

Percutaneous transhepatic drainage in obstructive jaundice: advantages and problems

This study is a critical prospective assessment of 37 patients with obstructive jaundice, treated by percutaneous transhepatic biliary drainage. The median duration of drainage was 18 days (range 44-56), and during this period clearance of bilirubin and improvement in creatinine clearance were obtained. Only 10 patients gained weight. Three patients required early laparotomy. Thirty-three patients underwent definitive surgery. Of these, 8 died without leaving hospital. The incidence of infection rose during drainage, and infected bile was clinically significant. Two deaths were associated with infection, arising in the drainage system, producing intrahepatic abscesses around the drain track.

While the evidence for a staged approach in the severely ill patient with obstructive jaundice is substantial, the procedure of percutaneous transhepatic tubal drainage carries significant hazards, under-emphasized in previous reports. Further controlled assessment is required before this technique is accepted as the initial best option for decompression of the obstructed biliary tract.

G. A. D. McPHERSON,
I. S. BENJAMIN, N. A. HABIB,
N. B. BOWLEY AND
L. H. BLUMGART

Hepatobiliary Unit, Department of Surgery and
Department of Diagnostic Radiology,
Hammersmith Hospital, London.

Correspondence to: L. H. Blumgart, Royal
Postgraduate Medical School, Hammersmith
Hospital, Du Cane Road, London W120HS.

Percutaneous drainage of the obstructed biliary tract was first proposed in 1962 (1-3). The first series of patients successfully treated by non-surgical biliary decompression was reported in 1974 by Molnar and Stockum (4). Since then, a number of reports has shown a low complication rate (4-5 per cent) and low operative mortality in patients who subsequently underwent surgical treatment (5-8). However, these reports have generally stressed the advantages of the technique without clear criteria for preliminary decompression. Percutaneous transhepatic drainage of the biliary tract does carry serious risks and problems. In this paper we report a series of 37 jaundiced patients so treated, with particular emphasis on problems in management.

Patients and methods

During the period August 1979-July 1981, 35 patients referred to the Hepatobiliary Unit of the Department of Surgery at Hammersmith Hospital with obstruction of the biliary tree were treated by percutaneous transhepatic tube drainage. Two further patients with hilar cholangiocarcinoma were referred from other hospitals where percutaneous drainage had been instituted 3 and 69 days before admission to our unit.

Selection of patients for percutaneous drainage was made according to the criteria shown in *Table 1*. There were 25 men and 12 women, aged 29-82 years. All patients were jaundiced with a mean bilirubin of 408 $\mu\text{mol/l}$ (range 164-745 $\mu\text{mol/l}$). Twenty-four patients had tumours at the hepatic hilus and 11 in the distal common bile duct; 2 had multiple strictures due to sclerosing cholangitis. Following liver function tests, Australia antigen measurement, coagulation screen and diagnosis of bile duct dilatation by means of grey scale ultrasound, percutaneous transhepatic cholangiography using the Chiba needle demonstrated the probable nature of the obstruction. All patients received vitamin K for at least 48 hours before percutaneous transhepatic cholangiography. Prophylactic broad spectrum antibiotics (gentamicin or tobramycin 100 mg or cephamandole 1 g intramuscularly, each with metronidazole 1 g rectally) were administered immediately before the procedure and maintained if the patient was pyrexial.

Technique of insertion and management of drain

Following percutaneous transhepatic cholangiography, the fine needle was replaced with a 5 FG transhepatic catheter needle sheathed by an external cannula, and a guide-wire fed through the cannula into the dilated bile ducts under radiological screening. When the guide-wire was in a satisfactory position, the cannula was removed and an 8 FG

Table 1: CRITERIA FOR PERCUTANEOUS TRANSHEPATIC DRAINAGE

Absolute	Creatinine clearance < 50 ml/min
	Bilirubin > 300 $\mu\text{mol/l}$
Relative	Candidates for major resection
	Albumin < 30 g/l
	Weight loss > 10 per cent
	Age > 60 yr

Ring-Lunderquist biliary drainage catheter (William Cook, Europe ApS) inserted over the wire into its final position in the biliary tree, either above or through the obstruction. Finally, the guide-wire was removed, allowing the 'pigtail'-shaped end to curl in the duct, and the catheter was stitched securely to the skin. A 2-ml sample of bile was taken for aerobic and anaerobic culture before connecting to a Wallace bile collection bag by way of a three-way tap. The local anaesthesia (1 per cent lignocaine) and intramuscular diazepam (10 mg) routinely used for percutaneous transhepatic cholangiography were found to be adequate for the drainage procedure, which normally took about 20 minutes.

