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Central hepatic bisectionectomy with hepatic artery and biliary tracts reconstruction for the patient with nodular type intrahepatic hilar cholangiocarcinoma: A case report

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ABSTRACT

INTRODUCTION AND IMPORTANCE: A central hepatic bisectionectomy (CHBS) for a hilar cholangiocarcinoma (CCA) is technically challenging because bilateral biliary reconstruction is required after resection. On the other hand, hepatic artery resection and reconstruction in a major liver resection are also technical procedures. In this report, we describe our radical CHBS with hepatic artery and biliary tracts reconstruction for a patient with nodular type intrahepatic hilar CCA.

CASE PRESENTATION: A 76-year-old man was referred for further investigation of an incidental hepatic tumor. The hepatic tumor was located from medial sector to anterior sector with encasement of the anterior branch of the right hepatic artery. Based on these findings, we performed a CHBS with right hepatic artery and biliary tracts reconstruction. The histopathological findings revealed that the tumor consisted of moderately differentiated tubular adenocarcinoma with tumor necrosis without a fibrous capsule. In this area, tumor cells had invaded branches of the hepatic vein; however, there was no destructive invasion to the hepatic artery. Consequently, he was diagnosed with a nodular type intrahepatic hilar CCA with pT2aNOM0.

CLINICAL DISCUSSION: A CHBS is usually performed with the intent of anatomically preserving a patient's liver as much as possible. Concomitant resection and reconstruction of the hilar vessels and biliary tracts with CHBS is one of the most technically challenging procedures in liver resections.

CONCLUSION: A CHBS with hepatic artery and biliary reconstruction may be a promising alternative if expert surgeons perform it on strictly selected patients.

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1. Introduction

Hepatic resection remains an important curative treatment option for patients with malignant hepatic tumors. With refined surgical techniques and better perioperative management, a liver resection has become a safer operation, and, as a result, more extensive and complicated liver resections have been advocated. A central hepatic bisectionectomy (CHBS) (resection of Couinaud segments IV, V and VIII) for malignant hepatic tumors, though, poses technical challenges to surgeons [1]. While a CHBS is sometimes employed for centrally located tumors in patients with marginal liver volume, left or right trisectionectomies are chosen when a hilar invasion or biliary ductal spread are pre-operatively diagnosed. A CHBS causes two cut surfaces and junctions of the hilar

branches and thus remains a major challenge for hepatobiliary surgeons because of the resulting high mortality and morbidity rates [2]. Due to the above reasons, a CHBS with vessel and biliary tracts reconstructions is not usually performed.

Cholangiocarcinoma (CCA) is a diverse group of rare malignancies that can arise from any part of the biliary epithelium. Traditionally, CCAs have been anatomically classified into extrahepatic and intrahepatic types; the intrahepatic CCA has been categorized as originating in small intrahepatic bile ducts or major intrahepatic bile ducts, including the hilum [3]. Normally, an intrahepatic CCA creates a nodular formation, which can distinguish it from hepatocellular carcinomas, and demands an anatomical hepatic resection for curative intent. In contrast, a hepatic hilar CCA usually extends along the biliary tract and invades the hilar vessels via a hilar plate [4]. Due to these factors, the nodular type hepatic hilar CCA demands various patterns of challenging hepatic resections. In this report, we describe our radical CHBS with hepatic artery and biliary tracts reconstruction for a patient with a nodular

