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HEPATIC SURGERY

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The ability of the human liver to undergo regenerative hyperplasia after resection has been recognised for many centuries and reference is found to it in ancient mythology. It is this amazing potential for the regrowth that allows resection of large portions of liver substance. In recent years, detailed anatomical studies have defined the segments and lobes of the liver and provide the Surgeon with the necessary planes of dissection.

There are 3 main indications for hepatic resection surgery, namely trauma, primary and secondary liver tumours and high bile duct obstruction. The indications for hepatic resection in trauma are well defined whereas there is still much debate as to the value of surgical removal of liver tumors. The role of liver resection in benign biliary obstruction is still evolving. Indications for surgery in each of these areas, along with an outline of the surgical anatomy, pre-operative assessment and operative technique form a basis for this chapter.

SURGICAL ANATOMY

A clear understanding of the anatomical structure of the liver is essential before undertaking hepatic resectional surgery. The liver is suspended from the undersurface of the diaphragm by suspensory ligaments which, because they are situated posteriorly, allow both hepatic lobes to be palpated manually at laparotomy.

The major anatomical division of the liver into right and left lobes is in a line from the gall bladder bed to the inferior vena cava, dividing the liver into almost equal portions by weight (Blumgart et al, 1971). An oblique plane running anteroposteriorly divides the right lobe into anterior and posterior segments; within each of these segments, the portal triads branch into superior and inferior portions. The left lobe of liver is divided along the line of insertion of the ligamentum teres into left lateral and medial segments. The lower border of the ligamentum teres runs sharply into the umbilical fissure of the liver in the base of which the main vascular and biliary channels branch to the medial and lateral segments of the left lobe. The portal vein and hepatic artery divide into major right and left branches outside liver substance below the hilus. When the overlying peritoneum is incised and elevated it is possible to dissect each major branch beyond the bifurcation for a short distance. The confluence of the right and left hepatic ducts also occurs outside the liver, although it is sometimes necessary to dissect into the hilus and push liver substance away in order to display the confluence completely. The left branch of the portal vein curves caudally in the plane of the falciform ligament supplying both the medial and lateral segments of the left lobe. The terminal part of the falciform ligament is often masked by a small portion of liver tissue

which can be easily dissected by finger fracture to allow exposure (Starzl et al, 1975). Dissection in the plane of the falciform ligament may be hazardous but is an important landmark in liver resection. In the operation of left lateral segmentectomy, the plane of resection should be just to the left of the umbilical fissure and if the lesion to be resected involves this area, then complete left lobectomy is required. For the operation of extended right hepatic lobectomy, dissection in the umbilical fissure allows devascularisation of the medial segment of the left lobe, and ligation of vessels should be just to the right of the ligament.

The right branch of the portal vein is short and its first branch often arises postero-inferiorly from the main trunk close to the bifurcation. Great care should be taken not to damage this branch when ligating the right portal vein.

The hepatic veins have a short course outside the liver and usually join before emptying into the vena cava although both right and left hepatic veins may enter the vena cava separately. Several smaller veins drain the posterior surface of the liver and the caudate lobe directly into the vena cava. The main right hepatic vein lies obliquely between the anterior and posterior segments of the right lobe. The left hepatic vein is usually joined by the middle hepatic vein which drains the medial segment of the left lobe and a portion of the lower anterior segment of the right lobe.

Dissection of the hepatic veins is extremely dangerous and only should be undertaken with proximal and distal control of the inferior vena cava. Indeed, such dissection is only necessary for tumours very close to the vena cava. Usually, the veins can be located and controlled from within the liver substance during *finger fracture* dissection.

Many variations in biliary drainage and vascular supply to the liver have been described. In practice, the most important variant is found in approximately 20% of patients, in whom the arterial supply to the right lobe arises from a large branch of the superior mesenteric artery which courses up behind the pancreas. In a similar proportion of patients, the left hepatic artery arises from the left gastric artery.

PRE-OPERATIVE ASSESSMENT

In patients who have sustained blunt abdominal trauma, the keystone of good management is careful observation and repeated clinical examination linked with an awareness of possible liver damage and a willingness to perform laparotomy on suspicion of intraperitoneal injury (Bolton et al, 1973). It is important to remember that in some cases of extensive liver injury clinical evidence of shock may be absent in the initial stages and there may be only minimal physical findings (Walt, 1969; Vajrabukka et al, 1975). The presence of fractured ribs on the right side or fractures of the right upper limb are not uncommonly associated with liver injury (Vajrabukka et al, 1975).

