Liver Resection for Non-Colorectal Liver Metastases – Standards and Extended Indications

Ulf Kulik   Frank Lehner   Hüseyin Bektas   Jürgen Klempnauer

General, Visceral and Transplantation Surgery, Hannover Medical School, Hanover, Germany

Summary

Background: Due to the uncertain benefit of liver resection for non-colorectal liver metastases (NCLM), patient selection for surgery is generally difficult. Therefore, the aim of this article was to propose standard and extended indications for liver resection in this heterogeneous disease collective. **Methods:** Review of the literature. **Results:** The myriad of biologically different primary tumor entities as well as the mostly small and retrospective studies investigating the benefit of surgery for NCLM limits the proposal of general recommendations. Only resection of neuroendocrine liver metastases (NELM) appears to offer a clear benefit with a 5- and 10-year overall survival (OS) of 74 and 51%, respectively, in the largest series. Resection of liver metastases from genitourinary primaries might offer reasonable benefit in selected cases – with a 5-year OS of up to 61% for breast cancer and of 38% for renal cell cancer. The long-term outcome following surgery for other entities was remarkably poorer, e.g., gastric cancer, pancreatic cancer, and melanoma reached a 5-year OS of 20–42, 17–25, and about 20%, respectively. **Conclusion:** Liver resection for NELM can be defined as a standard indication for the resection of NCLM while lesions of genitourinary origin might be defined as an extended indication.

© 2015 S. Karger GmbH, Freiburg

Introduction

Secondary liver malignancies from various origins are the most common malicious hepatic diseases [1]. Among this very heterogeneous group, colorectal liver metastases (CLM) definitely display the lion's share, and surgical resection appears to be the option of choice – with a well-demonstrated benefit regarding long-term survival [2, 3]. In contrast, concerning non-colorectal liver metastases (NCLM), the best suitable procedure is discussed controversially and varies enormously between the different primary tumor origins [4, 5]. The most common primary non-colorectal lesions are breast, gastrointestinal (esophageal, gastric, small bowel, and pancreatobiliary), neuroendocrine, renal, and genitourinary cancer, but also lung cancer, malignant melanoma, and soft tissue neoplasm (sarcoma) need to be taken into account [6]. Given this myriad of possible sources, it is problematic to estimate data regarding the overall benefit from hepatic resection since most studies report only small series with many different primary tumor entities. An exception to this is the surgical treatment of neuroendocrine liver lesion which has proven to be safe, providing a reasonable long-term survival similar to the resection of CLM [7]. In contrast, the benefit from the surgical treatment of metastases of other origin was generally considered as poor [8]. Therefore, defining a standard treatment is difficult; thus, regarding many tumor entities only some basic observations can be made. Nevertheless, since a few quality meta-analyses were published over the last years, reliable data to issue a treatment recommendation regarding some other entities is available. Accordingly, the aim of this article is to give an overview over the clinical outcome following the resection of various NCLM and to provide a guideline for standard and extended indications for hepatic resection of non-colorectal liver lesions.

Incidence of Liver Metastases

Most liver metastases are of colorectal origin. About 20–50% of patients either present with synchronous lesions or develop metachronous metastases after resection of the primary colorectal cancer [9, 10]. The benefit of surgical resection is widely accepted even in the case of recurrent disease and will not be further detailed [11]. Due to the hepatic first-pass effect of the intestinal venous

Prof. Dr. Jürgen Klempnauer
General, Visceral and Transplantation Surgery
Hannover Medical School
Carl-Neuberg-Straße 1, 30625 Hannover, Germany
klempnauer.juergen @ mh-hannover.de

Table 1. Recent studies evaluating outcome after liver resection for NELM (with n > 20 cases)

Author	Year	Patients included, n	Median follow-up, months	Median survival, months	5-year OS	10-year OS
Sarmiento and Que [40]	2003	170	NR	81	61	35
Landry et al. [17]	2008	23	NR	NR	75	NR
Frilling et al. [15]	2009	23	60	NR	100	100
Glazer et al. [7]	2010	172	49	116	77	50
Mayo et al. [16]	2010	339	43	125	74	51
Cusati et al. [19]	2012	72	NR	NR	60	45
Valadares et al. [41]	2015	22	NR	NR	44	NR

NR = Not reported; OS = overall survival.

drainage through the portal vein, the liver is also a primary site for far-distant metastases of almost all other gastrointestinal cancers. These include gastric, pancreatobiliary, small bowel, and neuroendocrine cancers mostly located in the pancreas or terminal ileum. Apart from neuroendocrine cancer, the presence of liver lesions was generally regarded as a palliative situation with poor overall prognosis although a metastasis to other body compartments might not have occurred.

