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Review

Liver resection for noncolorectal liver metastases: the good, the bad, and the ugly

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ABSTRACT

Background: Noncolorectal liver metastases (NONCOLMETs) are composed of a heterogeneous group historically associated with poor outcomes. Advances in systemic therapy and liver interventions have renewed interest in liver resection (LR) for selected patients. However, evidence remains inconsistent, and indications vary across tumor types.

Methods: A comprehensive MEDLINE and Embase search up to February 2025, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines, identified studies assessing the outcomes of liver interventions for NONCOLMETs. The studies were grouped by primary tumor. The extracted and summarized data included overall survival (OS), prognostic determinants, and comparisons with nonsurgical management.

Results: From 899 screened records, survival after LR varied markedly. The most favorable outcomes were seen in neuroendocrine tumors (median OS, 84–120 months) and gastrointestinal stromal tumors (GISTs) responding to tyrosine kinase inhibitors (TKIs; median OS, 70–90 months). Breast and selected urogynecologic cancers showed a median OS of > 36 months. However, esophageal, gastric, and pancreatic cancers showed benefit only in exceptionally selected, chemoresponsive liver-only disease. Across tumor types, specific favorable prognostic factors included oligometastatic and liver-only disease; longer disease-free interval; radiologic or biomarker response to systemic therapy, such as carbohydrate antigen 19–9 decline in pancreatic cancer, estrogen receptor/progesterone receptor positivity in breast cancer, human epidermal growth factor receptor 2 or programmed death-ligand 1 expression in gastroesophageal cancer, and TKI response in GIST; and well-differentiated histology. Comparative and propensity-matched analyses consistently suggested a survival benefit from LR in favorable subsets of patients with NONCOLMETs.

Conclusion: LR may provide meaningful survival benefit in carefully selected patients with biologically favorable, liver-dominant NONCOLMETs. Multidisciplinary evaluation and tumor-specific selection criteria remain essential. Prospective studies are needed to refine the indications.

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Introduction

Liver metastases (LMs) represent a final common pathway for systemic dissemination across various malignancies. Historically considered a manifestation of terminal disease, hepatic involvement is now recognized as a potentially controllable event in selected patients treated with multimodal strategies [1]. Over the past few decades, the combination of improved systemic regimens and hepatic surgery has redefined the role of liver resection (LR) and other local interventions for selected patients with LMs originating not only from the colon or rectum but also from noncolorectal LMs (NONCOLMETs) [2–5].

In patients with NONCOLMETs, reported survival varies widely, largely reflecting differences in primary tumor type, disease burden, and tumor biology [5]. Neuroendocrine tumors (NETs) display the most favorable outcomes, with 5-year overall survival (OS) rates of 60% to 80% after LR [6,7], reflecting their less aggressive behavior and the feasibility of repeated interventions. In contrast, gastrointestinal (GI) tumors, such as gastric, esophageal, or pancreatic cancers, demonstrate only marginal benefit from LR and only in highly selected cases. When LR is combined with tyrosine kinase inhibitors (TKI), such as imatinib, sunitinib, or regorafenib, good disease control can be achieved in specific tumor types, such as GI stromal tumors (GISTs) [8]. Similarly, selected patients with hormone receptor–positive breast cancer and those with some gynecologic, urological, melanoma, or soft tissue sarcoma (STS) LM may achieve durable survival with multimodal treatment [9–14].

Despite the heterogeneity of tumor origins, several cross-tumor principles have emerged to guide patient selection for liver-directed therapy. One of the most consistent determinants of benefit is limited hepatic-only disease, typically solitary or oligometastatic lesions [15]. Metachronous metastases and a disease-free interval (DFI) of > 12 months are consistently associated with improved survival [3,5]. Conversion to resectability after systemic therapy may identify subgroups with less aggressive tumor biology [2,3,5]. Biomarkers, such as carbohydrate antigen 19-9 (CA 19-9), decline in pancreatic cancer, hormone receptor status, and more specifically, estrogen receptor (ER)/progestin receptor (PR) status in breast cancer, human epidermal growth factor receptor 2 (HER2) expression in gastroesophageal adenocarcinoma, and molecular response to TKI in GIST further refine multidisciplinary decision-making [8,15–18]. Ultimately, LR for NONCOLMETs should be considered only after comprehensive multidisciplinary evaluation, ensuring oncologic rationale and technical feasibility within an integrated framework [3,5,19].

The current scoping review summarizes the current state of the art in the management of NONCOLMETs, reporting survival outcomes after liver interventions compared with systemic therapy alone in the era of modern, personalized systemic treatment, including targeted therapies and biological agents. In addition, using an anatomical, biological, and conditional (or patient-related) framework, it synthesizes prognostic and selection factors that may help liver surgeons distinguish patients likely to benefit from LR from those in whom surgery should be avoided.

Materials and methods

Search strategy

The search was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines for scoping review [20]. A comprehensive search of MEDLINE and Embase was performed for reports published before February 11, 2025, using combined text and Medical Subject Headings terms, with no language restrictions. Search terms included “non colorectal,” “noncolorectal,” “noncolorectal,” “liver metastases,” and tumor-specific keywords. The references of retrieved articles were cross-checked to identify additional relevant studies.

Study selection

Studies included in the review met the following criteria: (i) patients aged > 18 years, (ii) patients who underwent any type of liver intervention for NONCOLMETs, and (iii) experimental or observational (prospective and retrospective) and case series regarding the treatment of patients with NONCOLMETs. The exclusion criteria were animal studies, case reports, editorials, and comments. When duplicate reports from the same cohort were identified, only the most recent publication or the one with the longest follow-up period was included. Full-text articles were retrieved for further assessment if they were not excluded during the initial screening. In addition, reference lists of the included papers were cross-checked to identify additional eligible studies.

Data collection

To determine eligibility, several researchers assessed titles and abstracts of selected papers, grouped by primary tumor diagnosis. The full articles were reviewed in detail. Extracted data included country of study, design, number of participants, type of liver intervention, oncologic outcomes, and determinants of outcomes.

Statistical analysis

The authors independently evaluated the included studies for quality according to the study design. No specific tool for quality assessment was used because of the high heterogeneity of the included studies.

Data were summarized descriptively with numbers and percentages, proportions, and medians, along with corresponding ranges. No quantitative synthesis was planned due to heterogeneity in populations, interventions, and outcome reporting. Figures and tables were generated using Microsoft Office.

Results

The literature search yielded 899 records. The article selection process and full-text retrieval were performed separately for each tumor subtype. Fig. 1 and Tables 1 and 2 present a global overview of the evidence identified in the literature.

Reported survival

Survival outcomes after LR or other liver interventions for NONCOLMETs were highly heterogeneous, largely reflecting tumor-specific biology. The reported median OS ranged from 20 to 30 months in gastric, esophageal, and pancreatic primaries to more than 60 to 80 months in NETs and GISTs treated using targeted or multimodal strategies. Of note, the 5-year OS remained below 15% in pancreatic, gastric, and esophageal cancers; was 25% to 35% in breast and selected gynecologic tumors; was 30% to 50% in GISTs and STSs, and exceeded 50% to 70% in NETs. Table 1 and Fig. 1 present the reported survival outcomes for NONCOLMETs treated with LR or other liver interventions.

Comparative outcomes between surgery and nonsurgical management

Several determinants of favorable outcomes emerged consistently across tumor types. Oligometastatic disease, defined as limited hepatic tumor burden (solitary or ≤3 lesions with unilobar distribution) and resectability with negative (R0) margins, represented the most consistent predictor of long-term survival.

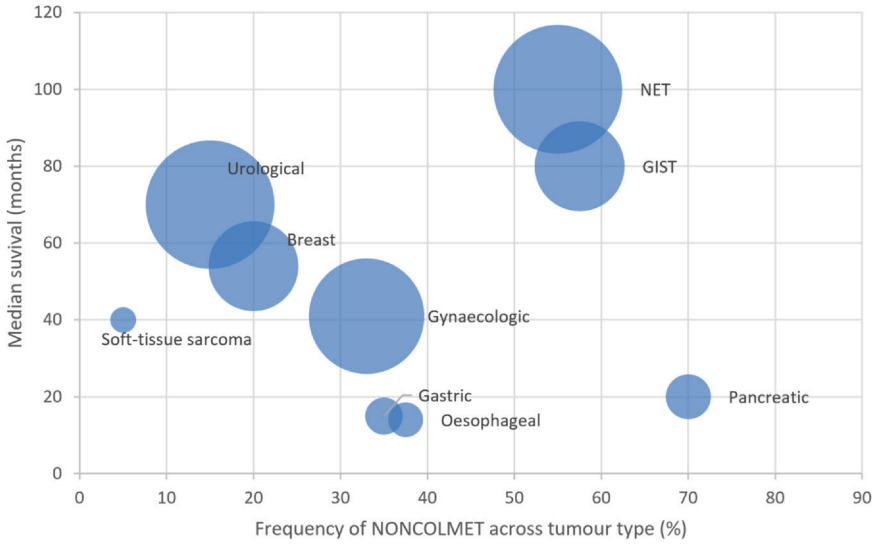

Figure 1. Bubble plot of NONCOLMET. The figure shows the frequency of liver metastases (x-axis) vs the expected median overall survival (y-axis) in months. GIST, gastrointestinal stromal tumor; NET, neuroendocrine tumor; NONCOLMET, noncolorectal tumor liver metastasis.

Metachronous presentation, a prolonged DFI (> 12 months), and objective radiologic or biomarker response to systemic or targeted therapy (eg, CA 19-9 decline in pancreatic cancer, TKI response in GIST, or hormonal or HER2 positivity in breast cancer) further identified biologically indolent disease suitable for LR. The absence of uncontrolled extrahepatic spread, good performance status, and integration of surgery within a multimodal treatment plan were universal prerequisites for benefit. Table 2 presents the cross-tumor determinants of favorable outcomes.

Esophageal cancer LMs

LMs were present in 35% to 40% of patients with esophageal cancer at diagnosis [21,22], with a median survival of only 5 to 10 months under chemotherapy alone [23,24].