Special methods of investigation such as ultrasound and isotope scanning and selective coeliac axis angiography are rarely indicated in patients with acute injury since not only do they give misleading information but may also cause delay in performing essential surgery. It has been our policy to adopt these investigations in patients presenting late after liver injury with intrahepatic haematomas or abscess formation. Abdominal paracentesis with peritoneal lavage may provide useful confirmation of intraperitoneal injury in patients having sustained blunt trauma (DuPriest et al, 1979).

In patients with tumour or biliary tract obstruction requiring elective liver resection, extensive investigations are essential for accurate pre-operative assessment (Blumgart et al, 1979). Biliary tract obstruction, whether benign or malignant, needs precise definition of the anatomical location, extent and nature of the obstruction. A combination of grey scale ultrasonography, fine needle percutaneous transhepatic cho-

langiography (PTC) and endoscopic retrograde choledochopancreatography (ERCP) are used in an ordered manner (Benjamin et al, 1978; Blumgart, 1978). Selective arteriography and splenoportography should also be performed in patients in whom it is considered that resection might be feasible. These two investigations are important to demonstrate the arterial and venous anatomy, the presence of tumour, and assess tumour involvement of vessels at the porta hepatis. Inferior vena cavography and hepatic venography may be necessary to assess the extent of tumor involvement of these structures. Tumour invasion, but not compression alone, of the inferior vena cava indicates irresectability of a tumour. Likewise, occlusion of both branches of the portal vein is an index of inoperability. However, a tumour may yet be resectable when only one branch of the portal vein is occluded.

It has been our policy to obtain histological confirmation of liver tumours by percutaneous target liver biopsy, using a Trucut needle, under direct laparoscopic control. This technique also provides visualisation of the extent of tumour spread and an assessment of operability. The presence of extrahepatic tumour deposits would preclude liver resectional surgery.

The patient's general condition should be assessed with special reference to the pathophysiological effects of jaundice (Blumgart, 1978), the presence or absence of coagulation defects, and an assessment of renal function (Dawson, 1965; Allison et al, 1979).

OPERATIVE TECHNIQUE

The choice of incision is dependent upon the circumstances. A right upper paramedian or midline incision is preferred when exploring for liver injury. This can be extended as a thoraco-abdominal incision either through the seventh interspace with incision of the diaphragm towards the vena cava or as a median sternotomy (Miller, 1972). The latter approach provides rapid access to the major hepatic veins and the intracardiac inferior vena cava whilst sparing disruption of either pleural cavity. The diaphragm can be split if required through the central tendon. A bilateral oblique «rooftop» incision usually provides excellent access in performing liver resection for tumour. Alternatively, a thoraco-abdominal incision similar to that used in trauma can be employed.

When there has been injury to the liver, it is mandatory that a full assessment of the extent of liver damage is made. It is important to determine whether or not there are areas of devitalised tissue. This may be difficult since minor tears on the surface of the liver can mask extensive injuries deep in the tissue. In particular, large shattering injuries which take origin in the bare area of the liver posterolaterally on the right and which extend in a stellate fashion centrally into the liver, may be missed. This form of injury is easily underestimated by the inexperienced surgeon (Hardy, 1972). Temporary control of bleeding can be achieved by occluding the structures in the free edge of the lesser omentum (Pringles' manoeuvre). Continued bleeding, despite this manouvre, usually indicates a tear in an hepatic vein or inferior vena cava.

In patients with liver metastases, careful assessment at laparotomy still provides the most reliable means of determining the extent of liver involvement of tumour (Bengmark et al, 1974). The best results for liver resection at surgery are obtained in patients with solitary metastases (Wilson & Adson, 1976). The results of hepatic resection in patients with multiple metastases, even when confined to one lobe of liver, are not encouraging (Wilson & Adson, 1976). It is also important to explore the peritoneal cavity fully for other possible or locally recurrent tumour.

An evaluation of invasion of bile ducts and of major vessels is particularly important at the liver hilus. Cholangio-carcinomas in this area are usually firm and may only be palpable with difficulty. It may be necessary to perform a hepatotomy (liver split) in

the median plane in order to fully assess such lesions. Detailed pre-operative investigations should have provided valuable information on the extent of the hilar tumours.

