

Exploring Ex Vivo Liver Resection: A Comprehensive Study of 173 Patients

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Abstract

Objective: This study aims to explore the efficaciousness and potential problems of auto-transplantation and ex vivo liver resection as novel therapeutic approaches for liver cancers. A thorough grasp of the gender distribution, tumor types, repaired segments, and difficulties associated with this alternative technique are the main goals of the research.

Methods: A retrospective analysis was performed on a cohort of 173 patients who, between 2010 and the present, had auto-transplantation and ex vivo liver resection at the first affiliated hospital of Xinjiang Medical University. The study's main subjects were the distribution of genders, types of tumors, reconstructive techniques, and the incidence of complications. Pertinent data were gathered and statistically examined to evaluate the frequency of difficulties and ascertain the significance of the reconstructed segments.

Result: The findings show a significant gender gap among the patients, with men making up the majority (77%). Of all the tumor types, biliary tract cancer was the most common (57%). The reconstruction techniques demonstrated different levels of importance, and the corresponding p-values highlighted the statistical significance. The identification of complications such as biliary leakage, stomach infections, and Clavien-Dindo Grade IIIa or higher shed light on the difficulties this treatment strategy faces.

Conclusion: Particularly in cases of biliary system cancer, ex vivo liver resection, and auto-transplantation offer promising results for the treatment of liver cancers. The research emphasizes the significance of managing side effects, such as infection and biliary leakage, to maximize the security and effectiveness of this novel treatment strategy. More research and developments are required to improve patient outcomes and optimize the procedure.

Keywords: Complications, New Treatment, Surgery, Cirrhosis, Infection

I. Introduction

The first line of treatment for liver cancers is surgery. Regretfully, not every patient can benefit from a traditional liver resection. 70% of patients receive an advanced diagnosis and forfeit the chance for surgical treatment due to the occult nature of liver cancer. Furthermore, some tumors are very difficult to remove because of their anatomical placement, which can result in serious bleeding. Examples of these locations include the central posterior area, the junction of major blood veins, and bile ducts. The label "non-resectable" was applied to this liver tumors¹⁻². Ex vivo liver resection and auto-transplantation (ELRA) are the result of advancements in surgical procedures, including total hepatic vascular blockage, porta-caval shunting, extracorporeal hepatectomy, and liver transplantation. This method is seen to be a good way to address the issues raised above and to give these liver cancers the chance to receive radical treatment (R0)³⁻⁶. Even with the tremendous advancements in chemotherapy over the past few years, only 4–6% of patients are expected to get a complete response, and its effect on survival rates is still unclear⁷⁻⁸. Many groups continue to offer criteria of unrepeatability in the aforementioned conditions, even though chemotherapy therapies enable a higher number of patients to be saved via liver surgery. Ex-situ surgery is removing organs whole, resecting and rebuilding them outside of the body in cold preservation, and then re-implanting the undamaged organ. Because of the complications associated with this technique, the need for precise and narrow patient selection criteria, the requirement for highly qualified surgeons, and the level of experience required for liver transplantation, ex-situ liver resection, and auto-transplantation have not been more successful than other surgical techniques. Advancements in surgical methods have addressed certain shortcomings of previous approaches, permitting the removal of progressively complex tumors and the restoration of blood vessels⁹⁻¹⁰.

II. Methodology

A retrospective investigation was conducted involving 173 patients who underwent ex vivo liver resection and auto-transplantation at the first affiliated hospital of Xinjiang Medical University between 2010 and the present. The primary objectives included examining the distribution of genders, different tumor types, reconstructive procedures, and the frequency of problems associated with this surgical strategy.

Inclusion Criteria

1. Patients who underwent ex vivo liver resection and auto-transplantation at the first affiliated hospital of Xinjiang Medical University between 2010 and the present.
2. Availability of complete and adequate data for analysis.

Exclusion Criteria

1. Cases with inadequate or missing data related to ex vivo liver resection and auto-transplantation.
2. Patients who did not meet the criteria for undergoing ex vivo liver resection and auto-transplantation.

The stringent inclusion and exclusion criteria were implemented to ensure a comprehensive analysis of the results and challenges associated with ex vivo liver resection and auto-transplantation.

Statistical analysis was employed to evaluate the frequency of surgical complications and ascertain the significance of the repaired liver segments. The focus was on understanding therapy outcomes, identifying obstacles or difficulties, and providing new insights into the advantages and disadvantages of auto-transplantation in the treatment of liver cancers. A thorough examination of the repaired segments aimed to contribute valuable information to the field.

III. Results

The results of the study on ex vivo liver resection involving 173 patients revealed notable findings:

Gender Distribution: The study demonstrated an overrepresentation of males (77%), with an overall positive outcome observed in 60% of cases (Tab. 1).

Table 1: Gender with percentages

Gender	Total Patients	Outcome (%)
Female	40 (23%)	60%
Male	133 (77%)	60%

Reconstruction and Removed Segments: Various reconstruction techniques were employed, with associated p-values indicating the significance of each approach. This included the evaluation of segments removed and corresponding reconstruction methods (Tab. 2).

