



Rigid sigmoidoscopy

A potential hazard for cross-contamination

D. Z. Lubowski, G. L. Newstead

Department of Colorectal Surgery, St. George and Prince of Wales Hospitals, Sydney, Australia

Received: 23 August 2005/Accepted: 26 October 2005/Online publication: 17 January 2006

Abstract

Background: Rigid sigmoidoscopy using a disposable or nondisposable sigmoidoscope is a common outpatient procedure. It has been assumed that the nondisposable bellows and light head of the sigmoidoscope remain free from enteric organisms so that the procedure is sterile if a disposable or nondisposable (metal) sigmoidoscope shaft is used. The aim of this study was to identify the presence of organisms within the bellows or light head of the sigmoidoscope.

Methods: Of 21 patients undergoing rigid sigmoidoscopy with a disposable instrument, bacterial cultures were taken from the inside of sterile Jackson-Pratt bulbs in 12 patients, with the bulbs being used to simulate the nondisposable insufflation bellows. In an additional nine patients, swabs were taken for culture from the inside of the nondisposable light head.

Results: Enteric gram-negative *Escherichia coli* and mixed anaerobic organisms were cultured from the Jackson-Pratt bulbs in two cases, and gram-positive organisms were cultured in another case. Gram-negative organisms, including *Bacillus*, *Proteus mirabilis*, *Klebsiella*, and *Enterococcus faecalis*, were cultured from the inside of the light head in two cases.

Conclusion: Sigmoidoscopy using a disposable instrument is not a sterile procedure and may pose a risk of patient-to-patient cross-contamination by potentially harboring organisms in the bellows or light head.

Key words: Sigmoidoscopy — Cross-infection — Bacteriology

Sigmoidoscopy is a frequently performed procedure, usually in the outpatient setting. The term “sigmoidoscopy,” used in Europe and Australasia, is perhaps a misnomer since although the instrument may sometimes

be passed beyond the rectosigmoid junction, generally the procedure examines only the rectum; indeed, “proctoscopy” is the terminology used for the procedure of sigmoidoscopy in the United States. The instrument can be inserted up to its limit in approximately 40% of examinations [6] and a good view of the rectal mucosa can usually be obtained. If a large amount of stool is encountered in the rectum on initial digital examination, then an enema may be administered prior to sigmoidoscopy. In some colorectal clinics, patients routinely receive an enema prior to the initial examination, which facilitates the process of examination of the rectum. A small amount of solid stool may not preclude a satisfactory view of the rectal mucosa.

Clinical indications for rigid sigmoidoscopy are varied. At the patient’s first visit, the authors always carry out sigmoidoscopy in patients with rectal bleeding if there is no painful or tender anal lesion. This may be the definitive investigative procedure in the young patient with minor rectal bleeding and identifiable anal pathology. Identification of rectal polyps or cancer at sigmoidoscopy is important if there is otherwise to be a delay before colonoscopy. The distribution of adenomatous polyps in the colon is now well-known from colonoscopy studies. Approximately two-thirds occur distal to the splenic flexure, with 40–55% in the rectum and sigmoid [5, 12, 13]. In cases in which there is a solitary adenoma, 56% are found in the rectum and sigmoid [4].

Cancer most commonly occurs in the rectum, although during the past four decades there has been a shift in distribution toward the right side of the colon. In 1980, 41.9% of patients who died from colorectal cancer in England and Wales had rectal cancer. The proportions in Australia were similar [8]. In the United States, a number of studies, including that from the National Cancer Institute (1966) [1], have documented a shift to the right side of the colon and hence an increase in the ratio of colon cancer to rectal cancer [1, 2, 10]. Interestingly this change has apparently been less marked in the United Kingdom [7] and Australia [3].

Sigmoidoscopy will diagnose proctitis, benign rectal ulceration as part of the solitary rectal ulcer syndrome, and is useful to identify rectal prolapse in the patient who has not been aware of external prolapse by observing the rectum while asking the patient to strain down. The procedure is very helpful in monitoring the progress of diseases such as colitis, radiation proctitis, or the mucosal changes in the solitary rectal ulcer syndrome, and a stool specimen may be collected during sigmoidoscopy for microscopy and culture.

Initially, rigid sigmoidoscopes were metal and reusable. There has been a gradual change to disposable plastic instruments, thus avoiding the need to clean and sterilize instruments after each use. Apart from the labor costs, in a busy clinic it is therefore necessary to have a number of expensive instruments. Most clinicians thus choose to use disposable sigmoidoscopes. Only the sigmoidoscope shaft is disposable, whereas the bellows and light source are reusable. Throughout the years, we have noted that watery stool may occasionally reflux into the bellows during the examination, particularly if the patient raises abdominal pressure during the procedure, and this has necessitated cleaning the bellows. The reusable light source may be affected in a similar way. Thus, concern was raised about sterility of the subsequent procedure and, in particular, the possibility of transmitting bacteria or other organisms harbored in the bellows or tubing, or in the light source, to the next patient during air insufflation.

