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# Tumor Seeding from Percutaneous Biliary Catheters

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Percutaneous transhepatic biliary decompression has been used since 1973 as a preoperative surgical adjunct in patients with obstructive jaundice. Tumor seeding along the catheter tract is an unusual complication but it occurred recently in one of our patients who had preoperative biliary drainage for four days. Four months after his pancreaticoduodenectomy, a 2-cm nodule developed at the catheter exit site. This nodule was a metastatic focus of adenocarcinoma similar to his pancreatic tumor. He died 1 month later and at autopsy was found to have numerous metastases along the catheter tract. A review of the world literature found 17 other patients with this complication. Thirteen of the 18 total patients had catheters placed for palliation, while 5 patients underwent preoperative drainage before definitive procedures, and 4 of these patients had undergone "curative" resections. Nine of the 18 patients had biliary obstruction from cholangiocarcinoma, while seven patients had primary pancreatic carcinoma. Positioning of the catheter tip above the obstructing tumor and maintaining the catheter for only a short duration before operation (mean 8 days for resected patients, range 2 to 16 days) did not protect against catheter-related tumor seeding. Patients with suspected malignant obstruction of the biliary tract who may have resectable tumors should not undergo routine preoperative biliary decompression. If, on exploration, the tumor is found to be unresectable, then a palliative bypass may be performed.

**O**BSTRUCTION OF THE BILIARY TREE with hyperbilirubinemia has long been thought to increase the operative rates of morbidity and mortality in patients with obstructive jaundice.<sup>1-6</sup> This association appears to be present in patients with benign or malignant obstruction of the biliary tract,<sup>4</sup> and the operative mortality rate seems to be directly proportional to the elevation in serum bilirubin. Thus as early as 1935, Whipple recommended a two-stage procedure in the treatment of patients with obstructive jaundice due to periampullary tumors.<sup>3</sup> The first stage consisted of biliary decompression with or without gastrojejunostomy for correction of any

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existing coagulopathy or nutritional depletion. The second stage involved the definitive resection and was performed when the degree of jaundice had lessened.

In the early 1970s the technique of percutaneous transhepatic catheter drainage of the biliary tree of patients with obstructive jaundice was developed,<sup>7</sup> and its adoption was recommended both for palliation in unresectable patients and as a preoperative means of lowering serum bilirubin in patients with potentially resectable malignancies of the pancreas or biliary tract.<sup>8-13</sup> Although the lowering of serum bilirubin by preoperative drainage has not been proved to eliminate the added risk associated with surgical procedures, it has remained a theoretical basis for performing preoperative biliary drainage.

There have been many reported complications of percutaneous biliary drainage (PTBD) since this procedure was first introduced.<sup>7-9,11-34</sup> Metastatic tumor seeding along the transhepatic biliary catheter is an unusual complication of this procedure but has been reported in 17 patients in the world literature<sup>20-31</sup> and may, in fact, be an unrecognized complication in many other patients.<sup>24,26,30</sup> We recently treated a patient in whom percutaneous biliary drainage was employed before operation, which resulted in subcutaneous tumor implantation at the catheter site 4 months later. This caused us to question seriously the usefulness of this procedure and led us to review the previously reported cases of tumor seeding in an attempt to identify any common features. We will present a summary of our patient's clinical course as well as a brief review of those patients previously reported.