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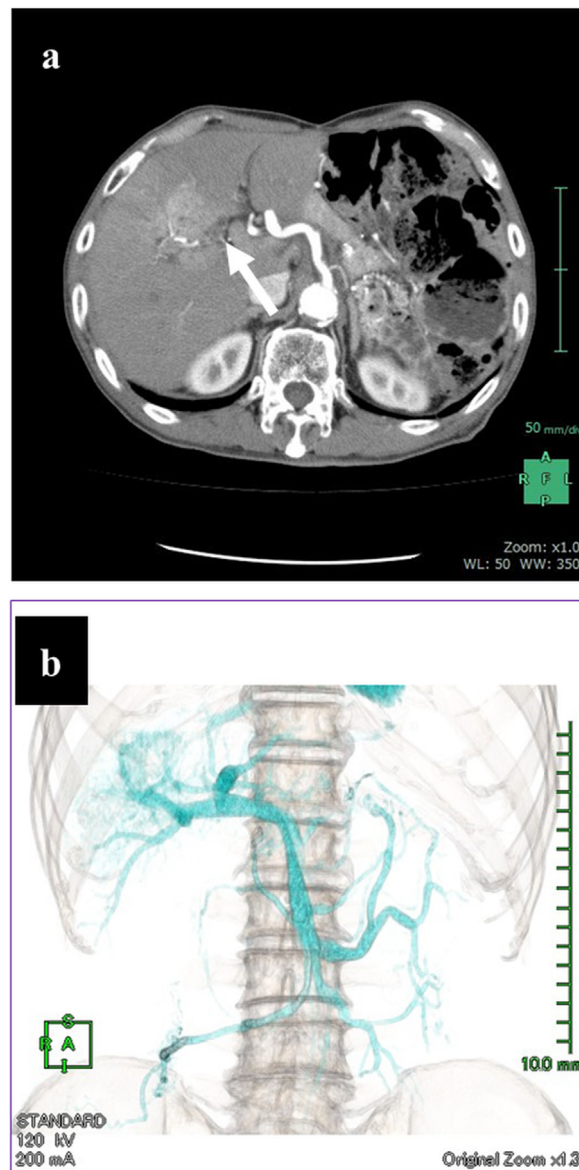


Fig. 1. a: Dynamic enhanced CT examination revealed that the anterior branch of the right hepatic artery was encased by the tumor (white arrow). b: A three-dimensional angiography also revealed that no portal vein invasion was observed.

type intrahepatic hilar CCA. This case report has been reported in line with the SCARE criteria [5].

2. Case presentation

A 76-year-old man was referred to our hospital for further investigation of an incidental hepatic tumor. He was not prescribed any medications, and he had no history of allergies or known adverse reactions to any medications. He had no other symptoms, pertinent family history, genetic disease, and pertinent psychosocial history. He had smoked 10–20 cigarettes a day from at 20 years old to 55 years old, and then he stopped smoking. He had a history of a total gastrectomy due to gastric cancer, and follow-up computed tomography revealed a hepatic tumor located in Couinaud segments IV, V and VIII.

On physical examination, he had no physical findings such as icterus or abdominal abnormal findings. A routine laboratory examination revealed only increased tumor markers, with carbohydrate antigen 19-9 of 144.1 U/mL. Contrast-enhanced computed tomography (CT) showed a hepatic tumor measuring 70 mm lying

between the medial and anterior sectors and dilatation of the intrahepatic bile ducts of B4 and B8. Moreover, CT angiography revealed that the anterior branch of the right hepatic artery was encased by the tumor and that the replaced left hepatic artery branched from the left gastric artery (Fig. 1a). No portal vein invasions were observed in three-dimensional CT angiography (Fig. 1b), while Gd-EOB-DTPA enhanced magnetic resonance imaging revealed that a low intensity tumor was located above the hepatic hilum with damming intrahepatic biliary ducts (Fig. 2a). On diffusion-weighted images, the hepatic tumor exhibited a mosaic intensity signal (Fig. 2b). Endoscopic retrograde cholangiography was not performed because of a Roux-en-Y reconstruction after the patient's total gastrectomy. Based on these findings, we diagnosed a nodular type intrahepatic hilar cholangiocarcinoma with the encasement of the right hepatic artery but without invasion into the hilar biliary ducts; consequently, we performed a CHBS with right hepatic artery and biliary tracts reconstruction as a curative intent operation.

