

## CHAPTER 3

# Left Hepatectomy and Extended Left Hepatectomy

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### Abstract

This chapter details how to remove the left liver, that is, segments two, three and four. As is emphasised throughout this book it is recommended that the structures to the left side of the liver be isolated within their Glissonian Sheath and clamped and divided en masse. The use of the Glissonian Sheath approach is also described for removal of segments five and eight in association with a left hepatectomy. Resection of segment one is also sometimes undertaken.

### Introduction

Left hepatectomy is the removal of the left liver, that is, removal of the liver to the left of the main fissure segments 2, 3 and 4 with or without segment 1 (Fig. 3-1).

### The Approach

The left liver is less bulky and more accessible than the right liver, so that access is not usually a problem and either a midline or a bilateral subcostal incision can be used. The authors favour a midline incision only if the patient is thin and it is certain that an extended left hepatectomy will not be necessary.

The falciform ligament is taken down back to the inferior vena cava and the left triangular ligament is also incised back to the midline. The anterior, left and inferior faces of the left hepatic vein are dissected enough to allow the placing of a vascular clamp across it should the need arise.

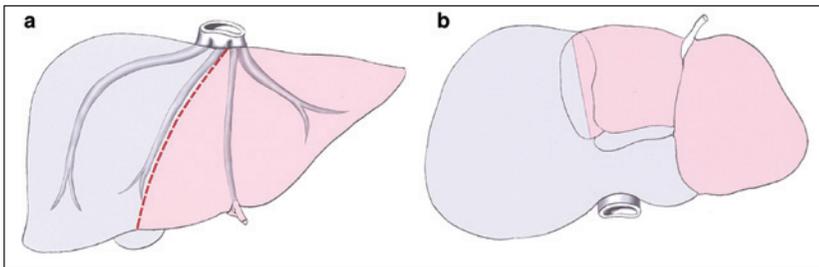


Figure 3-1. Liver substance removed by left hepatectomy: a) from anterior aspect; b) from inferior aspect. Reproduced from Launois B, Jamieson GG. *Modern Operative Techniques in Liver Surgery*. London: Churchill Livingstone, 1993; with permission from Elsevier.

The ligamentum teres is divided and held in a tie for retraction purposes and the main hepatic pedicle is encircled so that it can be clamped later during hepatic dissection.

### Delineation of the Left Liver

The line of delineation is the main fissure of the liver, which can be shown precisely by clamping the left main sheath, or can be estimated as a line through the middle of the gallbladder bed inferiorly and from the tip of the gallbladder back to the middle of the inferior vena cava superiorly. The posterior limit is the dorsal fissure, which is the continuation to the right of the plane of the fissure venosum (Fig 3-1).

### Dissection of the Liver

The portal trinity structures can be dissected outside the liver, but they have to be dissected individually in order to be sure of the anatomy. Variations in the relationships of the structures are common and this dissection is quite time consuming. Therefore the authors prefer to isolate the Glissonian sheath with the portal trinity structures. On the left side the main sheath is often extrahepatic for a variable length at the base of the quadrate lobe. By incising the tissue immediately at the base of the lobe, the left sheath can be dissected free, usually one to several centimetres from the confluence and this has an advantage in that some right-sided structures occasionally drain into or arise from left-sided structures near the confluence. By keeping a centimetre or more to the left, such structures are avoided.

The intrahepatic posterior approach can also be used here (see Chapter 2).

As it is the left main sheath which is being sought, accessibility for the posterior approach is provided by dividing the lesser omentum as it exits in front of the caudate lobe and then incising the caudate process posterior to the hilum. This also has the advantage of keeping the surgeon well to the left, away from the confluence. Once the sheath has been dissected free it can be clamped in order to observe the colour change to exactly delineate the main fissure of the liver.

Dissection is commenced after the main hepatic pedicle has been clamped. Our routine is to clamp the main pedicle for 15-20 minutes and then unclamp it for 10 minutes before repeating the cycle.

