with places to record all of the pre-procedure safety checks, vital signs, use of sedation/analgesia and other medications, monitoring of vital signs and patient responses, equipment and accessory usage, and image documentation. It concludes with a copy of the discharge instructions given to the patient.

Endoscopist's report

In many units, the endoscopist's report is written or dictated in the procedure rooms. In larger ones, there may need to be a separate area designed for that purpose.

The endoscopist's report includes the patient's demographics, reasons for the procedure (indications), specific medical risks and precautions, sedation/analgesia, findings, diagnostic specimens, treatments, conclusions, follow-up plans, and any unplanned events (complications). Endoscopists use many reporting methods—handwritten notes, preprinted forms, free dictation, and computer databases.

The paperless endoscopy unit

Eventually all of the documentation (nursing, administrative, and endoscopic) will be incorporated into a comprehensive electronic management system. Such a system will substantially reduce the paperwork burden, and increase both efficiency and quality control.

Management, behavior, and teamwork

Complex organizations require efficient management and leadership. This works best as a collaborative exercise between the medical director of endoscopy and the chief nurse or endoscopy nurse manager. The biggest units will also have a separate administrator. These individuals must be skilled in handling people (doctors, staff, and patients), complex equipment, and significant financial resources. They must develop and maintain good working relationships with many departments within the hospital (such as radiology, pathology, sterile processing, anesthesia, bioengineering), as well as numerous manufacturers and vendors. They also need to be fully cognizant of all of the many local and national regulations that now impact on endoscopy practice.

The wise endoscopist will embrace the team approach, and realize that maintaining an atmosphere of collegiality and mutual respect is essential for efficiency, job satisfaction, and staff retention, and for optimal patient outcomes.

It is also essential to ensure that the push for efficiency does not drive out humanity. Patients should not be packaged as mere commodities during the endoscopy process. Treating our customers (and those who accompany them) with respect and courtesy is fundamental. Always assume that patients are listening, even if apparently

sedated, so never chatter about irrelevances in their presence. Never eat or drink in patient areas. Background music is appreciated by many patients and staff.

Documentation and quality improvement

The agreed policies of the unit (including regulations dictated by the hospital and national organizations) are enshrined in an *Endoscopy Unit Procedure Manual*. This must be easily available, constantly updated, and frequently consulted.

Day-to-day documentation includes details of staff and room usage, disinfection processes, medications, instrument and accessory use and problems, as well as the procedure reports.

A formal quality assessment and improvement process is essential for maximizing the safety and efficiency of endoscopy services. Professional societies have recommended methods and metrics. The American Society for Gastrointestinal Endoscopy (ASGE) has incorporated these into its Endoscopy Unit Recognition Program, and the benefit of concentrating on and documenting quality is well exemplified by the success of the Global Rating Scale project in the UK.

Educational resources

Endoscopy units should offer educational resources for all of its users, including patients, staff, and doctors. Clinical staff need a selection of relevant books, atlases, key reprints, and journals, and publications of professional societies. Increasingly, many of these materials are available online, so that easy Internet access should be available. Many

organizations produce useful educational videotapes, CD-ROMs, and DVDs.

Teaching units will need to embrace computer simulators, which are becoming valuable tools for training (and credentialing).

Further reading

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Chapter video clip

Video 1.1 The endoscopy unit: a virtual tour

Now check your understanding—go to www.wiley.com/go/cottonwilliams/practicalgastroenterology

