



REVIEW HEPATOLOGY

## Hepatic Vein and Inferior Vena Cava Reconstruction during Hepatic Surgery Resection for Cancer

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### Abstract

Invasion of tumor in the liver requires surgical interventions that may reduce the effects or may eliminate the tumor-affected cells. The renewal of the hepatic vein and inferior vena cava has enabled most specialized oncologists and medical specialists to use advanced diagnostic methods in the treatment of the liver tumors. Liver resection has prolonged the lives of many patients and the invention of live donor organ transplants has effectively enabled the use of liver resection in most cancer centers across the world. By reviewing data from 10 articles, 21 surgical analyses were investigated and analyzed for the risks involved in the applications of reconstructions of hepatic vein and inferior vena cava in the surgical liver resection. The postoperative complications and the indications of reconstructions were mentioned. The results indicated that with these surgical procedures, complications are still involved but may be successful for particular patients.

*Keywords:* cancer/tumor; hepatic surgery; hepatic vein; inferior vena cava; liver resection; reconstruction

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### Introduction

The existence of malignant tumor attacking the hepatic vein and the inferior vena cava has presented a challenging impact in the surgical treatment of cancer patients. Various reports have indicated successful excision of the hepatic vein and inferior vena cava through man-made vessels (1). Successful excision of these tumors at advanced stages via reconstruction during hepatic surgery resection has been invariably reported. Reconstruction of hepatic vein and inferior vena cava to treat liver cancer is not necessarily the only available effective surgical therapeutic method, therefore it must be selected in exceptional cases of cancer treatment (2). This article tends to investigate through a literature search,

the cases regarding the successful operation of hepatic vein and inferior vena cava reconstruction during the hepatic surgery resection in patients with liver cancer.

### Materials and Methods

Materials used are the previously published articles which report cases of hepatic resection surgery of patients with liver tumors in combination with hepatic vein and inferior vena cava reconstruction. The particular searches were mostly based on an article published by the National Center for Biotechnology Information. The titles used to search in various search engines and sites were, “hepatic vein reconstruction,” “inferior vena cava reconstruction,” “hepatic

surgery resection,” “liver resection,” or “liver tumor correction.” Exclusion criteria were applied to the entire articles that were not published in English, those with duplicate information, and those with surgical therapeutic procedures that did not involve hepatic vein/inferior vena cava reconstruction or liver/hepatic resection. The remaining articles were then assessed based on their relevance to the title of the discussion. Thus, hepatic vein and inferior vena cava reconstruction in hepatic surgery resection on patients with hepatic tumors were extracted from the final selected articles. The indications of hepatic vein and inferior vena cava reconstruction and the results after restoration were also investigated.

## Results

In the inclusion criteria after the literature search, only 10 articles met the required standards to be included in the study. These articles have been included as the referencing section and a total of 21 cases were involved. The patients with liver cancer who underwent hepatic resection were as follows: the number of testicular tumor was four, leiomyosarcomas were two, metastatic liver tumor of the colon were two, hepatoblastoma were two, cholangiocarcinoma was one, and the other 10 had other types of cancer. Eleven of the total number presented prevailing conditions of liver cirrhosis while the rest were presented without liver cirrhosis (1, 3–5). Surgical procedures were examined based on cancer grade and liver function in the research studies. The type of hepatic resection was based on the hepatic vein and inferior vena cava reconstruction, that is, where the small involvement primary repair was considered, and also the effect of liver cirrhosis on the hepatic reconstruction. Primary hepatic resection involved includes hepatectomy, nephrectomy, retroperitoneal tumor extirpation, lymph node dissection, and right trisegmentectomy. Indications of postoperative reconstructions were also mentioned. Postoperative complications were reported and risks of cirrhosis during therapeutic surgical intervention were also reported (6). Causes of operative mortality were identified with most of them being a liver failure, rejection of the grafted organ, bleeding, and multiple organ failure were observed. Most of the resected cases had longer periods of survival after the hepatic resection.

## Discussion

Most articles showed that traditionally, resections of liver cancers targeting the hepatic veins and inferior vena cava were thought to be impossible before the invention of organ transplantations (5). In contemporary period, there has been a rising application of hepatic vein and inferior vena cava reconstruction in hepatic surgical resection for advanced liver cancer as a result of the long-term poor prognosis and risks involved (4). This has been made possible due to the

advances in liver surgery that has enabled live liver donor transplantation in some cases. This has increased the survival rate of most liver cancer patients and has reduced the mortality rates during pre- and postoperative care (7). Liver resection in a patient with cirrhosis present a higher rate of operative mortality as compared to those without liver cirrhosis because of inadequate hepatocellular reserves that lead to liver failure. Thus, maintaining the active liver mass during resection operative procedure in patients with liver cirrhosis is very important (8). Tumor cells situated on the right lobe of the liver superior segments need resection of the hepatic vein by removing the lesser segments that are tumor-free. In patients without liver cirrhosis, that is, where the hepatic vein functions normally, these inferior segments can be included in the resection during right hepatectomy to involve the middle hepatic vein where necessary, while in patient with cirrhosis, they are preserved if they are tumor-free (9). This still needs the reconstruction of the venous outflow to hold the required hepatic function. The withdrawal of normal liver function as a result of impaired venous outflow, especially in the cirrhotic patient, presents a risk during a surgical procedure as a result of continuous bleeding from the cut wound (10).

The evaluation of the type and the spread of a tumor into the inferior vena cava is very important, and has been made better by the availability of the advanced and reliable imaging methods, with a multidetector computed tomography reporting 78% sensitivity and 96% specificity (3). Malignant tumors that invade the inferior vena cava are mostly renal cell cancer cells, and hence can be excisional by thrombectomy techniques or removal of tumor affected cells with an artificial vessel. Other advanced tumors like the testicular tumors and leiomyosarcomas which attacks the walls of the inferior vena cava as well as the hepatic vein require total excision of inferior vena cava or hepatic vein during the tumor resection as a method of total control (6). In this study, two patients were reported to have severe stenosis and developed a deep vein thrombosis after radical resection of the inferior vena cava resulting in venous complications such as edema of the limbs.

Therefore, replacement of these inferior vena cava should be for the benefit of the patient (8).

The necessity for the graft material to be used in the reconstruction of hepatic vein or inferior vena cava should be limited based on the underlying risk factors and the degree of postoperative complications. This involvement of hepatic vein and inferior vena cava allows the excellent access of reconstruction for implantation, thereby allowing the liver to function normally by rotating to the surface of the operative field (10, 11). The applications of liver resection techniques and reconstructions of both inferior vena cava and hepatic vein promote the role of the liver in resection and is beneficial to some particular patients, thus requiring specialized centers with specialized medical personnel to administer (2).

In conclusion, the availability of innovative surgical techniques that promotes the applications and usability of extensive hepatic vein and inferior vena cava reconstruction in liver resection, surgical death, and postoperative complications remains at significant levels.

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