The final site of the drainage catheter varied. In 9 patients the catheter was threaded through the tumour so that side drainage holes were above and below the obstruction. In 3 patients in whom a hilar tumour obstructed the communication between the right and left ductal systems, a separate drainage catheter was inserted to each side.

Following insertion, the catheter was flushed with 20 ml normal saline via the three-way tap every 6 h for 24 h, and then twice daily for the duration of drainage. The drainage bag was emptied twice daily without disconnecting the three-way tap. Patients at the beginning of the series showed a high incidence of bacterial colonization of bile in the collecting bags during the course of drainage. Therefore, povidone iodine (betadine aqueous solution 10 per cent, Napp Laboratories) was instilled into the bag through the tap after emptying (9). The tap and bag were changed twice per week.

Operative management

During the period of percutaneous drainage selective visceral arteriography, splenoportography (by late phase arteriography or direct splenic puncture) and inferior vena cavography were used to assess the operability of hilar tumours. The angiographic predictors of resectability previously defined by our group proved reliable in the patients in the present study (10).

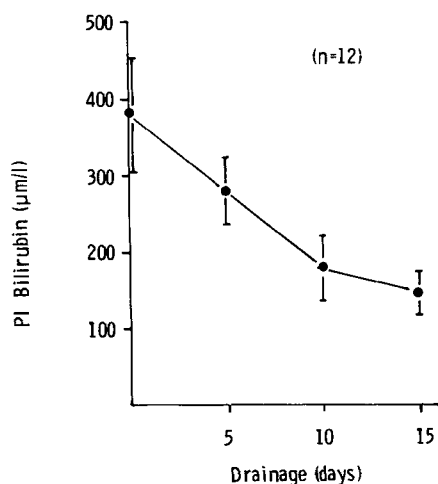


Fig. 1. Fall in plasma bilirubin during the course of percutaneous transhepatic biliary drainage. (Each value is mean \pm 1 s. d.)

Thirty-three patients underwent definitive surgery. Ten patients underwent radical resection for attempted cure. Four had pancreaticoduodenectomy for lesions of the ampulla or distal common bile duct, and 6 had hepatic lobectomy for tumours of the hilus of the liver. In 18 patients the hilar tumours were irresectable either because of involvement of branches of the portal vein and/or hepatic artery in contralateral lobes of the liver or because there were liver metastases (10). Palliative surgery included hepaticojejunostomy, trans-tumour transhepatic U tubes (11) or local palliative resection. In 2 cases an emergency laparotomy was required during drainage, one for intraperitoneal bile leakage and the other for inadequate drainage of a dilated bile duct filled with pus.

Results

Relief of jaundice

The median time of percutaneous transhepatic drainage was 18 days (range 4–56 days) for patients drained at Hammersmith Hospital. The 2 patients who were referred with percutaneous drains already in place had a total duration of drainage of 56 and 109 days respectively. The mean plasma bilirubin fell from 408 $\mu\text{mol/l}$ (range 164–745 $\mu\text{mol/l}$) before drainage to 136 $\mu\text{mol/l}$ (range 27–380 $\mu\text{mol/l}$) after drainage. An early transient rise in bilirubin was seen in several patients, and in 7 patients the bilirubin failed to fall below 200 $\mu\text{mol/l}$ (all 7 had irresectable tumours). The rate of fall of plasma bilirubin was measured in 12 patients, and the mean half-time for bilirubin clearance was 11.2 days (Fig. 1).

Renal function

Before the start of percutaneous drainage, 10 patients had severe renal impairment (creatinine clearance 50 ml/min or less). Eight of these 10 showed a sustained improvement, but the other 2 developed renal failure in the postoperative period despite the perioperative use of mannitol. One had severely impaired renal function before drainage (creatinine clearance 31 ml/min), which improved during the period of percutaneous drainage to 107 ml/min; this patient had a cholangiocarcinoma irresectable due to liver secondaries. In the second case creatinine clearance dropped from 50 to 24 ml/min during drainage, but at autopsy this patient was found to have renal amyloidosis secondary to old tuberculosis.

