How to Avoid Postoperative Liver Failure: A Novel Method

Eduardo de Santibañes, Fernando A. Alvarez & Victoria Ardiles
Your article is protected by copyright and all rights are held exclusively by Société Internationale de Chirurgie. This e-offprint is for personal use only and shall not be self-archived in electronic repositories. If you wish to self-archive your work, please use the accepted author’s version for posting to your own website or your institution’s repository. You may further deposit the accepted author’s version on a funder’s repository at a funder’s request, provided it is not made publicly available until 12 months after publication.
How to Avoid Postoperative Liver Failure: A Novel Method

Eduardo de Santibañes · Fernando A. Alvarez · Victoria Ardiles

Published online: 2 November 2011
© Société Internationale de Chirurgie 2011

Abstract

Background Postoperative liver failure (PLF) is the most feared and severe complication after extensive liver resections.

Methods We present an innovative surgical technique that has been employed for the treatment of three patients (two with multiple colorectal liver metastases and one with hilar cholangiocarcinoma) whose livers were previously considered locally unresectable because of an insufficient future liver remnant (FLR). In-situ liver transection with right portal vein ligation was implemented.

Results Six days after surgery a volumetric computed tomography (CT)-scan showed 40–80% hypertrophy of the FLR. The patients then underwent a completion surgery with right hepatectomy or right trisectionectomy. None of the patients developed PLF during a mean hospital stay of 16 days. After a mean follow-up of two months, the three of them are free of disease.

Conclusions This technique induced rapid growth of the FLR, greater than that reported with portal vein occlusion alone. It represents a promising advance in oncological liver surgery that readresses the current management of patients with primarily unresectable liver disease. Such a revolutionary strategy allows a two-stage surgical approach during a single hospital stay and without PLF. However, further research is needed to determine the long-term outcomes of this technique and to explain the occurrence of such enhanced liver regeneration.

Introduction

Despite recent advances in chemotherapy regimens, resection with curative intent remains the only choice for long-term survival in patients with malignant liver tumors [1, 2]. Usually, extended liver resections are required to accomplish tumor-free surgical margins [3]. Postoperative liver failure (PLF) is the most feared and severe complication, especially in patients with previous liver disease or toxicity secondary to modern chemotherapy, in whom mortality rates are as high as 32% [3, 4]. Avoiding this lethal complication remains a challenge for hepatobiliary surgeons. The estimated future liver remnant (FLR) volume to prevent PLF should be at least 25% of total liver volume in healthy livers and 40% in diseased livers. The induction of liver hypertrophy by preoperative portal vein occlusion (PVO) is the most widely used and effective tool to prevent PLF allowing a FLR growth of up to 20–35% in 45 days [5]. However, sufficient hypertrophy of the FLR is not always achieved, and there is still concern about the potential for simultaneous and faster growth of the tumor during the period prior to resection [5–8]. Moreover, in the case of hilar cholangiocarcinoma (hilar CC), PVO predetermines the resection side, creating a difficult surgical scenario if the embolized side does not match the intraoperative findings.

We present a novel surgical technique developed by Baumgart et al. [9] that allowed us to carry out an oncological resection in patients with primary and secondary liver tumors by increasing the FLR volume.

Material and methods

The surgery was performed in three patients, two with multiple colorectal liver metastases and one with hilar CC,
whose livers were previously considered locally unresectable because of insufficient FRL volume. Liver volumetry was preoperatively assessed in all patients by a virtual model built on a computed tomography (CT)-scan examination. The patients underwent a two-stage hepatectomy. During the first surgery in-situ liver transection and right portal vein ligation were implemented (Fig. 1). After 6 days from surgery, all patients underwent a volumetric CT-scan examination to determine the FLR volume. Likewise, the postoperative liver function volume was calculated from the measurement of total uptake of 99mTc-HIDA (dimethyl iminodiacetic acid) between 150 and 350 seconds after intravenous injection. If the resulting FLR volume was considered sufficient to overcome a major liver resection, a completion surgery was performed.

Results

All patients underwent the first surgery without complications and had an uneventful recovery. Six days after surgery the volumetric CT-scan evidenced more than 40–80% hypertrophy of the FLR volume, which was correlated with its functioning volume by liver scintigraphy (Fig. 2). On postoperative day 7, the patients underwent a right hepatectomy or right trisectionectomy. During their hospital stay, none of the patients developed PLF. Postoperative outcomes are detailed in Table 1. To date, after a mean...
follow-up of two months, all three of the patients are free of disease.

**Discussion**

Postoperative liver failure is the main cause of death after extensive liver resections. The presented technique prevented PLF by inducing rapid growth of the FLR (up to 80% in only 6 days), which is remarkably greater than that reported by PVO alone [5]. One possible explanation for this phenomenon might be the in-situ liver transection, which causes disruption of intrahepatic portal collaterals, allowing increased portal flow deprivation to the excluded segments and redistribution of hepatotropic factors [3, 10]. Despite the fact that the excluded liver does not have any portal blood flow, it acts as an auxiliary liver that contributes to the total liver function until the contralateral lobe has grown enough to tolerate the organ’s physiological function. This is the first report of this novel approach applied in the management of hilar CC.

Even though this procedure was feasible and safe in our practice, it is technically complex and should be undertaken only by experienced hepatobiliary surgeons in a high-volume center and by means of a multidisciplinary team effort.

In our opinion, this procedure represents one of the most important and promising advances in oncological liver surgery over the last decade. This revolutionary therapeutic strategy allows a complete resection (R0) in patients with locally advanced liver disease previously declared unresectable. This resection was achieved by means of a two-stage surgical approach during a single hospital stay and without PLF. This technique readdresses the current management of locally advanced liver malignancies and opens a new chapter in the history of liver surgery. However, further research is needed to determine the long-term outcomes of this technique and to explain such enhanced liver regeneration.

**Conflict of interest** The authors declare no conflicts of interest associated with the publication of this manuscript.

**References**