The role of LR in oligometastatic esophageal cancer LMs (ECLMs) has been controversial, as confirmed by the European clinical practice guidelines on OligoMetastatic Esophagogastric Cancer (OMEC-4) [15]. The literature search retrieved only a few retrospective mono- or multicentric studies [24,25], including 2 national registries, the Spanish AGAMENON [17] and the Dutch registry [22], but with relatively low patient numbers, therefore not suitable for forming robust recommendations.

Consistent factors for considering LR included low hepatic tumor burden, defined as solitary or ≤3 lesions, DFI > 12 months [22,26–28], and chemotherapy response before LR [29,30]. Conversely, synchronous presentation, diffuse lesions, or uncontrolled extrahepatic spread predicted poor outcomes. No specific esophageal cancer–related factors for a favorable or unfavorable prognosis were identified.

Overall, selected patients treated with a multimodal approach involving LR seemed to show a more favorable prognosis than those who did not undergo surgery [31], with 3-year survival rates in 21% to 50% of patients [5,17,25,32]. In the 2 studies with the longest OS after LR, 77% of the patients had solitary LMs, 15% of patients had 2 liver lesions, and only 1 patient was treated for 3 LMs [26,27]. Liu et al. [27] showed that the outcomes of patients who underwent

Table 1
Summary of reported survival after liver resection for noncolorectal liver metastases.

Primary tumor	Median OS (mo)	Main prognostic factors	Best candidates for local therapy
Neuroendocrine LM	84–120	Lower grade, cytoreduction ≥70% feasible, limited hepatic disease, and no extrahepatic spread	Parenchymal-sparing resection achieving ≥ 70% cytoreduction, repeatable liver-directed interventions
Breast cancer LM	12–84	ER/PR positivity, longer DFI, R0 resection, limited hepatic disease, and no extrahepatic spread	Liver-only disease under good systemic control
GIST and STS LM	70–90 (GIST)/ 30–50 (STS)	Response to TKI (GIST), metachronous presentation, R0 resection, limited hepatic disease, and no extrahepatic spread	Surgery after maximal TKI response for GIST. Resection of isolated or limited lesions for STS
Gynecologic LM (ovarian > endometrial > cervical)	27–54	Response to chemotherapy, complete cytoreduction (R0), limited disease, and no peritoneal carcinomatosis	Liver involvement included within planned cytoreductive surgery in which R0 is achievable
Urologic LM (RCC, GCT, selected bladder cancer)	27–120	Response to chemotherapy, longer DFI, R0 resection, and limited hepatic disease	Resection of isolated or limited lesions for RCC, GCT, or highly selected bladder LM
Pancreatic cancer LM	11–40	Response to chemotherapy, longer DFI, and very limited liver-only disease	Very selected liver-only disease with strong radiologic and biomarker response to modern chemotherapy
Gastric cancer LM	6–31	Response to chemotherapy, longer DFI, and very limited liver-only disease	Very selected liver-only disease with strong radiologic and biomarker response to modern chemotherapy
Esophageal cancer LM	5–27	Response to chemotherapy, longer DFI, and very limited liver-only disease	Very selected liver-only disease with strong radiologic and biomarker response to modern chemotherapy

DFI, disease-free interval; ER, estrogen receptor; GCT, germ cell tumor; GIST, gastrointestinal stromal tumor; LM, liver metastasis; NET, neuroendocrine tumor; OS, overall survival; PR, progesterone receptor; R0 resection, microscopically margin-negative resection (no residual tumor); RCC, renal cell carcinoma; STS, soft tissue sarcoma; TKI, tyrosine kinase inhibitor.

Table 2
Cross-tumor determinants of favorable outcome after liver-directed therapy for noncolorectal liver metastases.

Category	Favorable (Proceed to surgery)	Borderline	Unfavorable (Surgery contraindicated)
Patient factors	ECOG 0-1; age < 70; good nutritional status	ECOG 2; mild comorbidities	ECOG ≥ 3; severe comorbidities; malnutrition
Primary tumor biology	NET (lower grade), GIST (under effective TKI), sarcoma (low grade), breast (ER/PR+), ovarian or endometrial cancer (chemosensitive)		Undifferentiated/high-grade, small-cell, or anaplastic histology; aggressive mucinous, signet ring; or chemoresistant phenotypes
Liver metastasis biology	Chemoresponsive tumor, longer DFI, favorable biomarker trend → For pancreatic cancer CA 19-9 ↓ → For GIST TKI response	Partial chemoresponse or stable disease; modest or equivocal biomarker improvement	Progressive chemoresistant disease, increasing tumor markers, uncontrolled extrahepatic spread
Liver metastasis burden	"Oligometastatic disease"	Borderline resectable lesions	Diffuse/bilobar lesions, vascular encasement/invasion
Technical feasibility	Preserved hepatic reserve, R0 → For NET ≥ 70% cytoreduction		Limited hepatic reserve, R2 expected

CA 19-9, carbohydrate antigen 19-9; DFI, disease-free interval; ECOG, Eastern Cooperative Oncology Group; ER, estrogen receptor; GIST, gastrointestinal stromal tumor; LM, Liver metastasis; NET, neuroendocrine tumor; PR, progesterone receptor; R0, complete microscopic tumor resection; R2, macroscopically incomplete tumor resection; TKI, tyrosine kinase inhibitor.

surgery for metachronous ECLMs improved when the DFI was > 12 months. Seesing et al. [22] reported superior survival rates in 11 patients after the resection of mainly metachronous ECLMs, with a DFI between 11 and 27 months.

Gastric cancer liver LMs

LMs occurred in 30% to 40% of patients with gastric cancer, representing one of the most frequent metastatic sites, with poor prognosis under systemic therapy alone and a median OS of 6 to 11 months [33–36].

Gastric cancer LMs (GCLMs) are usually managed with palliative intent as indicated by the OMEC-4 guidelines [15]. However, emerging data suggest that LR is feasible in a selected subset of patients with oligometastatic GCLMs. The literature search retrieved retrospective studies and systematic reviews with no randomized controlled trials (RCTs) [37–41], including a national registry, the Italian Meta-Gastro register [42], and the Italian Research Group for Gastric Cancer (GIRCG) [43].

The indications for liver interventions included oligometastatic disease, generally defined as ≤3 nodules with a tumor size of ≤3 cm, metachronous presentation, and response to chemotherapy [37,44–46]. Recent papers considered the term "oligometastatic" to identify a subgroup of patients who could benefit from surgical treatment in the context of a multimodal approach [15,18,47,48]. Improved response to newer combinations, including triplet regimens with fluorouracil, leucovorin, oxaliplatin, and docetaxel (FLOT) and docetaxel, cisplatin, and fluorouracil, was shown to select potential candidates [49]. In addition, improved outcomes were observed in HER2 positive patients treated with systemic therapy in combination with trastuzumab [50] and in those with a programmed death-ligand 1 (PD-L1) expression who were treated with immune checkpoint inhibitors, such as nivolumab or pembrolizumab [51,52].

Liao et al. [38] published a systematic review that compared LR with other treatments. A total of 196 patients who underwent LR showed a median OS of 23.7 months compared with 7.6 months in those in the control group, with a 1-year OS of 69% vs 27%. Marte et al. [39] reported a 5-year OS of 26% and disease-free survival (DFS) of 22% in the LR group. In addition, Conde Monroy et al. [40] reported 1-, 3-, and 5-year OS rates of 70%, 35%, and 25%, respectively, and 1-, 3-, and 5-year DFS rates of 41%, 23%, and 20%, respectively. Better outcomes were associated with metachronous presentation, smaller tumor size, and unilobar and solitary lesions.

Data from the Italian prospective Meta-Gastro registry considered GCLMs as nonresectable in 120 of 142 patients. At reevaluation, 8% of patients were deemed resectable and, thus, underwent surgical resection. The median survival estimates of patients deemed operable at diagnosis and those receiving conversion therapy were 14.8 and 27.6 months, respectively, whereas the median survival estimates of patients who received palliative surgery and those who received chemotherapy alone were 13.4 and 10.9 months, respectively [42]. The efficacy of conversion surgery was confirmed in a multicenter cohort study of the GIRCG [43].

These findings laid the groundwork for the German ENAISSANCE (AIO-FLOT5) RCT [18], which compared patients with limited metastatic disease who received FLOT plus trastuzumab if HER2 positive and nivolumab if PD-L1 positive and those who underwent radical complete surgical resection vs chemotherapy alone. The results are still awaited.

Pancreatic cancer LMs

Pancreatic ductal adenocarcinoma exhibited hepatic metastases in more than 70% of nonlocalized diseases [26,27], with a median OS of 11 to 13 months [53,54].

Although systemic therapy remains the standard of care for pancreatic cancer LMs (PCLMs), a carefully selected subset of patients seemed to benefit from multimodal strategies that included LR [1,55–58]. The literature search retrieved systematic reviews based on retrospective studies with no RCTs [59–61] and a national registry from Spain [62].

Patients displaying a more indolent clinical course and considered for surgical resection presented with limited liver burden, absence of extrahepatic disease, and durable responses to chemotherapy [53,55]. Regimens, such as FOLFIRINOX or gemcitabine plus nab-paclitaxel, have modestly improved the median OS, which ranges from 11 to 13 months [63,64]. Tumor marker dynamics, particularly CA 19-9, and radiographic evaluation were increasingly used to evaluate treatment response and guide management among responders [65,66].

The role of liver-directed therapies remained controversial [53,67,68]. The reported median survival typically ranged from 27 to 34 months for synchronous disease and 24 to 40 months for metachronous LM [16,59,60,69] after LR. These findings laid the groundwork for the Italian multicenter prospective SONAR trial (identification number: NCT06690528), which was designed to evaluate the feasibility and benefit of surgical resection in patients with liver-only metastatic pancreatic cancer.

Neuroendocrine LMs

NETs have presented a strong propensity for hepatic dissemination, affecting 21% to 90% of patients [6]. Surgical series consistently reported a 5-year OS between 60% and 80% [70,71] due to their less aggressive nature and responsiveness to multimodal therapy. Integration with systemic options, such as somatostatin analogs or peptide receptor radionuclide therapy, further extended disease control.

