

- 1 Orenstein SR, Orenstein DM. Gastro-oesophageal reflux and respiratory disease in children. *J Pediatr* 1988;112:847-58.
- 2 Sondheimer JM. Gastro-oesophageal reflux: update on pathogenesis and diagnosis. *Pediatr Clin North Am* 1988;35:103-16.
- 3 Blumhagen JD, Rudd TG, Christie DL. Gastro-oesophageal reflux in children: radionuclide gastro-oesophagography. *AJR* 1980;135:1001-4.
- 4 Boyle JT, Tuchman DN, Altschuler SM, Nixon TE, Pack AI, Cohen S. Mechanisms for the association of gastro-oesophageal reflux and bronchospasm. *Am Rev Respir Dis* 1985;131:16-20.
- 5 Vandenplas Y, Sacre-Smits L. Continuous 24-hour pH monitoring in 285 asymptomatic infants 0 to 15 months old. *J Pediatr Gastroenterol Nutr* 1987; 6:220-4.
- 6 Baccino E, Le Goff D, Lancien G, Le Guillou M, Alix D, Motier D. Exploration of acid gastro-oesophageal reflux by 24-hour pH-metry in infants at risk of SIDS: a study of 50 cases. *Forensic Sci Int* 1988;36:255-60.
- 7 Vandenplas Y, De Wolf D, Deneyer M, Sacre L. Incidence of gastro-oesophageal reflux in sleep, awake, fasted and post-cibal periods in asymptomatic infants. *J Pediatr Gastroenterol Nutr* 1988;7:177-80.
- 8 Jolley SG, Herbst JJ, Johnson DG, et al. Oesophageal pH monitoring during sleep identifies children with respiratory symptoms from gastro-oesophageal reflux. *Gastroenterology* 1981;80:1501-6.
- 9 Hoyoux CI, Forget P, Lambrecht L. Chronic bronchopulmonary disease and gastro-oesophageal reflux in children. *Pediatr Pulmonol* 1985;1:149-53.
- 10 Newman LJ, Russe J, Glassman MS, et al. Patterns of gastro-oesophageal reflux in patients with apparent life-threatening events. *J Pediatr Gastroenterol Nutr* 1989;8:157-60.
- 11 Buts JP, Barudi C, Moulin D, et al. Prevalence and treatment of silent gastro-oesophageal reflux in children with recurrent respiratory disorders. *Eur J Pediatr* 1986;145:396-400.
- 12 Malfroot A, Vandenplas Y, Verlinden M, et al. Gastro-oesophageal reflux and unexplained chronic respiratory disease in infants and children. *Pediatr Pulmonol* 1987;3:208-13.
- 13 Shepherd RW, Wren J, Evans S, Lander M, Ong TH. Gastro-oesophageal reflux in children. *Clin Pediatr (Phila)* 1987;26:55-60.
- 14 Spitzer AR, Boyle JT, Tuchman DN, et al. Awake apnoea associated with gastro-oesophageal reflux; a specific clinical syndrome. *J Pediatr* 1984;104: 200-5.
- 15 Berquist WE, Rachelefsky GS, Kadden M, et al. Gastro-oesophageal reflux, associated recurrent pneumonia and chronic asthma in children. *Pediatrics* 1981;68:29-35.
- 16 Herbst JJ. Gastro-oesophageal reflux in the 'near-miss' SIDS. *J Pediatr* 1978; 92:73-5.
- 17 Ekstrom T, Tibbling L. Can mild bronchospasm reduce gastro-oesophageal reflux? *Am Rev Respir Dis* 1988;139:52-5.
- 18 Moote W, Lloyd DA, McCourtie DR, Wells GA. Increase in gastro-oesophageal reflux during methacholine induced bronchospasm. *J Allergy Clin Immunol* 1986;78:619-23.
- 19 Sindel BD, Maisels MJ, Ballantine TVN. Gastro-oesophageal reflux to the proximal oesophagus in infants with bronchopulmonary dysplasia. *Am J Dis Child* 1989;143:1103-6.
- 20 Paton JY, MacFadyen U, Williams A, Simpson H. Gastro-oesophageal reflux and apnoeic pauses during sleep in infancy—no direct relation. *Eur J Pediatr* 1990;149:680-6.
- 21 Wilson N, Charette L, Thomson AH, Silverman M. Gastro-oesophageal reflux and childhood asthma: the acid test. *Thorax* 1985;40:592-7.
- 22 McVeagh P, Howman-Giles R, Kemp A. Pulmonary aspiration studied by radionuclide milk scanning and barium swallow roentgenography. *Am J Dis Child* 1987;141:917-21.
- 23 Staugas R, Martin AJ, Binns G, Stevens IM. The significance of fat-filled macrophages in the diagnosis of aspiration associated with gastro-oesophageal reflux. *Aust Paediatr J* 1985;21:275-7.

