

1 Introduction

The vast majority of bile duct tumours are diagnosed late with upper abdominal discomfort, general malaise, fever, anorexia and jaundice. Tumours of the bile duct are much less common than hepatocellular carcinoma and the aetiology is unknown. Prognosis is poor and related to the extent of spread within the liver and regional lymph nodes and to the site of tumour. Peripheral cholangiocarcinomas can sometimes be resected. This is rarely possible for hilar carcinomas. The only curative treatment for extra-hepatic bile duct tumours is radical surgery but 70 to 80% are unresectable. Many nevertheless benefit from aggressive local treatment in which brachytherapy may play a part.

2 Anatomy

The majority of bile duct carcinomas involve the hepatic duct bifurcation, the common hepatic duct, the cystic duct and the ampulla may also be involved. The tumour can spread along the sinusoids and neoplastic destruction of normal cholangioles leads to the retention of bile around the margin of the tumour. Tumour emboli in the portal and hepatic veins are common and vascular invasion can occur in up to 90% of cases. Sixty to 70% of patients have signs of lymphatic spread, particularly in the hepatic hilum and in the retro-pancreatic and para-aortic regions. The tumour may also metastasise to lungs, peritoneum and intra-peritoneal organs.

3 Pathology

The majority of tumours are low grade cholangio-carcinomas.

4 Work Up

Patients commonly present with obstructive jaundice. Staging requires ultrasound and CT scan. The most important diagnostic procedure is cholangiography. The diagnosis can be confirmed by aspiration cytology during ERCP but for some hilar and peripheral tumours, ultrasound or CT guided biopsy may be necessary.

Biliary drainage should be established in the first instance, either trans-hepatically or by endoscopic insertion of a stent.

5 Indications

Malignant strictures of the bile duct which can be cannulated. Patients should be fit enough for the procedure and have been reviewed to confirm that they are not suitable for resection.

6 Target Volume

The location and length of bile duct stricture should be identified at cholangiography and a 1 or 2 cm margin taken proximally and distally. It is rarely possible to encompass the entire tumour volume because of the short range achievable with a single source.

7 Technique

In patients who are in reasonably good condition, it is usual to combine bile duct brachytherapy with external beam radiation. Thirty to 40 Gy are delivered to a volume which encompasses the porta hepatis, the common bile duct and regional nodes.

7.1 Trans-duodenal endoscopic technique

Where possible it is best to use a trans-duodenal endoscopic approach and before the procedure cholangiography is performed to identify the site of the tumour, the length of bile duct involved and the extent of disease. Endoscopic retrograde cholangiopancreatography (ERCP) is first performed and a sphincterotomy carried out to allow cannulation of the bile duct. A guidewire is then advanced through the malignant stricture and a nasobiliary tube threaded over the guidewire beyond the stricture into the biliary tree. The procedure is done under fluoroscopy to check the position of the guidewire. After removal of the endoscope the proximal end of the tube is repositioned from the mouth to the nose and the tube is taped to the patient's cheek.

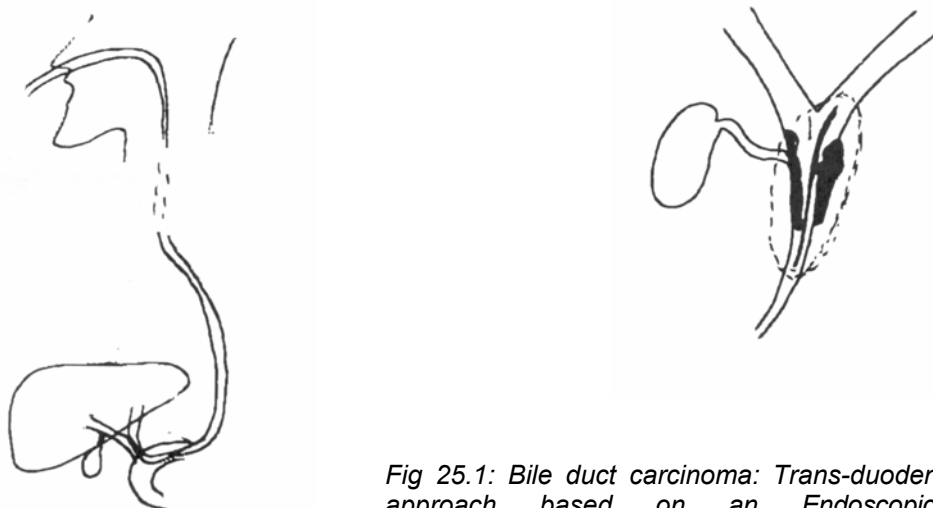


Fig 25.1: Bile duct carcinoma: Trans-duodenal endoscopic approach based on an Endoscopic Retrograde Cholangiography (ERC). Advancing of a guidewire through the malignant stricture in a patient with limited disease. Introduction of a nasobiliary tube as source carrier over this guidewire by means of the "Seldinger technique". The CTV is indicated.

An afterloading catheter containing radio-opaque wire is then passed through the naso-biliary tube under fluoroscopy and advanced through the lesion. The radio-opaque wire has markers at intervals which indicate where the radioactive source should be placed.

Orthogonal radiographs are taken to confirm the position and calculate the dosimetry.