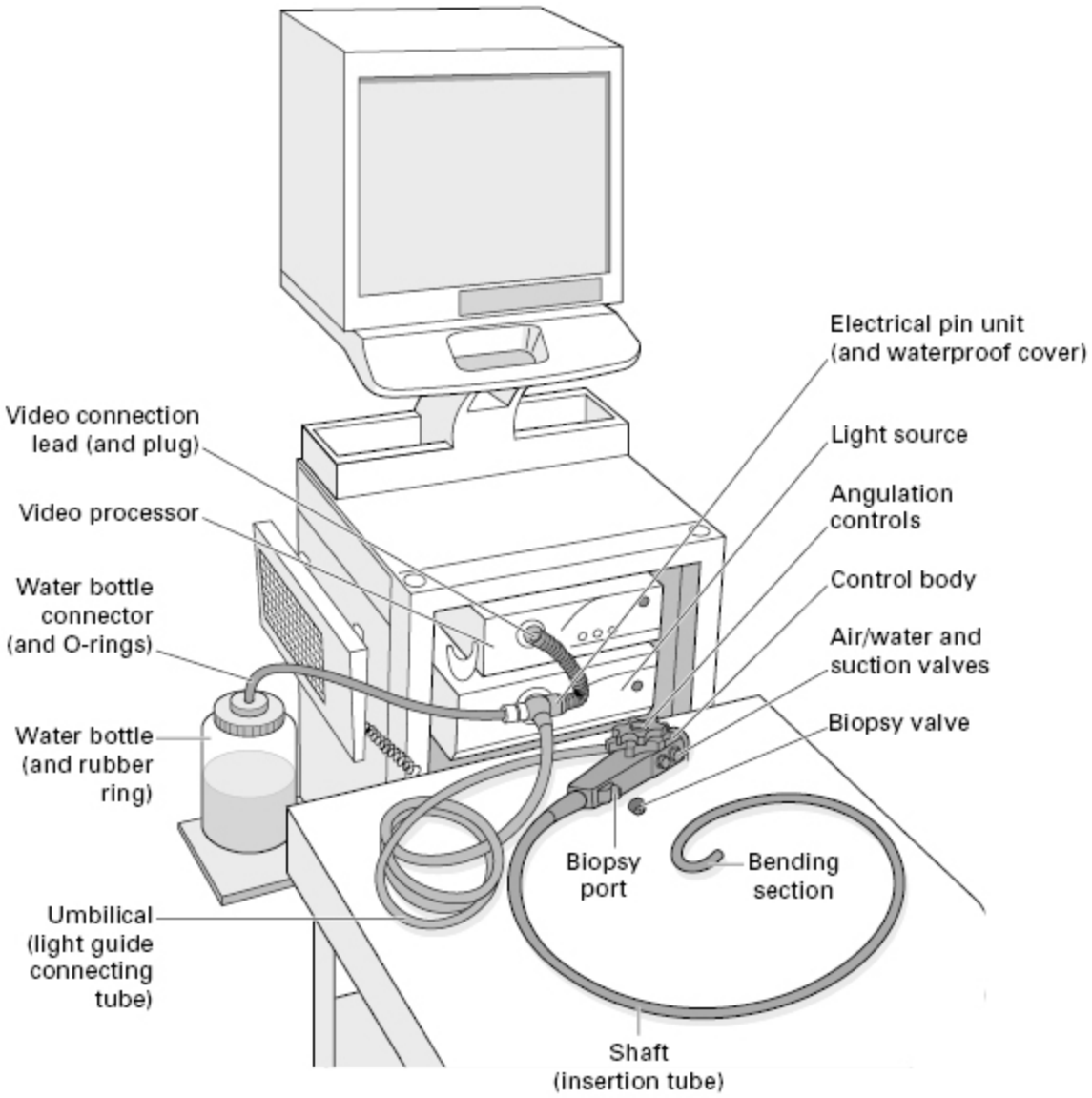
CHAPTER 2

Endoscopic Equipment

Endoscopes

There are many different endoscopes available for various applications, and several manufacturers, but they all have common features. There is a control head with valves (buttons) for air insufflation and suction, a flexible shaft (insertion tube) carrying the light guide and one or more service channels, and a maneuverable bending section at the tip. An umbilical or universal cord (also called “light guide connecting tube”) connects the endoscope to the light source and processor, air supply, and suction (Fig 2.1). Illumination is provided from an external high-intensity source through one or more light-carrying fiber bundles.

Fig 2.1 Endoscope system.



The image is captured with a charge-coupled device (CCD) chip, transmitted electronically, and displayed on a video monitor. Individual pixels (photo cells) in the CCD chips can respond only to degrees of light and dark. Color appreciation is arranged by two methods. So-called “color CCDs” have their pixels arranged under a series of color filter stripes (Fig 2.2). By contrast, “monochrome CCDs” (or, more correctly, sequential system CCDs) use a rotating color filter wheel to illuminate all of the pixels with primary color strobe-effect lighting (Fig 2.3). This type of chip can be made smaller, or can give higher resolution, but the system is more

expensive because of the additional mechanics and image-processing technology.

Fig 2.2 Static red, green, and blue filters in the “color” chip.