Nutritional status

All patients in this study had lost weight prior to admission and most were anorexic. An initial nutritional regimen was adopted in all cases aimed at providing an intake of over 3000 calories per day either by supplementary oral feeding or by the use of a fine-bore nasogastric tube. In only 10 of 37 patients was this regimen successful in halting weight loss or securing a gain of weight. A parenteral feeding regimen was adopted in the remainder, by means of a subclavian catheter. Nevertheless, it proved difficult to improve nutritional status significantly in these patients. In 14 patients the serum albumin was less than

Table II: COMPLICATIONS OF PERCUTANEOUS TRANSHEPATIC BILIARY DRAINAGE IN 37 PATIENTS

Early	
Abdominal pain	30
Intraperitoneal bile leakage	3
Haemobilia	2
Perforation of bowel	1
Late	
Mechanical	
Tube dislodgement	4
Fluid + electrolyte depletion with metabolic acidosis	2
Biochemical	
Failure to clear bilirubin below 200 $\mu\text{mol/l}$	7
Infective	
Bacteraemia	10
Intrahepatic abscesses	2

35 g/l before drainage, and in only 7 of the 14 was this restored to normal levels during drainage.

Complications

Mortality: There was no early death attributable to insertion of a percutaneous drain. Three patients with biliary obstruction due to extensive perihilar hepatic secondaries died during the course of palliative drainage.

Immediate complications (Table II): All patients experienced some abdominal pain during the first 24 h after insertion of the drain, but only 3 required narcotic analgesia; these 3 were found to have intraperitoneal bile collections at subsequent surgery, one requiring an emergency laparotomy. Haemobilia occurred in 2 patients, but was mild and lasted only 24 h. Hourly flushing of the drainage catheter was performed during this period until the cessation of bleeding to avoid obstruction of the catheter. In one patient the catheter failed to drain adequately during the first 24 h and repeat radiology showed that this was due to kinking of the catheter between the liver and the abdominal wall. After repositioning, drainage was satisfactory and there was no further complication. A second patient required laparotomy for suppurative cholangitis which failed to drain through the catheter, and a third patient had a percutaneous drain transfixing small bowel which was adherent to the lateral surface of the liver following previous surgery.

Late complications: Dislodgement of the drainage catheter occurred in 4 patients, all after at least 7 days of drainage. These patients continued to drain bile through an external biliary fistula, but went on to have early surgery. It was found that flushing of the drainage system twice daily was necessary to prevent blockage of the catheters.

Infection proved to be the major hazard of catheter drainage in our series. Aerobic and anaerobic culture of bile was obtained at the time of percutaneous transhepatic cholangiography, from the drainage catheters and collecting bags during the period of drainage and from the bile duct at the time of surgery. Ten of the 37 patients had infected bile at the time of the first culture, but 25 had positive bile cultures and 10 had positive blood cultures during the course of drainage. The blood cultures all grew the same organisms as in bile. Of the 33 patients who came to surgery, 18 had infected bile, and 14 of these patients had a polybacterial growth. The bacteria found on culture were *Streptococcus faecalis*, *Escherichia coli*, *Pseudomonas aerogenes* and *Klebsiella aerogenes*, the common pathogens of bile. Anaerobes were grown on only two occasions. Early in the series there was evidence of cross-infection amongst patients with external biliary drains. This became particularly clear during two hospital-wide outbreaks of aminoglycoside-resistant *Klebsiella* infection. The evidence of exogenous infection dictated our policy of the use of povidone iodine for antiseptic in the collecting system. This practice appears to have reduced the problem of exogenous infection and cross-contamination (9).

Eight of the 33 patients who underwent subsequent surgery died without leaving hospital and at least 2 of these deaths were associated with infection acquired during percutaneous

drainage. Both were patients whose bile was initially sterile but became infected during drainage, and who at post-mortem examination were found to have multiple liver abscesses in association with the transhepatic drain track.

The volume of bile during the first few days of drainage was often very large; in 4 patients this was over 2 litres per day and in 6 patients over 1.5 litres per day. Two developed fluid and electrolyte depletion due to failure to replace the large bile losses after only 5 days of drainage. One patient developed steatorrhoea during 1 month of bile drainage without replacement of bile salts.

