Regular Review

Strategies for reducing inappropriate laparotomy rate in the acute abdomen

S Paterson-Brown

Zachary Cope, of St Mary's Hospital, advised early operation for the acute abdomen in doubtful cases when he wrote in his classic treatise on the acute abdomen in rhyme:

In doubtful cases do not wait too long
before exploring for it is quite wrong
to act upon the slogan wait and see
when looking might provide the remedy.¹

Since then surgeons have come to accept the "pre-emptive strike," in which early laparotomy is performed when the need for an operation is in doubt to prevent the more serious complications that may follow untreated progression of disease. However, this view has been brought into question by recent advances in diagnostic and management aids.² Early exploration in doubtful cases will always be associated with the possibility of a "negative laparotomy" — "that is one in which no explanation for the patient's symptoms is found or one in which the symptoms are explained but the condition does not require an operation. Figures over 25% for the removal of a normal appendix are not uncommon² despite evidence that the complications which may follow such an operation are not insignificant.³ Although difficult to evaluate, the complications of negative laparotomy are likely to be more serious in patients who are ill from associated conditions, as has been shown for colonic pseudo-obstruction.⁴ Furthermore, hospital stay and final recovery are prolonged.

However, attempts to decrease the number of unnecessary interventions may lead to some patients having a necessary operation delayed; this has been termed a bad management error,⁵ as these patients have potentially life threatening conditions. The surgeon, like a latter day Ulysses, must steer a course between the Scylla of a negative laparotomy and the Charybdis of bad management errors. At the same time he has to be aware of the potential costs and benefits of his decisions.⁶

Several routine investigations have been added to history taking and physical examination in the clinical assessment of the acute abdomen. Few have convincingly contributed to the sensitivity or specificity of a diagnosis when couched in the terms: "Do I need to open the abdomen?" For example, urine microscopy, serum amylase concentration, and the presence of fever and leucocytosis have added little to clinical evaluation.^{7,8} Likewise, the role of plain radiographs, except when perforation or obstruction are suspected, has been questioned,⁹ particularly when they are interpreted by a junior doctor.¹⁰

Attempts to avoid a negative laparotomy or a bad management error rest not so much on the right

diagnosis but on making the right decision: to operate or not.¹¹ This decision will be influenced by the referral pattern and the urgency of presentation. Though diagnosis and decision may march together, the last is axiomatically more important.¹² The decision to operate on a patient with perforated appendicitis who at laparotomy turns out to have ischaemic bowel reflects a correct procedural decision but an incorrect diagnosis. Thus the assessment of any new diagnostic or management technique must take into account its ability to influence clinical decision making rather than its effect on diagnostic accuracy.^{13,14} This review examines those techniques and investigations currently available to the surgeon for improving overall management of the acute abdomen (fig 1).

Non-invasive techniques

STRUCTURED HISTORIES AND COMPUTER AIDED DIAGNOSIS

Much has been written over the past 15 years on the improvements in overall management which are associated with computer aided diagnosis.^{5,15-18} To use computer aided diagnosis workers have manipulated the bayesian probabilities on which most clinical decisions are made and formalised them into a computer program. Clinical information is collected with a structured data sheet and details are then entered into the computer, so that the clinician and the computer assimilate the same clinical data. The clinician reaches his or her diagnosis using previous experience and acquired knowledge, whereas the computer uses formalised bayesian probabilities based on a large data base of previous associations. Computer aided diagnosis has produced around a 20% improvement in diagnostic accuracy irrespective of the experience and seniority of the clinical staff who collected the data.¹⁶ A more recent multicentre study has confirmed the earlier improvements, showing that diagnostic accuracy improved from 46% to 65% and that the negative laparotomy rate fell to 10% while the incidence of bad management errors dropped to 0.2%.⁵

