- ³ Cohn PF, Gorlin R, Cohn LH, Collins JJ. Left ventricular ejection fraction as a prognostic guide in surgical treatment of coronary and valvular heart disease. *Am J Cardiol* 1974;**34**:136-41.
- ⁴ Borow KM, Green LH, Mann T, *et al.* End-systolic volume as a predictor of postoperative left ventricular performance in volume overload from valvular regurgitation. *Am J Med* 1980;**68**:655-63.
- ⁵ Saltissi S, Crowther A, Byrne C, Coltart DJ, Jenkins BS, Webb-Peploe MM. Assessment of prognostic factors in patients undergoing surgery for non-rheumatic mitral regurgitation. *Br Heart J* 1980;**44**:369-80.
- ⁶ Rosenblatt A, Clark R, Burgess J, Cohn K. Echocardiographic assessment of the level of cardiac compensation in valvular heart disease. *Circulation* 1976;**54**:509-18.
- ⁷ McDonald IG. Echocardiographic assessment of left ventricular function in mitral valve disease. *Circulation* 1976;**53**:865-71.
- ⁸ Schuler G, Peterson KL, Johnson A, *et al.* Temporal response of left ventricular performance to mitral valve surgery. *Circulation* 1979;**59**:1218-31.
- ⁹ Carpentier A, Chauvaud S, Fabiani JN, *et al.* Reconstructive surgery of mitral valve incompetence. Ten-year appraisal. *J Thorac Cardiovasc Surg* 1980;**79**:338-48.
- ¹⁰ Cohn LH, Mudge GH, Pratter F, Collins JJ. Five to eight-year follow-up of patients undergoing porcine heart-valve replacement. *N Engl J Med* 1981;**304**:258-62.

Pulmonary problems of the immunocompromised patient

The protective cuticle surrounding the body is deficient from mouth to anus. The lungs present an area of naked mucous membrane almost the size of a football pitch, making it scarcely surprising that they are the most common site of entry for pathogens. The chances of infection are narrowed by a field of defences set in readiness. IgA-laden mucus at the bronchi and IgG in the alveoli are both dependent on normal function of the thymic-independent, B-cell lymphocytes. Alveolar macrophages, regarded by some as the linchpin of pulmonary defence, depend on normal function of the thymic-dependent, T-cell lymphocytes and their free-ranging lymphokines.¹

Understanding of these mechanisms has become more important in recent years as patients have their defences suppressed, either as an unwanted side effect of cancer chemotherapy or deliberately in an effort to induce the host to accept transplanted foreign tissue. In such patients the physician should expect an increased chance of infection with common bacterial pathogens, but these can usually be identified either in sputum or in blood and controlled with broad-spectrum antibiotics. The more difficult problems are caused by the truly "opportunistic" agents—those organisms which infect only immunosuppressed patients, which are often difficult or impossible to isolate and which may fail to respond to conventional treatment. In practical terms the worried physician needs to know when to suspect opportunistic lung infection, how to isolate the organism responsible, and how to treat the patient.

The clinical setting is one of fever, shortness of breath, and unproductive cough in a patient with a pulmonary infiltrate in the chest radiograph. The shadowing produced is in no way characteristic but may provide a clue to the causative agent in a few instances.² In immunosuppressed patients with tissue transplants the diagnosis may be clear cut, but the picture is more complicated in patients receiving treatment for tumours, especially leukaemia, because the primary disease itself may be responsible for lung changes. Tenholder and Hooper³ suggest that an opportunistic infection

is more likely if the pulmonary infiltrate is diffuse and does not occur within three days of a pulse of cytotoxic treatment.

Opportunistic organisms cause great difficulties for microbiologists. They often demand the most bizarre nutritional requirements, and on many occasions more than one pathogen may be present. In a prospective study by Singer *et al*⁴ of 80 patients with lung infiltrates, many of whom had leukaemia, the most extensive laboratory investigations identified a cause in only a third. When open-lung biopsy was added to the investigations the success rate was improved to two-fifths. Nevertheless, in a little over a fifth of the cases no infecting agent was found either on open-lung biopsy or at necropsy.

Heading the list of opportunists is *Pneumocystis carinii*, accounting for 38% of lung infiltrates in the series reported by Singer *et al*⁴ and 33% in Tenholder and Hooper's study.³ The incidence among patients with transplants is lower, reported at 12% in one series of renal transplant recipients, probably because of their lower degree of immunosuppression.⁵ Running *Pneumocystis* a close second are fungal infections, especially with *Candida* spp and *Aspergillus fumigatus*, and viruses such as cytomegalovirus and herpes simplex. With improved diagnostic techniques an increasing number of exotic and unusual diseases are being unearthed. Recently a hitherto unknown organism, similar in staining properties to the tubercle bacillus, has been identified by open-lung biopsy and subsequently dubbed the "Pittsburgh pneumonia agent," after the city in which it was first isolated.^{6 7}

Open-lung biopsy is a major procedure for any seriously ill patient who already has diseased lungs, and many British physicians are reluctant to pursue investigations to that extent. Having excluded infection with common bacterial pathogens these pragmatists will give high doses of co-trimoxazole on the assumption that the infection is due to *Pneumocystis*. Scientific purists may object to this "cook-book" approach, but such pragmatism often pays off.

