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Ventral approach for resecting hepatocellular carcinoma in the caval portion of the caudate lobe

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ABSTRACT

Background. Resection of hepatocellular carcinoma located in the caudate lobe is challenging because this anatomical location is difficult to approach, especially the caval portion.
Methods. We performed resection of the caval portion of the caudate lobe using a ventral approach combined with the resection of segment IV, VII, or VIII for hepatocellular carcinoma in 41 patients (extended segmentectomy group). As a control group, 138 patients with hepatocellular carcinoma who underwent segmentectomy for IV, VII, or VIII (segmentectomy group) were studied. We compared surgical outcomes, including postoperative morbidity and survival, between the 2 groups.
Results. When compared with the segmentectomy group, platelet count was lower (12.8×10^4/μL [range, 2.4–33.8] vs 14.8×10^4/μL [3.2–41.4], $P = .085$), operation time was significantly longer (442 minutes [range, 184–710] vs 333 minutes [131–810], $P < .001$), blood loss was significantly greater (579 mL [range, 25–2688] vs 301 mL [10–3887], $P = .001$), and the percentage of patients with cirrhosis was greater (19 [46.3%] vs 41 [29.7%], $P = .059$) in the extended segmentectomy group. However, the morbidity rate (48.7% and 33.3%, $P = .096$) and median overall survival period (5.2 years; [95% confidence interval, 4.6–6.6] vs 6.2 years, [5.4–9.7], $P = .203$) were not significantly different between the 2 groups.
Conclusion. The ventral approach for the resection of hepatocellular carcinoma in the caval portion of the caudate lobe is a viable alternative to other approaches, especially in patients with insufficient liver function.

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Introduction

The caudate lobe of the liver is composed of the liver parenchyma surrounded by the 3 major hepatic veins, the hepatic hilum, and the inferior vena cava (IVC). The caudate lobe consists of 3 portions: Spiegel's portion, process portion, and caval portion.[1,2] Tumors in Spiegel's portion or the process portion can be removed using limited resection. However, it can be challenging to reach tumors located deep in the caval portion with close attachments to the hepatic hilum, hepatic veins, and IVC, especially in patients with cirrhosis. Right hepatectomy is usually used to remove tumors in the caval portion in patients with acceptable liver function to avoid the risk of massive bleeding during surgery.[3]

Most patients with hepatocellular carcinoma (HCC) have chronic liver disease. Therefore, some patients with HCC are not candidates for major liver resection. Consequently, different approaches to isolated caudate lobe resection have been reported to improve curability rates.[4,5] High dorsal resection (Takayama's procedure) involves the complete removal of the caudate lobe by digging from the caudal side without dissecting the remaining liver parenchyma.[5] This procedure is complex and technically demanding.[5,6] In contrast, during isolated caudate lobectomy via the transhepatic and anterior approaches, the caudate lobe is accessed by separating the liver parenchyma along the interlobar plane, providing a good surgical field.[4,7] However, when performing transection of the liver parenchyma using the anterior approach, transection of a large area of the liver is inevitable.

In this study, we investigated the use of the ventral approach for HCCs located in the caval portion of the caudate lobe. To demonstrate the viability of this procedure, we compared the surgical outcomes to those following standard segmentectomy.

Methods

Patients

Patients who underwent resection for HCCs at Nihon University Itabashi Hospital, Tokyo, Japan, between 2000 and 2016 were enrolled. Among these patients, we included those who

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underwent resection of the caval portion of the caudate lobe using the "ventral approach" combined with resection of the neighboring liver parenchyma, such as segment IV (defined as extended IV resection), VII (extended VII resection), or VIII (extended VIII resection) (extended segmentectomy group). As a control group, we included patients who underwent standard segmentectomy for segment IV, VII, or VIII for HCCs (segmentectomy group)[8] and compared the outcomes in this group with those in the extended segmentectomy group.