The patient was placed in the supine position under general anesthesia. The abdomen was entered by an upper abdominal J-

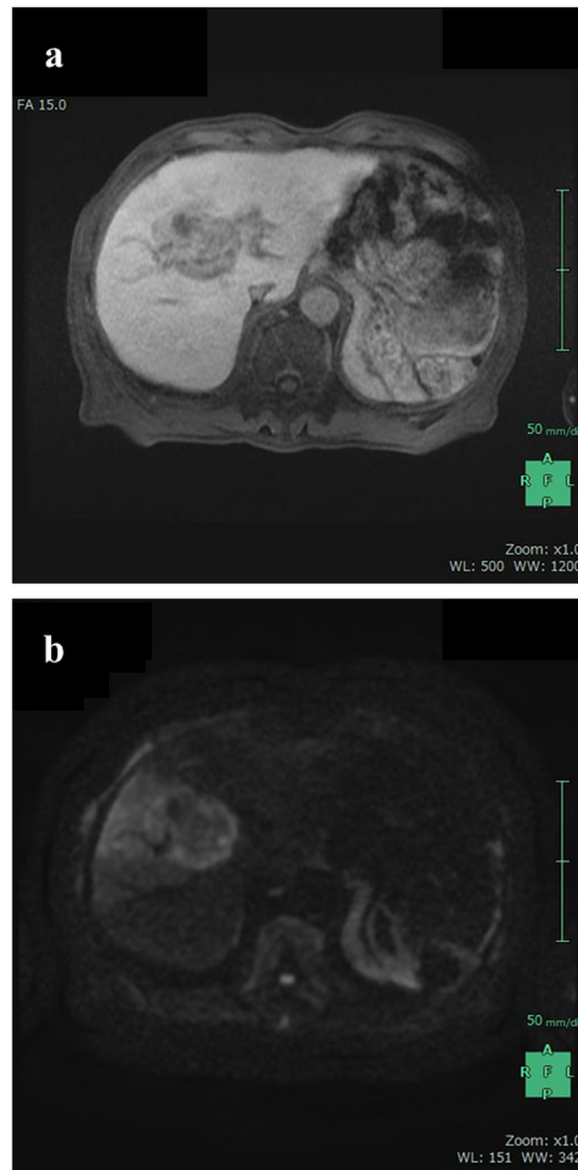


Fig. 2. a: Gd-EOB-DTPA enhanced magnetic resonance imaging revealed that a low intensity tumor was located above the hepatic hilum with damming intrahepatic biliary ducts. b: Diffusion-weighted images also revealed that the hepatic tumor exhibited a mosaic intensity signal.

shaped incision. The round, falciform, and coronary ligaments were divided. Then, we skeletonized the hilar vessels and performed a lymphadenectomy around the hepatoduodenal ligament. Next, the liver was mobilized and a hanging maneuver was employed for hanging the middle hepatic vein (MHV) (Fig. 3a). The left side of the parenchymal transection was performed along the right side of the falciform ligament by dividing the Glisson's branches arising from the umbilical portion (Fig. 3b). The proper hepatic artery was temporarily clamped, and the anterior branch of the right portal vein was clamped; subsequently, the demarcation line between the anterior section and the posterior section was confirmed (Fig. 3c). A parenchymal transection was performed along the demarcation line, and the right hepatic vein was identified in the depth of the dissection plane. After the confluence of the MHV was identified, the root of the MHV was encircled and taped. Finally, the MHV was divided by employing a linear stapler. A division of the hilar hepatic duct was performed, and the specimen was removed.

An intraoperative frozen section diagnosis of both sides of the hilar hepatic duct was negative. We first reconstructed the anastomosis between the proper hepatic artery and the posterior branch

(Fig. 3d) and then performed choledochojejunostomies of B6 + 7 (Fig. 3e) and B2 + 3 (Fig. 3f) with the insertion of external drainage tubes using an afferent jejunal limb. After hemostasis of the raw surface of the cut surface, closed drains were placed at the cut surface and dorsal side of choledochojejunostomies. Finally, the abdomen was closed in layers. The schema of the operative field after resection is shown in Fig. 4.