The gallbladder may be removed or partially dissected from its bed in order to make the line of incision 1 cm to the left of the main fissure. This is usually about the left edge of the gallbladder bed, or even slightly further to the left. Care must be taken as the plane of the hilum is approached, as the sheath to segment 6 is sometimes quite anterior here and can be inadvertently taken or damaged.

This line of incision is usually to the left of the middle hepatic vein and extends backwards to the left edge of the vena cava. The left hepatic vein is encountered high and posteriorly in the liver substance. Inferiorly, when the hilum of the liver is reached the transection has to be made transversely in order to separate segment 4 from the caudate lobe. This is a sloping plane from the posterior aspect of the left main sheath, which extends obliquely upwards and backwards to the inferior vena cava (Fig. 3-2).

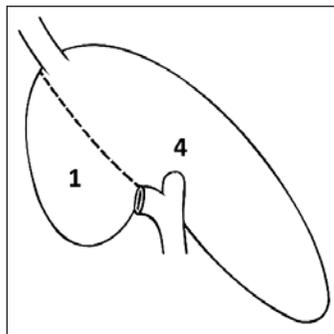


Figure 3-2. Sagittal view of dorsal fissure between segments 1 and 4. Reproduced from Launois B, Jamieson GG. *Modern Operative Techniques in Liver Surgery*. London: Churchill Livingstone, 1993; with permission from Elsevier.

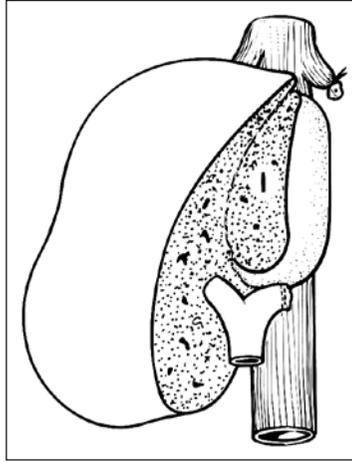


Figure 3-3. Remaining right liver and segment 1 after left hepatectomy. Reproduced from Launois B, Jamieson GG. *Modern Operative Techniques in Liver Surgery*. London: Churchill Livingstone, 1993; with permission from Elsevier.

The plane emerges to the left in the ligamentum venosum fissure. Some surgeons recommend leaving a small amount of segment 4 posteriorly in order to dissect in front of the fissure venosum, because it sometimes contains a small vein. We have not made a point of this.

The left main sheath is divided using a vascular stapler and as shown in Figure 3-3 this division is made about 2 cm to the left of the confluence to avoid any structures entering from the right liver. Small bleeding points are underrun and when the field is dry fibrin tissue 'glue is sprayed to cover the cut surface. A vacuum drain is inserted and the wound is closed.

### Left Hepatectomy and Segmentectomy 1

In some ways it seems as though this procedure should be more straightforward than retaining the caudate lobe, as the dissection proceeds directly back to the inferior vena cava. However, in practice the dissection involved in dividing the caudate lobe from segment 8 and segment 9 is considerably more than the separation of the caudate lobe from segment 4, as described above. Therefore this procedure is only carried out if the tumour is large or posterior and thought to be involving the caudate lobe.

As with any segmentectomy 1 operation the key to the procedure is to mobilize the caudate lobe from the inferior vena cava by dividing the tough layer of peritoneum which reflects off the inferior vena cava over the left edge of the caudate lobe. Following this, the small veins draining from the caudate lobe into the inferior vena cava are dissected free and ligated, or suture ligated (see Chapter 7). Once the left main sheath has been isolated the connections from this sheath to the caudate lobe are divided and the caudate process is also mobilized off the inferior vena cava by gentle blunt dissection.

The dissection of the liver substance proceeds as for left hepatectomy, but when the plane of the hilum is reached the caudate process is divided and the division of liver substance proceeds in the line of the main fissure back to the inferior vena cava. The liver substance has been previously separated from the inferior vena cava by the mobilization of the caudate lobe.