The literature search retrieved several retrospective series with no RCTs [7,70,72–91], with the most common sites for primary tumors being the pancreas and small bowel. Several studies have focused exclusively on small bowel NETs [72,84] and pancreatic NETs [81,88], which are known to have a higher tendency to develop LMs (50% and 75% of cases, respectively) [89,90] than NETs arising from other GI sites. According to the European Neuroendocrine Tumor Society (ENET) guideline, surgery with curative intent should be considered in grade 1 and grade 2 NETs, even in the presence of LM [92].

Optimal outcomes have been achieved in patients with unilobar disease and no extrahepatic spread [93]. R0 resection remains ideal but not mandatory, as meaningful cytoreduction significantly improves both survival and hormonal control [83,94]. NET-related predictors of prognosis included well-differentiated tumors and ≥70% tumor debulking.

A meta-analysis of 35 studies (N = 4834) [95] demonstrated a median OS of 84 to 120 months, markedly superior to that of nonsurgical cohorts (38–52 months). Recurrence rates reached 70% to 95%, predominantly intrahepatic, but iterative interventions maintained long-term survival [96]. Survival rates showed an increase over time, as demonstrated by Gudmundsdottir et al. [76], with a 5-year OS increasing from 71% to 78% to 81% during 3 distinct periods. The most outstanding survival was reported by Fairweather et al. [70], who reported a 5-year OS of 90% for 58 patients [76]. Modern management emphasized parenchymal-sparing hepatectomy, often in combination with intraoperative local ablation to achieve cytoreduction. Minimally invasive liver surgery has been increasingly adopted, offering reduced morbidity and similar DFS to open surgery [75,78]. In addition, many studies [74,81,82,85–87,91] showed a marked trend toward R1/R2 resections, achieving good symptom control and equivalent survival outcomes. The threshold of liver debulking was progressively lowered from 90% to 70%, without affecting survival outcomes [83,93,94,96]. Recurrence rates after resection were up to 95%, generally intrahepatic, with a 5-year DFS ranging from 13% to 46%. However, patients who underwent repeated resections showed favorable outcomes [83,85,86,93,94,96].

GIST and STS LMs

Of note, 50% to 65% of metastatic GISTs were found to involve the liver, frequently as the dominant site of spread. In contrast, STS metastases to the liver are rare, accounting for < 1% of hepatic metastases, with leiomyosarcoma being the most common [3,5,14].

LRs are commonly performed for GIST responding to TKI and rarely for selected sarcomas. Up to 80% of GISTs respond to TKI before developing resistance due to acquired secondary mutations in KIT or platelet-derived growth factor receptor alpha [97,98]. Because remission is rarely observed, LR should be performed at the maximal TKI response. The literature search yielded 1 RCT from China [8] and systematic reviews based on observational studies, including a prospective study [99] and several retrospective studies [100–104].

More favorable outcomes occurred in subjects with R0 resection, metachronous presentation, and no extrahepatic disease. The GIST-related predictors of good outcomes included partial or complete radiologic response to TKI. In STS, R0 resection was a key-positive predictor of outcomes, whereas incomplete (R1/R2) resection led to rapid recurrence (< 12 months) [8,14,99].

Combining surgery with TKI therapy yielded a median OS of 70 to 90 months for GIST, significantly exceeding that of TKI monotherapy, which was 40 to 50 months [102,105]. LR was typically performed at the maximal TKI response to minimize viable tumor [106]. In their RCT, Du et al. [8] recruited 41 patients with metastatic GISTs. Preliminary results showed 2-year progression-free survival (PFS) rates of 88.4% in the surgery group and 57.7% in the chemotherapy group. However, the imatinib-alone arm of the trial was closed early due to poor accrual.

For STS, pooled data showed a 1-year OS of 74% to 100% and a median OS of 30 to 50 months after resection [14]. Leiomyosarcoma is the most common histotype of resected sarcoma [14]. Incomplete resection and extrahepatic disease were the main predictors of poor OS [107,108].

Breast cancer LMs

The incidence of breast cancer LMs (BCLMs) ranged from 7.3% to 32%, with poor prognosis for patients treated with systemic therapy alone, with a median OS generally ranging from 18 to 24 months [109] and up to 24 to 84 months in surgical series [110–113].

Although systemic therapy remains the mainstay of treatment of BCLM, the role of liver-directed treatments remains controversial, especially in oligometastatic disease, and international guidelines, including the National Comprehensive Cancer Network and Advanced Breast Cancer [9,10], diverged in their recommendations. The literature search retrieved systematic reviews based on retrospective studies with no RCTs and national registries from Sweden, Spain, Greece, and Taiwan [110,114–116].

Significantly worse outcomes were reported in patients with multiple and larger metastases with a short DFI between breast surgery and diagnosis of BCLM. Additional adverse prognostic indicators included early progression of the disease under chemotherapy and the presence of extrahepatic spread [111–113,117–121]. In contrast, ER/PR positivity was consistently associated with improved outcomes, likely due to endocrine sensitivity. In addition, HER2 positivity was associated with good prognosis, although some studies reported discordant or nonsignificant results [122–124]. Triple-negative breast cancer was consistently associated with poorer survival in all studies in which this correlation reached statistical significance.

Data from propensity score–matched (PSM) analyses [117,125,126] and comparative cohort analyses [110,114,127,128] showed that LR was generally confirmed as an independent predictor of improved OS in selected patients. A meta-analysis based on 4070 subjects reported a pooled hazard ratio (HR) of 0.55 (95% CI, 0.44–0.69) in favor of surgery [110,117,125–128], and several PSM analyses confirmed improved OS and PFS of LR vs systemic therapy alone in selected patients [116,129–131].

Gynecologic cancer LMs

Liver involvement is a frequent event in advanced gynecologic malignancies, particularly ovarian and uterine cancers. Surveillance, Epidemiology, and End Results–based analyses reported hepatic metastases in 42% of ovarian cancer cases, 40% of uterine cancer cases, and 18% of cervical cancer cases with distant spread [132].

The literature search retrieved systematic reviews based on retrospective studies and 1 RCT [11].

The main determinants of a favorable outcome included limited hepatic involvement (solitary or few lesions ≤3 to 5 cm), complete cytoreduction (R0), chemoresponsive systemic disease, and absence

of peritoneal carcinomatosis or uncontrolled extrahepatic spread. The completeness of cytoreduction remained the strongest predictor of survival [12,19,132].

The DESKTOP III randomized trial [11] showed a significant survival benefit of cytoreductive surgery in patients with advanced ovarian cancer, with a median OS of 53.7 months compared with 46.0 months in those treated with systemic therapy alone. Good outcomes were further improved when complete (R0) cytoreductive surgery was achieved, with a reported OS of 61.9 vs 28.8 months. Of note, Mulligan et al. [19] demonstrated increased rates of complete cytoreduction, from 49.00% to 77.00%, and low mortality (0.68%) when the surgical procedure was performed not by gynecologists alone but in collaboration with a hepatobiliary team, supporting the importance of a multidisciplinary collaboration.

For endometrial cancer, Baldwin et al. [12] showed that adult women with metastatic endometrial cancer presented a survival benefit when treated with combined chemotherapy and LR. The 1-, 2-, and 3-year OS rates for chemotherapy plus LR vs chemotherapy alone were 67.8% vs 56.5%, 44.9% vs 33.4%, and 35.1% vs 23.1%, respectively.

Urologic cancer LMs

Among urological cancers, renal cell carcinoma (RCC), bladder cancer, and germ cell tumor (GCT) were the most frequent sources of LMs. In RCC, liver involvement occurred in approximately 20% of patients with disseminated disease, and only 5% of patients presented with isolated hepatic metastases [133]. The survival data reported in the literature were highly variable, with a median OS ranging from 16 to 140 months. For bladder carcinoma, LMs occurred in approximately 26.5% of cases, with an isolated liver disease occurring in 9% of cases. Visceral metastases from prostate cancer are relatively uncommon, with liver-only disease occurring in < 1% of advanced cases [134].

Data showed that LR remains the cornerstone of curative-intent treatment of RCC, bladder cancer, and GCT metastases. However, for prostate primaries, LR and LA were rarely indicated. The literature search retrieved systematic reviews based on retrospective studies with no RCTs and a national registry from the Netherlands [135].

Favorable prognostic determinants were limited hepatic tumor burden, metachronous presentation, long DFI (> 12 months), objective response to systemic therapy, and absence of uncontrolled extrahepatic disease. Conversely, progressive disease or extensive extrahepatic spread predicted poor outcomes and precluded hepatic intervention [3,5,133].

For RCC, a recent study on 40 patients who underwent hepatic resection for RCC metastases showed a significant improvement in median OS after the introduction of sunitinib in July 2006, with survival increasing from 27.5 to 45.2 months [136]. Although complete LR correlated with favorable outcomes, patient selection remained crucial, and integration with systemic immunotherapy and LR or LA was considered the standard of care [137].

For bladder carcinoma, a multicenter analysis of 508 patients with metastatic upper tract urothelial carcinoma showed that cytoreductive surgery improved survival (HR, 0.79; P =.015) and that the presence of LM predicted poorer outcomes (HR, 1.46; P < .001) [13]. LR was considered in highly selected cases with minimal disease burden and a favorable response to chemotherapy.

In GCTs, multimodal therapy combining chemotherapy and surgery led to long-term PFS, exceeding 90%, even in LM cases [133]. A multidisciplinary, individualized approach remains mandatory for these patients.

Melanoma LMs

The liver is a frequent site of LMs for both cutaneous and uveal melanomas. Historically, if untreated, survival was 1 to 8 months, reflecting the high aggressiveness of hepatic spread [5,138,139].

The optimal management of melanoma LMs remains a matter of considerable debate, with suggestions that LR might offer improved survival outcomes compared with nonsurgical approaches in selected patients [140–142].