Table 2: Reconstruction with removed segments details

Removed segments	Reconstruction	p-value
I, II, III, IV	MHV, IVC	0.51
V, III	IVC	0.4
V, VIII	IVC	0.2
I, V, VI, VI	RHA	0.0
VI, VIII	RHV	0.3
II, VIII	PV	0.56
Partial VI b, v	PV, RHA	0.63

Types of Tumors: Biliary tract cancer was the most prevalent (57%), followed by metastases from colonic carcinoma (27%) and small bowel stromal tumors (16%) (Tab. 3).

Table 3: Type of tumors

Type	Percentages
Biliary tract cancer	57%
Metastatic from colonic carcinoma	27%
Metastatic from Mall Bowl stromal tumor	16%

Complications: Noteworthy complications included abdominal infection (10%), hepatic dysfunction (1.4%), biliary leakage (27%), and IVC stenosis (8.6%). Clavien-Dindo Grade IIb or lower complications were reported in 24% of cases, while Grade IIIa or higher complications occurred in 15% of patients (Tab. 4).

Table 4: Complications

Complications	Percentages 40%/n=69
Abdominal infection	7(10%)
Hepatic dysfunction	1 (1.4%)
Biliary leakage	19 (27%)
IVC stenosis	6 (8.6%)
IVC stenosis	8 (12%)
Clavien-Dindo Grade IIb or lower	17 (24%)
Clavien-Dindo Grade IIIa or higher	11 (15%)



The gender breakdown revealed an overrepresentation of males (77%), with 60% of patients experiencing a positive outcome. Various reconstruction techniques and their corresponding p-values were outlined. Biliary tract cancer constituted the majority of cases (57%), followed by metastases from colonic carcinoma (27%) and small bowel stromal tumors (16%). Complications, including abdominal infection, biliary leakage, and varying degrees of Clavien-Dindo grades, were reported, providing a comprehensive overview of the complexities and outcomes associated with ex vivo liver resection and auto-transplantation.

IV. Discussion

The breakdown of patients by gender, with 133 men (77%), and 40 women (23%) making up the total. The reported result percentage for both genders is 60%. Roman numerals are used to classify the deleted segments, and the reconstruction techniques are shown. Every reconstruction strategy for the RHIVC is evaluated separately based on the preoperative assessment and the intraoperative reevaluation of the vascular defect. When the RHIVC defect was smaller than 180° of the lumen circumferences following radical excision of the lesion, our center employed the mending and reconstructing procedure. This pattern's hepatic phase and average operating time were comparatively longer than those of the other two techniques, which was explained by the intricacy and diversity of this strategy. Ten patients had RHIVC stenosis; only one of them experienced lower limb edema, and following balloon dilation, the symptoms went away. Meanwhile, the remaining nine patients showed no clinical signs¹¹⁻¹³. The statistical importance of the reconstruction techniques is shown by the p-values corresponding to each reconstruction category. The majority of instances (57%) are related to biliary tract cancer; with colonic carcinoma (27%) and small intestinal stromal tumors (16%) being the next most common metastatic cancers. Although the degree of vascular invasion is a crucial factor in determining the reconstruction technique, there is an ongoing debate about whether patients with sufficient collateral circulation need to have the IVC rebuilt. Blair et al. suggested that after collateral circulation was established, excision without reconstruction should be carried out

for low-grade retroperitoneal sarcoma. Furthermore, six patients with hepatic cancer had IVC resection without repair, according to Hardwigse et al¹⁴⁻¹⁵. explores the issues found, providing percentages derived from 69 examples in total. explores the complications seen, using percentages derived from 69 cases in total. 10% of patients have an abdominal infection, 1.4% have hepatic dysfunction, 27% have biliary leakage, 8.6% have IVC stenosis, and additional problems, such as Clavien-Dindo Grade IIb or lower (24%) and Grade IIIa or above (15%), are reported. This thorough data presentation provides information on gender distribution, reconstructive techniques, tumor kinds, and problems related to the study participants. Raising the R0 resect ability and maximizing the preservation of the remaining liver volume are two benefits of more exact extracorporeal resection of ELRA. Regardless of the duration of ischemia, in situ vascular repairs spare the patient from a lengthy and dangerous conventional hepatectomy. The combined efforts of the participating disciplines—intensive care, surgery, anesthesiology, oncology, and hepatology—will propel ELRA forward. More research is still needed to fully understand the long-term consequences and clinical improvement of ELRA¹⁶⁻²⁰.

V. Conclusion

The intricacies and achievements of this alternative therapy for liver cancers are illuminated by our retrospective examination of 173 individuals who had ex vivo liver resection and auto-transplantation. Males were overrepresented in the gender distribution, and the most common tumor types were large bowel stromal tumors, colonic carcinoma metastases, and biliary tract cancer. The multiple reconstruction methods demonstrated how adaptable the process is to handling various situations. Although there were complications, they were treated to differing degrees of severity. This work adds significant insights to the changing field of liver cancer treatment by offering a thorough review of the results, difficulties, and nuances related to ex vivo liver resection and auto-transplantation.

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