Discussion

Percutaneous transhepatic drainage is rapidly becoming a well-established technique. We have had no failures in insertion of a percutaneous drain, and this reflects the high success rate reported by others (7, 8, 12). The early complications of the procedure have been very low in this and other reports. Only 2 deaths have been reported as a direct consequence of the procedure (6, 13).

Drainage tubes passed through the tumour and into the duodenum may be more prone to blockage and to biliary infection, and we now try to avoid this practice. When possible, we have continued to practise trans-tumour drainage of high bile duct tumours leaving the catheter tip in the distal common bile duct. Three patients in our series with extensive perihilar hepatic invasion by tumour were treated palliatively by percutaneous drainage alone, with the successful relief of symptoms of pruritus and anorexia. We stress, however, that palliative decompression without surgery should not be indiscriminate and should only follow adequate assessment of tumour resectability.

Secure fixation of the catheter to the skin may be difficult. We have used the Molnar disc, available as part of a percutaneous biliary drainage kit (William Cook, Europe ApS). However, catheters may dislodge even in the presence of secure skin fixation. Respiratory excursions of the liver and the presence of ascites may predispose to kinking or coiling of the catheter between liver and abdominal wall, though this is less likely if the catheter is passed through the obstruction in the bile duct.

Although plasma bilirubin fell in the majority of cases, with a mean half-life of 11.2 days, in 7 patients with extensive irresectable tumours the bilirubin failed to fall below 200 $\mu\text{mol/l}$. Pruritus often disappeared within a few days accompanied by an improvement in well-being and return of appetite. However, despite intensive nutritional support, this was not uniformly associated with improvement in nutritional parameters.

In the majority of our cases renal function improved but, without a controlled study, it is not possible to ascribe this improvement to biliary drainage alone, since initial fluid replacement was undertaken as a routine whenever indicated. Replacement of fluid and electrolytes lost in externally drained bile is of clear importance, and these losses may be very high, especially during the early days after insertion. Two patients in this series sustained clinically severe electrolyte imbalance within 6 days of drainage. We now routinely replace the daily bile losses with an equal volume of oral solution with the same electrolyte composition as bile, made palatable by blackcurrant flavouring or by enteric-coated salt capsules. We have not routinely replaced bile salt losses, and have found, in common with others (12), that patients tolerate ingestion of their own bile poorly.

Infection emerges as the foremost problem with percutaneous biliary drainage, and at least a proportion of this infection is exogenous in origin. It is difficult to maintain a completely closed system of drainage, though we have achieved some improvement by the use of povidone iodine in the three-way taps and collection bags of our drainage system and by redesigning the biliary drainage system (13). Emphasis should be placed on aseptic handling techniques, and all removable external components should be changed at least twice per week.

Our findings suggest that bacterial colonization of bile is of clinical significance. Eight patients in this series died following subsequent surgery, 2 of them after curative pancreatic resection (1 pancreaticoduodenectomy, 1 total pancreatectomy).

The remaining 6 patients had irresectable hilar tumours treated by bypass. Although sepsis could not be proved as the primary cause of death in all of these cases, bacteria were isolated at blood culture in every case, and in 2 patients intrahepatic abscess cavities were found at post-mortem examination in association with the track of the transhepatic catheter. Two similar cases have been reported elsewhere (14). One of our 2 patients had drainage instituted at another centre 109 days before surgery. Infective complications thus constitute a very clear hazard in the maintenance of long term external biliary drains, which may well outweigh the benefits of the procedure for preoperative preparation.

The rationale for two-stage surgery rests on the demonstration of improved surgical outcome. Unfortunately, none of the available staging techniques, including percutaneous drainage, has been submitted to formal trial. Nakayama et al. (7) described 105 patients treated by percutaneous drainage of whom 49 with malignant disease came to second-stage surgery. The operative mortality in this group was 8.2 per cent, which compared well with a retrospective control group of 148 patients undergoing single-stage surgery for malignant obstruction, with an operative mortality of 28 per cent. The criteria for selection of patients for percutaneous drainage is not stated in this paper, however, and the use of an historical control group is not acceptable. In Dooley's series (12), 21 out of 33 patients drained externally underwent surgery following percutaneous drainage, with an operative mortality of 24 per cent. There was no control group in this series and, again, the criteria for selection for percutaneous drainage are not stated. In the present series, 33 patients underwent surgery following drainage and 8 (24 per cent) died in hospital within 6 weeks of operation.

