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BRIEF REPORT

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Is cholangiography required for ex situ splitting of cadaveric livers?

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Abstract Anomalous biliary anatomy is encountered frequently and, if not considered at the time of ex situ splitting of a cadaveric liver into left lateral segment and right lobe grafts, right-sided second-order ducts that enter the left system, or the segment IV duct, may be damaged, leading to biliary complications in the recipients. Bench cholangiography facilitates delineation of these anomalies, but if one considers the commonly encountered variations in biliary anatomy, in relation to the correct plane of division of the left hepatic duct (away from the hilum, close to the umbilical fissure), it is possible to avoid inadvertent injury to right-sided sectoral ducts. This approach, combined with careful probing of the ducts and absolute identification of the segment IV duct negates the contribution of cholangiography.

Keywords Cholangiography · Ex situ splitting · Cadaveric liver

Introduction

The ex situ splitting of a cadaveric liver to provide a left lateral segment and a right lobe graft is firmly established in practise [1]. Some units continue to perform bench cholangiography, while others do not, with no difference in the incidence of biliary complications. The advantage of cholangiography is that it defines biliary anatomy, prior to division of the left bile ducts [2]. However, cholangiography adds to logistical difficulties, increases the length of bench surgery and, thereby, the potential for ischaemic injury [3, 4]. In addition, it may lead directly to biliary epithelial damage [5]. We suggest that the contribution of cholangiography to the prevention of bile duct damage is substantially reduced by in-depth knowledge of biliary anatomical variants and appropriate surgical technique.

Discussion

Figure 1 demonstrates the nine commonly encountered variations in human biliary anatomy [6], in relation to the plane of parenchymal division. Variations A, B and C (73% of cases) are unlikely to pose difficulty, as the left duct in such cases is relatively long and division at any point lateral to the confluence is safe. With variations D and E (21% of cases), the right posterior sectoral duct joins the left duct at the hilum, while with variation F and G (2% of cases) the right anterior sectoral duct joins the left at a similar point. These four variations (D to G) are the anomalies where there is greatest risk of damage to the right sectoral ducts at surgery, leading to bile leak from the cut surface. This emphasises the need for minimising hilar dissection during the split and division of the left duct adjacent to the parenchymal division. If the left duct is divided immediately to the right of the umbilical fissure, close to where the segment IV branch joins, injury due to these anomalies can be avoided. These anomalies may also be divided by probing the left duct (malleable vascular probes) in the direction of insertion of these ducts. With this approach, these anomalies, which comprise 97% of cases, may pass unrecognised, but are unlikely to cause difficulty. Variations H and I, which constitute 3% of the anomalies, may be considered together. In these cases, the standard