If the middle hepatic vein is encountered posteriorly, the operator should stay to the left of it and the left hepatic vein is then encountered, ligated and divided and the stump is oversewn with a vascular suture.

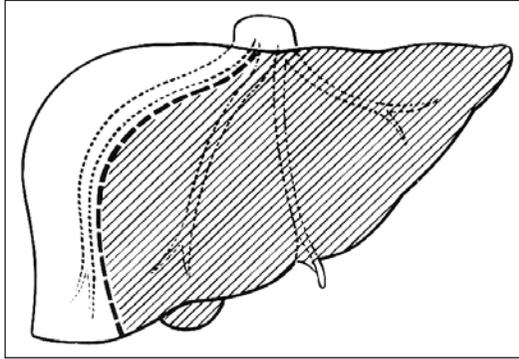


Figure 3-4. The shaded area shows the tissue removed in a left hepatectomy extended to include the right medial sector (segment 5 and 8). Reproduced from Launois B, Jamieson GG. *Modern Operative Techniques in Liver Surgery*. London: Churchill Livingstone, 1993; with permission from Elsevier.

### Left Hepatectomy and Segmentectomy 1, 5, 8

This is sometimes known as a left trisegmentectomy, but as the numbering of the anatomical segments is now widely accepted the term trisegmentectomy is best avoided. In this procedure the right medial sector is added to the left liver and segment 1. Thus all tissue to the left of the right fissure is removed (Fig. 3-4). When the patient has a large central tumour, the choice of operation is often between a left hepatectomy extended to the right or a right hepatectomy extended to the left. The latter operation is often chosen because it is technically a little easier and the potential hazards to the remaining trinity structures are less. However, segments 2 and 3 usually contain less functioning liver tissue than segments 6 and 7, so that the extended left hepatectomy is a safer operation from the point of view of postoperative liver failure.

As with other hepatectomy procedures the structures of the portal trinity can be dissected extrahepatically and then traced into the liver. However, this is not an easy technique to master and the use of an anterior approach through the right fissure after a control of the right medial pedicle by a posterior approach in front of and behind the hilum is easier and safer.

The advantage of the posterior approach is that selective clamping can be used to define the right fissure. Thus if the right medial sheath is isolated and then clamped, the right margin of the discoloration corresponds to the right fissure (Figs 3-5 and 3-6a,b). If the right lateral sheath

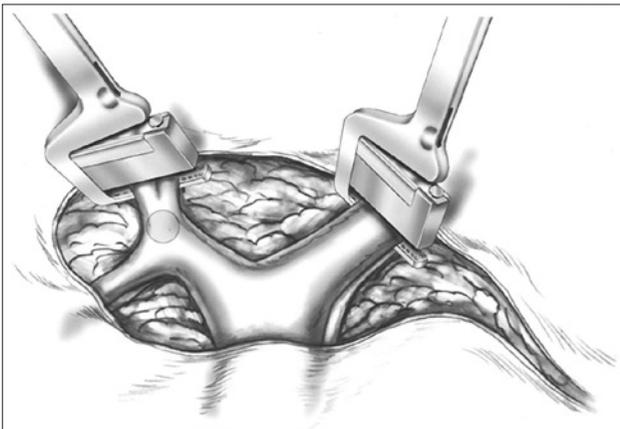


Figure 3-5. Double clamping of the left main pedicle and right medial pedicle.