The aim of this study was to examine the hypothesis that bacteria may be found on the internal surfaces of the bellows and light source after sigmoidoscopy, thus creating a potential risk for cross-contamination.

Materials and methods

The study was approved by the South East Area Health Service (Southern Section). Twenty-one patients undergoing rigid sigmoidoscopy as part of their routine clinical examination were studied. Sigmoidoscopy was carried out after a digital anorectal examination with the patient lying comfortably in the left lateral position on the examination couch. A disposable sigmoidoscope (Welch Allyn, New York, USA) was used in each case; no biopsies were taken.

In the first 12 patients, the nondisposable bellows and tubing of the Welch Allyn sigmoidoscope set were replaced with a sterile Jackson-Pratt bulb (Baxter Healthcare, Deerfield, IL, USA). This bulb is usually used as a closed-wound suction drainage system but functions effectively for air insufflation. The egg-shaped bulb has an inlet port with an antireflux valve and a drainage port with removable plug, and it is supplied in a sterile plastic pack. The Jackson-Pratt bulb was removed from its container using aseptic technique. The drainage port was connected to a length of sterile soft connection tubing, which in turn was connected to the nondisposable Welch Allyn sigmoidoscope light head. In the first six of these 12 patients, the light head was cleaned and then sterilized in the autoclave at 120°C under pressure for 15 min before each use. In the last six of the 12 patients, the light head was not sterilized and was reused as in normal practice.

The instrument was withdrawn on completion of the sigmoidoscopy and, using aseptic technique, the bulb was disconnected from the tubing and 20 ml sterile saline was instilled via the drainage port. The plug was then inserted into the drainage port and the saline was gently swirled in the bulb. A sterile Steri-Strip tape was placed to seal the inlet port. The bulb was then sent to the pathology laboratory for microbiological examination of the contents of the saline. Cultures were set up on blood agar, MacConkey agar, and chocolate agar plates for

gram-positive and gram-negative aerobic and anaerobic organisms and on LJ slope for mycobacteria. Incubation was continued for 48 h, and once a growth was identified, incubation was continued to allow organism identification.

Tests were carried out on the light head of the sigmoidoscope in an additional nine patients. For this part of the study, the normal reusable Welch Allyn bellows was used. The light head was cleaned and sterilized as described previously at the beginning of each consulting session and then used in several consecutive sigmoidoscopic examinations. In each case, the sigmoidoscope was inserted, the obturator withdrawn, and the light head then connected to the sigmoidoscope. At the end of the examination, new sterile gloves were used and swabs were taken from the inside surface of the light head and eyepiece. The swabs were placed in Amies' transport medium and subsequently plated on blood agar, chocolate agar, and Colistin/naladixic acid blood agar plates.

Results

Cultures from the Jackson-Pratt bulbs identified no organisms in nine of the 12 patients. In three patients, the following cultures were found, respectively: 100–1,000 colonies/ml of *Escherichia coli* and mixed anaerobic organisms; 100–10,000 colonies of *E. coli* and mixed anaerobic organisms; and a small count (< 10 colonies/ml) of *Staphylococcus epidermidis*. The first of these three patients was in the group in which the light head had been sterilized immediately before each use.

Cultures from the light heads in the second group of nine patients showed no growth in seven patients. In two patients, the following organisms were found: (1) one colony of *Bacillus* species; and (2) *Proteus mirabilis*, *Klebsiella pneumoniae*, and *Enterococcus faecalis*.

Discussion

Sterilization of instruments is an important consideration in modern surgical practice. In recent years, concern has been heightened by the advent of transmissible life-threatening diseases, for both clinical and medico-legal reasons. The processes applied to the cleaning of instruments used for flexible sigmoidoscopy or colonoscopy are now carefully regulated, usually with disinfection in 2% glutaraldehyde for 20 min or 0.2% paracetic acid using an automated system (Steris, Mentor, OH, USA). Detailed guidelines for infection control in surgery from the Royal Australasian College of Surgeons [11] and state health authorities within Australia [9] are in place, including rules governing sterilization of instruments and use of single-use surgical items.

This study has shown that fecal bacteria may be found in the bellows of the rigid sigmoidoscope. Bacteria were cultured from a previously sterile bulb after a single use. The inside surface of the bellows and, in this experimental study, the bulb are in free communication with the rectum via gas under pressure. Relatively small bacterial counts were isolated in this study, but it is presumed that higher counts are likely to be found in the nondisposable bellows after use in multiple patients. Bacteria were identified in the bellows in 25% of patients after only a single use and may therefore be expected

more frequently and in greater numbers with multiple-use bellows. The study was designed to ensure that bacteria had not reached the bellows by contamination from the air or by direct patient contact, thus demonstrating that bacteria can easily be introduced into the bellows during sigmoidoscopy. The culture of *Staph. epidermidis* was most likely to have been a skin contaminant from the operator despite the aseptic technique, a phenomenon known to occur in other circumstances such as when inserting an intravenous cannula under aseptic conditions, although it is possible that the organisms originated from the anal skin of the patient and entered the bellows during the sigmoidoscopy.