## Investigation of rectal bleeding

The passage of blood through the rectum by a child often causes considerable parental anxiety. Unlike the situation in the adult,<sup>1</sup> however, the causes are often transient, almost invariably benign, and usually simply treated. Occasionally the blood indicates serious underlying pathology, and to avoid delay in detecting this possibility a positive diagnosis should be sought at initial presentation and may be found in most cases.

The age of onset clearly relates to certain diagnoses: necrotising enterocolitis and malrotation in the premature baby and neonate, anal fissures and intussusception in the young infant, and lymphoid hyperplasia and inflammatory bowel disease in the older child. Classification of aetiology of bleeding through the rectum is therefore usually based on age groups.<sup>2</sup>

A good history may lead directly to diagnosis. Passage of a firm stool, streaked with red blood (haematochezia) and accompanied by anal pain is pathognomonic of anal fissure—a common problem. The child may be aware of 'something coming down' suggesting a rectal polyp or rectal mucosal prolapse. The dietary history may suggest features of intolerance (for example, cows' milk) leading to inflammation and bleeding.<sup>3</sup> The colour and amount of blood, its relation to stool, and the presence of abdominal or anal pain all point to the anatomical location of bleeding. Though melaena suggests an upper gastrointestinal haemorrhage, brisk bleeding from oesophageal varices, duodenal ulcer, or Meckel's diverticulum may result in passage of red blood. The possibility of bleeding due to a diathesis (von Willebrand's) or systemic illness (haemolytic uraemic syndrome, connective tissue disorders, Henoch-Schönlein purpura) should be considered and a detailed family history (familial polyposis coli) and drug history (non-steroidal anti-inflammatory agents, steroids, salicylates) is important. Bleeding due to stress ulceration should be considered in association with posterior fossa tumours,<sup>4</sup> burns, and cardiac surgery. Confirmation of the presence of blood by the examination of stool or nappy is important and, if doubt exists about whether stool contains blood, a faecal occult blood test should be performed.<sup>5</sup>

Examination centres on abdominal, perianal, and rectal findings together with inspection of stools, but a complete examination is needed to pick up clues. Cutaneous haemangioma may point to gastrointestinal haemangiomas. Buccal and lip pigmentation is classical with Peutz-Jegher polyposis. Petechial rash on buttocks and legs may not have been noticed by the parents of the child with Henoch-Schönlein purpura. Relevant abdominal findings include hepatosplenomegaly (cirrhosis and portal hypertension), mass (duplication cyst or intussusception), distended or thickened bowel (Crohn's disease, ulcerative colitis), and peritonism (inflamed Meckel's diverticulum or infective causes).

Anal and rectal examination is best conducted with the child lying either supine with hips and knees fully flexed or in the left lateral position (for a right handed examiner). The reassuring presence of parent or nurse holding the child, a sympathetic explanation to the child, and a calm and gentle approach normally permits full and detailed examination provided the child has not previously been hurt or frightened by rough or rapid examination. Careful separation of the buttocks and eversion of anal mucosa may reveal a fissure in the common posterior position. An anterior fissure is sometimes found when the anus is in an anterior ectopic position and slightly stenotic: further investigation and management will be needed. Fissures may be red and painful if acute or white and indurated if more chronic and inactive. Associated skin tags raise the suspicion of Crohn's disease. If the child can be persuaded to strain (a difficult manoeuvre for most children) an anal mucosal prolapse may appear. Prolapse of the complete rectal wall (proctidentia) is usually related to significant underlying disorders (for example, cystic fibrosis or neurological disorders).

Digital rectal examination may be resisted (and also be unnecessary) if there is an anal fissure but otherwise is mandatory; its omission leads to missed diagnosis or unnecessary investigations. Rectal polyps (usually simple and solitary) may be palpated by sweeping the examining finger circumferentially round the rectal lumen until the polyp reaches the limit of mobility on its pedicle: the polyp may be prolapsed through the anus and even removed by

avulsion by this manoeuvre. Pelvic intra-abdominal masses (duplication cysts, lymphosarcoma) may be identified by bidigital palpation. The appearance of blood, mucus, or pus on the examining finger indicates inflammatory bowel disorder.

If an infective cause is thought likely stools should be examined promptly; aerobic and anaerobic cultures and microscopy for ova and parasites are necessary. *Escherichia coli*, shigella, salmonella, campylobacter, and giardia all produce bloody diarrhoea. Severe bleeding due to cytomegalovirus colitis in a child with AIDS has recently been described.<sup>6</sup>

Whether sonography, radiography, or endoscopy is the first investigation depends on the suspected diagnosis, the expected yield of investigation, and whether or not general anaesthesia would be needed for endoscopy. Plain radiography and sonography are less invasive and distressing for a child and may give definitive information: a classical appearance of multiple short fluid levels in the right abdomen in a neonate with volvulus or the appearance of an intraluminal mass on sonography in a case of intussusception. Barium enema contrast radiography will give detailed information on the mucosal pattern and intraluminal lesions in the large bowel provided adequate preparation has been undertaken. Double contrast radiography gives better definition of intraluminal lesions.

