

# Resectability criteria for Klatskin tumours: The “Black Run” of liver surgery

Marcello Donati, Francesco Basile

Department of Surgery, General and Oncologic Surgery Unit, Policlinico-Vittorio Emanuele University Hospital of Catania, Italy

**Correspondence:** Marcello Donati. Address: Department of Surgery, General and Oncologic Surgery Unit, Policlinico/Vittorio-Emanuele University Hospital of Catania, Italy. Telephone: 39-095-743-5053. Fax: 39-095-714-3390. E-mail: mar\_donati@libero.it

**Received:** January 11, 2012

**Accepted:** June 25, 2012

**Published:** August 1, 2012

**DOI:** 10.5430/jst.v2n4p1

**URL:** <http://dx.doi.org/10.5430/jst.v2n4p1>

The surgical management of Klatskin tumours remains, to date, the only available treatment-option with curative intent, and with a potential influence on overall survival<sup>[1]</sup>. Despite all the modern progresses in preoperative diagnostic imaging, the resectability judgment criteria are for hilar cholangiocarcinomas still not standardized; Klatskin tumour surgery remains one of the most challenging for liver surgeons. There seems to be no consensus about resectability criteria of Klatskin tumours especially related to preoperative work-up and intra-operative findings. One of the hottest topics of this type of surgery, which is still a matter of debate, is how to assess resectability of hilar cholangiocarcinomas and which are reasonable criteria to judge such tumours unresectable. Also treatment outcomes are not so enthusiastic while the overall survival of R0 resected patients is about 20% at 5 years<sup>[2-5]</sup>. Furthermore, the problems of resectability are, for these tumours, also related to the "residual volume-function" after resection.

Some groups have started to perform laparoscopic resections for Type I and II<sup>[6,7]</sup>, proposing some anatomical selection criteria<sup>[7]</sup>, even if this approach maintains some critical weak points<sup>[8]</sup>. Resectability must be considered only for potentially R0-resections also if R1 seems to be acceptable when compared to R2 or no resection<sup>[9]</sup>. Many reports in the literature do not distinguish this aspect that strongly affects overall survival. In our experience about 15-20% of explored patients received a palliative operation because they were intra-operatively judged inoperable, however, 25% of patients with a questionable resectability or even with a preoperative Bismuth IV classification, became intra-operatively resectable (III a or b) and underwent a radical R0 resection<sup>[5]</sup>. All these data agree with data published by many groups over the last 10 years that underline the totally inadequacy of the Bismuth-Corlette classification that has the following limits: 1) it can be considered only intra-operatively and not pre-operatively; 2) it does not consider arterial infiltration that is, in our opinion, the most important parameter for resectability judgment. Among the so called Bismuth IV we have to distinguish: Tumours partially infiltrating only the parenchyma (still resectable, should be considered IVa or IVb), and tumours extensively infiltrating the liver parenchyma in both lobes, hosting each R0-resection with intrahepatic derivation of the biliary tree. Worldwide methods to achieve resectability conditions are preoperative biliary drainage and portal embolization with renowned advantages and limits. It is true that 3D-CT reconstructions are able to give more information to the surgeon but also this method seems to not be completely satisfying as concerns the determination of local invasion of hilar structures<sup>[10]</sup>. Nowadays, parenchymal resection concomitant to biliary tract resection should not be under discussion; with some exception limited to types I and II (Bismuth-Corlette)<sup>[11]</sup>, most of Authors agree with the need of a concomitant liver resection to achieve more survival<sup>[2, 8,9,12]</sup>. Systematic sampling of Lymphnodes has been shown to be one of the surgical factors strongly affecting radicality and therefore long-term survival in those patients<sup>[12-14]</sup>. As a matter

of fact, Nimura's group stated that the more frequent elective approach to Klatskin tumours usually gives indications to extended left hemi-hepatectomies (Nagoya approach) <sup>[13]</sup> while for Neuhaus et al. the most performed operation that can allow radicality is the extended right hemi-hepatectomy (Berlin approach) <sup>[12]</sup>. An alternative for Bismuth IV tumours, in an attempt to overcome remnant liver volume limits, came from Sotiropoulos et al. who proposed the more challenging complete mesohepatectomy with hilar bifurcation resection and bilateral multiple hepaticojunostomies <sup>[15]</sup>. The supporters of Nagoya's approach (when feasible) advocate the more radicality of such a technique related to Caudatus resection. The systematic resection of the Caudate Lobe <sup>[4]</sup>, not always achievable for remnant liver volume reasons, also if not considered a standard by all authors <sup>[16]</sup> seems to strongly affect the radicality purpose of resection and therefore survival <sup>[3, 17]</sup>. Another aspect that should be taken in consideration is the prognostic significance of perineural infiltration, as stated also by a recent review of TNM staging system <sup>[18]</sup>. Perineural infiltration of tumours is expressed as Pn1. Despite R0-resected, we usually consider all the Pn1 as R1-resected patients because of bad prognostic significance of this kind of tumour diffusion. Maybe in these cohorts of patients instead of IORT (very often the Pn1 is a definitive histologic verdict!), postoperative radiotherapy could have an indication but there are still no studies on it. Arterial infiltration remains, in our opinion, the last "hot spot" of hilar surgical dissection in order to establish R0-resectability. In fact, portal infiltration, even if a bad prognostic factor, is nowadays not considered an exclusion criterion for resectability <sup>[11, 17]</sup>.