Despite these impressive results computer aided diagnosis has not become widely accepted.¹⁹ Although this may partly reflect the high incidence of non-specific abdominal pain diagnosed by computer, which reaches 50% in some of the studies,^{15,20} perhaps the greatest obstacle remains an inbuilt irrational prejudice against using computers in direct patient management. This may be quite deep seated,²¹ and there are still many obstacles to the acceptance of formalised clinical decision analysis.²²

The diagnostic and procedural improvements associated with computer aided diagnosis are multi-

University Department of
Surgery, Royal Infirmary,
Edinburgh EH3 9YW
S Paterson-Brown, FRCS,
lecturer

BMJ 1991;303:1115-8

FIG 1—Algorithm for managing the acute abdomen

factorial; there is evidence that structured history and data collection sheets are perhaps the most important. When these are used without the computer, diagnostic accuracy^{17 23} and overall decision making¹¹ are both improved. But improved performance is always likely when this is combined with regular feedback of results, peer review, and audit,^{5 24-26} all of which are inherent components in studies of this sort. Thus the actual role of the computer is difficult to quantify, and it probably contributes less by itself than by association with the other factors mentioned. This does not, however, discount its central catalytic role²⁴ nor its contribution as a stimulus to good clinical practice.²⁷

PLAIN AND CONTRAST RADIOGRAPHY

The use of plain abdominal radiographs in assessing the acute abdomen seems to influence management in only 4% of cases.²⁸ The erect abdominal radiograph for diagnosing bowel obstruction also has little value,^{10 29} although the erect chest radiograph remains the best investigation for detecting a pneumoperitoneum.^{9 30} Unsurprisingly, senior staff are better at detecting abnormalities than juniors,^{29 30} and this suggests that, rather than restricting emergency radiography requested by junior staff, better education is needed about the most appropriate view to be obtained in each patient and subsequent interpretation.³²

The popularity of gastrointestinal contrast studies when evaluating patients with suspected obstruction or perforation has steadily increased.³³ Up to 70% of patients with a perforated duodenal ulcer can be successfully managed non-operatively by an aggressive regimen of nasogastric suction, intravenous antibiotics, and H₂ receptor antagonists.³⁴ Those in whom spontaneous sealing has not occurred can be detected by radiography after a contrast meal.³⁵ Based on a similar principle, contrast enemas have been used in patients with acute diverticular disease to identify those with a leak or peridiverticulitis. In one study 13 of 16 patients with a leak or peridiverticulitis identified by a contrast enema required surgery compared with only three of 30 in whom uncomplicated diverticular disease was seen.³⁶

A water soluble contrast enema has an important role in the diagnosis and management of patients with large bowel obstruction.^{37 38} The evidence is such that it can be persuasively argued that, to avoid unnecessary laparotomy for "pseudo-obstruction," a patient with a clinical diagnosis of large bowel obstruction should have either a contrast enema or a diagnostically successful colonoscopy before surgery. Not only does a contrast enema accurately identify those patients with a mechanical cause for the obstruction and who therefore require surgery but it also reveals those patients with pseudo-obstruction, who, by definition, do not. Other studies have suggested that a limited contrast meal and follow through may be useful for small bowel obstruction,^{39 40} although its influence on clinical decision making requires further study.

ULTRASONOGRAPHY

Ultrasonography is used increasingly commonly in investigating both acute and chronic abdominal conditions. It has a diagnostic accuracy over 95% in acute cholecystitis, which is similar to that of scintigraphy.⁴¹⁻⁴³ It therefore provides a swift and reliable means of diagnosis, which is essential if a policy of early cholecystectomy is to be followed.^{44 45}

Early reports from the Netherlands of the value of ultrasonography in detecting acute appendicitis⁴⁶ have recently been confirmed by a larger study from the same group.⁴⁷ The acutely inflamed appendix can be visualised sonographically in 86% of patients, the proportion being higher in those with non-perforated appendices. It seems, however, that ultrasonography is not superior to clinical assessment in typical cases of appendicitis, and its main use is in patients with a doubtful clinical picture.⁴⁸ High resolution ultrasonography may also have advantages in women with lower abdominal pain as the pelvic organs can be seen clearly.⁴⁹