The value of information obtained from proctoscopy, sigmoidoscopy, or colonoscopy relates to the experience of the observer, the degree of cooperation of the child, and to the success of bowel preparation. Even the most experienced observer will find examination of a squirming, anxious child with a loaded rectum inconclusive and preparation by fluids only, orally for 24 hours, oral sodium picosulphate, bowel wash out, and effective sedation or general anaesthesia are often necessary. In the newborn, the rectal mucosa can be seen using a small auriscope and the appearance of the inflamed and oedematous mucosa in necrotising enterocolitis may be recognised. Abnormal mucosal appearances may be quite characteristic<sup>7</sup>; hypertrophy, ulceration, and contact bleeding together with blood, mucus, or pus in the lumen strongly suggests Crohn's disease or ulcerative colitis. Lymphoid hyperplasia produces a nodular but intact mucosa. A biopsy specimen (by rectal suction or colonoscopy forceps) may give confirmation. Eosinophilia is noted with milk allergy.<sup>8</sup>

Full colonoscopic examination requires considerable expertise and the relative infrequency of indications in childhood impedes its acquisition by paediatricians and paediatric surgeons. Using a standard paediatric colonoscope, the lumen to the level of the splenic flexure can reliably be visualised, but transverse and ascending colon are not so easy. Young children may present additional challenges to technique.<sup>9</sup> Indications for colonoscopy are severe bleeding, moderate but persistent bleeding with negative barium double contrast enema findings, or a lesion of unknown nature seen on barium enema. A biopsy specimen

of abnormal areas of the mucosa may be taken. Polyps may be snared and removed using diathermy. Bleeding points may be controlled by electrocautery, laser irradiation, or heater probe.

When bleeding persists but the source cannot be defined by conventional radiology and endoscopy the use of either radionuclide studies or angiography can be considered. Technetium sulphur colloid scan will detect ectopic gastric mucosa in a Meckel's diverticulum, though it may give false negative results in the presence of active bleeding. Technetium labelled red cells will accumulate in the bowel and will pinpoint a bleeding area provided the bleeding rate is greater than 0.5 ml/minute but do not define the cause of bleeding. Angiography can define the site and display the vascular picture of a haemangioma provided bleeding is fairly brisk (1 ml/minute). Intra-arterial digital subtraction angiography may add further definition. In difficult cases, depending on local expertise, computed tomography (for duplications and haemangiomas) and magnetic resonance imaging (for inflammatory disorders, necrotising enterocolitis, bowel wall haematoma) may give useful information, though their roles are not yet clearly defined.<sup>10</sup>

In dire circumstances laparotomy may be necessary in the absence of a firm diagnosis. Techniques such as combined endoscopy and laparotomy, extensive transillumination of gut and mesentery, multiple enterotomies, and injection of methylene blue may help in the search for the bleeding point. Small bowel resection and anastomosis for bleeding Meckel's diverticulum and colectomy for inflammatory bowel disease may be life saving. Very occasionally small bowel tumours (lymphosarcoma, leiomyosarcoma) may be discovered.

When an episode of bleeding through the rectum has been mild and self limiting, when the history has revealed no clues, and examination has proved negative, however, it is reasonable to defer investigation until a second bleed in view of the significant proportion of cases in which all investigations will prove negative.

P A M RAINE

Royal Hospital for Sick Children,  
Yorkhill, Glasgow G3 8SJ

- 1 Anonymous. Investigation of rectal bleeding [Editorial]. *Lancet* 1989;i:195-7.
- 2 Oldham KT, Lobe TE. Gastrointestinal hemorrhage in children: a pragmatic update. *Pediatr Clin North Am* 1985;32:1247-63.
- 3 Berezin S, Schwartz SM, Glassman M, et al. Gastrointestinal milk intolerance of infancy. *Am J Dis Child* 1989;143:361-2.
- 4 Ross AJ, Siegel KR, Bell W, et al. Massive gastrointestinal hemorrhage in children with posterior fossa tumours. *J Pediatr Surg* 1987;22:633-6.
- 5 Tate JTT, Northway J, Royle GT. Faecal occult blood testing in symptomatic patients: comparison of three tests. *Br J Surg* 1990;77:523-6.
- 6 Schwartz DL, So HB, Bungarz WR, et al. A case of life-threatening gastrointestinal hemorrhage in an infant with AIDS. *J Pediatr Surg* 1989;24:313-5.
- 7 Silverstein FE, Tytgat GNJ, eds. *Atlas of gastrointestinal endoscopy*. Edinburgh: Churchill Livingstone, 1987.
- 8 Hill SM, Milla PJ. Colitis caused by food allergy in infants. *Arch Dis Child* 1990;65:132-3.
- 9 Kawamitsu T, Nagashima K. Instrumental technique for total colonoscopy in children under 3 years of age. *Pediatric Surgery International* 1990;5:121-3.
- 10 Stringer DA. *Paediatric gastrointestinal imaging*. Toronto: Becker, 1989.