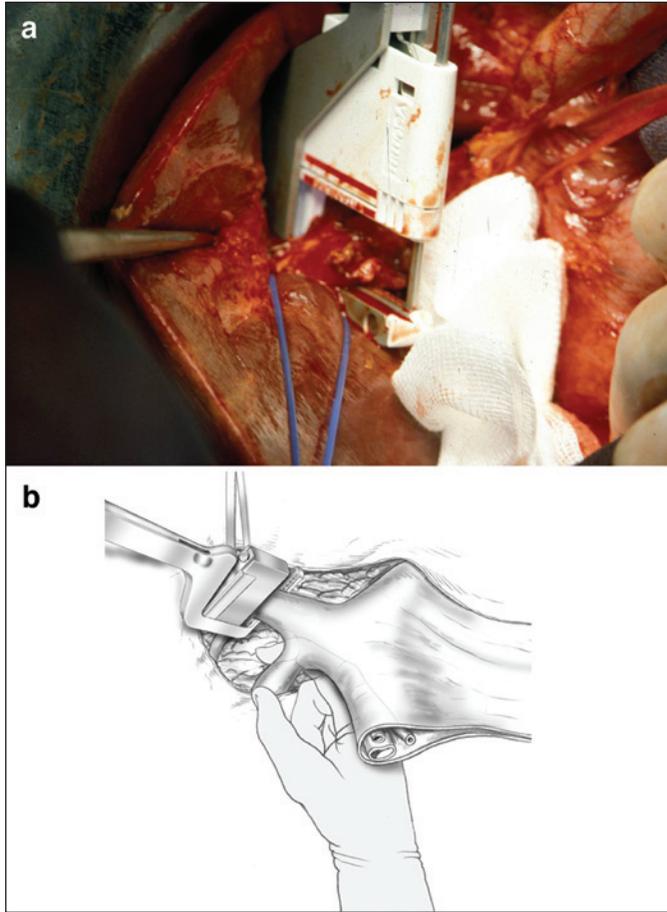


Figure 3-6. a) After dissection of the right medial pedicle by the posterior approach: stapling of the pedicle (operative view). b) Drawing of the stapling of the right medial pedicle. Notice the distal placement of the stapler on the right medial pedicle. The right lateral pedicle is diving posteriorly to the right lateral sector. The right lateral bile duct is very well protected inside the sheath and far from the stapling.

is isolated then the left margin of the discoloration corresponds to the right fissure. (If only the sheath to segment 6 is found and clamped in the hilum, then at least the anterior limit of the right fissure can be demonstrated).

The usefulness of the posterior approach is demonstrated in two ways. First, the early dissection of the right lateral and medial sheaths means that the liver resection is performed *after* they have been exposed, reducing the possibility of damage to either during resection and second, the right fissure is so variable in its position that it cannot be determined accurately by using anatomical landmarks. The clamping of the sheaths to produce colour changes in the liver overcomes this problem by demonstrating the right fissure's position exactly. The best possible access is required for this procedure, and the authors advocate a bilateral subcostal incision with a vertical extension in front of the xiphoid process, which is excised.

All attachments of both livers are divided, although it is not necessary to mobilize the right liver off the right side of the inferior vena cava. Both right and left main sheaths are dissected free, using the posterior approach. The left sheath is then divided using a vascular stapler (Fig. 3-5).

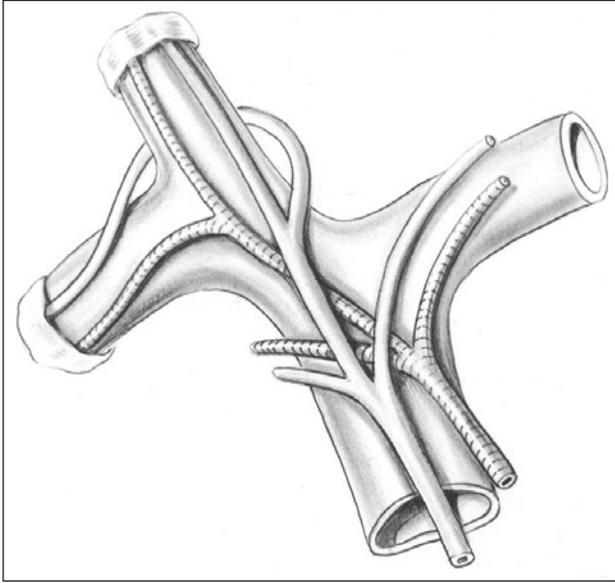


Figure 3-7. Right lateral bile duct—'Horstjo's crook' and its relationship to the other portal trinity structures.. Reproduced from Launois B, Jamieson GG. *Modern Operative Techniques in Liver Surgery*. London: Churchill Livingstone, 1993; with permission from Elsevier.