Macroscopic findings of the resected specimens showed a whitish nodule, measuring 60 × 56 × 45 mm, in the parenchyma rising segments IV, V, and VIII (Fig. 5a). Microscopic findings using a hematoxylin and eosin (HE) stain revealed a moderately differentiated tubular adenocarcinoma with tumor necrosis but without a fibrous capsule (Fig. 5b). In this area, tumors cells had invaded branches of the hepatic vein; however, there was no destructive invasion to the hepatic artery (Fig. 5c). From these histopathological findings, the patient was diagnosed as having a nodular type intrahepatic hilar CCA with pT2aN0M0.

The postoperative recovery was uneventful and the patient discharged on 29th postoperative day. He has been followed up in our outpatient clinic for three years after surgery. There has been no

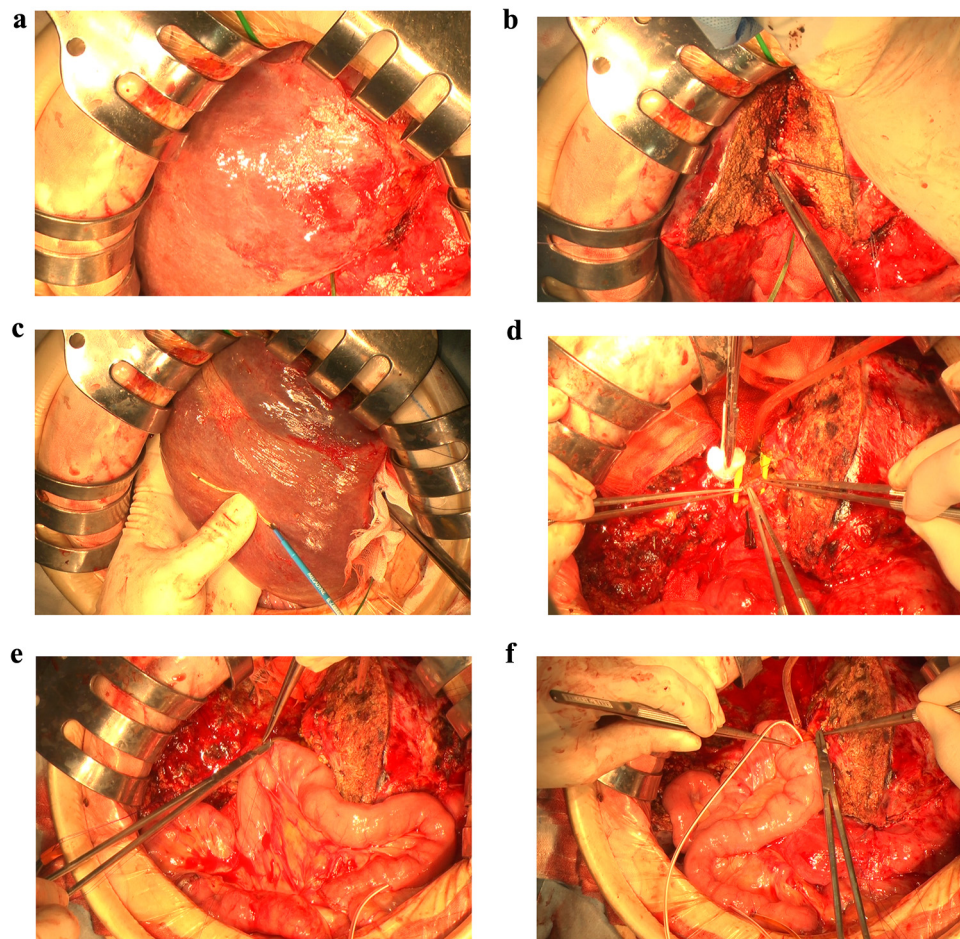


Fig. 3. a: We applied a hanging maneuver for hanging the middle hepatic vein. b: The Glisson's pedicle of S4 is ligated and divided. c: The demarcation line between the anterior section and the posterior section was confirmed and marked. d: The proper hepatic artery was anastomosed to the posterior branch. e: Choledochojejunostomy of B2 + 3 was performed. f: Choledochojejunostomy of B6 + 7 with the insertion of external drainage tubes using an afferent jejunal limb were performed.

recurrence by monitoring blood tests and follow-up CT examinations.