Brachytherapy can be performed with a continuous length of iridium wire. This is advanced up the naso-biliary catheter after removal of the dummy source under fluoroscopy control until it is in the desired position. Alternatively, the naso-biliary catheter can be attached to a remote afterloading machine which will give a fraction of high dose rate brachytherapy. In this case, the dwell positions of the source must be programmed taking into account the measured distances from the localising radiographs.

After the treatment is completed the naso-biliary tube is removed and an endoprosthesis is either left or repositioned in the stricture to maintain biliary drainage. The patient is placed on intravenous antibiotics and kept under observation in hospital for one or two days.

7.2 Trans-hepatic technique

In those cases where it is not possible to gain access to the tumour endoscopically, this can be performed with a percutaneous trans-hepatic technique which allows the passage of a catheter through the stricture. Cholangiography is performed and then check radiographs with a dummy source in the catheter. Loading the radioactive source into the catheter is similar to that already described for the endoscopic technique.

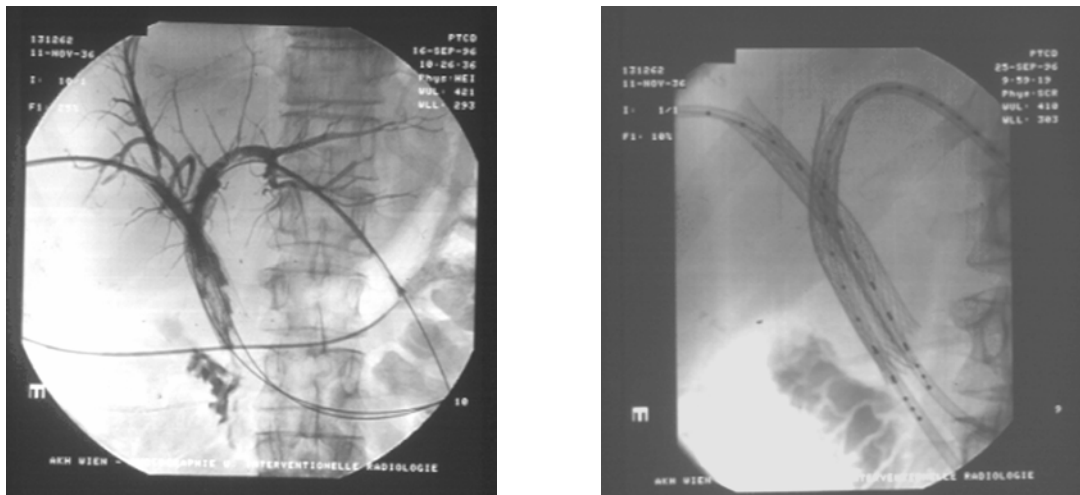


Fig 25.2. 2 Bile duct carcinoma: Percutaneous Trans-hepatic approach based on a Percutaneous Trans-hepatic Cholangiogram (PTC) (Courtesy of Wolfgang Seitz, Vienna).

Patient with a history of stenting of both major bile ducts and the choledochus because of extensive obstructive disease. The patient presents with symptoms from tumour progression.

A: Cholangiogram shows tumour (re)-growth through the stent wall. Percutaneous transhepatic recanalisation of the stent from right and left results in reopening of the bile duct and choledochus lumen. Two introducer sheaths.

B: Localisation radiograph (anterior-posterior) with the intraluminal plastic catheters for the source and calibrated dummy marker wires for definition of the adequate determination of the Active Source Length and the Reference Isodose Length in the major bile ducts and the choledochus.

8 Treatment Planning and Dose Calculation

Treatment Planning is based on radiography taken with the applicator in place and the cholangiogram showing the malignant stenosis. Dose is usually prescribed at 10 mm from the source axis. Dose should

(additionally) be reported 5mm from the applicator surface and at the applicator surface. The Length of the Reference Isodose encompasses the Planning Target Length as closely as possible.

In case of treating both major bile ducts with brachytherapy, care has to be taken to avoid major overdosage at the bifurcation. This is achieved by introducing a gap between the two line sources or by choosing a gap between dwell positions at the bifurcation when using a stepping source.

9 Dose, Dose Rate, Fractionation

For continuous low dose rate irradiation a dose of 15 to 20 Gy can be given at 1 cm from the centre of the source axis at a dose rate of 0.2 to 0.3 Gy/hr over 60 to 75 hours. This is combined with the prior external beam radiation.

For high dose rate brachytherapy, 5 Gy per fraction is prescribed at 1 cm from the centre of the catheter and can be given twice daily with a minimum of 6 hours between treatments. A total dose of 20 Gy in 4 fractions over 2 days can be given if combined with external beam radiation. If the patient is being treated by brachytherapy alone, 30 Gy in 6 fractions over 3 days may be given.

10 Monitoring

The most common complication is infection. Antibiotic prophylaxis should therefore be given before, during and after the procedure.

11 Results

The median survival for this procedure is 10 to 12 months and approximately 15% of patients survive for 2 years or more.

Late effects of treatment are often difficult to distinguish from symptoms due to recurrence or blockage of the biliary drain. Upper gastrointestinal bleeding can occasionally occur unrelated to recurrence.

Blockage of the stent or biliary drain is fairly common and it may need to be replaced every 3 to 4 months.

12 References

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