Positive prognostic indicators identified included age < 70 years [141], a prolonged DFI between primary resection and metastases, absence of extrahepatic disease, a limited number of hepatic metastases, unilobar involvement, and R0 resections [135,140,143–147].

The literature search identified studies that focused exclusively on uveal melanoma, cutaneous melanoma [139,147], or both [135,141,146,148–150]. Pawlik et al. [25] observed that metastatic uveal melanoma had a particular tropism for the liver and that cutaneous melanoma had a more systemic recurrence pattern. Therefore, patients who underwent LR for uveal melanoma had prolonged OS, which was also due to the limited number of lesions. Hau et al. [150] reported a relatively good OS among patients treated with LR in conjunction with multimodal therapy, with 1-, 3-, and 5-year survival rates of 28.1%, 15.6%, and 3.1%, respectively. In contrast, patients who received systemic therapy alone had significantly lower survival rates.

Discussion

Unlike in colorectal cancer, in which LR is well established, evidence of NONCOLMET is limited [2–5]. NONCOLMET differs markedly in natural history. However, a consistent observation is that a limited, biologically favorable disease can achieve meaningful survival after LR. Most available evidence is retrospective and subject to selection bias. Nonetheless, reproducible survival gains across independent series confirm the validity of these criteria.

The role of LR should be considered within this spectrum, guided by tumor biology and treatment response. Ideal candidates are those with liver-dominant disease, stable or regressing lesions after systemic treatment, and no uncontrolled spread [151]. Favorable biological and clinical features include good performance status and a long DFI. Tumor-specific characteristics, such as CA 19-9 decline or BRCA expression in pancreatic cancer [65,66], ER and PR status in breast cancer [122–124], HER2 [50] and PD-L1 expression [51,52] in gastroesophageal adenocarcinoma, or response to TKI in GIST, can provide additional guidance for multidisciplinary decision-making [8,14,99]. Ultimately, the literature review highlighted that LR for NONCOLMET should be considered but only after a comprehensive multidisciplinary evaluation, ensuring both oncologic rationale and technical feasibility within an integrated framework [3,5,19,152].

Several gray areas still exist in the management of NONCOLMET. The concept of oligometastatic disease, a state between localized and systemic dissemination, has gained prominence, reframing metastatic management toward tailored, dynamic strategies. This has been highlighted in gastroesophageal cancer [15] and pancreatic cancer [60]. However, no consensus exists on its definition. The criteria vary widely across studies, including number of lesions (often ≤3), timing, and treatment response, making comparison and trial design challenging [54,60,61]. Similarly, the definitions of “conversion surgery” and “curative-intent surgery” after successful disease control with chemotherapy require clarification. In addition, although achieving an R0 resection was indicated in several types of LM, cytoreduction provided comparable survival and symptomatic benefit specific to LM, including colorectal LMs [153]. Cytoreduction of ≥70% showed favorable results in NETs [83,94] and demonstrated good outcomes in some ovarian cancer cases [12,154]. These are tumor types displaying a less aggressive clinical course, in which

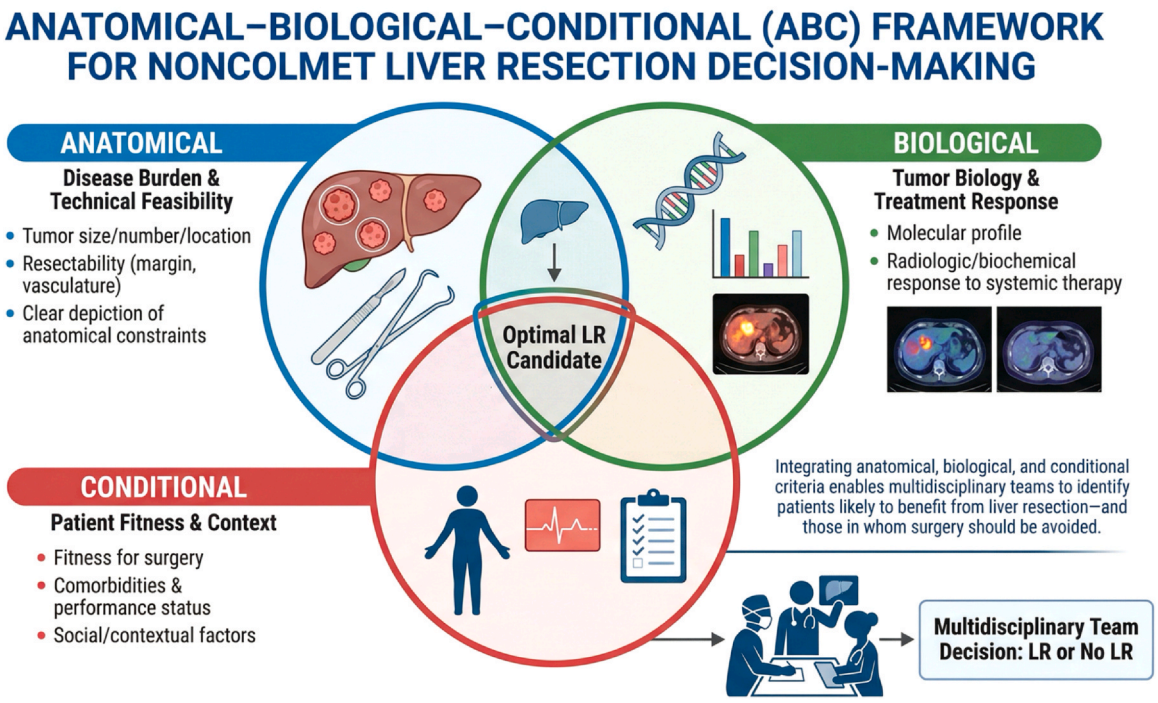

Figure 2. ABC framework for NONCOLMET LR decision-making. The figure shows the "ABC" model applied for NONCOLMET that should be used to identify the best candidates for LR. ABC, anatomical-biological-conditional; LR, liver resection; NONCOLMET, noncolorectal tumor liver metastasis.

surgical resection, even of recurrences, should be considered. Thus, the prognostic role of cytoreduction/debulking surgery in NONCOLMET without extrahepatic sites of disease should be investigated.

Several classification systems and risk models have been proposed for specific tumor types. However, none has achieved universal clinical acceptance. Yoshida et al. [48] proposed a 4-category biological classification for stage IV gastric cancer, based on the presence of macroscopic peritoneal dissemination and the technical and oncologic resectability of distant metastases. The classification ranged from category 1, which includes a technically resectable disease, to category 4, which encompasses peritoneal dissemination in combination with other organ metastases. An anatomical classification of ovarian LMs was proposed by Rosati et al. [155] to refine surgical planning. The authors described 5 types of hepatic involvement, ranging from type I with the Glisson capsule to type 5 with parenchymal metastases [155]. This classification was later validated in 615 patients, confirming that LR during cytoreductive surgery is safe (90-day mortality of 0.5%) and effective (complete cytoreduction of 86.7%) [154].

Beyond tumor-specific models, the anatomical-biological-conditional framework widely used to characterize pancreatic cancer resectability [156] offers a potentially transferable, pragmatic structure for NONCOLMET decision-making. The framework integrates disease burden and technical feasibility of LR (anatomical); tumor biology, including molecular profile and radiologic/biochemical response to systemic therapy (biological); and patient fitness and context (conditional). As synthesized in the current review, applying this lens may help liver surgeons and multidisciplinary teams identify patients most likely to benefit from LR and, equally importantly, those in whom surgery should be avoided (Fig. 2).

This review has several limitations, which are primarily related to the extreme heterogeneity and overall low methodological quality of the included studies. Furthermore, many historical series involve patients treated before the adoption of contemporary systemic regimens and modern principles of surgical oncology. The integration of molecular profiling and tumor biology into clinical pathways may help refine patient selection beyond the radiologic criteria. Establishing standardized definitions of concepts, such as oligometastatic disease or conversion chemotherapy, and proposing validated prognostic scores will be crucial for translating heterogeneous retrospective evidence into robust clinical guidance. Prospective registries, such as the NONCOLMET study recently launched [157], aim to address some of these gaps by developing comprehensive contemporary datasets of patients undergoing LR for NONCOLMET, thereby providing high-quality data on clinical practice, outcomes, and biological and morphological prognostic factors. However, this review provides a comprehensive overview of the surgical treatment of NONCOLMET, which we believe may be very useful for the surgical oncologist approaching these different diseases.

Conclusion

Across NONCOLMET, LR can offer a significant survival benefit in highly selected patients with liver-dominant, biologically favorable disease. Thus, LR should not be excluded a priori. Selection must be based on an integrated assessment of the feasibility of LR; tumor biology, including molecular profile and response to systemic therapy; and patient conditions rather than the primary tumor site alone. Ongoing trials and multidisciplinary collaboration are essential to refine indications and optimize multimodal strategies, ultimately transforming liver-directed therapy from an exception based on local practice into an evidence-based component of comprehensive oncologic care.

Author contributions

M. Donadon and M. Di Martino contributed to the conceptualization of the study, design of the study, data collection, data analysis and interpretation, and manuscript writing. S. Ministrini, G. Tiberio, S. Conci, A. Ruzzenente, A. Maekawa, G. Perri, G. Marchegiani, A. Libia, M.G. Spampinato, F. Romano, M. Garancini, S.

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Data availability

The datasets generated and/or analyzed during the current study are not publicly available but are available from the corresponding author on reasonable request.

Declaration of competing interest

The authors declare no competing interests.

Supplementary material

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.gassur.2026.102398.