The *finger fracture* technique is the one most usually employed for resecting liver tumours. For this method, Glisson's capsule is incised along the line of dissection. Liver tissue can be divided by blunt finger dissection or with a suction catheter which is used to tear apart the liver tissue. The exposed major vessels and ducts are ligated or clipped individually. The hepatic veins can be approached safely within the liver and controlled more readily than by extrahepatic dissection. On the posterior surface liver tissue is freed from Glisson's capsule and can then be used to cover the exposed liver surface. Haemostasis can be secured by direct suture of bleeding points or by use of liver buffers (Wood et al, 1976).

The standard techniques for right hepatic lobectomy and extended right hepatic lobectomy (Trisegmentectomy) have been described previously (Balasegaram, 1970; Smith, 1974; Fortner et al, 1978). The methods for extended left hepatic lobectomy and hepatotomy (liver split) have also been recently described (Blumgart et al, 1979; Blumgart, 1978). However, several important points should be highlighted for these procedures.

Extended left hepatectomy involves resection of the entire left lobe of the liver, quadrate and caudate lobe and a portion of the right lobe. The usual indication for this operation is a tumour involving mainly the left side but extending into the hilus of the liver. It is essential to maintain an arterial supply and venous and biliary drainage to the remaining portion of the right lobe. As with all major liver resections, it is vital to control the relevant arterial and venous structures at the porta hepatis before embarking on dissection of liver. The liver is split just to the left of the gall bladder fossa and the incision deepened posteriorly to give adequate clearance of the tumour. If the tumour is occluding the left main branch of the portal vein, this may be resected en bloc and the defect in the vein closed. The right main branch of the portal vein and the antero inferior and posterior segmental branches of the portal triad should be carefully preserved. Pre-operative venography should have shown the right portal vein to be clear of tumour involvement. The middle and left hepatic veins are ligated during the dissection.

Hepatotomy, or liver split, is performed in the median plane by dividing the liver just to the left of the gall bladder fossa and deepening the incision posteriorly in a slightly oblique direction towards the vena cava. This incision skirts the right margin of the quadrate lobe and the right side of the main trunk of the middle hepatic vein, thereby exposing the confluence of the bile ducts. This is a useful manoeuvre for tumours at the porta-hepatis and in some patients with high bile duct strictures since it will allow assessment of operability, and can be followed by hepatic lobectomy after division of the appropriate vessels. It is sometimes necessary to transect the bile duct below a carcinoma at the hilus and elevate it into the liver split to allow access to major vessels beneath.

It is important to point out that performing a hepatotomy provides a great deal of useful information without having made any irrevocable step. Should a lesion prove inoperable, palliative manoeuvres can still be performed. Even if the bile duct has been transected below the tumour, a choledochojejunostomy Roux-en-Y can be fashioned.

A number of specially designed liver clamps have been described but we have found them of most limited value with the exception of the flexible clamp reported by Longmire (1974). This instrument will allow rapid resection of the left lateral lobe, particularly in an emergency situation.

Insertion of a T-tube into the common bile duct following resection is a matter for debate. It is clearly advantageous to have a T-tube where there has been damage to the common bile duct, or if there has been difficulty in defining the biliary tree, in patients with liver injury. Furthermore, a T-tube cholangiogram is a useful investiga-

tion, especially in patients with post-operative jaundice or haemobilia. Bile samples may also be collected for culture if sepsis is suspected. However, it has been clearly shown that external biliary drainage does not produce a reduction in intrahepatic pressure, nor any alteration in morbidity or mortality rates in dogs with standard liver injuries (Lucas & Walt, 1970). In a large controlled study of patients with liver injuries Lucas & Walt (1972) showed no distinct advantage for the insertion of a T-tube and even demonstrated increased infective complications associated with the T-tube. However, the majority of their patients had sustained penetrating trauma to the liver and were therefore at risk of infection. In our practice,patients having resection for tumour rarely require T-tube drainage unless there has been damage to a major biliary structure. If a portion of the biliary tree has been resected, with either direct repair or by means of a choledochojejunostomy Roux-en-Y, transanastomotic splintage is used via a transhepatic or transenteric tube (Benjamin & Blumgart, 1979).