More recently all the surgical efforts to achieve resectability were concentrated on vascular reconstruction, De Santibanes' group proposed an original method of vascular reconstruction by using the not infiltrated artery as an auto-graft to substitute the infiltrated artery <sup>[19]</sup> (for example left artery to cut and turn to the right side in an extended left hemihepatectomy with infiltration of the right hepatic artery), or, following other techniques, using gastroduodenal-hepatic artery end-to-end anastomosis <sup>[20]</sup> in order to enlarge the resectability rate of such cohorts of patients. Of course the remnant liver volume and its function are the main surgical factors strongly affecting the intra-operative judgment of resectability; from this point of view a good foreseeable application could be the recently proposed two-stage procedure with combination of portal ligation and in situ split in order to achieve more volume in RLV <sup>[21, 22]</sup>. The Surgeon approaching a Klatskin tumour has constantly the doubt of resectability, and is dramatically under stress of an acceptable compromise in the difficult balance between oncologically radical resection and the need of an acceptable remaining liver function.

Taking into account all the above mentioned reasons, the surgery of Klatskin tumours is nowadays one of the most engaging surgical fields, requiring advanced knowledge of liver surgery features, good surgical skills and multidisciplinary management of patients. Therefore "Klatskin tumours" is to date a dramatic diagnosis and the surgical approach to these tumours should be the prerogative of specialized centres where, despite all the technological advancements and complex integration of diagnostic and therapeutic sources, Altmeyer-Klatskin surgery remains, and must be considered, the "Black Run" of liver surgeons.

## References

- [1] Mihalache F, Tantau M, Diaconu B, Acalovschi M. Survival and Quality of Life of Cholangiocarcinoma Patients: a Prospective Study over a 4 Year Period. *J. Gastrointestin. Liver Dis.* 2010; 19 (3): 285-90. PMID:20922193
- [2] Shi Z, Yang M-Z, He Q-L, Ou R-W, Chen Y-T. Addition of hepatectomy decreases liver recurrence and leads to long survival in hilar cholangiocarcinoma. *WJG.* 2009; 15 (15): 1892-6. PMID:19370789 <http://dx.doi.org/10.3748/wjg.15.1892>
- [3] Dinant S, Gerhards M, Bush O, Obertop H, Gouma D, Van Gulik T. The importance of complete excision of the caudate lobe in resection of hilar cholangiocarcinoma. *HPB.* 2005; 7(4): 263-267. PMID:18333204 <http://dx.doi.org/10.1080/13651820500372376>
- [4] Hasegawa S, Ikai I, Fujii H, Hatano E, Shimahara Y. Surgical Resection of Hilar Cholangiocarcinoma: Analysis of Survival and Postoperative Complications. *World J Surg.* 2007; 31: 1256-1263. PMID:17453285 <http://dx.doi.org/10.1007/s00268-007-9001-y>
- [5] Lang H, G. Kaiser T, Zöpf, Sotiropoulos G, Frilling A, Malagó M, Broelsch C. Zentrale Gallengangskarzinome. *Chirurg.* 2006; 77(4): 325-334.
- [6] Zhu AD, Liu Q, Chen DX. Laparoscopic radical resection of hilar cholangiocarcinoma and lymph node dissection. *Chin. J. Minim. Invas. Surg.* 2010; 10: 10.

