Ex vivo liver resection for liver tumors: Last resort when conventional technique is not applicable

Danilo Coco 1,* and Silvana Leanza 2

1 Department of General Surgery, Ospedali Riuniti Marche Nord, Pesaro, Italy.
2 Department of General Surgery, Carlo Urbani Hospital, Jesi (Ancona), Italy.

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Abstract

Purpose: The treatment of hepatic neoplasms has undergone, in recent years, various evolution of the surgical technique and extension to the indication for resection. Many patients with liver tumors cannot benefit from resection due to the difficulty of the anatomical site of the lesion. Of these patients, only some can benefit from ex vivo hepatic resection, which consists of a complete hepatectomy, bench tumor resection and self-transplant.

Materials and methods: We have retrospectively evaluated PUBMED databases. Studies was evaluated from 2010 to 2020. Only very few studies analyzed "Ex situ liver resection", "Extracorporeal liver resection", "Liver auto-transplantation".

Conclusion: Ex vivo liver resection and autotransplantation is feasible in very few patients with unresectable hepatic tumor fit for surgery. R0 resection accounts about 60%-90% but outcomes are less satisfactory due to high complications rate of about 25% and low survival in 3 years.

Keywords: Ex situ liver resection; Extracorporeal liver resection; Liver auto-transplantation

1. Introduction

Primary liver malignancies such as HepatoCellular Carcinoma (HCC), CholangioCarcinoma (CC) and secondary tumors such as Colo-Rectal Liver Metastases (CRLM) are the most common neoplasms in the liver. R0 resection can achieve 30%-50% of 5 year median survival while R1-2 resection achieves only 7%.(1). However, some hepatic tumors are considered unresectable because of large size or for involving Retro-hepatic Inferior Vena Cava (RIHV) or Hepato-caval Confluence (HC) or because liver can safely tolerate total vascular occlusion for only about 60–90 min (2). By Ex vivo Liver Resection and Autotransplantation (EVL RAT) we mean the removal of the liver from the abdominal cavity, the subsequent resection of the tumor lesion on the table in cold ischemia and the subsequent reimplantation of the same organ deprived of the tumor. As early as 1988, Pichlmayr (3) and colleagues made the first attempt. This technique allows the surgeon to have yet another liver resection technique, to be able to access sections of the liver that are difficult to access, to be able to resect the neoplasm better, to operate in a bloodless operating field, to reconstruct the vessels and to avoid a hot ischemia harmful to the liver (4). However, this technique is not used frequently due to the fact that advanced tumors near or involving vascular structures have a poor prognosis, due to the fact that it is an extremely complex technique and, last but not least, that it has a high morbidity and mortality (2,4,5,6,7,8,9). Actually, does not exit an well-stabilish guidelines. The ideal fit patient is the patient suffers of benign tumor or low-grade tumor, huge tumor, tumor near vital structures such as hepatic artery or vena cava or hepatic veins and a patient who can achieves long-term survival.

* Corresponding author: Danilo Coco MD
Department of General Surgery, Ospedali Riuniti Marche Nord, Pesaro, (Italy).

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2. Methods

We have retrospectively evaluated PUBMED databases. Studies was evaluated from 2000 to 2020. Only very few studies analyzed a “Ex vivo liver resection”. Two independent research DC and SL performed the review. The search terms were identified with medical subject heading (MeSH). Research inclusion criteria were “Ex vivo liver resection”,“Ex situ liver resection”,“extracorporeal liver resection”,“liver autotransplantation”. The outcomes were complete were indications, operative time, blood loss, morbidity, and mortality. We exclude all manuscript abstract and non-English manuscript. After rejecting review articles and repetitive reports, the relevant literature included 9 manuscripts.