POSTOPERATIVE SEQUELAE

Regenerative hyperplasia of the liver after major hepatic resection is a remarkable phenomenon, without which removal of large amounts of liver tissue would not be possible. Restoration of liver mass and functions occurs rapidly in a predictable fashion. Earlier studies suggested that replacement of liver size and function took from 4-6 months (Pack et al, 1962; McDermott et al, 1963), but more recent evidence has shown that there is an increase in liver volume within the first two post-operative weeks, after which liver size does not change to any significant degree. This early increase in size is due, in part, to vascular congestion, swelling of the hepatocytes and fatty infiltration. At the cellular lever, mitotic figures and double-cell plates are visible within three days of liver resection (Blumgart, 1974). Despite a large amount of research, the precise factor, or factors, controlling liver regeneration are not known. Certainly the regenerating liver requires adequate blood supply (Blumgart, 1978) and *hepatotrophic factors* e. g. insulin or glucagon may also play a vital role (Starzl et al, 1973). In patients with cirrhosis, there is a much poorer regenerative response and recovery of function is delayed (Lin & Cheng, 1965).

During the initial period of active liver regrowth the hepatocytes are concerned primarily with cell division and the liver's metabolic functions are depressed such that a degree of liver failure exists. The metabolic and haematological sequelae play a significant role in the post-operative management and the patient's eventual survival. In man, liver function is depressed for two or three weeks and complete recovery may not be seen until the sixth or seventh post-operative week. Total serum protein and albumin levels fall after hepatic resection and this is usually more evident after resection for injury (Pack et al, 1962; Aronsen & Ericson, 1969; Blumgart & Vajrabukka, 1972). The administration of albumin may not prevent hypoalbuminaemia but serum albumin levels usually return to within the normal range by 4-6 weeks after resection. An elevation in serum transaminase levels is commonly seen but levels return rapidly to normal.

An elevation in the serum bilirubin level is characteristic after partial hepatectomy but is usually mild in nature. This is almost certainly the result of the liver's decreased capacity to excrete bilirubin after partial hepatectomy (Weinbren & Billing, 1956). Liver hypoperfusion, perhaps as a result of haemorrhagic shock, may lead to centrilobular hepatocyte damage (Champion, 1976). This results in an intrahepatic cholestasis which can produce very high serum bilirubin levels. Post operative infection, which is not uncommon after major hepatic resection, may also contribute to cholestasis. Vajrabukka et al (1975) described two patterns of jaundice and showed that patients with high bilirubin levels had a much poorer prognosis than those with a slight

elevation which rapidly returned to normal. An organic obstruction to the biliary system might also produce post-operative jaundice. In such cases, the presence of a T-tube allows cholangiography to be performed and the site of obstruction to be defined.

Following major liver resection, the remaining liver portion becomes rapidly depleted of glycogen stores. As a result, hypoglycaemia occurs often, particularly after hepatic lobectomy performed for injury (Blumgart & Vajrabukka, 1972). Dextrose 5% solution should be administered during the first 48 hours post-operatively and supplements of 50% glucose may be required. Certainly, blood sugar levels should be monitored regularly during the first two days after operation.

The liver plays a major role in the haemostatic mechanisms of the body. It is the only site of fibrinogen production and the main site of synthesis of Vitamin K dependent clotting factors II, VII, IX, X and of factor V. In addition, it clears coagulation factors by virtue of its reticuloendothelial system. Removal of large portions of liver lead to decreased levels of coagulation factors (Vajrabukka et al, 1975) and may lead to haemostatic problems. The half life of factors V and IX is short and deficiency readily occurs. Circulating fibrinogen has a longer half life and results in a later depression of blood levels. In addition, patients requiring large blood transfusions may develop thrombocytopaenia and coagulation factor deficiencies since stored blood is deficient in functional platelets and in factors V and VII. Furthermore, intravascular coagulation which can accompany any severe injury or surgical procedure, might also complicate liver surgery. A coagulation screen should be performed on all patients undergoing hepatic resection, preferably before blood transfusion is commenced.

The treatment of an established coagulation defect is usually with fresh blood since this provides platelets and coagulation factors. Fresh frozen plasma, fibrinogen and Vitamin K may also be necessary.

Haematemesis, usually occurring in the second or third post-operative week, is not uncommon after major hepatic resection (Walt, 1969). Gastric erosions are the most common cause of haemorrhage although haemobilia should be carefully looked for. It has been suggested that diversion of bile results in a greater risk of erosive bleeding. However, biliary diversion is most often used when resection has been performed in the presence of jaundice and infection and these factors may of themselves be important. It has been our policy to use Cimetidine (Tagamet) in the post-hepatic resection situation since this drug has been shown to be successful in the prevention of erosive bleeding in liver failure (McDougall et al, 1977).

