

## ORIGINAL ARTICLE

# Outcomes after vascular resection during curative-intent resection for hilar cholangiocarcinoma: a multi-institution study from the US extrahepatic biliary malignancy consortium

Gregory V. Schimizzi<sup>1</sup>, Linda X. Jin<sup>1</sup>, Jesse T. Davidson IV<sup>1</sup>, Bradley A. Krasnick<sup>1</sup>, Cecilia G. Ethun<sup>2</sup>, Timothy M. Pawlik<sup>3</sup>, George Poultsides<sup>4</sup>, Thuy Tran<sup>4</sup>, Kamran Idrees<sup>5</sup>, Chelsea A. Isom<sup>5</sup>, Sharon M. Weber<sup>6</sup>, Ahmed Salem<sup>6</sup>, William G. Hawkins<sup>1</sup>, Steven M. Strasberg<sup>1</sup>, Maria B. Doyle<sup>1</sup>, William C. Chapman<sup>1</sup>, Robert C.G. Martin<sup>7</sup>, Charles Scoggins<sup>7</sup>, Perry Shen<sup>8</sup>, Harveshp D. Mogal<sup>8</sup>, Carl Schmidt<sup>9</sup>, Eliza Beal<sup>9</sup>, Ioannis Hatzaras<sup>10</sup>, Rivfka Shenoy<sup>10</sup>, Shishir K. Maithel<sup>2</sup> & Ryan C. Fields<sup>1</sup>

<sup>1</sup>Department of Surgery and the Alvin J. Siteman Cancer Center, Washington University School of Medicine, St Louis, MO, <sup>2</sup>Division of Surgical Oncology, Department of Surgery, Winship Cancer Institute, Emory University, Atlanta, GA, <sup>3</sup>Division of Surgical Oncology, Department of Surgery, The Johns Hopkins Hospital, Baltimore, MD, <sup>4</sup>Department of Surgery, Stanford University Medical Center, Stanford, CA, <sup>5</sup>Division of Surgical Oncology, Department of Surgery, Vanderbilt University Medical Center, Nashville, TN, <sup>6</sup>Department of Surgery, University of Wisconsin School of Medicine and Public Health, Madison, WI, <sup>7</sup>Division of Surgical Oncology, Department of Surgery, University of Louisville, Louisville, KY, <sup>8</sup>Department of Surgery, Wake Forest University, Winston-Salem, NC, <sup>9</sup>Division of Surgical Oncology, The Ohio State University Comprehensive Cancer Center, Columbus, OH, and <sup>10</sup>Department of Surgery, New York University, New York, NY, United States

## Abstract

**Background:** Surgical resection is the cornerstone of curative-intent therapy for patients with hilar cholangiocarcinoma (HC). The role of vascular resection (VR) in the treatment of HC in western centres is not well defined.

**Methods:** Utilizing data from the U.S. Extrahepatic Biliary Malignancy Consortium, patients were grouped into those who underwent resection for HC based on VR status: no VR, portal vein resection (PVR), or hepatic artery resection (HAR). Perioperative and long-term survival outcomes were analyzed.

**Results:** Between 1998 and 2015, 201 patients underwent resection for HC, of which 31 (15%) underwent VR: 19 patients (9%) underwent PVR alone and 12 patients (6%) underwent HAR either with (n = 2) or without PVR (n = 10). Patients selected for VR tended to be younger with higher stage disease. Rates of postoperative complications and 30-day mortality were similar when stratified by vascular resection status. On multivariate analysis, receipt of PVR or HAR did not significantly affect OS or RFS.

**Conclusion:** In a modern, multi-institutional cohort of patients undergoing curative-intent resection for HC, VR appears to be a safe procedure in a highly selected subset, although long-term survival outcomes appear equivalent. VR should be considered only in select patients based on tumor and patient characteristics.