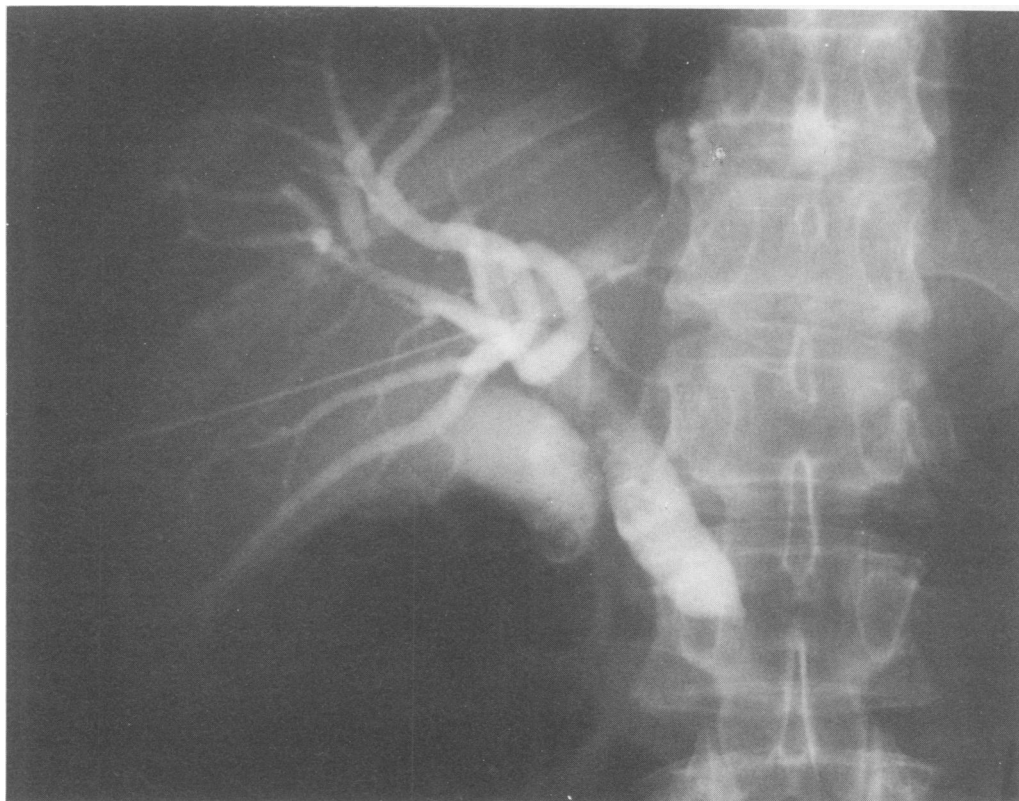
## Case Report

A 63-year-old man presented to the Nashville Veterans Administration Medical Center with a 1-week history of epigastric pain and was found

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FIG. 1. Percutaneous transhepatic cholangiogram demonstrating complete obstruction of the common bile duct in the region of the pancreatic head.



to have an amylase of 850 IU/l with a total bilirubin of 0.6 mg/dl. He was admitted and had resolution of his symptoms with nasogastric suction and IV hydration. Abdominal ultrasound and CT scans were normal. He gave no history of alcohol abuse, and there was no evidence of gallstone disease.

The patient returned to the hospital 3 months later with recurrent epigastric pain and was found to have a mass in the right upper quadrant. His serum bilirubin had risen to 9.3 mg/dl with an amylase of 73 IU/l. The patient underwent percutaneous cholangiography (on the morning following admission), which demonstrated a "rat tail" stenosis of the common bile duct (Fig. 1). A Ring biliary catheter was manipulated through the stenotic region and into the second portion of the duodenum (Fig. 2). Four days later the patient developed diffuse abdominal pain and was taken to the operating room where he was found to have acute cholecystitis. The transhepatic biliary catheter was removed and a cholecystectomy was performed with placement of a T-tube for biliary drainage with a different catheter exit site. The percutaneous transhepatic catheter was in place for only 4 days.

Following a brief period to allow resolution of his acute inflammatory process, the patient was returned to the operating room, where a pancreaticoduodenectomy was performed with the pathologic specimen showing a well-differentiated adenocarcinoma of the pancreatic head (Fig. 3); 2 of 20 nodes were positive for tumor. His postoperative course was unremarkable, and he was discharged on a regular diet with a serum bilirubin of 0.7 mg/dl.

This patient returned 4 months following removal of his percutaneous biliary catheter with mild epigastric pain and was found to have a 2-cm firm nodule at the previous exit site of the percutaneous catheter. The nodule was excised and found to be a metastatic focus of adenocarcinoma in the skin (Fig. 4). He was readmitted 2 weeks later with fever and malaise and suffered a continued decline in general health and died.

An autopsy was performed and demonstrated numerous metastatic foci along the route of the percutaneous biliary catheter extending into

the subcutaneous tissue of the right lateral chest wall. There were also other parenchymal hepatic metastases and small abscesses present within the liver. No residual tumor was found in the pancreatic bed.