Frequently seen are also metastases of breast cancer in advanced tumor stages as well as lesions originating from genitourinary cancers (ovarian, uterine, prostate, testicular, and renal cell cancer). Furthermore, malignant melanoma and soft tissue cancer such as sarcoma may spread into the liver. In these cases, hepatic metastasis is seen as a sign of systemic disease since tumor cells reach the liver through systemic circulation and not via the portal vein flow.

Standard Indication

Since surgical resection of CLM is the best documented procedure so far, a distinct benefit from the resection of metastases of other entities should be compared to these results. Depending on the literature cited, resection for CLM provides 5-year survival rates between 25 and 60% and an individual survival of up to 15 years [12, 13]. Until now, only surgical treatment of neuroendocrine liver metastases (NELM) appears to offer similar long-term results. Neuroendocrine tumors (NET) arise mostly from the gastrointestinal and bronchopulmonary tracts and are rare lesions, though with an increasing incidence during the last years. Approximately 13% of patients display metastases at primary diagnosis while approximately 40% of the patients develop some during the further course [14]. Resection appears to be the only possible treatment in curative intent and is limited by the metastatic pattern in most cases. The following three metastatic types were described: i) type 1 with single lesion of any size, ii) type 2 defined by one metastatic bulk with smaller surrounding satellites and bilateral participation, and iii) type 3 with bilateral disseminated lesions and near total consumption of normal liver tissue [15]. In summary, only between 10 and 20% of these, and mostly the first two types, seem feasible for surgical resection. Within the last years, various publications examining long-term survival following liver resection of NELM were issued. Even though they vary in the number of patients included and the location of the primary lesion, an assessment of the benefit from surgical treatment is possible. In some studies, overall survival (OS) following resection amounted up to 9.6 and 10.5 years [7, 16], while in others a median 5- and 10-year survival of 59–75% and 31–45%, respectively, was described [17–19]. Recent studies evaluating the outcome following liver resection for NELM are summarized in table 1.

It is noteworthy that almost all of these studies report a high rate of early recurrence after 2 years, mostly regarding the liver. Within 5 years the overall rate of recurrence rose up to 94% [16, 18]. Negative predictors for early recurrence or impaired outcome were synchronous onset of NELM, presence of non-functional lesions, and extrahepatic tumor manifestations. The location of the primary tumor, administration of neoadjuvant regimes, histological grading, and, interestingly, the R status do not appear to have an impact on OS [16]. A matter of ongoing discussion is the effectiveness of orthotopic liver transplantation (OLT) as a curative treatment for unresectable hepatic metastases of NET. A large European multicenter study from 2013 displayed a reasonable 5-year OS and disease-free survival following OLT of 52 and 30%, respectively [20]. A large meta-analysis from 2015 even reported a 5-year OS of 70% [21]. Markers associated with poor prognosis were pancreatic or duodenal primary tumor, major surgery in the upper abdomen such as partial duodenopancreatectomy prior to OLT, hepatomegaly, and highly dedifferentiated lesions [20, 22]. The selection of patients eligible for OLT is mainly based on the inclusion criteria established by Mazzaferro et al. [23], i.e. prior resection of the primary tumor located in the portal vein drainage area, well-differentiated tumors (Ki < 10%), and limitation of the disease to the liver with less than 50% tumor involvement. A follow-up of at least 6 months to assess the biological behavior and to document a stable disease was also considered reasonable but was not recommended by Fan et al. [21].