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## Correspondence

Ryan C. Fields, Washington University School of Medicine, 660 South Euclid Avenue, Campus Box 8109, St. Louis, MO, 63110-8109, United States. E-mail: [fieldsr@wustl.edu](mailto:fieldsr@wustl.edu)

## Introduction

In the United States, cholangiocarcinoma has a reported autopsy prevalence of 0.01–0.46% and an incidence of 1–2/100,000 population, although the incidence is much higher in Asia.<sup>2,7,10</sup>

Surgical resection or transplant is the only potentially curative treatment of hilar cholangiocarcinoma,<sup>18</sup> however, the role of en bloc vascular resection remains controversial.<sup>17,19</sup> Therefore, the aim of the current study was to explore the safety and long-term

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**Table 1** Clinicopathologic variables associated with vascular resection in 201 patients after curative resection for hilar cholangiocarcinoma<sup>a</sup>

	No vascular resection n = 170	PV resection n = 19	HA resection n = 12	p
Female (n, %)	101 (60)	9	6	0.515
Age (x, sd)	66 (10)	62	52	p < 0.001
Race				0.804
White	129 (78)	15	10	
Black	12 (7)	2	1	
Asian	13 (8)	0	0	
BMI (x, sd) <sup>b</sup>	26 (6)	2	0	
		26	26	0.108
Functional Status <sup>c</sup>				
Independent	152 (99)			0.367
Partially Dependent	2 (1)	17	11	
ASA class		1	0	
1	2 (1)			0.928
2	40 (28)	0	0	
3	94 (67)	7	3	
4	5 (4)	10	5	
Hypertension	90 (55)	1	0	
Diabetes Mellitus		12	10	0.060
Managed with Oral Medications	14 (9)			0.549
Insulin-Dependent	8 (5)	1	2	
Prior Cardiac Event	23 (14)	2	0	
Congestive Heart Failure	2 (0)	5	0	0.136
Dyspnea	4 (3)	0	0	0.830
Tobacco Use	42 (26)	0	0	0.687
COPD	9 (6)	3	5	0.203
Acute Kidney Injury	2 (1)	2	1	0.639
Preoperative sepsis	11 (7)	0	0	0.830
Preoperative jaundice	133 (80)	1	0	0.648
Primary Sclerosing Cholangitis	4 (3)	15	11	0.592
Ascites	6 (4)	0	1	0.310
Preoperative stent placement		0	1	0.435
Endoscopic stent only	68 (41)			0.142
Percutaneous stent only	35 (21)	5	4	

**Table 1** (continued)

	No vascular resection n = 170	PV resection n = 19	HA resection n = 12	p
Both	36 (21)	7	5	
Neoadjuvant chemotherapy	6 (4)	1	3	0.002

<sup>a</sup> Fields with missing data may not add to 100 percent.

<sup>b</sup> BMI indicates body mass index; ASA class, American Society of Anesthesiologists classification.

<sup>c</sup> Functional status: Independent, the patient does not require assistance from another person for activities of daily living. This includes a person who is able to function independent with prosthetics, equipment or devices. Partially dependent, the patient requires some assistance from another person for activities of daily living. This includes a person who utilizes prosthetics, equipment or devices but still requires some assistance from another person for activities of daily living.

outcomes of vascular resection during surgical treatment of hilar cholangiocarcinoma using data from a large cohort of patients from the U.S. Extrahepatic Biliary Malignancy Consortium.

## Methods

The U.S. Extrahepatic Biliary Malignancy Consortium (USEBMC) is a collaboration of 10 high-volume, academic institutions, and includes Emory University, Johns Hopkins University, New York University, The Ohio State University, Stanford University, University of Louisville, University of Wisconsin, Vanderbilt University, Wake Forest University, and Washington University in St. Louis. All patients at participating institutions with HC who underwent resection with curative intent from 1998 to 2015 and had long-term follow-up data, including vital status and recurrence status, were included. Exclusion criteria included planned palliative or noncurative resections including bile duct resection only, missing data on vascular resection status, or incomplete follow-up data.

Standard demographic and clinicopathologic data were collected including age, sex, body mass index (BMI), American Society of Anesthesiologists (ASA) score, comorbidities (including history of hypertension, diabetes, COPD, congestive heart failure, renal failure, chronic steroid use, and tobacco use), tumor-related signs and symptoms, type of surgery and tumor-specific characteristics. In particular, data were collected on presence of jaundice or ascites and preoperative biliary drainage. Data on treatment-related variables, such as type of surgery and receipt of lymphadenectomy and intraoperative estimated blood loss (EBL), were also collected. Pathology review was performed by experienced GI pathologists at each institution, and staging was assigned as per American Joint Committee on Cancer (AJCC) 7th edition guidelines.<sup>6</sup> Institutional Review Board approval was obtained at each institution prior to data collection.

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