### Discussion

In 1973, Molnar and Stockum presented the first reported series<sup>7</sup> in which percutaneous transhepatic biliary decompression (PTBD) was used as a diagnostic and therapeutic procedure in patients with obstructive jaundice. Several subsequent reports<sup>8-11</sup> suggested that this procedure, by improving hepatic function before operation, could reduce the postoperative incidences of morbidity and mortality in patients with hyperbilirubinemia, and its use was recommended as a preoperative adjunct in patients with both benign and malignant disease. However, these retrospective studies compared sequential groups of patients with and without preoperative drainage.<sup>8,11</sup> Because patients undergoing preoperative percutaneous drainage were compared to patients who had had operations at least several years previously without the benefit of improved perioperative care, the validity of these conclusions has remained open to question. More recent studies<sup>14,16,17,33,34</sup> have failed to show a significant decrease in complications when this procedure has been used to lower serum bilirubin prior to operation. Furthermore, there has been no significant improvement in postoperative mortality rates using this procedure in prospective randomized studies.<sup>16,33,34</sup> These studies also showed a



FIG. 2. Abdominal roentgenogram showing Ring biliary catheter after manipulation past the point of obstruction and into the duodenum.

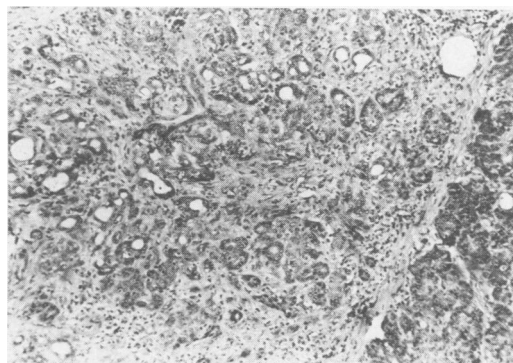


FIG. 3. Photomicrograph of primary tumor from the head of the pancreas demonstrating moderately well-differentiated adenocarcinoma.

significant increase in the length of the hospital stay and overall costs for the patients undergoing preoperative biliary drainage.<sup>34</sup>

The most common complications of percutaneous transhepatic cholangiography (PTC) and biliary catheter placement are sepsis, hemorrhage, and bile leak with or without peritonitis. Initial reports<sup>8,9</sup> indicated a 5% to 10% incidence of these complications; however, recent studies<sup>18,19,32</sup> have shown a complication rate as high as 69%. These higher complication rates combined with unproved results and increased hospital costs have raised serious questions regarding the routine preoperative use of this procedure in patients with biliary obstruction.

Tumor seeding along a percutaneous transhepatic biliary catheter tract is an unusual complication of this procedure, but has now been reported in 18 patients (including this case report) (Table 1).<sup>20-31</sup> The pattern of tumor recurrence most commonly identified has been subcutaneous tumor implantation at the catheter exit site (14 of 18 patients). Three of the 18 patients (all 3 had a cholangiocarcinoma) developed diffuse peritoneal seeding that

TABLE 1. Clinical Features of Patients with Catheter-Related Tumor Seeding

Patient	Sex/ Age	Location of Tumor†	Time Catheter in Place	Time from Initial Placement Until Recurrence Detected	Site of Recurrence	Catheter for Palliation Only	Reference
1	F/65	2	1 month	2 months	Skin exit site	Yes	20
2	M/60	1	16 months	16 months	Skin exit site	Yes	21
3	M/58	2	12 days	5 months	Skin exit site	No	22
4	M/84	1	3 months	3 months	Peritoneal seeding	Yes	23
5	*	1	*	*	Peritoneal seeding	*	23
6	*	1	*	*	Peritoneal seeding	*	23
7	F/51	2	8 days	2 months	Skin exit site	No	24
8	*	1	*	*	Skin exit site	Yes	25
9	M/69	2	5 days	5 months	Skin exit site	Yes	26
10	M/73	1	7 days	3 months	Skin exit site	Yes	26
11	F/54	2	8 days	5 months	Skin exit site	Yes	26
12	F/79	3	*	14 months	Skin exit site	*	27
13	M/48	2	2 days	*	Skin exit site, malignant pleural effusion	No	28
14	F/60	1	18 months	18 months	Malignant pleural effusion	Yes	29
15	M/66	1	16 days	13 months	Skin exit site	No	30
16	F/79	1	4 months	4 months	Skin exit site	Yes	30
17	M/51	3	6 months	6 months	Skin exit site	Yes	31
18	M/63	2	4 days	4 months	Skin exit site	No	Present case

\* Clinical feature not specified.