In summary, it appears certain that liver resection for NELM is safe and provides long-term survival with the handicap of risk for early recurrence. Nevertheless, resection for NELM should always be considered when technically possible and may be defined as a standard indication for liver resection due to NCLM.

Table 2. Recent selected studies evaluating outcome after liver resection for NCNN liver metastases

Primary tumor entity	Author	Year	Single vs. multi-center	Patients included, n	Median survival, months	One-year OS, %	Three-year OS, %	Five-year OS, %
Breast cancer	Pocard et al. [42]	2000	single	49	NR	86	49	NR
	Yoshimoto et al. [43]	2000	single	25	NR	NR	71	27
	Vlastos et al. [44]	2004	single	31	63	NR	86	61
	Sakamoto et al. [45]	2005	single	34	NR	NR	NR	21
	Adam et al. [39]	2006	multi	454	45	NR	NR	41
	Kollmar et al. [46]	2008	single	25	NR	NR	NR	50
	Lehner et al. [24]	2009	single	57	NR	84	52	30
	Chua et al. [27]	2011	review	553	40	NR	NR	40
Renal cell cancer	Alves et al. [47]	2003	single	14	26	69	26	NR
	Adam et al. [39]	2006	multi	85	36	NR	NR	38
	Thelen et al. [30]	2007	single	31	NR	82	54	38
	Lehner et al. [24]	2009	single	29	NR	73	47	22
Gastric cancer	Shirabe et al. [48]	2003	single	36	NR	64	26	26
	Sakamato et al. [45]	2003	single	22	NR	73	38	38
	Koga et al. [35]	2007	single	42	34	76	48	42
	Cheon et al. [49]	2008	single	58	NR	75	32	21
	Tiberio et al. [50]	2009	multi	73	NR	81	30	20
	Lehner et al. [24]	2009	single	22	NR	80	10	–
Pancreatic cancer	Adam et al. [39]	2006	multi	40	20	NR	NR	25
	Yamada et al. [51]	2006	single	40	NR	67	33	17
	Gleisner et al. [52]	2007	single	22	NR	13	7	NR
	Lehner et al. [24]	2009	single	12	NR	30	18	8
Melanoma (ocular vs. cutaneous)	Pawlik et al. [36]	2006	single	20/20	NR	NR	NR	21/0
	Adam et al. [39]	2006	multi	104/44	19/27	NR	NR	21/22
	Hsueh et al. [38]	2007	single	24	11	NR	NR	39 (cutaneous)
	Lehner et al. [24]	2009	single	20	NR	63	42	21 (both types)

NR = Not reported; OS = overall survival.

Extended Indications

Although the overall value of surgical resection for non-colorectal and non-neuroendocrine (NCNN) liver metastases was generally considered as poor, numerous publications over the last years emphasized that selected patients may gain long-term survival from surgical therapy. However, since all of these case collectives were inhomogeneous regarding primary tumor location, individual treatment history, and staging at the time of liver surgery, it is difficult to reach a universal conclusion. Most challenging appears to be the appropriate selection of patients technically feasible for resection, taking into consideration that the indication should not only rely on surgical operability but also on the context of primary tumor disease, prior administered systemic treatment, and the response of the tumor to it.

Nevertheless, a case series of 273 patients from our center which investigated long-term survival following liver resection for NCNN liver metastases documented a 5-year OS of 28% [24], while various other studies reported rates of 19–39%, thus matching favorably with our results [6, 25, 26]. All of the studies showed that liver resection for NCNN liver metastases was safe and associated with similar rates of postoperative complications as seen in surgery for colorectal liver lesions. These overall results may not be satisfactory in general but might outrange non-surgical options depending on individual cases.

Most important in terms of prognosis and therefore defining the appropriate indication for resection is the primary tumor entity. Our own published data suggested that patients with liver metastases from breast and genitourinary cancer might benefit most from resection; the 5-year OS was 21–61%. On the contrary, liver resection for metastases from other gastrointestinal cancers showed worse outcomes – with a 5-year OS of only 10–20% [24]. The relatively encouraging results concerning the resection of liver metastases of the breast and of genitourinary origin are supported by other review analyses, with a 5-year OS of 20–60% for breast cancer [27, 28] and of 38–43% for renal cell cancer [29, 30].

