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In view of the significant venous collaterals, a standard hepaticojejunostomy was not feasible. To provide a definitive surgical solution to the patient’s recurrent cholangitis and stones, an intrahepatic segment 3 bypass was therefore performed. During the operation care was taken to avoid the extensive venous collaterals in the hilar region. The location of the segment 3 portal pedicle was confirmed with intraoperative ultrasound. A wedge of liver parenchyma was resected with a cavition ultrasonic surgical aspirator (CUSA) and the segment 3 duct was identified (Figs 3 and 4). The duct was opened and flushed to clear debris (Fig. 5). A Roux-en-Y jejunal loop was anastomosed to the segment 3 duct (Figs 5 and 6), and the PTC catheter was left in situ. Histological examination of the liver confirmed ‘onion skin’ fibrosis in keeping with secondary sclerosing cholangitis.

The patient recovered uneventfully, and the biliary stents and PTC drain were removed 2 weeks after the procedure. A check cholangiogram confirmed good biliary drainage via the segment 3 duct. His jaundice resolved fully and no further episodes of cholangitis had occurred at the time of writing (after 12 months’ follow-up). His general condition has improved, and he has returned to work.

**Discussion**

Most patients with PB remain largely asymptomatic and can be managed conservatively. One-third will develop symptoms including jaundice, pruritus, biliary colic and recurrent cholangitis related to biliary obstruction. These patients warrant careful

<p>| Table 1. Classification of portal biliopathy&lt;sup&gt;6&lt;/sup&gt; |</p>
<table>
<thead>
<tr>
<th>Type</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Involvement of extrahepatic duct only</td>
</tr>
<tr>
<td>II</td>
<td>Involvement of intrahepatic ducts only</td>
</tr>
<tr>
<td>IIIa</td>
<td>Involvement of extrahepatic duct and unilateral intrahepatic ducts</td>
</tr>
<tr>
<td>IIIb</td>
<td>Involvement of extrahepatic duct and bilateral intrahepatic ducts</td>
</tr>
</tbody>
</table>

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**Fig. 1.** Magnetic resonance cholangiopancreatogram showing a stricture of the common bile duct (arrow).

**Fig. 2.** Percutaneous cholangiogram showing the common bile duct stricture. Plastic biliary stent and percutaneous cholangiogram catheter in situ (arrow).

**Fig. 3.** Left lateral segment. Area to be dissected marked with diathermy.

**Fig. 4.** Segment 3 duct identified.
investigations to plan for possible treatment strategies.[1] Initial investigations in the assessment of PB involve ultrasonography, computed tomography (in particular to assess segmental atrophy of the liver and the portal venous anatomy), and magnetic resonance imaging/MRCP to delineate the biliary anatomy. The typical cholangiographic features of PB include indentations and irregularities in the wall of the bile duct, strictures, angulations, ectasia and filling defects.[10,11]

Surgical treatment is guided by the extent of the biliary involvement as defined by the Chandra classification (Table 1). Patients with extensive biliary involvement (intra- and extrahepatic or isolated intrahepatic strictures) who are unsuitable for a biliary bypass operation can be offered a PSS, which will resolve the biliary obstruction in about 50% of cases. With type I involvement the conventional strategy is to perform a PSS first and then to follow this, if required, with a standard hepaticojejunostomy (Table 2). This treatment strategy may not be applicable in patients with cholangitis and associated gallstones, in whom urgent biliary drainage is essential. Endoscopic intervention is important in the initial management and may provide definitive management in some patients. In more severe cases where there is a combination of a significant stricture and multiple intrahepatic stones, endoscopic interventions are less successful.[12-14]

There is a paucity of data on the role of segment 3 bypass in PB, and few reports have considered this approach as part of a management algorithm. The advantages of this operation are that the risk of bleeding is minimised by the procedure being performed away from the portal hypertensive field, avoiding the need for a PSS. Also, it is the only safe surgical option in those patients with extensive portal venous thrombosis who, like our patient, are unsuitable for a PSS. It is unclear from the data on the surgical management of PB what proportion of cases would be suitable for a segment 3 bypass. In a large series, most of the patients who underwent a standard hepaticojejunostomy had type I biliary abnormalities and may have been suitable for a segment 3 bypass.[7,9,15-19] The long-term follow-up of four patients who had a segment 3 bypass showed a high incidence of recurrent stone disease between 7 and 40 months after the surgery. Biliary

<table>
<thead>
<tr>
<th>Study</th>
<th>Patients (N)</th>
<th>Intervention</th>
<th>Results</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chaudhary et al.[15]</td>
<td>9</td>
<td>Proximal splenorenal shunt (+ splenectomy)</td>
<td>Resolution of jaundice 7/9 patients (77.8%)</td>
<td>Not clear</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Persistent jaundice requiring biliary enteric</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>anastomosis 2/9 patients (22.2%)</td>
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</tr>
<tr>
<td>Vibert et al.[9]</td>
<td>10</td>
<td>Retroperitoneal splenorenal shunt with jugular vein</td>
<td>Resolution of jaundice/cholangitis/stones 4/10</td>
<td>Mean 8.2 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td>interposition</td>
<td>patients (40%)</td>
<td>(range 1.3 - 18.4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Persistent jaundice 3/10 patients (30%)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Recurrent jaundice/cholangitis/stones 3/10</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>patients (30%)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Went on to have biliary enteric anastomosis 5/10</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>patients (50%)</td>
<td></td>
</tr>
<tr>
<td>Agarwal et al.[7]</td>
<td>37</td>
<td>Proximal splenorenal shunt (+ splenectomy)</td>
<td>Resolution of jaundice 23/37 patients (62.2%)</td>
<td>Mean 32 months</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Persistent jaundice 14/37 patients (7.8%)</td>
<td>(range 5 - 129)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Went on to have biliary enteric anastomosis 13/37</td>
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<td></td>
<td></td>
<td></td>
<td>patients (35.1%)</td>
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</table>

PSS = portosystemic shunt.
clearance was facilitated by cholangioscopy via the afferent bowel loop. Three (75%) of the patients were alive and asymptomatic after a follow-up range of 8 - 9 years.9

Conclusion
Careful evaluation of the biliary anatomy and identification of stones is important when considering the best surgical procedure for patients with PB. A segment 3 bypass provides a definitive single-stage surgical procedure that allows biliary decompression and stone removal in one operation. As endoscopic techniques to control oesophageal varices have improved, the need for surgical shunts to prevent bleeding has decreased. A segment 3 bypass should be considered as an alternative procedure to a PSS in patients with PB with favourable biliary anatomy, especially in the presence of stone disease.

REFERENCES