Invasive techniques

FINE CATHETER ASPIRATION

Needle aspiration of the peritoneal cavity in patients with acute abdominal pain has been used for many years,⁵⁰ but the recent introduction of a technique for examining peritoneal cytology using fine catheter aspiration⁵¹ has important refinements. A small umbilical catheter is inserted through a size 14 G cannula inserted into the peritoneal cavity under local anaesthesia (fig 2). Aspirates are then taken for immediate microscopic analysis. The risk of perforating underlying viscera seems to be small when a cannula of this size is used.⁵¹ An increase in the proportion of polymorphonuclear cells (>50%) has been shown to predict reliably the presence of acute intra-abdominal inflammatory conditions (fig 3).⁵¹ This technique has now been used to improve clinical decision making in difficult cases of acute abdominal pain⁵¹ and, when performed on every patient with acute abdominal pain,

significantly reduces the number of inappropriate management decisions.⁵² Acute inflammatory conditions requiring surgery and those which do not cannot be differentiated by peritoneal cytology, although it does identify patients without an inflammatory focus. Thus fine catheter aspiration is of most value as an investigation before laparoscopy, with negative results preventing unnecessary laparoscopy and patients with positive results proceeding to laparotomy or laparoscopy depending on the clinical picture.^{53 54}

Peritoneal lavage, although usually used to investigate blunt abdominal trauma,⁵⁵ has also been used to assess the acute (non-traumatic) abdomen.⁵⁶ As in trauma examination of lavage fluid for leucocytes, red cells, bile, amylase, and bacteria provides valuable information about the underlying condition and the need for surgery.

LAPAROSCOPY

The use of laparoscopy before an operation in patients with acute abdominal pain is not new,⁵⁷ and several studies have investigated its role in diagnostic decision making.⁵⁸⁻⁶³ A selective policy of laparoscopy in patients with acute abdominal pain in whom the decision to operate is in doubt¹³ can reduce the management error rate to almost zero. Patients with possible appendicitis are particularly suitable for this technique as the normal appendix can be visualised at laparoscopy in at least three quarters of patients,⁶⁴ and with experience this proportion rises to nearly 100%.⁶⁵ It could be argued that laparoscopy should be performed in all women with suspected appendicitis, irrespective of the certainty of the diagnosis, because of the high error rate in this group.^{61 65-69} Failure to reduce unnecessary appendectomy rates despite pre-operative laparoscopy may reflect inexperience in the technique.⁷⁰ Non-visualisation of the appendix does not inevitably necessitate its removal as signs of inflammation in the right iliac fossa will usually alert the laparoscopist to the possibility of appendicitis,^{61 62} and in some cases another obvious cause for the acute abdominal pain may be found.⁶⁵

Laparoscopy is safe and relatively simple to learn; the introduction of laparoscopic cholecystectomy⁷¹ will also make it more familiar to surgeons. The complication rate associated with laparoscopy is about 3% with a mortality of eight per 100 000.⁷² These figures include both diagnostic and operative laparoscopic procedures and are considerably less than the reported complication rate after the removal of a normal appendix, which can reach 17%.³ Although laparoscopy in the acute abdomen is usually done under general anaesthesia, it can be readily performed under local

FIG 2—Equipment for fine catheter aspiration: (left to right) 10 ml syringe, 25 G needle (for fenestrating the distal 5-10 cm of umbilical catheter), 14 G venous cannula, and 3.5 CH umbilical catheter

FIG 3—Peritoneal aspirates from patients (top) with and (bottom) without acute inflammation. Smears were air dried and stained by modified Romanovsky's method. The darkly stained nuclei of neutrophils is clearly seen in the top picture (magnification $\times 400$)

anaesthesia.⁷³ However, it remains difficult to do so in the presence of acute abdominal pain with possible inflamed parietes. The new minilaparoscope, which has been used under local anaesthesia in the assessment of blunt abdominal trauma,⁷⁴ may prove valuable in the acute abdomen.