References

[1] Siegel RL, Kratzer TB, Giaquinto AN, Sung H, Jemal A. Cancer statistics, 2025. CA Cancer J Clin 2025;75(1):10–45.
[2] Aksoy F, Gökçe E, Balkan EA, Dündar HZ, Kaya E. Surgical results of liver metastases of tumors other than colorectal-neuroendocrine: is it really worth it or is it necessary? Turk J Surg 2024;40(4):267–74.
[3] de Ridder J, de Wilt JHW, Simmer F, Overbeek L, Lemmens V, Nagtegaal I. Incidence and origin of histologically confirmed liver metastases: an explorative case-study of 23,154 patients. Oncotarget 2016;7(34):55368–76.
[4] Hoffmann K, Bulut S, Tekbas A, Hinz U, Büchler MW, Schemmer P. Is hepatic resection for non-colorectal, non-neuroendocrine liver metastases justified? Ann Surg Oncol 2015;22(3):S1083–92.
[5] Adam R, Chiche L, Aloia T, Elias D, Salmon R, Rivoire M, et al. Hepatic resection for noncolorectal nonendocrine liver metastases: analysis of 1452 patients and development of a prognostic model. Ann Surg 2006;244(4):524–33.
[6] Sharma A, Muralitharan M, Ramage J, Clement D, Menon K, Srinivasan P, et al. Current management of neuroendocrine tumour liver metastases. Curr Oncol Rep 2024;26(9):1070–84.
[7] Mahuron KM, Limbach KE, Hernandez MC, Ituarte PHG, Li D, Kessler J, et al. Liver resection for gastroenteropancreatic neuroendocrine tumors with extrahepatic disease. J Clin Med 2024;13(17):4983.
[8] Du CY, Zhou Y, Song C, Wang YP, Jie ZG, He YL, et al. Is there a role of surgery in patients with recurrent or metastatic gastrointestinal stromal tumours responding to imatinib: a prospective randomised trial in China. Eur J Cancer 2014;50(10):1772–8.
[9] Cardoso F, Paluch-Shimon S, Schumacher-Wulf E, Matos L, Gelmon K, Aapro MS, et al. 6th and 7th International consensus guidelines for the management of advanced breast cancer (ABC guidelines 6 and 7). Breast 2024;76:103756.
[10] Gradishar WJ, Moran MS, Abraham J, Abramson V, Aft R, Agnese D, et al. NCCN guidelines(R) insights: breast cancer. J Natl Compr Cancer Netw 2023;21(6):594–608.
[11] Harter P, Sehouli J, Vergote I, Ferron G, Reuss A, Meier W, et al. Randomized trial of cytoreductive surgery for relapsed ovarian cancer. N Engl J Med 2021;385(23):2123–31.
[12] Baldwin XL, Park J, Pak J, Clark LH, Kim HJ, LeCompte MT. Evaluation of the role of liver metastasectomy in the treatment of stage IV endometrial cancer. J Gynecol Oncol 2025;36(5):e79.
[13] Hu H, Lai S, Ni R, Wang M, Lai C, Ji J, et al. Efficacy of cytoreductive surgery for metastatic upper tract urothelial carcinoma: a Surveillance, Epidemiology and End Results (SEER) study of 508 patients. Transl Androl Urol 2024;13(6):983–93.
[14] Tirotta F, Hodson J, Parente A, Pasquali S, Sutcliffe R, Desai A, et al. Liver resection for sarcoma metastases: A systematic review and experience from two European centres. Eur J Surg Oncol 2020;46(10_Pt A):1807–13.
[15] Kroese TE, Bronzwaer S, van Rossum PSN, Schoppman SF, Deseyne PRAJ, van Cutsem E, et al. European clinical practice guidelines for the definition, diagnosis, and treatment of oligometastatic esophagogastric cancer (OMEC-4). Eur J Cancer 2024;204:114062.
[16] Frigerio I, Malleo G, de Pastena M, Deiro G, Surci N, Scopelliti F, et al. Prognostic factors after pancreatectomy for pancreatic cancer initially metastatic to the liver. Ann Surg Oncol 2022;29(13):8503–10.
[17] Carmona-Bayonas A, Jiménez-Fonseca P, Echavarria I, Sánchez Cánovas M, Aguado G, Gallego J, et al. Surgery for metastases for esophageal-gastric cancer in the real world: data from the AGAMENON national registry. Eur J Surg Oncol 2018;44(8):1191–8.
[18] Al-Batran SE, Goetze TO, Mueller DW, Vogel A, Winkler M, Lorenzen S, et al. The Renaissance (AIO-FLOT5) trial: effect of chemotherapy alone vs. chemotherapy followed by surgical resection on survival and quality of life in patients with limited-metastatic adenocarcinoma of the stomach or esophagogastric junction - a phase III trial of the German AIO/CAO-V/CAOGI. BMC Cancer 2017;17(1):893.
[19] Mulligan KM, Glennon K, Donohoe F, O'Brien Y, Mc Donnell BC, Bartels HC, et al. Multidisciplinary surgical approach to increase complete cytoreduction rates for advanced ovarian cancer in a tertiary gynecologic oncology center. Ann Surg Oncol 2021;28(8):4553–60.
[20] Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. Ann Intern Med 2018;169(7):467–73.
[21] Procopio F, Marano S, Gentile D, Da Roit A, Basato S, Riva P, et al. Management of liver oligometastatic esophageal cancer: overview and critical analysis of the different loco-regional treatments. Cancers 2020;12(1):20.
[22] Seesing MFJ, van der Veen A, Brenkman HJF, Stockmann HBAC, Nieuwenhuijzen GAP, Rosman C, et al. Resection of hepatic and pulmonary metastasis from metastatic esophageal and gastric cancer: a nationwide study. Dis Esophagus 2019;32(12):doz034.
[23] Huddy JR, Thomas RL, Worthington TR, Karanjia ND. Liver metastases from esophageal carcinoma: is there a role for surgical resection? Dis Esophagus 2015;28(5):483–7.
[24] Ichida H, Imamura H, Yoshimoto J, Sugo H, Kajiyama Y, Tsurumaru M, et al. Pattern of postoperative recurrence and hepatic and/or pulmonary resection for liver and/or lung metastases from esophageal carcinoma. World J Surg 2013;37(2):398–407.
[25] Pawlik TM, Gleisner AL, Bauer TW, Adams RB, Reddy SK, Clary BM, et al. Liver-directed surgery for metastatic squamous cell carcinoma to the liver: results of a multi-center analysis. Ann Surg Oncol 2007;14(10):2807–16.
[26] Bauschke A, Altendorf-Hofmann A, Homman M, Manger T, Pertschy J, Helfritzsch H, et al. Surgical treatment of liver metastases from non-colorectal non-neuroendocrine carcinomas. J Cancer Res Clin Oncol 2022;148(2):503–15.
[27] Liu J, Wei Z, Wang Y, Xia Z, Zhao G. Hepatic resection for post-operative solitary liver metastasis from oesophageal squamous cell carcinoma. ANZ J Surg 2018;88(4):E252–6.
[28] Weiss ARR, Donlon NE, Schlitt HJ, Hackl C. Resection of oesophageal and oesophagogastric junction cancer liver metastases - a summary of current evidence. Langenbecks Arch Surg 2022;407(3):947–55.
[29] Schizas D, Vailas M, Sotiropoulou M, Ziogas IA, Mylonas KS, Katsaros I, et al. Surgery for metachronous oligometastatic esophageal cancer: is there enough evidence? Cir Esp 2021;99(7):490–9.
[30] Chevallay M, Jung M, Wassmer C-H, MÖnig S. Role of surgery in the management of synchronous metastatic esophageal cancer. Ann Esophagus 2021;4:39.
[31] Van Daele E, Scuderi V, Pape E, Van de Putte D, Varin O, Van Nieuwenhove Y, et al. Long-term survival after multimodality therapy including surgery for metastatic esophageal cancer. Acta Chir Belg 2018;118(4):227–32.
[32] Hiyoshi Y, Morita M, Kawano H, Otsu H, Ando K, Ito S, et al. Clinical significance of surgical resection for the recurrence of esophageal cancer after radical esophagectomy. Ann Surg Oncol 2015;22(1):240–6.
[33] Shah MA, Kelsen DP. Gastric cancer: a primer on the epidemiology and biology of the disease and an overview of the medical management of advanced disease. J Natl Compr Cancer Netw 2010;8(4):437–47.
[34] RiihimÄki M, Hemminki A, Sundquist K, Sundquist J, Hemminki K. Metastatic spread in patients with gastric cancer. Oncotarget 2016;7(32):52307–16.
[35] Van Cutsem E, Sagaert X, Topal B, Haustermans K, Prenen H. Gastric cancer. Lancet 2016;388(10060):2654–64.
[36] Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 2021;71(3):209–49.
[37] Markar SR, Mikhail S, Malietzis G, Athanasiou T, Mariette C, Sasako M, et al. Influence of surgical resection of hepatic metastases from gastric adenocarcinoma on long-term survival: systematic review and pooled analysis. Ann Surg 2016;263(6):1092–101.
[38] Liao YY, Peng NF, Long D, Yu PC, Zhang S, Zhong JH, et al. Hepatectomy for liver metastases from gastric cancer: a systematic review. BMC Surg 2017;17(1):14.
[39] Marte G, Tufo A, Steccanella F, Marra E, Federico P, Petrillo A, et al. Efficacy of surgery for the treatment of gastric cancer liver metastases: a systematic review of the literature and meta-analysis of prognostic factors. J Clin Med 2021;10(5):1141.
[40] Conde Monroy D, Ibañez-Pinilla M, Sabogal JC, Rey Chaves C, Isaza-Restrepo A, Girón F, et al. Survival outcomes of hepatectomy in gastric cancer liver metastasis: a systematic review and meta-analysis. J Clin Med 2023;12(2):704.
[41] Takahashi K, Terashima M, Notsu A, Koseki Y, Furukawa K, Fujiya K, et al. Surgical treatment for liver metastasis from gastric cancer: a systematic review and meta-analysis of long-term outcomes and prognostic factors. Eur J Surg Oncol 2024;50(10):108582.
[42] Bencivenga M, Ministrini S, Morgagni P, Mura G, Marrelli D, Milandri C, et al. Oligometastatic gastric cancer: clinical data from the meta-gastro prospective register of the Italian research group on gastric cancer. Cancers 2024;16(1):170.