3. Discussion

A CHBS is usually performed with the intent of anatomically preserving a patient's liver as much as possible. It is generally strictly limited to use on intrahepatic tumors located in the internal and anterior sectors, but without invasion of the hilar vessels and biliary tracts because a CHBS is one of the most technically challenging procedures in liver resections. A genuine appreciation of the liver anatomy is imperative for conducting this procedure safely without compromising the oncological clearance. A CHBS is usually indicated for patients with marginal liver volume and is also considered when a right or left trisectionectomy is not indicated due to hilar vessel invasion or biliary ductal spread of the tumor.

A hepatic hilar CCA is a highly malignant tumor; previous reports have demonstrated that an R0 resection is the only effective therapeutic method to guarantee a patient's long-term survival [6]. In addition, keeping a tumor-free margin is one of the strongest surgical factors for the prognosis of a hilar CCA [6]. To achieve an R0 resection while ensuring the safety of the patient, a major hepatectomy with choledochojejunostomies and vascular reconstruction is not a suitable procedure; however, with the advance in vascular anastomosis and surgical techniques, vascular invasion is no longer a contraindication for a curative intent resection of a hilar CCA. From the anatomical view, the right hepatic artery is mainly located

behind the biliary confluence; therefore, the right hepatic artery is mainly located behind the biliary confluence and thus tends to be involved by tumor expansion or a strong inflammation of severe cholangitis from a hepatic hilar CCA. In this case, the right hepatic artery became constricted due not to a direct invasion but because of severe cholangitis.

Some previous reports have concluded that hepatic artery resections cannot be justified because none of the patients who underwent hepatic artery resection survived for longer than three years after surgery [7,8]. However, a recent study demonstrated that the three- and five-year survival rates of patients who underwent aggressive major liver resections with hepatic artery resection (with or without reconstruction) were 44 % and 22 %, respectively [9], furthermore, Nagino et al. have recently reported the efficacy of hepatopancreatoduodenectomy with simultaneous resection of the portal vein and hepatic artery for locally advanced hilar CCAs as the last option [10]. Therefore, curative attempts for hilar CCAs with hepatic artery resection in selected patients can be a promising alternative.

4. Conclusion

We have presented a radical CHBS with hepatic artery and biliary tracts reconstruction for a patient with a nodular type intrahepatic hilar CCA. In this case, biliary reconstruction after CHBS was technically challenging because we had to perform bilateral choledochojejunostomies. In addition, hepatic artery resection and