Discussion

Emergency admissions continue to account for the largest proportion of the overall general surgical workload and available resources⁷⁵ and have stimulated, along with surgical audit and peer review,^{26 27 76} the development of many techniques described in this review. Rigorous analysis of management successes as well as failures must be encouraged, and sufficient evidence now exists to support the widespread introduction of structured data sheets for the initial history taking and physical examination of all patients who present with acute abdominal pain. Whether a computer is used to produce diagnostic probabilities remains a personal choice, but the additional advantages of teaching and data collection make it an attractive adjunct. The decision about additional investigations will always rest with the clinician, but both ultrasonography and fine catheter aspiration should become more widely used and must be available 24 hours a day. Similarly, gastrointestinal contrast studies in the emergency investigation of the acute abdomen are to be encouraged, particularly in cases of large bowel obstruction. Laparoscopy remains the final tool in the surgeons' armamentarium with which an incorrect management decision can be avoided and in the future must become as familiar to the general surgeon as it has been in the past to the gynaecologist.

In each patient who presents with an acute abdomen the decision to operate is central. A negative laparotomy or the failure to operate early may have far reaching consequences, and it could be argued that those units

which do not pursue routines of the kind discussed here are failing to provide an adequate service to their patients.

I thank Professor H A F Dudley for his advice and criticism.