The poor results for other than colorectal gastrointestinal tumor sites were reported in numerous studies elsewhere; the 5-year OS rates ranged from less than 15 to 30%. Some studies displayed that none of the patients even reached a 3-year survival [8, 31]. The

worst outcome was described for lesions originating from esophageal, cardia, and pancreatic cancer; selected patients with metastases arising from gastric or duodenal cancer seem to show better outcomes [32, 33], albeit the data is not very conclusive in the case of gastric cancer. On the one hand, one review summarized that of 436 cases only 29 patients were alive after 5 years [34], while, on the other hand, a small report with obviously well-selected patients from Asia showed a 5-year OS of 42% [35]. Solitary lesions and low primary T stage were associated with a favorable prognosis.

Very variable are also the results following liver resection for metastases from malignant melanoma. Lesions originating from cutaneous melanoma were associated with impaired outcome due to the disseminated metastatic pattern and high risk of recurrence while metastases of the ocular type were considered as prognostically superior by some authors [36, 37]. However, the 5-year OS for both types mentioned was 7–36% [26, 38]. Taken together, in view of missing alternatives, resection was recommended as part of a multidisciplinary approach.

As already stated, all of the presented studies are limited by the lack of sizable patient numbers for the many different primary tumor entities, the heterogeneity of the individual cases, and the mostly retrospective approach. It must be speculated that all included patients were highly selected and did not represent an average treatment history. Therefore, a thorough review of the available data is required to classify the diverse entities into those feasible for liver resection and a reasonable benefit from it and into those who should be directed to multimodal treatment options. A great asset regarding this aspect was the large meta-analysis of 1,452 patients by Adam et al. [39], emphasizing that at least three different prognostic groups can be distinguished, which matches fairly well with the findings presented above.

The first group comprises tumors with the most benefit from resection and includes lesions of the breast as well as of genitourinary (testicular, ovarian, uterine, renal, and adrenal) and small bowel origin. The 5-year OS was >30% for these cases. The second group consisted of tumor origins from the foregut (gastric, duodenal, and exocrine pancreas) as well as both types of melanoma and displayed a 5-year OS of 15–30%. The last group showed a 5-year OS of less than 15% and comprised esophageal, lung, and head and neck primaries [39]. Table 2 provides a variety of selected studies exploring the outcome after resection for NCNN liver metastases.

In summary, in the case of lesions of the breast and of genitourinary origin, reasonable evidence for a benefit of liver resection is available, given that patients are thoroughly screened to exclude extrahepatic manifestations and hepatic surgery is embedded in a multimodal individual treatment concept. Hence, this group should define an extended indication for liver resection for NCLM.

Regarding liver metastases from other primaries the data is more inconclusive and difficult to interpret. Still, it appears that only highly selected patients might benefit from resection. In each individual case a careful reconsideration of the prior treatment history, the biological behavior of the tumor, and the effectiveness of alternative systemic chemotherapeutic therapies should be performed. As a result, an extended indication for resection in general cannot be proposed.

Conclusion

In conclusion, liver resection for NELM can be defined as a standard indication. Under distinct preconditions and based on thorough patient selection, liver metastases of breast and genitourinary primaries are extended indications for surgical hepatic treatment. In all other entities, hepatic resection should only be considered as a part of individual treatment concepts.

Disclosure Statement

The authors have no conflict of interest to declare.

References

1 McCarter MD, Fong Y: Metastatic liver tumors. Semin Surg Oncol 2000;19:177–188.

2 Rees M, Tekkis PP, Welsh FK, O'Rourke T, John TG: Evaluation of long-term survival after hepatic resection for metastatic colorectal cancer: a multifactorial model of 929 patients. Ann Surg 2008;247:125–135.

3 Vigano L, Ferrero A, Lo Tesoriere R, Capussotti L: Liver surgery for colorectal metastases: results after 10 years of follow-up. Long-term survivors, late recurrences, and prognostic role of morbidity. Ann Surg Oncol 2008;15:2458–2464.