Similarly, the right main pedicle is dissected but more importantly the right medial pedicle is dissected as far as possible. It is rarely possible and certainly not easy to divide separately the sheaths to segments 5 and 8 (except after opening the right fissure). The key-point is to clamp this right medial pedicle in order to recognize the right lateral fissure (Figs. 3-5 and 3-6). It is worth emphasizing this point. Then the clamp is replaced by a vascular stapler as far as possible from the confluence with right lateral pedicle. As reference to Figure 3-7 indicates, the right lateral sector bile duct (the only remaining bile duct) is extremely vulnerable to injury during an extended left hepatectomy. In the past, when the operator had dissected the structures extrahepatically and then proceeded to dissect the right medial sector portal vein, it can be seen that it is easy to damage or even ligate the lateral sector duct. This is the reason why the initial publications of left extended hepatectomy were associated with many biliary complications: biliary fistulas and strictures. If the operator ligates (or staples) the sheath to the medial sector en masse, **then it is important to do this as far distally** as possible to avoid the lateral sector bile duct (Fig. 3-8).

Attention is next turned the caudate lobe, which is carefully dissected off the inferior vena cava from left to right, terminating the dissection in about the midline of the cava. The trunk of the left hepatic vein is now sought and divided. (Fig. 3-9) (If two veins are found entering the inferior vena cava, the right one must be regarded as the right hepatic vein until it is proven otherwise and therefore it must not be divided). The posterior face of the right liver is now dissected from the inferior vena cava on its anterior face, approaching it from the left side, until the inferior vena cava is freed.

After this dissection and clamping of the sheaths to find the line of the right fissure, dissection of the liver substance is commenced. The line of dissection is approximately 10-15 mm to the left of the right fissure, as it is important to dissect on the left side of the right hepatic vein (see Fig. 3-4). This line will usually be just outside the right margin of the gallbladder bed and as the dissection is deepened we emphasize again that care must be taken to avoid damaging the sheath of segment 6. Obviously it is much easier to avoid this sheath if it has been mobilized during the posterior approach to the right main sheath and its branches during the earlier phase of the

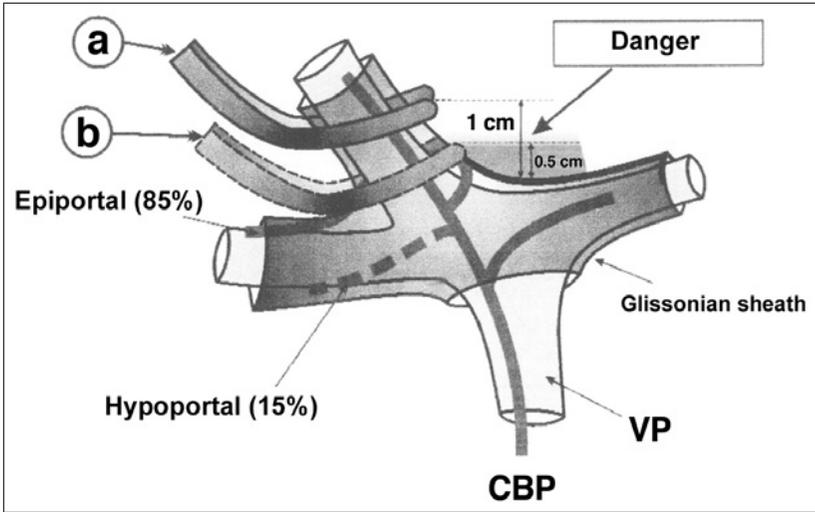


Figure 3-8. The risk of biliary complications. At (a) there is no risk of a stricture of the right lateral duct when stapling the right medial pedicle. Reprinted with permission from: Cimpeanu L. In: Popescu I, ed. *Chirurgia Ficatului*, Editura Universitara "Carol Davila". Bucuresti, 2004.