- 1 Cope VZ. The diagnosis of the acute abdomen in rhyme (by Zeta). 1st ed. London: H K Lewis, 1947:88.
- 2 Paterson-Brown S, Vipond MN. Modern aids to clinical decision-making in the acute abdomen. *Br J Surg* 1990;77:13-8.
- 3 Chang FC, Hogle HH, Welling DR. The fate of the negative appendix. *Am J Surg* 1973;126:752-4.
- 4 Dudley HAF, Paterson-Brown S. Pseudo-obstruction. *BMJ* 1986;292:1157-8.
- 5 Adams ID, Chan M, Clifford PC, Cooke WM, Dallos V, de Dombal FT, et al. Computer aided diagnosis of acute abdominal pain: a multicentre study. *BMJ* 1986;293:800-4.
- 6 Neutra R. Indications for the treatment of suspected acute appendicitis: a cost-effectiveness approach. In: Bunker JP, Mosteller F, eds. *Costs, risks and benefits of surgery*. New York: Oxford University Press, 1977:277-307.
- 7 Howie CR, Gunn AA. Temperature: a poor diagnostic indicator in abdominal pain. *J R Coll Surg Edinb* 1984;29:249-51.
- 8 Blacklock ARE, Gunn AA. The "acute abdomen" in the accident and emergency department. *J R Coll Surg Edinb* 1976;21:165-9.
- 9 Wilkins RA, de Lacey GJ. The appropriate use of diagnostic services: investigating intra-abdominal disease; reducing x-ray wastage. *Health Trends* 1986;18:25-7.
- 10 Field S, Guy PJ, Upsdell SM, Scourfield AE. The erect abdominal radiograph in the acute abdomen: should its routine use be abandoned? *BMJ* 1985;290:1934-6.
- 11 Paterson-Brown S, Vipond MN, Simms K, Gatzert C, Thompson JN, Dudley HAF. Clinical decision making and laparoscopy versus computer prediction in the management of the acute abdomen. *Br J Surg* 1989;76:1011-3.
- 12 Macartney FJ. Diagnostic logic. *BMJ* 1987;295:1325-31.
- 13 Paterson-Brown S, Eckersley JRT, Sim AJW, Dudley HAF. Laparoscopy as an adjunct to decision making in the acute abdomen. *Br J Surg* 1986;73:1022-4.
- 14 Moore AT, Dixon AK. Cost-benefit evaluation of body computed tomography. *Health Trends* 1987;19:8-12.
- 15 de Dombal FT, Leaper DJ, Staniland JR, McCann AP, Horrocks JC. Computer-aided diagnosis of acute abdominal pain. *BMJ* 1972;iii:9-13.
- 16 de Dombal FT, Leaper DJ, Horrocks JC, Staniland JR, McCann AP. Human and computer-aided diagnosis of abdominal pain: further report with emphasis on performance of clinicians. *BMJ* 1974;ii:376-80.
- 17 Gunn AA. The diagnosis of acute abdominal pain with computer analysis. *J R Coll Surg Edinb* 1976;21:170-2.
- 18 de Dombal FT. The OMGE acute abdominal pain survey—progress report, 1982. *Scand J Gastroenterol* 1984;19 (suppl 95):28-40.
- 19 Sutton GC. Computer-aided diagnosis: a review. *Br J Surg* 1989;76:82-5.
- 20 Scarlett PY, Cooke WM, Clarke D, Bates C, Chan M. Computer aided diagnosis of acute abdominal pain at Middlesbrough General Hospital. *Ann R Coll Surg Engl* 1986;68:179-81.
- 21 Oldham JFM, Dudley HAF. Some unusual obstacles to the use of computers in medical science. *Med J Aust* 1972;1:483-6.
- 22 Balla JJ, Elstein AS, Christensen C. Obstacles to clinical decision analysis. *BMJ* 1989;298:579-82.
- 23 Lawrence PC, Clifford PC, Taylor IF. Acute abdominal pain: computer aided diagnosis by non-medically qualified staff. *Ann R Coll Surg Engl* 1987;69:233-4.
- 24 Gunn AA. Diagnosis and management of abdominal pain. *Br J Surg* 1989;76:422.
- 25 Gough MH, Kettlewell MGW, Marks CG, Holmes SJK, Holderness J. Audit: an annual assessment of the work and performance of a surgical firm in a regional teaching hospital. *BMJ* 1980;281:913-8.
- 26 Gruer R, Gordon DS, Gunn AA, Ruckley CV. Audit of surgical audit. *Lancet* 1986;ii:23-6.
- 27 McAdam WAF, Davenport P, Brock BM, Chan M, Armitage T, de Dombal FT. Twelve years' experience of computer-aided diagnosis in a district general hospital. *Ann R Coll Surg Engl* 1990;72:140-6.
