Extracorporeal Hepatic Resection and Autotransplantation Using Temporary Portocaval Shunt Provides an Improved Solution for Conventionally Unresectable HCC

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Patient Selection and Pre-operative Evaluation

In 2011, ECHRA was performed in three patients with liver tumors at anatomically critical locations that were deemed technically impossible to resect (Fig. 1). Patient characteristics and indications for this technique are outlined in Table 1. To ensure sufficient liver function after liver resection, we estimated pre- and post-operative liver volumes using 3-D computed tomography volumetry. Indocyanine green (ICG) test was performed in selected patients. None of the patients showed evidence of portal hypertension.

Surgery

ECHRA was performed as described previously with minor modifications [6]. Unlike previous reports, we employed temporary portocaval shunt during the anhepatic period (Fig. 2). In patients with tumor-invaded major vasculature, the vessel wall was pared and reconstruction with a venous patch harvested from the explanted liver (Fig. 3). Details of the surgery are given in Table 2. The affected segments of liver were resected after total hepartectomy and the autograft was re-implanted orthotopically. Pathology evaluation confirmed all three tumors to be HCC.

Results and Outcome

The outcomes are outlined in Table 3. Patient 3 had major complications included postoperative biliary leakage and intra-abdominal abscess, which were treated with endoscopic retrograde cholangiopancreatography and surgical drainage of the abscess, respectively. There was no hospital mortality.

Two of the three patients experienced tumor recurrence 8 months after the operation. Patient 2 was treated with radiofrequency ablation while the other was treated by transarterial chemoembolization. All patients are currently alive with stable disease at the most recent follow-up.
To date, the only large series involving ECHRA was reported by Oldhafer et al. [7]. The difficulty of the surgical technique and the high perioperative and postoperative morbidity impede surgeons from using this procedure. We are the first institution to use preoperative liver volumetry to prevent postoperative hepatic failure, the most serious
complication. The preoperative evidence of preserved liver function and without liver cirrhosis or portal hypertension were other determinants for a good outcome. The three patients did well after the operation. In the literature reporting patients with HCC receiving ECRHA, our first patient had the longest survival [5, 7].

Unlike other studies, we used a temporary portocaval shunt instead of venovenous bypass to facilitate hemodynamic stability during the anhepatic period. Temporary portocaval shunts have been shown to improve hemodynamic status, reduce requirement of intraoperative blood transfusion, and preserve renal function during orthotopic liver transplantation [8]; however, it has not been reported to be used in ECRHA. We believed that the relatively short cold ischemic time and preservation of the inferior vena cava enhanced the functionality of the temporary portocaval shunt during the anhepatic period.

Table 2 Operation characteristics

| Operation (OP) details | Patient 1 | Patient 2 | Patient 3 |
|------------------------|-----------|-----------|-----------|
| Replanted graft segments | S 2, 3, and partial S 4 | S 5–8 | S 2, 3, and S 6, 7 |
| Graft weight (g)       | 440       | 696       | 961       |
| Blood loss (ml)        | 1,500     | 5,300     | 7,000     |
| Cold ischemic time (min) | 120     | 202       | 162       |
| Warm ischemic time (min) | 40       | 14        | 43        |

Table 3 Postoperative data

| Post-op data | Patient 1 | Patient 2 | Patient 3 |
|--------------|-----------|-----------|-----------|
| ICU days (days) | 8         | 7         | 8         |
| Length of stay (days) | 30        | 22        | 39        |
| Ishak score | 3         | 3         | 4         |
| Metavir fibrosis score | F2       | F2        | F3        |
| Post-op complication | 1. Sepsis | 1. Sepsis | 1. Sepsis |
|                        | 2. Transient hepatic insufficiency | 2. Transient hepatic insufficiency | 3. Biliary leakage |
|                        | 4. Intra-abdominal abscess | | 4. Intra-abdominal abscess |
| Intervention | None      | None      | ERCP for biliary leakage |
| Reoperation | None      | None      | Laparotomy for drainage of abscess |
| Long-term follow-up | | | |
| Recurrence | None      | In post-op 8 month | In post-op 8 month |
| Management for recurrence | None | RFA | TACE |
| Current status | Alive (28 months) | Alive (26 months) | Alive (23 months) |

*RFA* radiofrequency ablation, *TACE* transarterial chemoembolization

a Alive until May, 2013

![Fig. 3](image_url) **a** Large HCC compressing the juncture of left hepatic vein and IVC. **b** Part of the IVC wall was excised and repaired with a venous patch (arrow). **c** Unification of V7 and right hepatic vein, which was later widened with a venous patch.
Conclusions

ECHRA represents an additional surgical option in the treatment of unresectable hepatic tumors, including HCC. In addition, the use of a temporary portocaval shunt is a feasible alternative to venovenous bypass during the anhepatic period.

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