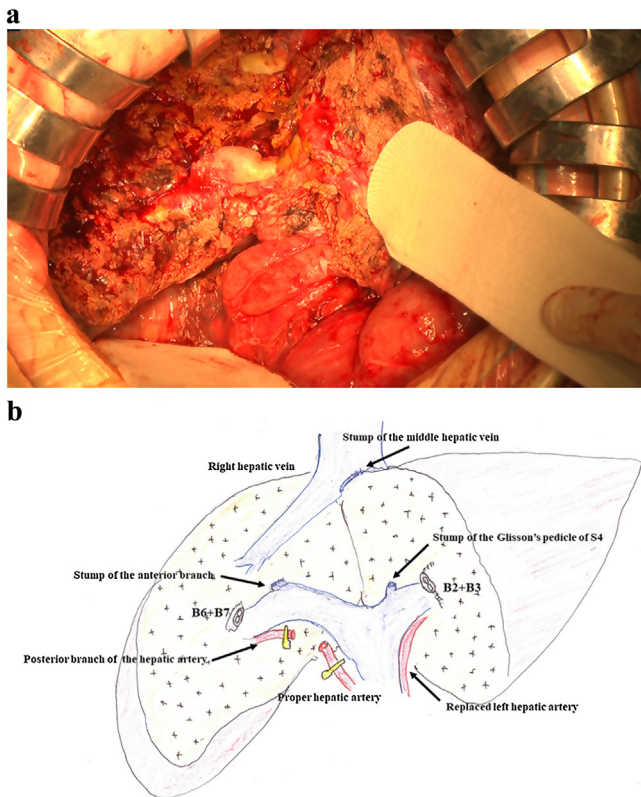


Fig. 4. a: The operative field after resection is shown. This photograph was taken after hepatic artery reconstruction. b: The schema is presenting the operative field after tumor resection. The posterior branch of hepatic artery and biliary tracts were in the state of stumps.

reconstruction were required due to severe inflammation caused by the hilar CCA. The hilar CCA with hepatic artery invasion seemed to be poor prognosis according to previous reports; however, a recent study demonstrated that aggressive major liver resection for hilar CCAs with hepatic artery resection could achieve similar long-term survival rates after surgery.

Declaration of Competing Interest

The authors declare that there is no conflict of interest, financial or otherwise, related to the publication of this study or its findings.

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Ethical approval

This case report is exempt from ethical approval by our institution.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Umemura Akira – study concept, data collection, draft preparation.

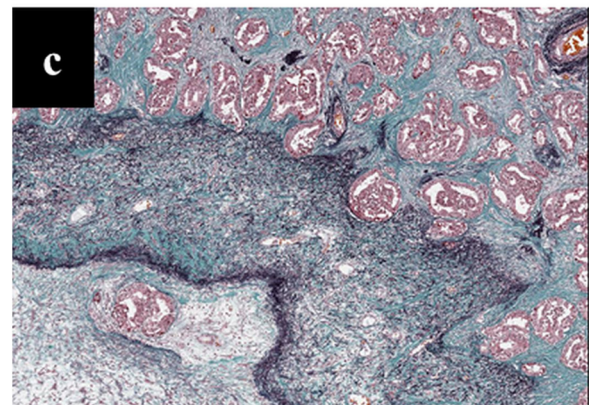
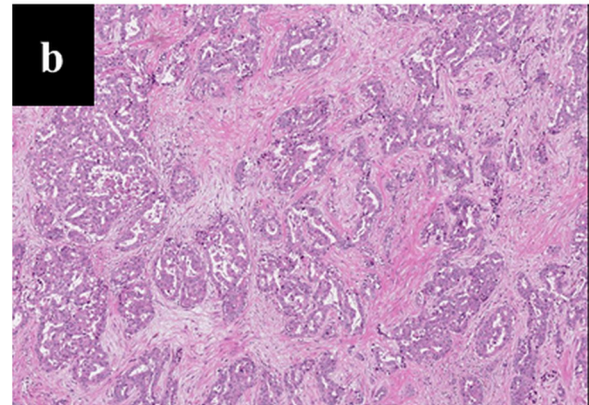
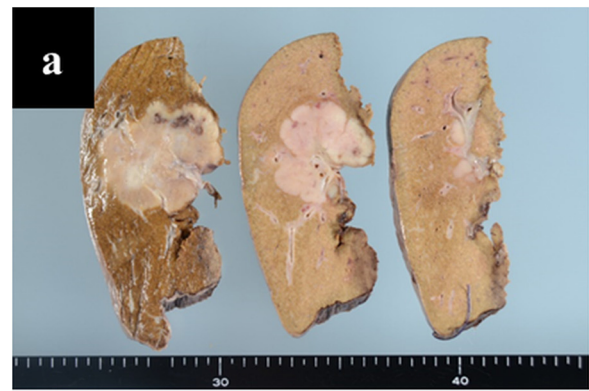


Fig. 5. a: A whitish nodule was located extending over segment IV, V, and VIII. b: A low-power field revealed a moderately differentiated tubular adenocarcinoma with tumor necrosis but without a fibrous capsule (HE stain, $\times 40$). c: Elastica-Masson (EM) stain also revealed that tumor cells had invaded branches of the hepatic vein (EM stain, $\times 40$).