† 1 = Cholangiocarcinoma; 2 = Pancreatic carcinoma; 3 = G.I. car-

cinoma with metastases to liver hilum and obstructive jaundice.

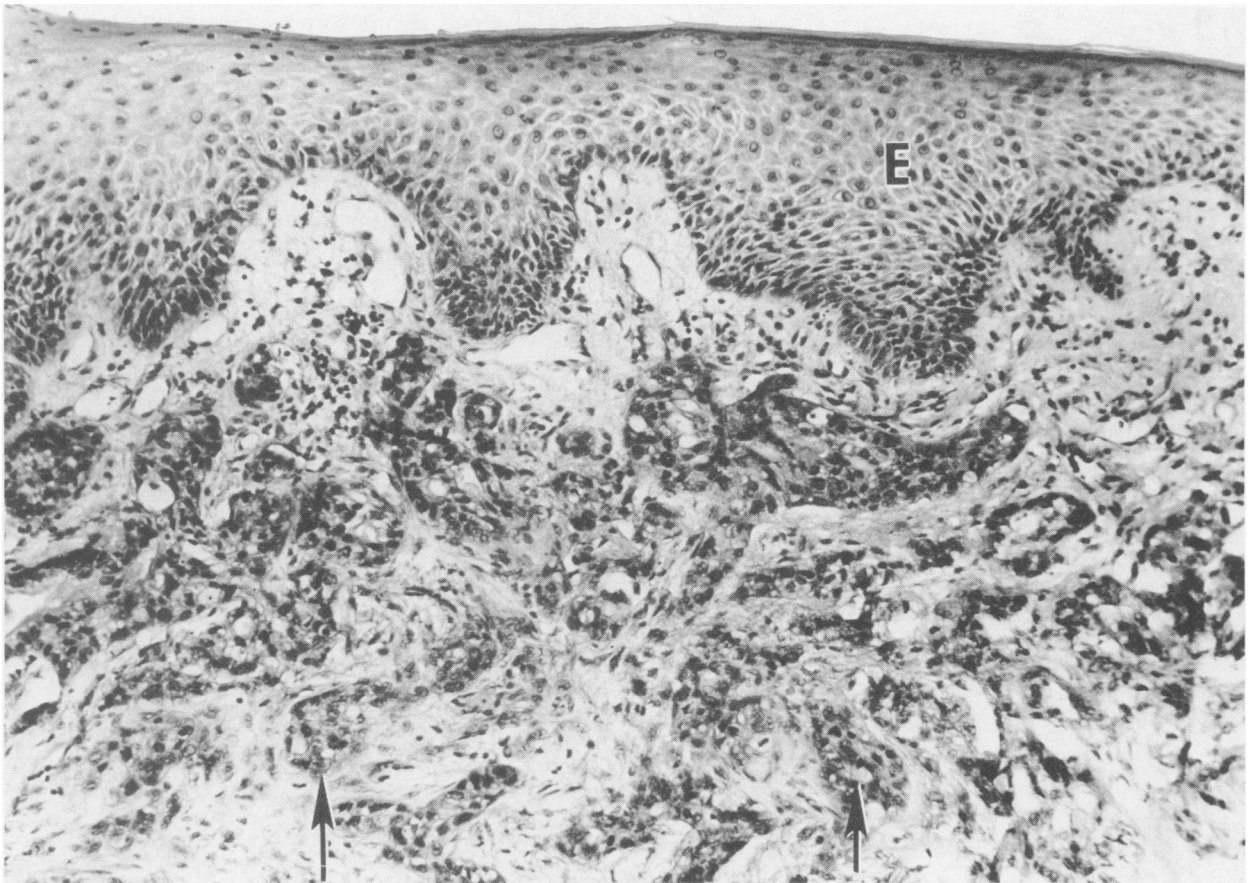


FIG. 4. Photomicrograph of subcutaneous nodule at PTBD catheter exit site demonstrating adenocarcinoma similar to pancreatic primary (arrows); (E = epidermis).

was believed to be secondary to the transperitoneal catheter,<sup>23</sup> and 2 patients had malignant pleural effusions from transpleural percutaneous biliary catheters as a manifestation of the tumor recurrence.<sup>28,29</sup>

The tumor recurrences have tended to occur early after catheter placement, with detection at a median interval of 5 months following catheter insertion (range 2 to 18 months). Although the percutaneous biliary catheters were in place for an average of 5.5 months (often with frequent changes) when used for palliation, this was not the case when they were used as a preoperative adjunct (Fig. 5), in which the duration of placement averaged only eight days. Thus a short duration of catheter drainage before operation did not protect against catheter-related tumor seeding in the four patients undergoing "curative" resection.

