# Resection options

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Segmental resections Hepatic resection traditionally involved the formal removal of the right (segments V–VIII) or left (segments II–IV with/ without I) hemiliver to ensure the largest possible clearance. Although anatomical resection remains the treatment of choice for patients with HCC, a parenchyma-sparing non- anatomical approach involving multiple segmentectomies and/ or metastectomies is now the standard of care for colorectal liver metastasis ( Figure 69.21 ). Staged procedures Extensive resection of the liver in two stages was first described in 1965. The aim is to ‘clear’ one lobe of the liver of all known disease followed 4–6 weeks later by a formal major resection to clear all residual disease. Staged resections are usually only possible if the left side can be cleared first by local resections, something that is usually not possible on the right because of the need to remove as little normal parenchyma as possible to avoid stimulating too much regeneration. The stimulus for regeneration following resection of too much liver may accel erate growth of the tumour, which despite chemotherapy may become inoperable. ‘ ALPPS’ stands for Associating Liver Partition and Portal vein Ligation for Staged hepatectomy and was first described in 2011. It is the most recent modification of techniques developed to facilitate two-stage hepatectomies for resection of widespread or extensive liver tumours and employs the remarkable capacity of the liver to regenerate. ALPPS involves two stages. Initially the right portal vein is ligated and, depending on the distribu - tion of the tumour within the liver, transection is performed as for a formal hemihepatectomy or left lateral segmentectomy ( in situ splitting). In contrast to a classical hepatectomy , the liver containing the tumour(s) is left in situ and remains vascularised by the right hepatic artery and the biliary and systemic venous drainage, represented by the right bile duct and hepatic veins, preserved. The second stage of the procedure is performed 1–2 weeks after the first stage following CT demonstration of adequate hypertrophy; the involved liver is resected after division of the right hepatic artery , bile duct and hepatic vein. Initially ALPPS was associated with significant morbidity and mortality but modifications of the technique, particularly a reduction in the amount of liver transected, improved results. Portal vein embolisation Preoperative PVE induces hypertrophy of one side of the liver prior to a planned resection of the other side. The procedure - -

(a) (b) Figure 69.21 (a, b) Segmental resection. Removal of a primary liver tumour by resection of liver segment VI in a patient with well- compensated liver cirrhosis.

was first described by Makuuchi in 1984 before an extended hepatectomy for bile duct carcinoma. Several techniques for PVE have been reported, including intraoperative ligation, transileocolic PVE and the percutaneous transhepatic ipsilat eral or contralateral PVE techniques. The underlying principle is to block the portal venous blood flow to the liver segments that require resection. This induces atrophy of the ipsilateral liver segments and compensator y hypertrophy of the contra lateral liver segments, resulting in an increase in the size of the proposed FLR. In addition to the di ff erent techniques, di ff erent embolisation materials are used, including polyvinyl alcohol particles, coils, gelatin sponge, n -butyl cyanoacrylate and lipiodol, or fibrin glue. Indications for

PVE depend on the ratio of the proposed FLR to total estimated liver volume (TELV) and the condition of the liver. There is no clear consensus about the volume required for adequate postresec tion liver function but an FLR/TELV ratio of at least 25% is recommended with a normal liver and 40% in the presence of cirrhosis. Patients who have received extensive chemotherapy with an FLR/TEL V ratio less than 30% should also receive PVE prior to resection. Laparoscopic liver resections The development of laparoscopic liver resection (LLR) follow ing its first performance in the USA in 1991 for a benign tumour on the edge of the liver has been one of the most impressive in the field of hepatobiliary surgery . Technical innov ation has made LLR a safe and e ff ective procedure with significantly improved postoperative recovery . The potential advantages of LLR mean that it is gradually replacing conventional open liver resection. Indications have expanded from local resec tions to include major liver resection, isolated resection of the caudate lobe, living donor liver resection and ALPPS. For some procedures such as laparoscopic local resection and left lateral segmentectomy LLR is the appr oach of choice and formal hepatectomies are now routinely performed laparoscopically in high-volume centres. Robotic surgery With the safe and e ff ective development of laparoscopic liver surgery , robotic surgery , which obviates some of the technical issues, was welcomed and the first robotic liver resection was performed in 2007 for a 2.4-cm HCC. Indications for robotic surgery will expand but are presently limited by cost, time constraints, the lengthy learning curve, the lack of haptic feedback and the availability of dedicated instruments for parenchymal transection (see Chapter 10 ).

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