operation. The dissection proceeds posteromedially only because the right liver is held forwards until the line of dissection emerges in front of the middle of the inferior vena cava (if the liver was in its normal position, the dissection would be more in a coronal plane) (Fig. 3-10). This is necessary to avoid damaging the right hepatic vein. The specimen is now ready to be removed. When haemostasis has been secured a fibrin glue is sprayed on the cut surface, a suction drain is inserted and the wound is closed.

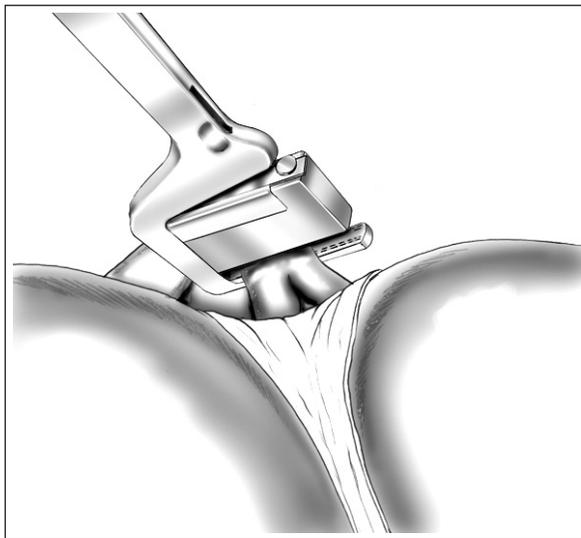


Figure 3-9. Stapling of the common trunk of the left and the middle hepatic veins. The division of the trunk and the freeing of the caudate lobe allows the posterior face of the liver to be dissected.

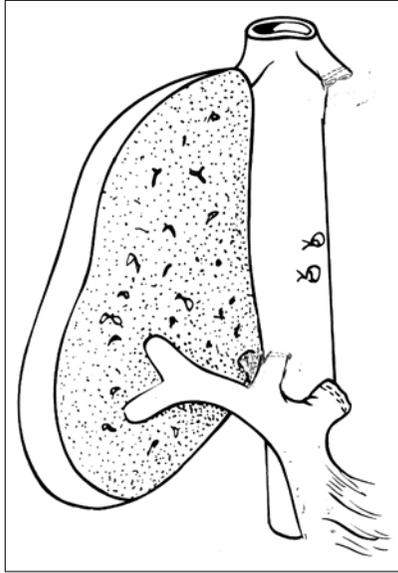


Figure 3-10. Area of liver remaining after removal of the left liver, segment 1, 5 and 8. Reproduced from Launois B, Jamieson GG. *Modern Operative Techniques in Liver Surgery*. London: Churchill Livingstone, 1993; with permission from Elsevier.

## Conclusion

A left hepatectomy has two main advantages: it is the easiest and the safest extended hepatectomy and it preserves the major part of liver tissue volume. The main pedicle is superficial and sometimes can be reached by the extrafascial approach. However, extended left hepatectomy is a difficult and hazardous procedure. The transfissural posterior approach has the advantage of isolation, clamping and stapling of the right medial pedicle, thus delineating the right lateral fissure and then guiding the dissection of liver parenchyma. When a patient has a large central tumour, the choice of operation is often between left hepatectomy extended to the right and right hepatectomy extended to the left.

The latter operation is often chosen because it is technically a little easier and the potential hazards to the remaining hepatic trinity hepatic structures are less. However, segments 2 and 3 usually contain less functioning liver tissue than segments 6 and 7, so that an extended left hepatectomy is a safer operation from the point of view of postoperative liver failure.