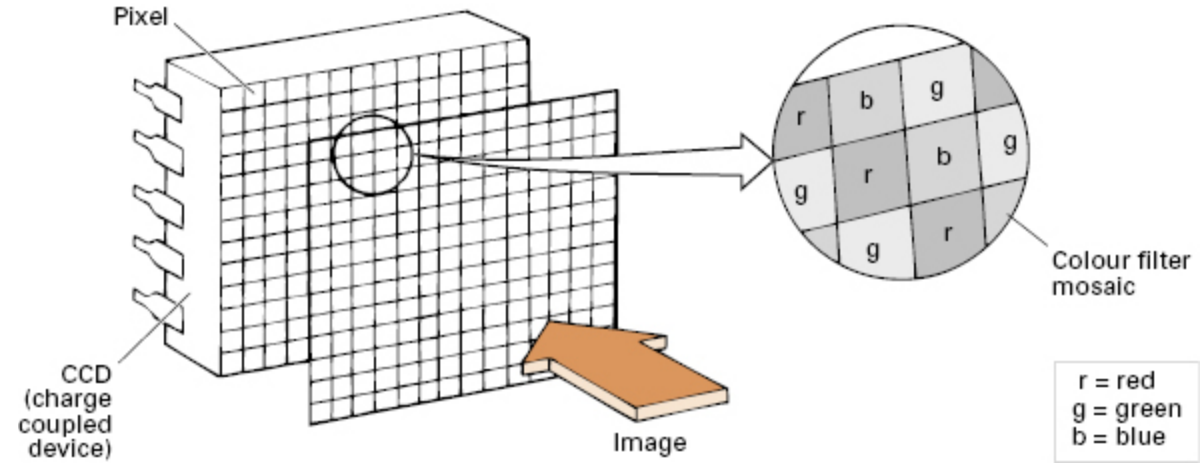
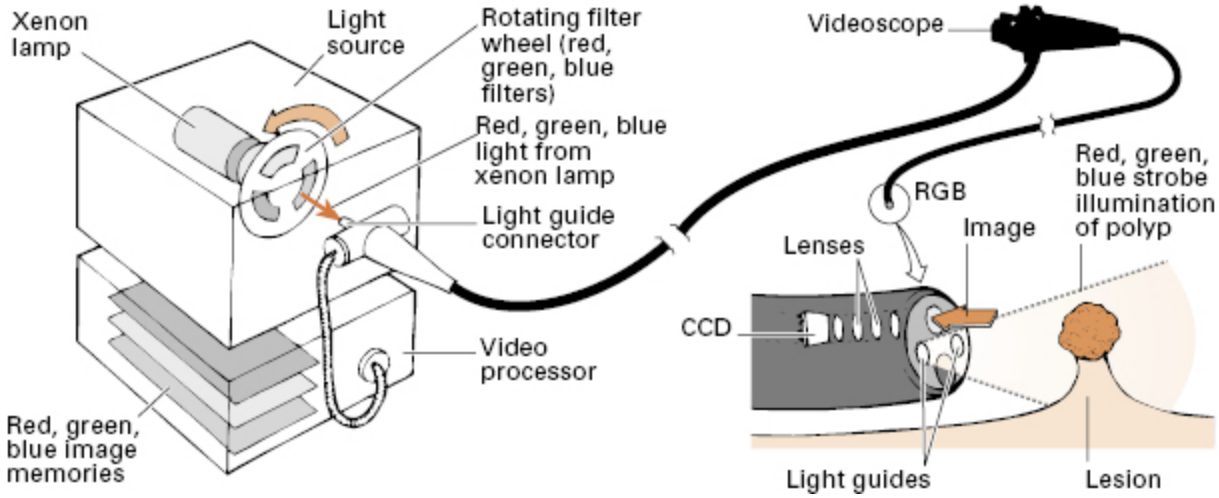


Fig 2.3 Sequential color illumination.



“Electronic chromoendoscopy” systems are now standard in many endoscopes, allowing enhancement of aspects of the surface of the gastrointestinal mucosa. Narrow band imaging (NBI; Olympus Corporation) uses optical filters to select certain wavelengths of light, which correspond to the peak light absorption of hemoglobin, enhancing the visualization of blood vessels and certain surface structures. The Fuji Intelligent Chromo Endoscopy (FICE; Fujinon Endoscopy) and i-Scan (Pentax Medical) systems take

ordinary endoscopic images and digitally process the output to estimate different wavelengths of light, providing a number of different imaging outputs. Autofluorescence imaging can detect endogenous fluorophores, a number of which occur in the gastrointestinal tract. Two systems now also allow magnification of the endoscopic image down to the cellular level: termed confocal microscopy (Pentax Medical, Mauna Kea Technologies). Blue laser light is focused on the desired tissue after injecting fluorescent materials, which become excited by the laser light and are detected at defined horizontal levels.

Tip control

The distal bending section (10 cm or so) and tip of the endoscope is fully deflectable, usually in both planes, up to 180° or more. Control depends upon pull wires attached at the tip just beneath the outer protective sheath, and passing back through the length of the instrument shaft to the two angulation control wheels (for up/down and right/left movement) on the control head (Fig 2.4). The wheels incorporate a friction braking system, so that the tip can be fixed temporarily in any desired position. The instrument shaft is torque stable, so that rotating movements applied to the head are transmitted to the tip when the shaft is relatively straight.

Fig 2.4 Basic design—control head and bending section.