¹ Green GM, Jakab GJ, Low RB, Davis GS. Defense mechanisms of the respiratory membrane. *Am Rev Respir Dis* 1977;**115**:479-514.

² Greene R. Opportunistic pneumonias. *Semin Roentgenol* 1980;**15**:50-72.

³ Tenholder MF, Hooper RG. Pulmonary infiltrates in leukemia. *Chest* 1980;**78**:3:468-73.

⁴ Singer C, Armstrong D, Rosen PP, Walzer P, Yu B. Diffuse pulmonary infiltrates in immunosuppressed patients. *Am J Med* 1979;**66**:110-20.

⁵ Munda R, Alexander JW, First MR, Gartside PS, Fidler JP. Pulmonary infections in renal transplant recipients. *Ann Surg* 1978;**187**:126-33.

⁶ Rogers BH, Donowitz GR, Walker GK, Harding SA, Sande MA. Opportunistic pneumonia. A clinicopathological study of five cases caused by an unidentified acid-fast bacterium. *N Engl J Med* 1979;**301**:959-61.

⁷ Myerowitz RL, Pasculle AW, Dowling JN, *et al.* Opportunistic lung infection due to "Pittsburgh pneumonia agent." *N Engl J Med* 1979;**301**:953-8.

Hazards of biliary tract surgery

Operating on the biliary tract of patients with obstructive jaundice is hazardous; the immediate mortality is broadly correlated with the depth of jaundice. Factors which may increase the risks of operation include cholangitis and predisposition to septicæmia,¹ impaired renal function with a low glomerular filtration rate,² malnutrition with hypoalbuminaemia, failure of hepatic reticuloendothelial cells to remove endotoxin from the portal venous blood,³ and depres-

sion of cell-mediated immunity.⁴ Pitt *et al* have recently studied the risk factors in 155 consecutive patients undergoing biliary surgery for both benign and malignant conditions.⁵ Of the 15 clinical or laboratory features studied, eight associated with increased mortality were selected as the basis of a simple scoring system: age greater than 60, malignant obstruction, hypoalbuminaemia (<30 g/l), packed cell volume less than 30%, leucocytosis, and raised serum concentrations of total bilirubin, creatinine, and activities of alkaline phosphatase above defined limits. No patient with two or fewer risk factors died, but as more than three factors became positive mortality increased progressively. Ten of the 12 patients who died had five or more risk factors.

Until recently attempts to reduce the mortality of biliary surgery for obstructive jaundice have centred on antibiotic cover to reduce the risk of sepsis; maintenance of urine flow by an adequate fluid intake, supplemented when necessary by agents such as mannitol; and correction of anaemia and coagulation deficits. Nevertheless, the high operative mortality has obliged surgeons to consider staged operations with preliminary decompression of the biliary tract at laparotomy for those requiring major surgical procedures such as pancreaticoduodenectomy.

An important recent advance has been the development of non-operative techniques for biliary decompression as a prelude to definitive surgery. These include percutaneous transhepatic biliary drainage,^{6,7} endoscopic insertion of a catheter into the biliary system from the duodenum,⁸ and endoscopic papillotomy to allow internal biliary drainage in patients with carcinoma in or around the papilla of Vater.⁹ Of the options available, percutaneous transhepatic biliary drainage has probably been used most extensively and should be within the compass of a radiologist experienced in the technique for percutaneous transhepatic cholangiography.

As described by Nakayama and colleagues,⁷ percutaneous transhepatic biliary drainage is preceded by cholangiography carried out through the right flank by the Chiba technique. A dilated intrahepatic duct is then punctured with a steel needle, a guide wire inserted into the biliary system, and the needle removed. A polyethylene catheter is advanced over the guide wire, which is then withdrawn. Two catheters may be used to ensure drainage of both right and left hepatic ductal systems in patients with lesions causing obstruction at the confluence of the two systems. Complications have been reported in 5% of patients,^{7,10} and include leakage of bile into the peritoneal or pleural cavities, intraperitoneal bleeding, pneumothorax, haematobilia, and dislocation of the catheter. Percutaneous transhepatic biliary drainage reduced serum concentrations of bilirubin in patients with malignant obstruction at the same rate as cholecystostomy in a group of comparable patients reviewed retrospectively.⁷ Nakayama and colleagues successfully achieved percutaneous transhepatic biliary drainage in 104 of 105 patients with obstruction due to benign (21) or malignant disease (84), proceeding to laparotomy in 69 cases after intervals ranging from eight to 70 days. The operative mortality (defined as death within one month of surgery or caused by a condition directly attributable to operation) was 6% for the 69 patients as a whole, and 8% for the subgroup of 49 patients with malignant disease. Retrospective assessment of 148 patients operated on for malignant obstruction without prior decompression showed an operative mortality of 28%, most of the deaths being attributed to hepatic failure or rapid debilitation. The limitations of such retrospective comparison are obvious: no fewer than 35 of the 104 patients undergoing percutaneous transhepatic biliary