- [7] Yu H, Wu S-d, Chen D-x, Zhu G. Laparoscopic Resection of Bismuth Type I and II Hilar Cholangiocarcinoma: An Audit of 14 Cases from Two Institutions. *Dig. Surg.* 2011; 28: 44-9. PMID:21293131 <http://dx.doi.org/10.1159/000322398>
- [8] Donati M, Stavrou G. A, Oldhafer K-J. Laparoscopic resections for hilar cholangiocarcinomas: a critical appraisal. *Dig. Surg.* 2011; 28: 277-8. PMID:21778727 <http://dx.doi.org/10.1159/000329583>
- [9] Kosuge T, Yamamoto J, Shimada K, Yamasaki S, Makuuchi M. Improved Surgical Results for Hilar Cholangiocarcinoma With Procedures Including Major Hepatic Resection. *Ann. Surg.* 1999; 230 (5): 663-671. PMID:10561090 <http://dx.doi.org/10.1097/00000658-199911000-00008>
- [10] Endo I, Shimada H, Sugita M, Fujii Y, Morioka D, Takeda K, Sugae S, Tanaka K, Togo S, Bourquain, Peitgen H.O. Role of three-dimensional imaging in operative planning for hilar cholangiocarcinoma. *Surgery.* 2007; 142(5): 666-675. PMID:17981186 <http://dx.doi.org/10.1016/j.surg.2007.05.018>
- [11] Ito F, Cho CS, Rikkers LF, Weber SM. Hilar Cholangiocarcinoma:current management. *Ann. Surg.* 2009; 250: 210-8. PMID:19638920 <http://dx.doi.org/10.1097/SLA.0b013e3181afe0ab>
- [12] Neuhaus P, Jonas S, Bechstein W, Lohmann R, Radke C, Kling N, Wex C, Lobeck H, Hintze R. Extended Resections for Hilar Cholangiocarcinoma. *Ann. Surg.* 1999; 230(6): 808-819. PMID:10615936 <http://dx.doi.org/10.1097/00000658-199912000-00010>
- [13] Nimura Y. Radical surgery of left-sided klatskin tumors. *HPB.* 2008; 10: 160-70. PMID:18773047 <http://dx.doi.org/10.1080/13651820801992674>
- [14] Nimura Y, Kamiya J, Kondo S Nagino M, Uesaka K, Oda K, Sano T, Yamamoto H, Hayakawa N. Aggressive preoperative management and extended surgery for hilar cholangiocarcinoma: Nagoya experience. *J Hepatobiliary Pancreat Surg.* 2000; 7: 155-162. PMID:10982608 <http://dx.doi.org/10.1007/s005340050170>
- [15] Sotiropoulos G. C, Lang H, Molmenti E. P, Kaiser G. M, Paul A, Broelsch C. E. Partial or complete mesohepatectomy combined with resection of the hilar bifurcation in cases of Klatskin tumors: a reasonable strategy? *Am. J. Surg.* 2009; 198(2): 297-8. PMID:19268903 <http://dx.doi.org/10.1016/j.amjsurg.2008.11.022>
- [16] Jang JY, Kim SW, Park DJ Ahn YJ, Yoon YS, Choi MG, Suh KS, Lee KU, Park YH. Actual long term outcome of extrahepatic bile duct cancer after surgical resection. *Ann.Surg.* 2005; 241: 77-84. PMID:15621994
- [17] Tsao JI, Nimura Y, Kamiya J, Hayakawa N, Kondo S, Nagino M, Miyachi M, Kanai M, Uesaka K, Oda K, Rossi RL, Braasch JW, Dugan JM. Management of hilar cholangiocarcinoma: comparison of an American and a Japanese experience. *Ann Surg.* 2000; 232(2): 166-74. PMID:10903592 <http://dx.doi.org/10.1097/00000658-200008000-00003>
- [18] Perihilar Bile Ducts. In *AJCC Cancer Staging Manual.7th Edition.* Springer. 2010; 219-25.
- [19] de Santibanes E, Ardiles V, Alvarez FA, Pekolj J, Brandi C, Beskow A. Hepatic artery reconstruction first for the treatment of hilar cholangiocarcinoma bismuth IIIb with contralateral arterial invasion:a novel technical strategy. *HPB (Oxford).* 2012; 14(1): 67-70. PMID:22151454 <http://dx.doi.org/10.1111/j.1477-2574.2011.00404.x>
- [20] Chen D, Lai JM, Liang LJ, Yin XY, Peng BG, Qi J, Li SQ. Combination with vascular resection and reconstruction in resection of hilar cholangiocarcinoma. *Zhonghua Wai Ke Za Zhi.* 2011; 49(7): 607-10. In Chinese. PMID:22041674
- [21] Oldhafer K-J, Donati M, Maghsoudi T, Ojdanić D, Stavrou G. A. Integration of 3D Volumetry, Portal Transection and In Situ Split procedure: a new Surgical Strategy for inoperable Liver Metastasis. *J. Gastrointest. Surg.* 2012; 16(2): 415-6.
- [22] De Santibanes E, Alvarez F, Ardiles V. How to avoid postoperative liver failure: a novel method. *World J. Surg.* 2012; 36(1): 125-8. PMID:22045448 <http://dx.doi.org/10.1007/s00268-011-1331-0>