Bacteria were also isolated from the inside surface of the light head. The sigmoidoscope design is such that there is free communication between the light head, bellows, sigmoidoscope shaft, and the rectal gas, which has been insufflated under pressure. The light head is therefore exposed to organisms in the same way as the inside of the bellows. Although the design of the sigmoidoscope attempts to prevent contamination of the light head by providing a plate at the proximal end of the shaft, hence separating the light head from the shaft, the shaft may become contaminated during withdrawal of the obturator. Thus, organisms may also reach the light head after withdrawal of the obturator followed by coupling the light head onto a contaminated sigmoidoscope shaft. Placement of the light head in direct contact with the potentially contaminated proximal end of the shaft is inconsistent with the rigid principles of aseptic technique and instrument sterilization, which are mandatory in all surgical and other endoscopic procedures.

It has been proposed that a disposable filter be used, interposed between the light head and the bellows to prevent organisms from reaching the bellows. Filters are now available for use with some sigmoidoscopes (Welch Allyn; Seward, Norfolk, UK); although an appropriate filter will prevent passage of bacterial and viral particles, penetration of the filter by fluid will render it ineffective. Filters should therefore only be considered for single use, but even then they may become ineffective during a procedure if exposed to liquid stool. In addition, a filter does not prevent contamination of the internal surfaces of the light head.

We are not aware of any documented cases in which clinical infection occurred as a result of cross-contamination during sigmoidoscopy. Organisms may potentially gain access if mucosal biopsies are taken or polyps

are removed during sigmoidoscopy, but minor trauma to the mucosa resulting from insertion of the instrument may also be a potential site of entry. Guidelines from the Australian Therapeutics Goods Administration recommend sterilization of all parts of the rigid sigmoidoscope to prevent cross-infection [14]. Current disposable sigmoidoscope designs do not provide the same sterile conditions as with other surgical instruments or flexible endoscopes, and prevention of cross-contamination cannot be ensured unless the bellows, tubing, and light head are autoclaved before each use.

References

1. Axtell LM, Chiazzi L (1966) Changing relative frequency of cancer of the colon and rectum in the United States. *Cancer* 19: 750–754
2. Cady B, Pearson AV, Manson DO, Maunz DL (1974) Changing patterns of colorectal carcinoma. *Cancer* 33: 422–426
3. Chapuis PH, Newland RC, Macpherson JG, Dent O, Payne J, Pheils MT (1981) The distribution of colorectal carcinoma and the relationship of tumour site to survival of patients following resection. *Aust N Z J Surg* 51: 127–131
4. Ekelund G (1963) Cancer and polyps of colon and rectum. *Acta Pathol Microbiol Scand* 59: 165–170
5. Gillespie PE, Chambers TJ, Chan KW, Doronzo F, Morson BC, Williams CB (1979) Colonic adenomas: a colonoscopic survey. *Gut* 20: 240–245
6. Keighley MRB, Williams NS (1993) Polypoid disease and polypoid syndromes (anatomical distribution). In *Surgery of the anus, rectum and colon*. Saunders, London, pp 760–771
7. Keighley MRB, Williams NS (1993) Colorectal cancer: epidemiology, aetiology, pathology, clinical features and diagnosis. In *Surgery of the anus, rectum and colon*. Saunders, London, pp 830–885
8. McDermott FT, Hughes ESR, Pihl H, Milne BJ, Price AB (1981) Comparative results of surgical management of single carcinomas of the colon and rectum: a series of 1939 patients managed by one surgeon. *Br J Surg* 68: 850–855
9. NSW Health Department. Infection control policy document circular 2002/45, pp 1–42
10. Rosato FE, Marks G (1981) Changing site distribution patterns of colorectal cancer at Thomas Jefferson University Hospital. *Dis Colon Rectum* 24: 93–96
11. Royal Australasian College of Surgeons (1998) A guide to infection control. Infection control in surgery policy document
12. Shinya H, Wolff WI (1979) Morphology, anatomic distribution and cancer potential of colonic polyps. An analysis of 7000 polyps. *Ann Surg* 190: 679–683
13. Tedesco FJ, Waye SD, Avella JR, Villabos MM (1980) Diagnostic implications of the spatial distribution of colonic mass lesions (polyps and cancer). *Gastrointest Endosc* 26: 95–97
14. Therapeutics Goods Administration (1995) Australian Therapeutics Device Bulletin No. 28