drainage did not go on to laparotomy. Nevertheless, on the available evidence, a prospective controlled trial of preliminary percutaneous transhepatic biliary drainage versus no preliminary drainage in patients undergoing biliary surgery for obstructive jaundice would be difficult to justify on ethical grounds.

A number of authors¹¹⁻¹⁴ have described the use of the percutaneous transhepatic route to pass a guide wire through the site of malignant obstruction, allowing subsequent dilatation of the strictured area and insertion of an endoprosthesis to allow bile to drain into the common bile duct or duodenum. Further study will be needed to define the place of long-term percutaneous transhepatic biliary drainage as an alternative to surgical intervention in patients with malignant obstruction. Non-operative drainage may prove to be a valuable palliative procedure in poor-risk patients with malignant obstruction, but the attractions of the technique must not be allowed to deny curative resection to selected patients in this group or to permit unnecessary procrastination.

- ¹ O'Connor MJ, Schwartz ML, McQuarrie DG, Sumner HW. Cholangitis due to malignant obstruction of biliary outflow. *Ann Surg* 1981;**193**: 341-5.
- ² Allison MEM, Prentice CRM, Kennedy AC, Blumgart LH. Renal function and other factors in obstructive jaundice. *Br J Surg* 1979;**66**: 391-7.
- ³ Bailey ME. Endotoxin, bile salts and renal function in obstructive jaundice. *Br J Surg* 1976;**63**:774-8.
- ⁴ Gianni L, Di Padova F, Zuin M, Podda M. Bile acid-induced inhibition of the lymphoproliferative responses to phytohemagglutinin and pokeweed mitogen: an in vitro study. *Gastroenterology* 1980;**78**:231-5.
- ⁵ Pitt HA, Cameron JL, Postier RG, Gadacz TR. Factors affecting mortality in biliary tract surgery. *Am J Surg* 1981;**141**:66-72.
- ⁶ Burcharth F. A new endoprosthesis for nonoperative intubation of the biliary tract in malignant obstructive jaundice. *Surg Gynecol Obstet* 1978;**146**:76-8.
- ⁷ Nakayama T, Ikeda A, Okuda K. Percutaneous transhepatic drainage of the biliary tract. Technique and results in 104 cases. *Gastroenterology* 1978;**74**:554-9.
- ⁸ Osnes M, Odd G, Grønøth K, Havig Ø. Nonoperative internal drainage of obstructive common bile ducts. *Arch Surg* 1979;**114**:862-5.
- ⁹ Alderson D, Lavelle MI, Venables CW. Endoscopic sphincterotomy before pancreaticoduodenectomy for ampullary carcinoma. *Br Med J* 1981;**282**:1109-11.
- ¹⁰ Hansson JA, Hoevels J, Simert G, Tylene U, Vang J. Clinical aspects of nonsurgical percutaneous transhepatic bile drainage in obstructive lesions of the extrahepatic bile ducts. *Ann Surg* 1979;**189**:58-61.
- ¹¹ Smale BF, Ring EJ, Frieman DB, *et al*. Successful long-term percutaneous decompression of the biliary tract. *Am J Surg* 1981;**141**:73-6.
- ¹² Burcharth F, Jensen LI, Olesen K. Endoprosthesis for internal drainage of the biliary tract. Technique and results in 48 cases. *Gastroenterology* 1979;**77**:133-7.
- ¹³ Sarrafzadeh MS, Philip PK, Goldman ML. Percutaneous transhepatic T-tube placement for antegrade biliary drainage. A new technique. *Radiology* 1980;**137**:545-6.
- ¹⁴ Pereiras RV, Rheingold OJ, Hutson D, *et al*. Relief of malignant obstructive jaundice by percutaneous insertion of a permanent prosthesis in the biliary tree. *Ann Intern Med* 1978;**89**:589-93.

Metastases in the liver

Liver metastases are an all too common finding at laparotomy for intra-abdominal cancer. Oxley and Ellis,¹ in a report typical of many, found that 112 (18%) patients out of a total of 640 undergoing surgery for carcinoma of the large bowel had deposits in the liver detected by palpation at operation.

The presence of liver metastases has a dramatic effect on prognosis and will considerably affect the surgeon's management of the case. So can we make a confident preoperative assessment of the state of the liver, and how accurate is the surgeon's palpating hand at the time of operation?