3. Results

Zawistowski et al.(10) analyzed fifty-three studies with total 244 patients through a Meta-analysis. The study revealed R0 resection rate was achieved in 93% of cases with major surgical complications of 25%, a 30-day mortality of 10%, 90-day mortality rate was 12% for malignant tumors versus 8% in benign tumors and a 1-year survival of 79%. In particular post-operative 1 year survival was 65% for malignant tumors and 90% for benign tumors. Cheng et al.(11) describes EVLRAT in 43 patients suffering from HepatoCarcinoma and Cholangiocarcinoma (HCC/CCC). They demonstrated some notes: duration operative time 8 hours, blood loss about 1500 cc, anhepatic time high of 250 minutes, mortality rate of 20% 9/43 patients. Aji et al.(12) analyzed 69 cases of EVLRT for echinococcosis demonstrated similar operative time and blood loss but a better 30 day and 90 day mortality respectively of 7% and 11% and 1 year survival rate of 87% of patients, showing a better prognosis and utility of this techniques for non-malignant liver tumors. Applying EVLRAT for alveolar Echinococcosis, Beldi et al.(13) noted that the survival rate in the group of autotransplantation was greater than those who underwent allotransplantation. Boggi et al.(14) applied the ex situ technique repair in a patient with severe liver trauma in such an emergency situation. Hemming et al. Yang et al. and Mo et al. (15, 16, 17) used a temporary portacaval shunt avoiding an extracorporeal veno-venous bypass. Sugimachi K et al.(18) described the resection of a huge HCC of 18 cm involved IVC and RHC in a young patient. Oldhafer et al.(19) described 22 cases of EVLRAT 22 colorectal metastases (n = 9), leiomyosarcoma (n = 3), hepatocellular carcinoma (n = 2), cholangiocellular carcinoma (n = 2), Klatskin tumors (n = 4), focal nodular hyperplasia (n = 2) with in mortality rate of 6/22. Lodge et al.(20) EVLRT for 4 cases of colorectal metastases with 1/4 in mortality while Lechaux and Chui et al.(21, 22) demonstrated no mortality after EVLRAT after hilar cholangiocarcinoma resections, Ikegami et al.(23) published a case of resection of hemangiomas with no mortality.

4. Discussion

Liver resections have had, over time, a rapid improvement in technique, technical means and survival. However, some primary or secondary tumors of the liver are difficult to remove due to their location and size. These include those involving the infrahepatic vena cava and those of the hepatocaval junction. Ex Vivo Liver Resection and Auto-Transplantation (EVLRAT) is a challenging procedure in patients with hepatic tumors in whom is not possible classical liver resection. This technique consists in total hepatectomy, liver back-table resection and then autotransplantation. This procedure seems to achieve an 1 year survival rate of 82%, R0 resection in 98% of cases but has many complications, high peri-operative mortality about 9% especially for EVRAT for malignant tumors. As reviewed in the literature, it can be applied for malignant tumors such as HCC, CCC, CRLM but also for benign diseases such as Alveolar Echinococcosis (AE) or Hemangiomas (H). EVLRAT has many advantages: the back-table resection facilitates the chances of obtaining R0 resection; gives the chances to reconstruction of blood vessels; it is not a time-consuming technique respect to conventional surgery when warm ischemia time is present; autotransplantation avoid problems of transplant surgery (5, 24, 25, 26, 27, 28). EVLRAT permits to use radiotherapy in ex situ liver avoiding radiotherapy complications in abdomen (7) and it seems to have less cost comparing it with allotransplantation (28). EVLRAT needs of transplantation team, complex anesthesia and a multidisciplinary approach. It is reserved to fit for surgery patients with non-cirrhotic liver, normal liver functions and unresectable tumors with conventional resection and it represents the last chance when other types of techniques failure. Correct indications are large tumors, risk hemorrhage of in situ resection, risk of liver failure for a prolonged warm ischemia, tumors in difficult anatomic locations such as infiltration of retro-hepatic inferior vena cava or hepatic vein or hepato-caval confluence or large tumors near biliary structures (2, 5, 6, 7, 8). Analyzing the review of literature results, we can notice that: segment resection were from 1 segment to six segments; operative time was between 7h-19h; anhepatic phase had a time between 168-384 min and the main complications were bleeding, liver failure and portal thrombosis.
5. Conclusion
Ex vivo liver resection and autotransplantation (EVLRAT) is feasible but very complex technique. It can apply in few patients with unresectable hepatic tumor fit for surgery, benign tumor or malignant low-grade tumor with long term survival with R0 resection about 60%-90% but outcomes are less satisfactory due to high complications rate of about 25% and low survival in 3 years. EVLRAT may offers a last resort when conventional technique is not applicable (2,4,5,6,7,8,9). In patients with no curative prospect and a life expectancy, this procedure may improve curative surgery and the patient’s quality of life (29,30).

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare no competing interests.

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