- 28 Stower MJ, Amar SS, Mikulin T, Kean DM, Hardcastle JD. Evaluation of the plain abdominal X-ray in the acute abdomen. *J R Soc Med* 1985;78:630-3.
- 29 Simpson A, Sandeman D, Nixon SJ, Goulbourne IA, Grieve DC, MacIntyre IMC. The value of an erect abdominal radiograph in the diagnosis of intestinal obstruction. *Clin Radiol* 1985;36:41-2.
- 30 Miller RE, Nelson SW. The roentgenologic demonstration of tiny amounts of free intraperitoneal gas: experimental and clinical studies. *AJR* 1971;112:574-85.
- 31 Lee PWR. The plain X-ray in the acute abdomen: a surgeon's evaluation. *Br J Surg* 1976;63:763-6.
- 32 Campbell JPM, Gunn AA. Plain abdominal radiographs and acute abdominal pain. *Br J Surg* 1988;75:554-6.
- 33 Ott DJ, Gelfand DW. Gastrointestinal contrast agents: indications, uses, and risks. *JAMA* 1983;249:2380-4.
- 34 Crofts TJ, Park KGM, Steele RJC, Chung SSC, Li AKC. A randomized trial of non-operative treatment for perforated peptic ulcer. *N Engl J Med* 1989;320:970-3.
- 35 Donovan AJ, Vinson TL, Malsby GO, Gewin JR. Selective treatment of duodenal ulcer with perforation. *Ann Surg* 1979;189:627-36.
- 36 Kourtesis GJ, Williams SE. Acute diverticulitis: safety and value of contrast studies in predicting need for operation. *Aust N Z J Surg* 1988;58:801-4.
- 37 Stewart J, Finan PJ, Courtney DF, Brennan TG. Does a water soluble contrast enema assist in the management of acute large bowel obstruction: a prospective study of 117 cases. *Br J Surg* 1984;71:799-801.
- 38 Koruth NM, Koruth A, Matheson NA. The place of contrast enema in the management of large bowel obstruction. *J R Coll Surg Edinb* 1985;30:258-60.
- 39 Dunn JT, Halls JM, Berne TV. Roentgenographic contrast studies in acute small bowel obstruction. *Arch Surg* 1984;119:1305-8.
- 40 Brolin RE, Krasna MJ, Mast BA. Use of tubes and radiographs in the management of small bowel obstruction. *Ann Surg* 1987;206:126-33.
- 41 Worthen NJ, Uszler JM, Funamura JL. Cholecystitis: prospective evaluation of sonography and ^{99m}Tc-HIDA cholescintigraphy. *AJR* 1981;137:973-8.
- 42 Samuels BI, Freitas JE, Bree RL, Schwab RE, Heller ST. A comparison of radionuclide hepatobiliary imaging and real-time ultrasound for the detection of acute cholecystitis. *Radiology* 1983;147:207-10.
- 43 Ralls PW, Colletti PM, Lapin SA, Chandrasoma P, Boswell WD, Ngo C, et al. Real-time sonography in suspected acute cholecystitis. *Radiology* 1985;5:767-71.
- 44 McArthur P, Cuschieri A, Sells RA, Shields R. Controlled clinical trial comparing early with interval cholecystectomy for acute cholecystitis. *Br J Surg* 1975;62:850-2.
- 45 Fowkes FGR, Gunn AA. The management of acute cholecystitis and its hospital cost. *Br J Surg* 1980;67:613-7.
- 46 Puylaert JB, Rutgers PH, Lalising RI, de Vries BC, van der Werf SD, Dörr JP, et al. A prospective study of ultrasonography in the diagnosis of appendicitis. *N Engl J Med* 1987;317:666-9.
- 47 Ooms HWA, Koumans RKJ, Ho Kang You PJ, Puylaert JBCM. Ultrasonography in the diagnosis of acute appendicitis. *Br J Surg* 1991;78:315-8.
- 48 Kang W-M, Lee C-H, Chou Y-H, Lin H-J, Lo H-C, Hu S-C, et al. A clinical evaluation of ultrasonography in the diagnosis of acute appendicitis. *Surgery* 1989;105:154-9.
- 49 Pearson RH. Ultrasonography for diagnosing appendicitis. *BMJ* 1988;297:309-10.
- 50 Baker WNW, Mackie DB, Newcombe JF. Diagnostic paracentesis in the acute abdomen. *BMJ* 1967;iii:146-9.
- 51 Stewart RJ, Gupta RK, Purdie GL, Isbister WH. Fine-catheter aspiration cytology of peritoneal cavity improves decision-making about difficult cases of acute abdominal pain. *Lancet* 1986;ii:1414-5.