4 van Ruth S, Mutsaerts E, Zoetmulder FA, van Coevorden F: Metastasectomy for liver metastases of noncolorectal primaries. Eur J Surg Oncol 2001;27:662–667.

5 Metcalfe MS, Mullin EJ, Maddern GJ: Hepatectomy for metastatic noncolorectal gastrointestinal, breast and testicular tumours. ANZ J Surg 2006;76:246–250.

6 O'Rourke TR, Tekkis P, Yeung S, Fawcett J, Lynch S, Strong R, Wall D, John TG, Welsh F, Rees M: Long-term results of liver resection for non-colorectal, non-neuroendocrine metastases. Ann Surg Oncol 2008;15:207–218.

7 Glazer ES, Tseng JF, Al-Refaie W, Solorzano CC, Liu P, Willborn KA, Abdalla EK, Vauthey JN, Curley SA: Long-term survival after surgical management of neuroendocrine hepatic metastases. HPB (Oxford) 2010;12:427–433.

8 Lendoire J, Moro M, Andriani O, Grondona J, Gil O, Raffin G, Silva J, Bracco R, Podesta G, Valenzuela C, Imventarza O, Pekolj J, De Santibanes E: Liver resection for non-colorectal, non-neuroendocrine metastases: analysis of a multicenter study from Argentina. HPB (Oxford) 2007;9:435–439.

9 Haddad AJ, Bani Hani M, Pawlik TM, Cunningham SC: Colorectal liver metastases. Int J Surg Oncol 2011;2011:285840.

10 Jemal A, Bray F, Center MM, Ferlay J, Ward E, Forman D: Global cancer statistics. CA Cancer J Clin 2011;61:69–90.

11 Kulik U, Bektas H, Klempnauer J, Lehner F: Repeat liver resection for colorectal metastases. Br J Surg 2013;100:926–932.

12 Kulik U, Framke T, Grosshennig A, Ceylan A, Bektas H, Klempnauer J, Lehner F: Liver resection of colorectal liver metastases in elderly patients. World J Surg 2011;35:2063–2072.

13 Welsh FK, Tekkis PP, John TG, Rees M: Predictive models in colorectal liver metastases – can we personalize treatment and outcome? Dig Surg 2008;25:406–412.

14 Modlin IM, Lye KD, Kidd M: A 5-decade analysis of 13,715 carcinoid tumors. Cancer 2003;97:934–959.

15 Frilling A, Li J, Malamutmann E, Schmid KW, Bockisch A, Broelsch CE: Treatment of liver metastases from neuroendocrine tumours in relation to the extent of hepatic disease. Br J Surg 2009;96:175–184.

16 Mayo SC, de Jong MC, Pulitano C, et al: Surgical management of hepatic neuroendocrine tumor metastasis: results from an international multi-institutional analysis. Ann Surg Oncol 2010;17:3129–3136.

17 Landry CS, Scoggins CR, McMasters KM, Martin RC 2nd: Management of hepatic metastasis of gastrointestinal carcinoid tumors. J Surg Oncol 2008;97:253–258.

18 Sarmiento JM, Heywood G, Rubin J, Ilstrup DM, Nagorney DM, Que FG: Surgical treatment of neuroendocrine metastases to the liver: a plea for resection to increase survival. J Am Coll Surg 2003;197:29–37.

19 Cusati D, Zhang L, Harmsen WS, Hu A, Farnell MB, Nagorney DM, Donohue JH, Que FG, Reid-Lombardo KM, Kendrick ML: Metastatic nonfunctioning pancreatic neuroendocrine carcinoma to liver: surgical treatment and outcomes. J Am Coll Surg 2012;215:117–124; discussion 124–115.

20 Le Treut YP, Gregoire E, Klempnauer J, et al: Liver transplantation for neuroendocrine tumors in Europe – results and trends in patient selection: a 213-case European liver transplant registry study. Ann Surg 2013; 257:807–815.

21 Fan ST, Le Treut YP, Mazzaferro V, Burroughs AK, Olausson M, Breitenstein S, Frilling A: Liver transplantation for neuroendocrine tumour liver metastases. HPB (Oxford) 2015;17:23–28.