Surgical anatomy

According to Kumon's classification based on the perfusion area of the portal vein, the portal venous branches of the caval portion were ramified from the left portal vein.[2] The caval portion of the caudate lobe was surgically defined by Takayama et al. as the liver parenchyma just below the middle hepatic vein (MHV) and dorsal side of the right hepatic vein (RHV) and the connective tissue at the cranial side of the main right portal trunk, the ventral side of the IVC, and the lateral side of the RHV.[1,5,6]

Operative techniques

After mobilizing the right liver by dissecting the right coronary and triangle ligaments and the right adrenal gland, all short hepatic veins were divided. The IVC ligaments were ligated and dissected to enable isolation of the main hepatic veins. Thus, the right liver was completely dissected from the retroperitoneum and IVC. If necessary, Arantius' ligament was divided at the cranial and caudal ends on the left side. Liver transection was initiated at the caudate side of the adjacent liver segments. Liver transection proceeded cranially along the surface of the major hepatic veins (eg, left wall of the MHV in extended IV resection, right wall of the RHV in extended VII resection, and right wall of the MHV and left wall of the RHV in extended VIII resection). After confirming that the transection reached the dorsal side of the deepest portion (eg, the liver surface adjacent to the IVC) the tumor was removed without exposure. This procedure was facilitated through combined removal of Spiegel's portion, especially in the case of extended VIII resection.

At the end of the procedure, bile leakage was assessed to confirm the presence or absence of bile staining.[9] A closed irrigation drain (Pleats drain; Sumitomo Co, Ltd, Tokyo, Japan) was placed at each cut surface of the liver. The drainage tube was managed as described previously.[10]

Complications

Complications were categorized into 7 grades according to the modified Clavien-Dindo classification, which defines morbidities as complications with a score of ≥3.[11] Complications specific to liver resection were defined as described previously.[12]

Statistical analysis

Data collected from each group were statistically analyzed using Fisher exact test and the Wilcoxon rank-sum test. Survival curves were generated using the Kaplan-Meier product-limit method and compared using the log-rank test.

Results

Patients

Of the 1,618 patients who underwent curative liver resection for HCC, 63 (3.8%) were diagnosed with HCC in the caval portion of the caudate lobe (Fig 1). Among these, 9 (14.2%) underwent right hepatectomy, 6 (9.5%) high dorsal resection, 5 (7.9%) left hepatectomy, and 2 (3.1%) right paramedian sectoriectomy. In total, 41 (65.0%) patients underwent combined resection of the paracaval portion with the adjacent liver segment (Fig 2). In contrast, the segmentectomy group comprised 138 patients who underwent complete resection of segment IV, VII, or VIII. The number of patients with hepatitis C virus infection was significantly greater in the extended segmentectomy group (32 [78.0%] vs 78 [56.5%] patients, $P = .016$), while the segmentectomy group tended to have more non-B non-C patients (6 [14.6%] vs 36 [26.0%] patients, $P = .146$). Platelet count tended to be lower ($12.8 \times 10^4/\mu L$ [range, 2.4–33.8] vs $14.8 \times 10^4/\mu L$ [3.2–41.4], $P = .085$) in the extended segmentectomy group. Secondary liver resection for recurrent HCC was performed for 6 (14.6%) and 10 (7.2%) patients in the extended segmentectomy and segmentectomy groups, respectively ($P = .207$) (Table 1).

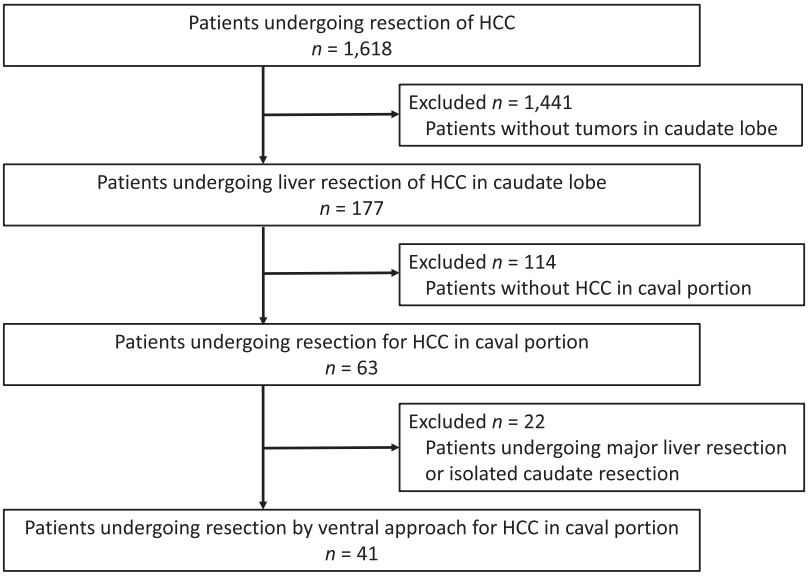

Fig. 1. Flow diagram of patient recruitment.

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