DISCUSSION

The indications for a liver resection require careful definition because such surgery can carry a high mortality and morbidity rate. Clearly, liver resection should not be performed if simpler techniques are sufficient. On the other hand, it should not be ignored in situations where less radical procedures have no chance of success.

The indications for hepatic resection are well defined in liver injury. For minor wounds of the liver in which there is no devitalisation of liver, simple suturing of the wound is usually sufficient. However, wounds which shatter and disrupt liver substance, and which result in much devitalisation of tissue, require liver resection. Resectional debridement can sometimes be employed to remove large amounts of liver tissue, control of major blood and bile vessels being obtained by direct suture ligation. However, where there has been extensive disruption of liver pulp, debridement along anatomical lines at the periphery of the liver lobe is not possible and formal liver resection is indicated. This type of injury is most frequently seen in blunt injuries or shotgun wounds to the liver.

In our experience the mortality rate for liver resection following major blunt injury is 20%, and this is similar to the experience of others who have found mortality figures of 30% or less (Little & Williams, 1969; Walt, 1969; Blumgart & Vajrabukka, 1972). However, a recent American survey by Walt (1978) found the mortality after resection for severe injury to be approximately 50% and used this to argue for limited use of extensive resection in these patients. It is difficult to determine the true mortality for liver injury alone since many factors, such as speed of transfer to hospital, the number of other organs injured and the experience of the surgical team have to be taken into account. Furthermore, the results of liver resection should be compared with the alternative methods of treatment for major injury. Packing of major liver injuries has been used but is generally contra-indicated because of the poor control of bleeding and the high incidence of secondary haemorrhage, infection and biliary leakage. However, temporary packing may be valuable in some cases in order to allow transport of the patient to a centre where resection can be performed (Calne, 1979; Walt, 1978). It may also be the only thing possible in patients with extensive damage to both lobes of the liver.

Hepatic arterial ligation can be a useful method for controlling arterial bleeding from liver injuries (Aaron et al, 1975). The portal circulation will provide adequate nourishment to a liver deprived of its arterial supply and a collateral arterial circulation rapidly develops. However, this relatively simple technique may be associated with considerable mortality, particularly in patients with major liver injuries (Flint et al, 1977) who would be best treated by liver resection. The morbidity rate may also be high with this procedure and it should be remembered that immediate control of haemorrhage should not necessarily be sought at the expense of later sepsis and delayed mortality (Atik, 1976). If ligation is performed, cholecystectomy should also be carried out plus debridement of areas of dead tissue. Failure of arterial ligation to control the bleeding would suggest haemorrhage from hepatic veins or inferior vena cava.

The prognosis of patients with hepatic tumours, whether primary or secondary, is very poor. Untreated patients with hepatocellular carcinoma survive on average between 3-6 months after diagnosis. Similarly, the average survival for patients with secondary deposits is approximately 6 months and within a year most are dead (Foster, 1970; Wood et al, 1976; Foster & Berman, 1977). The results of palliation using chemotherapy, radiotherapy or hepatic artery ligation have been disappointing. The only real prospect of a cure in these patients is with liver resection.

Most primary liver tumours remain confined to liver for a long period before metastasising. Thus, provided liver resection is possible, and tumour is confined to an anatomical lobe of liver, encouraging results can be obtained. Fortner et al (1978) reported 13 patients with primary liver cancer operated on for possible cure and found 7 living beyond 3 years. Four of the 15 patients treated by Miller (1974) were alive 4-23 years after liver resection for primary tumour. Five year survival figures as high as 40% have been recorded (Adson, 1978). Thus, as Foster & Berman (1977) have suggested, liver resection is justified in patients with primary cancer in a non-cirrhotic liver. Large tumours, the presence of multiple nodules (if confined to one lobe), poor histological type, invasion of the diaphragm or rupture into the peritoneal cavity do not exclude the possibility of cure provided there is no evidence of distant spread.