22 Le Treut YP, Gregoire E, Belghiti J, Boillot O, Soubrane O, Mantion G, Cherqui D, Castaing D, Ruszniewski P, Wolf P, Paye F, Salame E, Muscari F, Pruvot FR, Baulieux J: Predictors of long-term survival after liver transplantation for metastatic endocrine tumors: an 85-case French multicentric report. Am J Transplant 2008;8:1205–1213.

23 Mazzaferro V, Pulvirenti A, Coppa J: Neuroendocrine tumors metastatic to the liver: how to select patients for liver transplantation? J Hepatol 2007;47:460–466.

24 Lehner F, Ramackers W, Bektas H, Becker T, Klempnauer J: Liver resection for non-colorectal, non-neuroendocrine liver metastases – is hepatic resection justified as part of the oncosurgical treatment? (Article in German). Zentralbl Chir 2009;134:430–436.

25 Bresadola V, Rossetto A, Adani GL, Baccarani U, Lorenzin D, Favero A, Bresadola F: Liver resection for noncolorectal and nonneuroendocrine metastases: results of a study on 56 patients at a single institution. Tumori 2011;97:316–322.

26 Groeschl RT, Nachmany I, Steel JL, Reddy SK, Glazer ES, de Jong MC, Pawlik TM, Geller DA, Tsung A, Marsh JW, Clary BM, Curley SA, Gamblin TC: Hepatectomy for noncolorectal non-neuroendocrine metastatic cancer: a multi-institutional analysis. J Am Coll Surg 2012;214:769–777.

27 Chua TC, Saxena A, Liauw W, Chu F, Morris DL: Hepatic resection for metastatic breast cancer: a systematic review. Eur J Cancer 2011;47:2282–2290.

28 Howlader M, Heaton N, Rela M: Resection of liver metastases from breast cancer: towards a management guideline. Int J Surg 2011;9:285–291.

29 Ruys AT, Tanis PJ, Nagtegaal ID, van Duijvendijk P, Verhoef C, Porte RJ, van Gulik TM: Surgical treatment of renal cell cancer liver metastases: a population-based study. Ann Surg Oncol 2011;18:1932–1938.

30 Thelen A, Jonas S, Benckert C, Lopez-Hanninen E, Rudolph B, Neumann U, Neuhaus P: Liver resection for metastases from renal cell carcinoma. World J Surg 2007;31:802–807.

31 Hemming AW, Sielaff TD, Gallinger S, Cattral MS, Taylor BR, Greig PD, Langer B: Hepatic resection of noncolorectal nonneuroendocrine metastases. Liver Transpl 2000;6:97–101.

32 Slotta JE, Schuld J, Distler S, Richter S, Schilling MK, Kollmar O: Hepatic resection of non-colorectal and non-neuroendocrine liver metastases – survival benefit for patients with non-gastrointestinal primary cancers – a case-controlled study. Int J Surg 2014;12:163–168.

33 Uggeri F, Ronchi PA, Goffredo P, Garancini M, Degrate L, Nespoli L, Gianotti L, Romano F: Metastatic liver disease from non-colorectal, non-neuroendocrine, non-sarcoma cancers: a systematic review. World J Surg Oncol 2015;13:191.

34 Kerkar SP, Kemp CD, Avital I: Liver resections in metastatic gastric cancer. HPB (Oxford) 2010;12:589–596.

35 Koga R, Yamamoto J, Ohyama S, Saiura A, Seki M, Seto Y, Yamaguchi T: Liver resection for metastatic gastric cancer: experience with 42 patients including eight long-term survivors. Jpn J Clin Oncol 2007;37:836–842.

36 Pawlik TM, Zorzi D, Abdalla EK, Clary BM, Gershenwald JE, Ross MI, Aloia TA, Curley SA, Camacho LH, Capussotti L, Elias D, Vauthey JN: Hepatic resection for metastatic melanoma: distinct patterns of recurrence and prognosis for ocular versus cutaneous disease. Ann Surg Oncol 2006;13:712–720.

37 Rivoire M, Kodjikian L, Baldo S, Kaemmerlen P, Negrier S, Grange JD: Treatment of liver metastases from uveal melanoma. Ann Surg Oncol 2005;12:422–428.