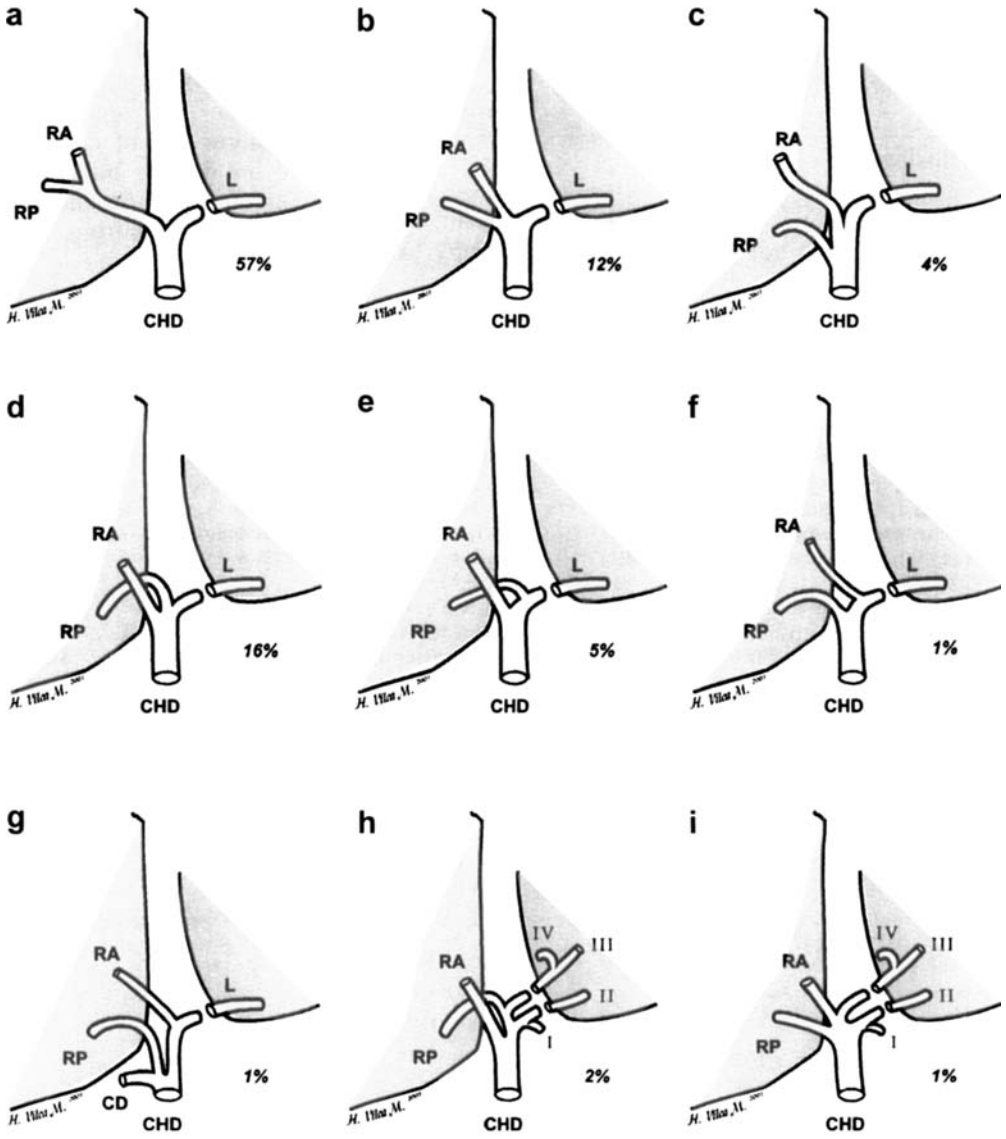

Fig. 1 The common variations of biliary anatomy [6] in relation to splitting of the liver into a left lateral segment and a right lobe graft. Variations of the common hepatic duct (*CHD*), right anterior sectoral duct (*RA*), right posterior sectoral duct (*RP*) and left hepatic duct (*L*) may occur as shown. With variations *H* and *I*, the relations of ducts from segments I–IV are shown separately

ex situ split procedure will result in two ducts in the left lateral segment graft, without any risk to the right cut surface. Cholangiograms in these patients may not identify these anomalies because of their peripheral nature. Failure to identify these anomalies during the parenchymal division will lead to ligation of the segment III duct, possibly with a cut surface bile leak, or atrophy of segment III. The leaks settle with time due to segmental atrophy and should therefore not be regarded as a contra-indication to splitting.

The segment IV duct may be responsible for bile leaks in both paediatric and adult recipients and, therefore, deserves individual mention. In the paediatric graft, the bile leaks are usually due to failure of ligation of the distal end of segment IV. Any increased pressure in the biliary system in the early post-operative period will lead to leak from the divided segment IV duct. These usually settle, with non-operative management, as the oedema at the anastomosis settles. A divided or ligated segment IV duct may also lead to bile leak in the right lobe recipient, but as segment IV is relatively ischaemic—as in most instances, it receives its portal supply from the left—it atrophies, leading to spontaneous resolution of bile leaks. Careful identification and

ligation of segment IV is essential and, at completion of the split, flushing of both ducts to identify leak points is a helpful confirmatory step.

Conclusions

Approximately 97% of potential variations in biliary anatomy should not pose technical difficulty when splitting the liver into left lateral segment and right lobe grafts, provided hilar dissection is limited and the left duct is divided adjacent to the plane of parenchymal dissection and segment IV duct is identified. In the remaining 3% of cases cholangiography may identify rare anomalies, but may not necessarily prevent bile leaks, unless these anomalies are regarded as a contra-indication to splitting.

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