Several authors (Terblanche et al 1963; Terblanch & Louw, 1972; Cameron et al, 1978) have suggested the use of bile duct intubation for patients with cholangio--carcinoma at the confluence of the bile ducts. We have used this technique with success in some patients but have employed a much more aggressive surgical approach in patients with potentially resectable cholangio-carcinomas. In this respect, the role of precise pre-operative evaluation is essential, in order to assess the extent of tumour spread both within and without the liver. At laparotomy an initial hepatotomy may be required to determine the full extent of tumour involvement of hilar structures.

Hepatic transplantation has been proposed as an alternative method for treating patients with liver tumours and occasional long-term survival has been reported (Calne & Williams, 1977; Putnam & Starzl, 1977). However, these patients require post-operative immunosuppression and the long-term results after transplantation for tumour have been disappointing. The greatest prospect for cure still lies with hepatic resection (Shiu & Fortner, 1975; Ong & Chan, 1976).

Secondary deposits in the liver are found in approximately 20% of patients with primary colorectal cancer (Bengmark & Hafstrom, 1969; Wood, et al. 1976), and the incidence is even higher in post mortem studies (Goligher, 1975). The prognosis is related to the extent of tumour spread within the liver. Jaffe et al (1968) found that in patients with solitary liver metastases the median survival time was 136 days compared to 93 days for patients with metastases localised to a single liver lobe and 72 days for patients with widespread liver metastases. In a retrospective study Wood et al (1976) showed the one year survival rates to be 5.7% for patients with widespread liver metastases compared with 60% for patients with solitary metastases. Furthermore, this study showed a mean survival of 25 months for patients in whom solitary liver metastases were the only evidence of metastatic spread from colorectal cancer. Despite the much better prognosis for patients with solitary metastases, all patients eventually died with tumour. However, encouraging results have been reported for hepatic resection of liver metastases. Foster (1970) reviewed the literature and found 83 patients who had undergone liver resection for metastases; the 2 year and 5 year survival rates were 47% and 21% respectively. Even better results were reported by Wilson & Adson (1976) from the Mayo Clinic. Of their 60 patients who had resection of hepatic metastases from colorectal cancer, multiple lesions were removed from 20 patients and solitary lesions from the remaining 40.The results for surgical resection of apparent solitary metastases showed a 5 year survival rate of 42% and a 10 year survival of 28%. Wanebo et al (1978) found that 9 (36%) of 25 patients with resected solitary liver metastases survival 4 years, whilst only 3 (17%) of 18 patients with unresected solitary metastases survived for the same length of time.

The number of patients who might be eligible for liver resection of secondary tumour is small since only about 10% of those with liver metastases have solitary or localised lesions. Thus, it is difficult for any one surgeon to gain adequate experience of the operative and post-operative management of these patients. However, in specialised centres liver resection carries an acceptable operative mortality (Adson & Beart, 1977; Blumgart et al, 1979) and encouraging results can be obtained. Certainly, the best results are obtained in those patients with solitary metastases (Wilson & Adson, 1976).

There is much debate as to the optimal timing for resection of secondary tumour. Because of the risk of infection, it should only be performed rarely at the same time as resection of the primary gastrointestinal tumour. It is however, unnecessary to wait for prolonged periods before proceeding to hepatic resection. Our usual policy is to remove the primary tumour first and perform hepatic resection after a period of a few weeks.

The majority of benign strictures occur in the extrahepatic portion of the biliary apparatus and can be dealt with by an intrahepatic reconstruction. The use of liver resection for benign high bile duct strictures is uncommon. Smith (1974) advocated the use of a *mucosal graft* technique using a transhepatic tube. However, this method cannot be used in the presence of small, non-dilated hepatic ducts or with secondary biliary cirrhosis where the passage of the transhepatic tube may be difficult. In these situations we have performed a hepatotomy (Benjamin & Blumgart, 1978) to display the confluence of the bile ducts in the area of the stricture. An hepatojejunostomy Roux-en-Y anastomosis can be fashioned to either the right and left hepatic ducts individually or at the confluence of the ducts. A transjejunal tube is used to splint the anastomosis. In some cases formal hepatic resection is necessary in order to allow a biliary drainage procedure.

We have performed hepatic resection for benign bile duct strictures in 8 patients. All patients survived operation and are alive and well at periods ranging from 3 months to 5 years. In one of these patients a previous right hepatic lobectomy had been performed for liver injury with subsequent high bile duct stricture formation. A left lobectomy with an intrahepatic hepatojejunostomy was required at the subsequent operation.

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