Many surgeons now accept that a staged procedure is a useful approach in the severely ill and deeply jaundiced patient who may undergo major resectional surgery. Moreover, even for patients with irresectable lesions there may be a case for preliminary percutaneous transhepatic drainage since the mortality of simple palliative bypass is higher than most would suppose. Pooling cases from 8 reported series of patients with pancreatic and peri-ampullary cancer treated by simple biliary bypass from the years 1970–79, 372 postoperative deaths were found amongst 1699 patients (21.9 per cent) (17–21). It appears, however, that the use of percutaneous transhepatic drainage for this purpose is gaining wide acceptance without due consideration of the hazards and disadvantages of the procedure, and without a satisfactory controlled trial (22). Although uncontrolled, our present study of the technique is prospective and uses defined criteria for selection, and indicates that the procedure does carry significant hazards which have not been clearly defined. It is evident that percutaneous drainage requires further assessment in controlled trials before it is accepted as the initial best option for patients with an obstructed biliary tract. Several such trials are now in progress, including one in our own unit.

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Promising young men*

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RESULT OF TRANSPLANTATION OF URETERS MORE THAN A QUARTER OF A CENTURY AFTER OPERATION.

BY P. R. ALLISON,
THE GENERAL INFIRMARY, LEEDS.

TRANSPLANTATION of both ureters into the rectum for the relief of ectopia vesicae is an operation which has been performed on many occasions. Some of the cases succumb either as a result of the operation or from ascending pyelonephritis a few months or years later. The case reported below has survived for twenty-seven years in a state of good general health, and is therefore of sufficient rarity and interest to be reported.

The patient, E. V. B., male, aged 7 years, was admitted to the General Infirmary at Leeds on July 21, 1905, under the care of Mr. Lawford Knaggs, suffering from incontinence of urine since birth as a result of ectopia vesicae. His mother picturesquely ascribed the deformity to a fall from a dog-cart which she sustained during pregnancy. When the child was 11 months old he was taken to the Infirmary, where Mr. Knaggs performed a plastic operation on the anterior abdominal wall; the boy, however, developed measles, and in consequence of his poor general condition the wound failed to heal.

During his stay in hospital he cried so much that the presence of a hitherto unsuspected left inguinal hernia became apparent. On discharge he was supplied with an instrument, consisting of a cage strapped to the abdomen with a tube leading into a receptacle on one leg, and with this he existed until the age of 7, but of this period of his life he remembers very little.

The accidental breakage of the instrument caused his mother to consult Mr. Knaggs again, with the result that the patient was readmitted to hospital and the operation of transplantation of ureters was undertaken. The following is an abstract of the clinical notes made at that time (1905):—

On examination the upper two-thirds of the bladder are covered with thickened epithelium, whilst the lower part of the mucosa is raw and in a state of irritation. The urine can be seen dribbling from the ureteric orifices on to the raw area. The upper part of the penis is deficient, the testicles are not descended, and the pubic bones are separated by 2 to 3 in. The recti abdominis form a V-shaped hood to the bladder. A left inguinal hernia is present.

Operation was performed by Mr. Lawford Knaggs, on Aug. 1, 1905, under ether anaesthesia. The rectum was washed out. The bladder was first separated from its connections and from the peritoneum, leaving both ureters attached; the latter were splinted with catheters. Douglas's pouch was then separated from the rectum; the latter was pushed up by the fingers and a horizontal incision was made into it. The bladder was trimmed, leaving a portion with the ureters attached, which was drawn through into the rectum. The rectal aperture was closed by three sutures uniting the bowel wall and separating the ureters. The anal sphincter was dilated, a drainage tube inserted, and the suprapubic wound packed.

* Philip Roland Allison qualified in 1931 and worked until the mid-1950s at the United Leeds Hospital where he was appointed the first full-time thoracic surgeon. There, he wrote his classic paper on the relationship between reflux oesophagitis and sliding hiatus hernia, and advocated a method of repair which was used, with only slight modification, for the next 20 years. He was later appointed to the Nuffield Chair in Surgery at the Radcliffe Infirmary, Oxford, where he developed open heart surgery. His main interest was in the aetiology and prevention of pulmonary embolus, about which he wrote many papers.