[43] Solaini L, Ministrini S, Bencivenga M, D'Ignazio A, Marino E, Cipollari C, et al. Conversion gastrectomy for stage IV unresectable gastric cancer: a GIRCG retrospective cohort study. Gastric Cancer 2019;22(6):1285–93.
[44] Debureaux PE, Brignier A, Soret-Dulphy J, Réa D, Michonneau D, Peffault de Latour R, et al. Thrombocytapheresis and sequential chemotherapy for extreme symptomatic thrombocytosis secondary to myelofibrosis: a case report. Ann Hematol 2020;99(4):897–8.
[45] Lohar J, Sood H, Gosai P, Shekh TM. 3P's in retreatment endodontics-an often forgotten virtue. J Pharm Bioallied Sci 2019;11(1):S76–80.
[46] Ministrini S, Solaini L, Cipollari C, Sofia S, Marino E, D'Ignazio A, et al. Surgical treatment of hepatic metastases from gastric cancer. Update Surg 2018;70(2):273–8.
[47] Morgagni P, Bencivenga M, Carneiro F, Cascinu S, Derks S, Di Bartolomeo M, et al. International consensus on the management of metastatic gastric cancer: step by step in the foggy landscape: Bertinoro Workshop, November 2022. Gastric Cancer 2024;27(4):649–71.
[48] Yoshida K, Yasufuku I, Terashima M, Young Rha S, Moon Bae J, Li G, et al. International retrospective cohort study of conversion therapy for Stage IV gastric Cancer 1 (CONVO-GC-1). Ann Gastroenterol Surg 2022;6(2):227–40.
[49] Al-Batran SE, Homann N, Pauligk C, Goetze TO, Meiler J, Kasper S, et al. Perioperative chemotherapy with fluorouracil plus leucovorin, oxaliplatin, and docetaxel versus fluorouracil or capecitabine plus cisplatin and epirubicin for locally advanced, resectable gastric or gastro-oesophageal junction adenocarcinoma (FLOT4): a randomised, phase 2/3 trial. Lancet 2019;393(10184):1948–57.
[50] Bang YJ, Van Cutsem E, Feyereislova A, Chung HC, Shen L, Sawaki A, et al. Trastuzumab in combination with chemotherapy versus chemotherapy alone for treatment of HER2-positive advanced gastric or gastro-oesophageal junction cancer (ToGA): a phase 3, open-label, randomised controlled trial. Lancet 2010;376(9742):687–97.
[51] Janjigian YY, Shitara K, Moehler M, Garrido M, Salman P, Shen L, et al. First-line nivolumab plus chemotherapy versus chemotherapy alone for advanced gastric, gastro-oesophageal junction, and oesophageal adenocarcinoma (CheckMate 649): a randomised, open-label, phase 3 trial. Lancet 2021;398(10294):27–40.
[52] Shitara K, Van Cutsem E, Bang YJ, Fuchs C, Wyrwicz L, Lee KW, et al. Efficacy and safety of pembrolizumab or pembrolizumab plus chemotherapy vs chemotherapy alone for patients with first-line, advanced gastric cancer: the KEYNOTE-062 Phase 3 randomized clinical trial. JAMA Oncol 2020;6(10):1571–80.
[53] Bachellier P, Addeo P, Averous G, Dufour P. Resection of pancreatic adenocarcinomas with synchronous liver metastases: a retrospective study of prognostic factors for survival. Surgery 2022;172(4):1245–50.
[54] Mitsuka Y, Yamazaki S, Yoshida N, Yan M, Higaki T, Takayama T. Time interval-based indication for liver resection of metastasis from pancreatic cancer. World J Surg Oncol 2020;18(1):294.
[55] Groot VP, Rezaee N, Wu W, Cameron JL, Fishman EK, Hruban RH, et al. Patterns, timing, and predictors of recurrence following pancreatectomy for pancreatic ductal adenocarcinoma. Ann Surg 2018;267(5):936–45.
[56] Stoop TF, Javed AA, Oba A, Koerkamp BG, Seufferlein T, Wilmink JW, et al. Pancreatic cancer. Lancet 2025;405(10485):1182–202.
[57] Katada T, Hashidate H, Yokoyama N, Sudo N, Mitsuma K, Otani T. Initial features of hepatic metastases from pancreatic cancer: histological and Radiolographical appraisal of hepatic micrometastases detected by real-time fluorescent imaging. Pancreas 2017;46(9):1196–201.
[58] Shi H, Li J, Fu D. Process of hepatic metastasis from pancreatic cancer: biology with clinical significance. J Cancer Res Clin Oncol 2016;142(6):1137–61.
[59] D'Ambra V, Ricci C, Ingaldi C, Alberici L, Minghetti M, Casadei R. Stage IV pancreatic ductal adenocarcinoma (PDAC) with synchronous liver metastasis: are there survival benefits in liver resection? A systematic review and meta-analysis. Eur J Surg Oncol 2025;51(5):109598.
[60] Fiorillo C, Langellotti L, Panza E, Daloiso G, Biffoni B, Lucinato C, et al. Surgical treatment of synchronous liver-only oligometastatic pancreatic adenocarcinoma: a systematic review and meta-analysis of long-term outcomes. Int J Surg 2025;111(5):3589–98.
[61] Giuliante F, Panettieri E, Campisi A, Coppola A, Vellone M, De Rose AM, et al. Treatment of oligo-metastatic pancreatic ductal adenocarcinoma to the liver: is there a role for surgery? A narrative review. Int J Surg 2024;110(10):6163–9.
[62] Ramia JM, Blanco-Asensio N, Rubio JJ, López-López V, Robles-Campos R, Blanco-Fernández G, et al. Surgical treatment of liver metastasis from pancreatic cancer. Surg Oncol 2025;63:102308.
[63] Nichetti F, Rota S, Ambrosini P, Pircher C, Gusmaroli E, Droz Dit Busset M, et al. NALIRIFOX, FOLFIRINOX, and gemcitabine with nab-paclitaxel as first-line chemotherapy for metastatic pancreatic cancer: a systematic review and meta-analysis. JAMA Netw Open 2024;7(1):e2350756.
[64] Marschner N, Hegewisch-Becker S, Reiser M, von der Heyde E, Bertram M, Hollerbach SH, et al. FOLFIRINOX or gemcitabine/nab-paclitaxel in advanced pancreatic adenocarcinoma: a novel validated prognostic score to facilitate treatment decision-making in real-world. Int J Cancer 2023;152(3):458–69.
[65] Berger AC, Garcia Jr M, Hoffman JP, Regine WF, Abrams RA, Safran H, et al. Postresection CA 19-9 predicts overall survival in patients with pancreatic cancer treated with adjuvant chemoradiation: a prospective validation by RTOG 9704. J Clin Oncol 2008;26(36):5918–22.
[66] Frigerio I, Regi P, Giardino A, Scopelliti F, Girelli R, Bassi C, et al. Downstaging in stage IV pancreatic cancer: a new population eligible for surgery? Ann Surg Oncol 2017;24(8):2397–403.
[67] Jackson WC, Tao Y, Mendiratta-Lala M, Bazzi L, Wahl DR, Schipper MJ, et al. Comparison of stereotactic body radiation therapy and radiofrequency ablation in the treatment of intrahepatic metastases. Int J Radiat Oncol Biol Phys 2018;100(4):950–8.
[68] Hackert T, Niesen W, Hinz U, Tjaden C, Strobel O, Ulrich A, Michalski CW, Büchler BW. Radical surgery of oligometastatic pancreatic cancer. Eur J Surg Oncol 2017;43(2):358–63.
[69] Yun WG, Han Y, Lee M, Cho YJ, Jung HS, Kwon W, et al. Efficacy of local treatment for isolated liver metastasis after pancreatectomy in pancreatic ductal adenocarcinoma: a propensity score-matched analysis. J Hepato-Bil Pancreat Sci 2024;31(1):50–60.
[70] Fairweather M, Swanson R, Wang J, Brais LK, Dutton T, Kulke MH, et al. Management of neuroendocrine tumor liver metastases: long-term outcomes and prognostic factors from a large prospective database. Ann Surg Oncol 2017;24(8):2319–25.
[71] Kaçmaz E, Heidsma CM, Besselink MGH, Dreijerink KMA, Klümpen HJ, Nieveen van Dijkum EJM, et al. Treatment of liver metastases from midgut neuroendocrine tumours: a systematic review and meta-analysis. J Clin Med 2019;8(3):403.
[72] Addeo P, Bertin JB, Imperiale A, Averous G, Terrone A, Goichot B, et al. Outcomes of simultaneous resection of small bowel neuroendocrine tumors with synchronous liver metastases. World J Surg 2020;44(7):2377–84.
[73] Ammann M, Gudmundsdottir H, Antwi SKA, Santol J, Podrascanin V, Thiels CA, et al. Long-term outcome of cytoreductive hepatectomy in metastatic neuroendocrine neoplasia G3: a single center retrospective analysis. Eur J Surg Oncol 2025;51(8):109678.
[74] Aoki T, Kubota K, Kiritani S, Arita J, Morizane C, Masui T, et al. Survey of surgical resections for neuroendocrine liver metastases: a project study of the Japan Neuroendocrine Tumor Society (JNETS). J Hepato-Bil Pancreat Sci 2021;28(6):489–97.
[75] Butz F, Dukaczewska A, Jann H, Dobrindt EM, Reinhard L, Lurje G, et al. Surgical approach to liver metastases in GEP-NET in a tertiary reference center. Cancers 2023;15(7):2048.
[76] Gudmundsdottir H, Habermann EB, Vierkant RA, Starlinger P, Thiels CA, Warner SG, et al. Survival and symptomatic relief after cytoreductive hepatectomy for neuroendocrine tumor liver metastases: long-term follow-up evaluation of more than 500 patients. Ann Surg Oncol 2023;30(8):4840–51.
[77] Hans SS, Catanescu I. Selective shunting for carotid endarterectomy in patients with recent stroke. J Vasc Surg 2015;61(4):915–9.
[78] Kandil E, Noureldine SI, Koffron A, Yao L, Saggi B, Buell JF. Outcomes of laparoscopic and open resection for neuroendocrine liver metastases. Surgery 2012;152(6):1225–31.
[79] Maspero M, Rossi RE, Sposito C, Coppa J, Citterio D, Mazzaferro V. Long-term outcomes of resection versus transplantation for neuroendocrine liver metastases meeting the Milan criteria. Am J Transpl 2022;22(11):2598–607.
[80] Mayo SC, de Jong MC, Bloomston M, Pulitano C, Clary BM, Reddy SK, et al. Surgery versus intra-arterial therapy for neuroendocrine liver metastasis: a multicenter international analysis. Ann Surg Oncol 2011;18(13):3657–65.
[81] Partelli S, Andreasi V, Battistella A, Tamburrino D, Pecorelli N, Crippa S, et al. Gender and age as preoperative predictors of early disease progression in patients undergoing surgery for pancreatic neuroendocrine tumors with liver metastases. Ann Surg Oncol 2025;32(6):4388–95.
[82] Sahara K, Merath K, Tsilimigras DI, Hyer JM, Guglielmi A, Aldrighetti L, et al. Conditional disease-free survival after curative-intent liver resection for neuroendocrine liver metastasis. J Surg Oncol 2019;120(7):1087–95.
[83] Scott AT, Breheny PJ, Keck KJ, Bellizzi AM, Dillon JS, O'Dorisio TM, et al. Effective cytoreduction can be achieved in patients with numerous neuroendocrine tumor liver metastases (NETLMs). Surgery 2019;165(1):166–75.
[84] Selberherr A, Freermann S, Koperek O, Niederle MB, Riss P, Scheuba C, et al. Neuroendocrine liver metastasis from the small intestine: is surgery beneficial for survival? Orphanet J Rare Dis 2021;16(1):30.
[85] Spolverato G, Bagante F, Aldrighetti L, Poultsides G, Bauer TW, Field RC, et al. Neuroendocrine liver metastasis: prognostic implications of primary tumor site on patients undergoing curative intent liver surgery. J Gastrointest Surg 2017;21(12):2039–47.
[86] Valadares LJ, Costa Junior W, Ribeiro HSC, Diniz AL, Coimbra FJF, Herman P. Resection of liver metastasis from neuroendocrine tumors: evaluation of results and prognostic factors. Rev Col Bras Cir 2015;42(1):25–31.
[87] Wang G, Liu C, Qi W, Li L, Xiu D. Role of indocyanine green fluorescence imaging in margin assessment and recurrence-free survival in laparoscopic parenchyma-sparing hepatectomy for neuroendocrine tumor liver metastases. Surg Endosc 2025;39(3):1574–82.
[88] Xu Q, Yin B, Han X, Ren S, Jiang J, Li F, et al. Long-term outcomes of surgical treatment for pancreatic neuroendocrine neoplasm with synchronous hepatic metastasis: a multicenter retrospective cohort study. Pancreas 2025;54(3):e179–87.
[89] Norlén O, Stålberg P, Öberg K, Eriksson J, Hedberg J, Hessman O, et al. Long-term results of surgery for small intestinal neuroendocrine tumors at a tertiary referral center. World J Surg 2012;36(6):1419–31.
[90] Modlin IM, Lye KD, Kidd M. A 5-decade analysis of 13,715 carcinoid tumors. Cancer 2003;97(4):934–59.
[91] Elias D, Lasser P, Ducreux M, Duvillard P, Ouellet JF, Dromain C, et al. Liver resection (and associated extrahepatic resections) for metastatic well-differentiated endocrine tumors: a 15-year single center prospective study. Surgery 2003;133(4):375–82.
[92] Sorbye H, Grande E, Pavel M, Tesselaar M, Fazio N, Reed NS, et al. European Neuroendocrine Tumor Society (ENETS) 2023 guidance paper for digestive neuroendocrine carcinoma. J Neuroendocr 2023;35(3):e13249.