- 52 Stewart RJ, Gupta RK, Purdie GL, Holloway LJ, Isbister WH. Fine catheter peritoneal cytology for the acute abdomen: a randomized, controlled trial. *Aust N Z J Surg* 1988;58:965-70.
- 53 Vipond MN, Paterson-Brown S, Tyrell MR, Thompson JN, Coleman D, Dudley HAF. An evaluation of fine catheter aspiration cytology of the peritoneum as an adjunct to decision making in the acute abdomen. *Br J Surg* 1990;77:86-7.
- 54 Baigrie RJ, Saidan Z, Scott-Coomes D, Hamilton JB, Katesmarke M, Vipond MN, et al. The role of fine catheter peritoneal cytology and laparoscopy in the management of acute abdominal pain. *Br J Surg* 1991;78:167-70.
- 55 Velanovich V. Bayesian analysis of the reliability of peritoneal lavage. *Surg Gynecol Obstet* 1990;170:7-11.
- 56 Hoffmann J. Peritoneal lavage in the diagnosis of the acute abdomen of non-traumatic origin. *Acta Chir Scand* 1987;153:561-5.
- 57 Sugarbaker PH, Bloom BS, Sanders JH, Wilson RE. Preoperative laparoscopy in diagnosis of acute abdominal pain. *Lancet* 1975;ii:442-5.
- 58 Anteby SO, Schenker JG, Polishuk WZ. The value of laparoscopy in acute pelvic pain. *Ann Surg* 1975;181:484-6.
- 59 Leape LL, Ramenofsky ML. Laparoscopy for questionable appendicitis—can it reduce the negative appendectomy rate? *Ann Surg* 1980;191:410-3.
- 60 Anderson JL, Bridgewater FHG. Laparoscopy in the diagnosis of acute lower abdominal pain. *Aust N Z J Surg* 1981;51:462-4.
- 61 Deutsch AA, Zelikovsky A, Reiss R. Laparoscopy in the prevention of unnecessary appendectomies: a prospective study. *Br J Surg* 1982;69:336-7.
- 62 Clarke PJ, Hands LJ, Gough MH, Kettlewell MG. The use of laparoscopy in the management of right iliac fossa pain. *Ann R Coll Surg Engl* 1986;68:68-9.
- 63 Nagy AG, James D. Diagnostic laparoscopy. *Am J Surg* 1989;157:490-3.
- 64 Paterson-Brown S, Olufunwa SA, Galazka N, Simmons SC. Visualisation of the normal appendix at laparoscopy. *J R Coll Surg Edinb* 1986;31:106-7.
- 65 Crichton D. Ultrasonography for diagnosing appendicitis. *BMJ* 1988;297:857.
- 66 Spiertos NM, Eisenkop SM, Spiertos TW, Poliakin RI, Hibbard LT. Laparoscopy—a diagnostic aid in cases of suspected appendicitis. Its use in women of reproductive age. *Am J Obstet Gynecol* 1987;156:90-4.
- 67 Paterson-Brown S, Thompson JN, Eckersley JRT, Ponting GA, Dudley HAF. Which patient with suspected appendicitis should undergo laparoscopy? *BMJ* 1988;296:1363-4.
- 68 Woodward A, Hemingway D, Greaney MG, Murphy C. Which patients should undergo laparoscopy? *BMJ* 1988;296:1740.
- 69 Foster HMcA. Which patients should undergo laparoscopy? *BMJ* 1988;297:489.
- 70 Whitworth CM, Whitworth PW, Sanfilippo J, Polk HC. Value of diagnostic laparoscopy in young women with possible appendicitis. *Surg Gynecol Obstet* 1988;167:187-90.
- 71 Dubois F, Icard P, Berthelot G, Levard H. Coelioscopic cholecystectomy. *Ann Surg* 1989;211:60-2.
- 72 Chamberlain GVP, Carron Brown JA. *Report of the working party of the confidential enquiry into gynaecological laparoscopy*. London: Royal College of Obstetricians and Gynaecologists, 1978.
- 73 Hall TJ, Donaldson DR, Brennan TG. The value of laparoscopy under local anaesthesia in 250 medical and surgical patients. *Br J Surg* 1980;67:751-3.
- 74 Cuschieri A, Hennessy TPJ, Stephens R, Berci G. Diagnosis of significant abdominal trauma after road traffic accidents: preliminary results of a multicentre trial comparing minilaparoscopy with peritoneal lavage. *Ann R Coll Surg Engl* 1988;70:153-5.
- 75 Ellis BW, Rivett RC, Dudley HAF. Extending the use of clinical audit data: a resource planning model. *BMJ* 1990;301:159-62.
- 76 Buck N, Devlin HB, Lunn JN. *Report of the confidential enquiry into perioperative deaths*. London: Nuffield Provincial Hospitals Trust and King's Fund, 1987.