Nitta Hiroyuki, Takahara Takeshi, Hasegawa Yasushi, Katagiri H – surgical therapy for this patient and follow-up.
Sugai Tamotsu – histopathological examination.
Nitta Hiroyuki, Akira Sasaki – data interpretation.

Registration of research studies

Not applicable.

Guarantor

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References

- [1] K. Yanaga, Central bisectionectomy (bisegmentectomy) of the liver (with video), *J. Hepatobiliary Pancreat Sci.* 19 (2012) 44–47.
- [2] T.K. Gallagher, A.C. Chan, R.T. Poon, T.T. Cheung, K.S. Chok, S.C. Chan, C.M. Lo, Outcomes of central bisectionectomy for hepatocellular carcinoma, *HPB (Oxford)* 15 (2013) 529–534.
- [3] X.F. Zhang, F. Bagante, Q. Chen, E.W. Beal, Y. Lv, M. Weiss, I. Popescu, H.P. Marques, L. Aldrighetti, S.K. Maithel, C. Pulitano, T.W. Bauer, F. Shen, G.A. Poultsides, O. Soubrane, G. Martel, B.G. Koerkamp, A. Guglielmi, E. Itaru, T.M. Pawlik, Perioperative and long-term outcome of intrahepatic cholangiocarcinoma involving the hepatic hilus after curative-intent resection: comparison with peripheral intrahepatic cholangiocarcinoma and hilar cholangiocarcinoma, *Surgery* 163 (2018) 1114–1120.
- [4] S. Matsukuma, Y. Tokumitsu, Y. Shindo, H. Matsui, H. Nagano, Essential updates to the surgical treatment of biliary tract cancer, *Ann. Gastroenterol. Surg.* 3 (2019) 378–389.
- [5] R.A. Agha, T. Franchi, C. Sohrabi, G. Mathew, for the SCARE Group, The SCARE 2020 guideline: UPDATING CONSENSUS SURGICAL CAse REport (SCARE) guidelines, *Int. J. Surg.* 84 (2020) 226–230.
- [6] K. Matsuo, F.G. Rocha, K. Ito, M.I. D'Angelica, P.J. Allen, Y. Fong, R.P. Dematteo, M. Gonen, I. Endo, W.R. Jarnagin, The Blumgart preoperative staging system for hilar cholangiocarcinoma: analysis of resectability and outcomes in 380 patients, *J. Am. Coll. Surg.* 215 (2012) 343–355.
- [7] M. Nagino, Y. Nimura, H. Nishio, T. Ebata, T. Igami, M. Matsushita, N. Nishikimi, Y. Kamei, Hepatectomy with simultaneous resection of the portal vein and hepatic artery for advanced perihilar cholangiocarcinoma: an audit of 50 consecutive cases, *Ann. Surg.* 252 (2010) 115–123.
- [8] Y. Sakamoto, T. Sano, K. Shimada, T. Kosuge, Y. Kimata, M. Sakuraba, J. Yamamoto, H. Ojima, Clinical significance of reconstruction of the right hepatic artery for biliary malignancy, *Langenbecks Arch. Surg.* 391 (2006) 203–208.
- [9] H.J. Hu, Y.W. Jin, R.X. Zhou, A. Shrestha, W.J. Ma, Q. Yang, J.K. Wang, F. Liu, N.S. Cheng, F.Y. Li, Hepatic artery resection for bismuth type III and IV hilar cholangiocarcinoma: is reconstruction always required? *J. Gastrointest. Surg.* 22 (2018) 1204–1212.
- [10] M. Nagino, T. Ebata, Y. Yokoyama, T. Igami, T. Mizuno, J. Yamaguchi, S. Onoe, N. Watanabe, Hepatopancreatoduodenectomy with simultaneous resection of the portal vein and hepatic artery for locally advanced cholangiocarcinoma: Short- and long-term outcomes of superextended surgery, *J. Hepatobiliary. Sci.* (2021), <http://dx.doi.org/10.1002/jhbp.914>.

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