38 Hsueh EC, Essner R, Foshag LJ, Ye X, Wang HJ, Morton DL: Prolonged survival after complete resection of metastases from intraocular melanoma. Cancer 2004; 100:122–129.

39 Adam R, Chiche L, Aloia T, Elias D, Salmon R, Rivoire M, Jaeck D, Saric J, Le Treut YP, Belghiti J, Mantion G, Mentha G; Association Française de Chirurgie: Hepatic resection for noncolorectal nonendocrine liver metastases: analysis of 1,452 patients and development of a prognostic model. Ann Surg 2006;244:524–535.

40 Sarmiento JM, Que FG: Hepatic surgery for metastases from neuroendocrine tumors. Surg Oncol Clin N Am 2003;12:231–242.

41 Valadares LJ, Costa Junior W, Ribeiro HS, Diniz AL, Coimbra FJ, Herman P: Resection of liver metastasis from neuroendocrine tumors: evaluation of results and prognostic factors. Rev Col Bras Cir 2015;42:25–31.

42 Pocard M, Pouillart P, Asselain B, Salmon R: Hepatic resection in metastatic breast cancer: results and prognostic factors. Eur J Surg Oncol 2000;26:155–159.

43 Yoshimoto M, Tada T, Saito M, Takahashi K, Uchida Y, Kasumi F: Surgical treatment of hepatic metastases from breast cancer. Breast Cancer Res Treat 2000;59: 177–184.

44 Vlastos G, Smith DL, Singletary SE, Mirza NQ, Tuttle TM, Popat RJ, Curley SA, Ellis LM, Roh MS, Vauthey JN: Long-term survival after an aggressive surgical approach in patients with breast cancer hepatic metastases. Ann Surg Oncol 2004;11:869–874.

45 Sakamoto Y, Yamamoto J, Yoshimoto M, Kasumi F, Kosuge T, Kokudo N, Makuuchi M: Hepatic resection for metastatic breast cancer: prognostic analysis of 34 patients. World J Surg 2005;29:524–527.

46 Kollmar O, Moussavian MR, Richter S, Bolli M, Schilling MK: Surgery of liver metastasis in gynecological cancer – indication and results. Onkologie 2008;31: 375–379.

47 Alves A, Adam R, Majno P, Delvart V, Azoulay D, Castaing D, Bismuth H: Hepatic resection for metastatic renal tumors: is it worthwhile? Ann Surg Oncol 2003;10:705–710.

48 Shirabe K, Shimada M, Matsumata T, Higashi H, Yakeishi Y, Wakiyama S, Ikeda Y, Ezaki T, Fukuzawa S, Takenaka K, Kishikawa K, Ikeda T, Taguchi K, Maehara Y, Sugimachi K: Analysis of the prognostic factors for liver metastasis of gastric cancer after hepatic resection: a multi-institutional study of the indications for resection. Hepatogastroenterology 2003;50:1560–1563.

49 Cheon SH, Rha SY, Jeung HC, Im CK, Kim SH, Kim HR, Ahn JB, Roh JK, Noh SH, Chung HC: Survival benefit of combined curative resection of the stomach (D2 resection) and liver in gastric cancer patients with liver metastases. Ann Oncol 2008;19:1146–1153.

50 Tiberio GA, Coniglio A, Marchet A, Marrelli D, Giacopuzzi S, Baiocchi L, Roviello F, de Manzoni G, Nitti D, Giulini SM: Metachronous hepatic metastases from gastric carcinoma: a multicentric survey. Eur J Surg Oncol 2009;35:486–491.

51 Yamada H, Hirano S, Tanaka E, Shichinohe T, Kondo S: Surgical treatment of liver metastases from pancreatic cancer. HPB (Oxford) 2006;8:85–88.

52 Gleisner AL, Assumpcao L, Cameron JL, Wolfgang CL, Choti MA, Herman JM, Schulick RD, Pawlik TM: Is resection of periampullary or pancreatic adenocarcinoma with synchronous hepatic metastasis justified? Cancer 2007;110:2484–2492.