[93] Maxwell JE, Sherman SK, O'Dorisio TM, Bellizzi AM, Howe JR. Liver-directed surgery of neuroendocrine metastases: what is the optimal strategy? Surgery 2016;159(1):320–33.
[94] Graff-Baker AN, Sauer DA, Pommier SJ, Pommier RF. Expanded criteria for carcinoid liver debulking: maintaining survival and increasing the number of eligible patients. Surgery 2014;156(6):1369–76. discussion 76-7.
[95] Ruzzenente A, Bagante F, Bertuzzo F, Aldrighetti L, Campagnaro T, Ercolani G, et al. Liver resection for neuroendocrine tumor liver metastases within Milan criteria for liver transplantation. J Gastrointest Surg 2019;23(1):93–100.
[96] Chambers AJ, Pasieka JL, Dixon E, Rorstad O. The palliative benefit of aggressive surgical intervention for both hepatic and mesenteric metastases from neuroendocrine tumors. Surgery 2008;144(4):645–51. discussion 51-3.
[97] Heinrich MC, Corless CL, Blanke CD, Demetri GD, Joensuu H, Roberts PJ, et al. Molecular correlates of imatinib resistance in gastrointestinal stromal tumors. J Clin Oncol 2006;24(29):4764–74.
[98] Seesing MF, Tielen R, van Hillegersberg R, van Coevorden F, de Jong KP, Nagtegaal ID, et al. Resection of liver metastases in patients with gastrointestinal stromal tumors in the imatinib era: a nationwide retrospective study. Eur J Surg Oncol 2016;42(9):1407–13.
[99] Kanda T, Masuzawa T, Hirai T, Ikawa O, Takagane A, Hata Y, et al. Surgery and imatinib therapy for liver oligometastasis of GIST: a study of Japanese Study Group on GIST. Jpn J Clin Oncol 2017;47(4):369–72.
[100] Zaydfudim V, Okuno SH, Que FG, Nagorney DM, Donohue JH. Role of operative therapy in treatment of metastatic gastrointestinal stromal tumors. J Surg Res 2012;177(2):248–54.
[101] Sutton TL, Walker BS, Billingsley KG, Sheppard BC, Corless CL, Heinrich MC, et al. Hepatic metastases in gastrointestinal stromal tumors: oncologic outcomes with curative-intent hepatectomy, resection of treatment-resistant disease, and tyrosine kinase inhibitor therapy alone. HPB 2022;24(6):986–93.
[102] Zeng Y, Ling Y, Chen X, Ding C, Jin Y, Feng S, et al. Radiofrequency ablation vs. hepatectomy for liver metastases from gastrointestinal stromal tumors. Oncol Lett 2024;27(3):133.
[103] Xue A, Gao X, He Y, Shu P, Huang X, Sun J, et al. Role of surgery in the management of liver metastases from gastrointestinal stromal tumors. Front Oncol 2022;12:903487.
[104] Hu B, Ye Y, Gao Z. The benefit of surgery during systematic therapy for gastrointestinal stromal tumor liver metastasis: a SEER-based retrospective study. Gastroenterol Rep 2024;12:goae095.
[105] Xia L, Zhang MM, Ji L, Li X, Wu XT. Resection combined with imatinib therapy for liver metastases of gastrointestinal stromal tumors. Surg Today 2010;40(10):936–42.
[106] Wen H, Huang Y, Huang S, Xiao H, Xie W, Zhou Q, et al. The long-term efficacy of imatinib with hepatic resection or other local treatment for gastrointestinal stromal tumours liver metastases: a retrospective cohort study. Int J Surg 2024;110(4):2151–61.
[107] González-Abós S, Molina Santos V, Homs Samsó R, Martín Arnau B, Rodríguez Blanco M, González López JA, et al. Surgical and oncological results after surgical treatment of patients diagnosed with sarcoma liver metastases. Cir Esp 2023;101(2):80–9.
[108] Lang H, Nussbaum KT, Kaudel P, Frühauf N, Flemming P, Raab R. Hepatic metastases from leiomyosarcoma: a single-center experience with 34 liver resections during a 15-year period. Ann Surg 2000;231(4):500–5.
[109] Dawood S, Broglio K, Ensor J, Hortobagyi GN, Giordano SH. Survival differences among women with de novo stage IV and relapsed breast cancer. Ann Oncol 2010;21(11):2169–74.
[110] Sundén M, Hermansson C, Taflin H, Andersson A, Sund M, Hemmingsson O. Surgical treatment of breast cancer liver metastases - a nationwide registry-based case control study. Eur J Surg Oncol 2020;46(6):1006–12.
[111] Ruiz A, Sebagh M, Wicherts DA, Castro-Benitez C, van Hillegersberg R, Paule B, et al. Long-term survival and cure model following liver resection for breast cancer metastases. Breast Cancer Res Treat 2018;170(1):89–100.
[112] Ercolani G, Zanello M, Serenari M, Cescon M, Cucchetti A, Ravaioli M, et al. Ten-year survival after liver resection for breast metastases: a single-center experience. Dig Surg 2018;35(4):372–80.
[113] Adam R, Aloia T, Krissat J, Bralet MP, Paule B, Giacchetti S, et al. Is liver resection justified for patients with hepatic metastases from breast cancer? Ann Surg 2006;244(6):897–907. [discussion].
[114] Chen PC, Lee YC, Su YC, Lee CH, Chen JH, Chen CY. Does hepatectomy improve outcomes of breast cancer with liver metastasis? A nationwide analysis of real-world data in Taiwan. PLoS One 2022;17(4):e0266960.
[115] Pentheroudakis G, Fountzilas G, Bafaloukos D, Koutsoukou V, Pectasides D, Skarlos D, et al. Metastatic breast cancer with liver metastases: a registry analysis of clinicopathologic, management and outcome characteristics of 500 women. Breast Cancer Res Treat 2006;97(3):237–44.
[116] Cantalejo-Díaz M, Ramia JM, Álvarez-Busto I, Kokas B, Blanco-Fernández G, Muñoz-Forner E, et al. Long-term outcomes after breast cancer liver metastasis surgery: a European, retrospective, snapshot study (LIBREAST STUDY). Surg Oncol 2024;57:102129.
[117] Mariani P, Servois V, De Rycke Y, Bennett SP, Feron JG, Almubarak MM, et al. Liver metastases from breast cancer: surgical resection or not? A case-matched control study in highly selected patients. Eur J Surg Oncol 2013;39(12):1377–83.
[118] Zou X, Zou HL, Luo X, Chen XW, Huang WL, Zhang C, et al. Retrospective comparative survival analysis of ablation plus systemic therapy versus systemic therapy alone for breast cancer liver metastases, stratified by extrahepatic metastases status. Breast 2025;79:103876.
[119] Abbott DE, Brouquet A, Mittendorf EA, Andreou A, Meric-Bernstam F, Valero V, et al. Resection of liver metastases from breast cancer: estrogen receptor status and response to chemotherapy before metastasectomy define outcome. Surgery 2012;151(5):710–6.
[120] Kostov DV, Kobakov GL, Yankov DV. Prognostic factors related to surgical outcome of liver metastases of breast cancer. J Breast Cancer 2013;16(2):184–92.
[121] Ruiz A, Wicherts DA, Sebagh M, Giacchetti S, Castro-Benitez C, van Hillegersberg R, et al. Predictive profile-nomogram for liver resection for breast cancer metastases: an aggressive approach with promising results. Ann Surg Oncol 2017;24(2):535–45.
[122] Franzese C, Comito T, Viganò L, Pedicini V, Franceschini D, Clerici E, et al. Liver metastases-directed therapy in the management of oligometastatic breast cancer. Clin Breast Cancer 2020;20(6):480–6.
[123] Hoffmann K, Franz C, Hinz U, Schirmacher P, Herfarth C, Eichbaum M, et al. Liver resection for multimodal treatment of breast cancer metastases: identification of prognostic factors. Ann Surg Oncol 2010;17(6):1546–54.
[124] Bacalbasa N, Balescu I, Ilie V, Florea R, Sorop A, Brasoveanu V, et al. The impact on the long-term outcomes of hormonal status after hepatic resection for breast cancer liver metastases. In Vivo 2018;32(5):1247–53.
[125] Feng Y, He XG, Zhou CM, Zhang QY, Huang SY, Li Z, et al. Comparison of hepatic resection and systemic treatment of breast cancer liver metastases: a propensity score matching study. Am J Surg 2020;220(4):945–51.
[126] Ruiz A, van Hillegersberg R, Siesling S, Castro-Benitez C, Sebagh M, Wicherts DA, et al. Surgical resection versus systemic therapy for breast cancer liver metastases: results of a European case matched comparison. Eur J Cancer 2018;95:1–10.
[127] Bilani N, Yaghi M, Singh Jabbal I, Elson L, Elimimian EB, Liang H, et al. Survival benefit of a combined surgical approach in patients with metastatic breast cancer. J Surg Oncol 2021;124(8):1235–41.
[128] Millen JA, Hofmann A, Mesquita-Neto JW, Rose J, Macedo FI. Evolving role of liver resection in selected patients with metastatic breast cancer. J Surg Res 2021;259:363–71.
[129] He X, Zhang Q, Feng Y, Li Z, Pan Q, Zhao Y, et al. Resection of liver metastases from breast cancer: a multicentre analysis. Clin Transl Oncol 2020;22(4):512–21.
[130] Lucidi V, Bohlok A, Liberale G, Bez M, Germanova D, Bouazza F, et al. Extended time interval between diagnosis and surgery does not improve the outcome in patients operated for resection or ablation of breast cancer liver metastases. Eur J Surg Oncol 2020;46(2):229–34.
[131] Margonis GA, Buettner S, Sasaki K, Kim Y, Ratti F, Russolillo N, et al. The role of liver-directed surgery in patients with hepatic metastasis from primary breast cancer: a multi-institutional analysis. HPB 2016;18(8):700–5.
[132] Gardner AB, Charo LM, Mann AK, Kapp DS, Eskander RN, Chan JK. Ovarian, uterine, and cervical cancer patients with distant metastases at diagnosis: most common locations and outcomes. Clin Exp Metastasis 2020;37(1):107–13.
[133] Martel G, Bertens KA, Canil C. Surgical management of genitourinary cancer liver metastases. Surg Oncol Clin N Am 2021;30(1):89–102.
[134] Budnik J, Suri J, Bates JE, Bylund KC, Milano MT. Prognostic significance of sites of visceral metastatic disease in prostate cancer: a population-based study of 12,180 patients. Clin Genitourin Cancer 2019;17(4):260–7.
[135] de Ridder J, van Walsum M, Verhoef C, Nagtegaal I, de Wilt J, Dutch Liver Working Group. Hepatic resection for metastatic melanoma in the Netherlands: survival and prognostic factors. Melanoma Res 2013;23(1):27–32.
[136] Beetz O, Söffker R, Cammann S, Oldhafer F, Vondran FWR, Imkamp F, et al. Extended hepatic metastasectomy for renal cell carcinoma-new aspects in times of targeted therapy: a single-center experience over three decades. Langenbecks Arch Surg 2020;405(1):97–106.
[137] Francolini G, Campi R, Ciccarese C, European Association of Urology (EAU) Young Academic Urologists (YAU) Renal Cancer working group. Definitions and unmet needs in the management of oligometastatic renal cell carcinoma in the modern era. Curr Opin Urol 2024;34(4):300–6.
[138] Caralt M, Martí J, Cortés J, Fondevila C, Bilbao I, Fuster J, et al. Outcome of patients following hepatic resection for metastatic cutaneous and ocular melanoma. J Hepato-Bil Pancreat Sci 2011;18(2):268–75.
[139] Rose DM, Essner R, Hughes TM, Tang PC, Bilchik A, Wanek LA, et al. Surgical resection for metastatic melanoma to the liver: the John Wayne Cancer Institute and Sydney Melanoma Unit experience. Arch Surg 2001;136(8):950–5.
[140] Chua TC, Saxena A, Morris DL. Surgical metastasectomy in AJCC stage IV M1c melanoma patients with gastrointestinal and liver metastases. Ann Acad Med Singap 2010;39(8):634–9.
[141] Faries MB, Leung A, Morton DL, Hari D, Lee JH, Sim MS, et al. A 20-year experience of hepatic resection for melanoma: is there an expanding role? J Am Coll Surg 2014;219(1):62–8.
[142] Maspero M, Pezzoli I, Di Guardo L, Angi M, Lo Dico S, Sposito C, et al. Intention-to-treat analysis of hepatic resection for liver metastases from uveal melanoma: a single-center experience. Ann Surg Oncol 2025;32(7):4989–96.
[143] Akyuz M, Yazici P, Dural C, Yigitbas H, Okoh A, Bucak E, et al. Laparoscopic management of liver metastases from uveal melanoma. Surg Endosc 2016;30(6):2567–71.
[144] Ripley RT, Davis JL, Klapper JA, Mathur A, Kammula U, Royal RE, et al. Liver resection for metastatic melanoma with postoperative tumor-infiltrating lymphocyte therapy. Ann Surg Oncol 2010;17(1):163–70.
[145] Rivoire M, Kodjikian L, Baldo S, Kaemmerlen P, Négrier S, Grange JD. Treatment of liver metastases from uveal melanoma. Ann Surg Oncol 2005;12(6):422–8.
[146] Ryu SW, Saw R, Scolyer RA, Crawford M, Thompson JF, Sandroussi C. Liver resection for metastatic melanoma: equivalent survival for cutaneous and ocular primaries. J Surg Oncol 2013;108(2):129–35.