The single most common feature (in 17 of these 18 cases) involves tumor manipulation with passage of a guide wire and a large catheter through an obstructing carcinoma. This is likely to result in cellular disruption and dissemination of tumor cells within the biliary system and could account for the observed tumor seeding. If PTC was performed without biliary drainage or if biliary drainage was performed with the percutaneous biliary catheter

positioned above the obstructing lesion without tumor manipulation, then the likelihood of tumor spread might be lessened, although tumor seeding has been demonstrated in the latter situation as well.<sup>28</sup> On a slightly different note, Weiss et al.<sup>35</sup> reviewed a series of patients undergoing intraoperative diagnostic pancreatic biopsies without resection who later came to second-look laparotomy. Surprisingly, they found that many of the patients had developed rapid intra-abdominal spread of pancreatic carcinoma, which was associated with the number of biopsy attempts, an association apparently also related to tumor manipulation. Tumor implantation at the site of transperitoneal skinny-needle biopsy of pancreatic carcinoma has been previously reported<sup>36-38</sup> and likewise has been associated with multiple needle passes. This, however, did not occur in any of the five patients in this series in which it was used.<sup>22,23,26</sup> Brush biopsies performed through the percutaneous catheter tract drag denuded malignant cells through the liver and subcutaneous tissue and may have contributed to the tumor recurrence in the one patient<sup>29</sup> in this series in whom this procedure was used. Clearly, unnecessary manipulation of pancreatic and cholangiocarcinoma should be avoided or minimized before definitive resection.

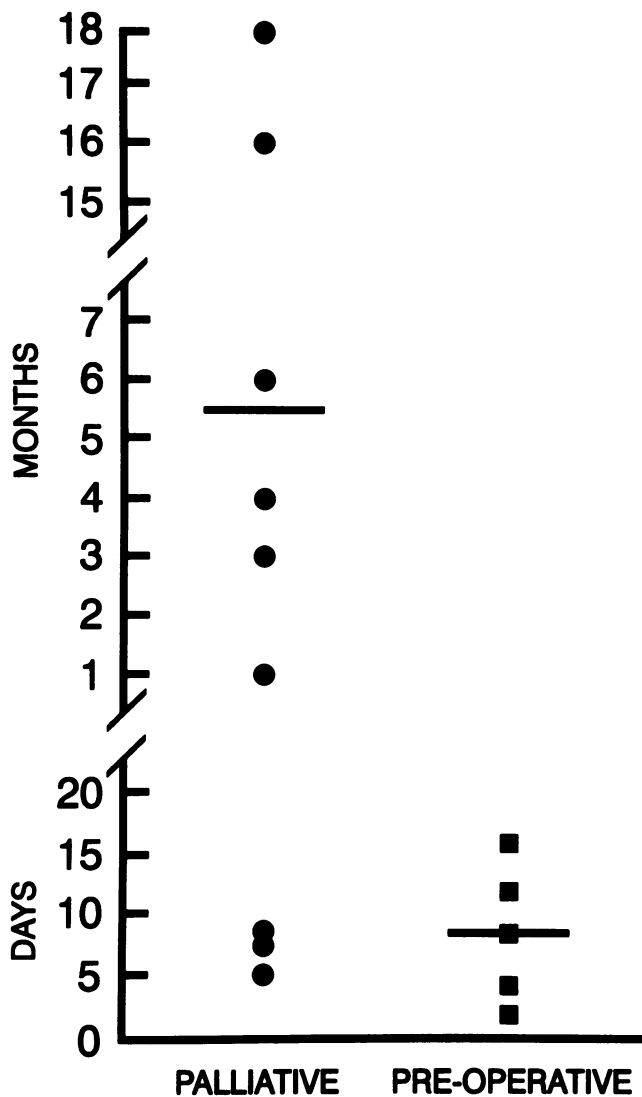


FIG. 5. Duration of percutaneous biliary catheter drainage in patients with tumor seeding. The catheters were present for an average of 5.5 months when placed for palliation; however, when placed prior to a planned definitive operative procedure, the catheters were present for an average of only 8 days.