[147] Mariani P, Piperno-Neumann S, Servois V, Berry MG, Dorval T, Plancher C, et al. Surgical management of liver metastases from uveal melanoma: 16 years' experience at the Institut Curie. Eur J Surg Oncol 2009;35(11):1192–7.
[148] Aghayan DL, Kazaryan AM, Fretland AA, Sahakyan MA, Røsok BI, Bjørnbeth BA, et al. Laparoscopic liver resection for metastatic melanoma. Surg Endosc 2018;32(3):1470–7.
[149] Doussot A, Nardin C, Takaki H, Litchman TD, D'Angelica MI, Jarnagin WR, et al. Liver resection and ablation for metastatic melanoma: a single center experience. J Surg Oncol 2015;111(8):962–8.
[150] Hau HM, Tautenhahn HM, Schoenberg MB, Atanasov G, Wiltberger G, Morgül MH, et al. Liver resection in multimodal concepts improves survival of metastatic melanoma: a single-centre case-matched control study. Anticancer Res 2014;34(11):6633–9.
[151] Podda M, Di Martino M, Pata F, Pellino G, Di Saverio S, Di Saverio S, et al. Current status of liver surgery for non-colorectal non-neuroendocrine liver metastases: the NON.LI.MET. Italian Society for Endoscopic Surgery and New Technologies (SICE) and Association of Italian Surgeons in Europe (ACIE) collaborative international survey. Update Surg 2024;76(1):43–55.
[152] Mulligan K, Corry E, Donohoe F, Glennon K, Vermeulen C, Reid-Schachter G, et al. Multidisciplinary surgical approach to increase survival for advanced ovarian cancer in a tertiary gynaecological oncology centre. Ann Surg Oncol 2024;31(1):460–72.
[153] Adam R, Kitano Y, Abdelrafee A, Allard MA, Baba H. Debulking surgery for colorectal liver metastases: foolish or chance? Surg Oncol 2020;33:266–9.
[154] Rosati A, De Rose AM, Gallotta V, Giannarelli D, Ghirardi V, Pavone M, et al. Feasibility and operative outcomes of surgery in the liver area in advanced ovarian cancer. Gynecol Oncol 2024;187:98–104.
[155] Rosati A, De Rose AM, Sala E, Giuliante F, Scambia G, Fagotti A. Ovarian cancer metastases in the liver area: proposal of a standardized anatomo-surgical classification. Int J Gynecol Cancer 2022;32(7):955–6.
[156] Isaji S, Mizuno S, Windsor JA, Bassi C, Fernández-Del Castillo C, Hackert T, et al. International consensus on definition and criteria of borderline resec pancreatic ductal adenocarcinoma 2017. Pancreatology 2018;18(1):2–11.
[157] Di Martino M, Ercolani G, Cipriani F, Baiocchi G, Bordonaro R, Cescon M, et al. Non-colorectal liver metastases undergoing liver resection: the NONCOLMET study group. Dig Surg 2025;42(6):1–5.