Tumor seeding from percutaneous biliary catheters has received little attention as a potential complication of PTBD.<sup>39</sup> However, these patients illustrate that tumor seeding is more than a theoretical risk. In our patient, this was suspected only when the subcutaneous nodule appeared 4 months following removal of the percutaneous biliary catheter. As suggested by others,<sup>24,26,30</sup> the prevalence of catheter-related metastatic seeding may, in fact, be widely underestimated. Because the technique of percutaneous biliary tract drainage requires that the biliary catheter traverse the hepatic parenchyma, a common location of catheter-related metastatic deposits might be expected to be found in the liver along the catheter tract, and only occasionally would one expect that these deposits

would extend all the way to the subcutaneous tissue or skin. Thus, it is possible that many catheter-tract metastatic deposits in the liver parenchyma are detected at autopsy or operation but are mistakenly identified as arising from a hematogenous or lymphatic source and are not attributed to a catheter-related process. Therefore, it is possible that catheter-related metastases are underreported and that this problem far exceeds the 18 patients found in our review.

Percutaneous biliary drainage for palliation in patients with unresectable biliary tumors is a reasonable therapeutic modality, although perhaps less advantageous than a biliary endoprosthesis because it may promote tumor seeding to the liver, peritoneal cavity,<sup>23</sup> or pleural space<sup>28,29</sup> or result in a painful nodule<sup>21,26</sup> at the catheter exit site. Percutaneous biliary drainage in patients with benign strictures may be helpful in defining ductal anatomy during operation and may serve as a method for prolonged drainage in high-risk patients.<sup>7,8,12,13</sup> The preoperative use of PTBD in patients with malignant bile duct obstruction has remained controversial, with some groups advocating catheter placement as a technical aid,<sup>40</sup> while others believe that PTBD does not affect intraoperative decisions and may make operative drainage more difficult.<sup>41</sup> We suggest that PTBD should not be used as a routine preoperative procedure in patients with potentially resectable disease because it may jeopardize the operative results as illustrated by these patients. In patients with suspected malignant obstruction of the biliary tract, if PTC is performed, percutaneous catheter drainage should be used only for the purposes of palliation. If there is a reasonable chance of resection based on initial studies, then we advise abdominal exploration without preoperative biliary decompression. At exploration, if the tumor is found to be unresectable, then a palliative bypass may be performed.

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#### DISCUSSION

DR. JOHN L. CAMERON (Baltimore, Maryland): Dr. Sawyers has addressed in his usual eloquent style a problem that has been discussed by liver, pancreatic, and biliary surgeons in the past as only a theoretical risk. That is, do any of the preoperative diagnostic or therapeutic procedures increase the risk of altering the natural history of the disease in any way, and in particular, with tumor dissemination or tumor implantation? They have presented 18 patients who clearly have had that complication. The question is: What is the denominator? There is another similar situation in which there is information in terms of the incidence of prevalence of tumor implantation. The interventional radiologists have tried to document in several series the incidence of tumor tract implantation with percutaneous biopsy of pancreatic lesions. In 2 or 3 series they have estimated this incidence to be 1 in 20,000; so it appears to be very, very low. However, we all know that radiologists really don't follow

their patients for any period of time after their procedures and so this is probably a falsely low figure. But at any rate, I think it probably indicates that it isn't common.

We have a series of patients, to which Dr. Sawyers alluded, in which we do have some information concerning the denominator, and I would like briefly to run through our figures to demonstrate that I think this phenomenon is not common.

(Slide) This is a patient with a proximal biliary carcinoma, a Klatskin tumor. One or two days before this patient was operated on, as is our routine now, the patient went to the cath lab and had a Ring catheter put into the left hepatic duct, down through the tumor, into the duodenum; the same catheterization was done on the right.

This is done one or two days before surgery because we certainly agree with Dr. Sawyers that there is no evidence that the morbidity or the mortality rates of surgery are decreased any by decompressing the hyperbilirubinemia that these patients inevitably present with. Many of