



SYSTEMATIC REVIEW

Metastasis to the stomach: a systematic review [version 1; peer review: 2 approved]

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Abstract

Background: This study reviews the literature on gastric metastases (GM) in terms of diagnosis, treatment, and outcomes. The goal of this study was to provide clinicians with a reliable and beneficial source to understand gastric metastases arising from various primary tumors and to present the growing literature in an easily accessible form.

Methods: Articles published in English language from implementation of MEDLINE and Cochrane databases until May 2022 were considered for the systematic review. Articles other than English language, letters to the editor, posters, and clinical images were excluded. Hematogenous and lymphogenic metastases were included whereas direct tumoral invasion and seeding were excluded. Articles and abstracts were analyzed and last selection was done after cross-referencing and by use of defined eligibility criteria.

Results: In total 1,521 publications were identified and 170 articles were finally included totaling 186 patients with GM. The median age of patients was 62 years. Gynecologic cancer was the most common cancer type causing GM (67 patients), followed by lung cancer (33 patients), renal cancer (20 patients), and melanoma (19 patients). One of the main treatment methods performed for metastasis was resection surgery (n=62), sometimes combined with chemotherapy (ChT) or immunotherapy. ChT was the other most used treatment method (n=78). Also, immunotherapy was amongst the most preferred treatment options after surgery and ChT (n=10).

Conclusions: As 172 case reports were screened in the systematic review from different journals, heterogeneity was inevitable. Some articles missed important information such as complete follow-up or clinical information. Moreover, since all of the included articles were case reports quality assessment could not be performed. Among 172 case reports reviewed, resection surgery was performed the most and was sometimes combined with ChT and immunotherapy. Further research about what type of treatment has the best outcomes for

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Any reports and responses or comments on the article can be found at the end of the article.

patients with gastric metastases is needed.

Keywords

Metastasis to stomach, gastric metastases, gastric metastasis, gastric cancer, stomach cancer

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Introduction

Metastases to the stomach are rare conditions with poor prognosis that may present with both gastrointestinal and systemic symptoms, such as loss of appetite, abdominal pain, fatigue, nausea, and vomiting, with a reported incidence of 0.2-0.7% based on clinical and autopsy findings.¹ Gastrectomy is thought to be the only potentially curative treatment for metastatic gastric cancer but the primary site of the tumor is also considered along with the type and grade of the tumor when planning treatment in gastric metastases. Therefore, chemotherapy is also an option for patients with higher grades and multi-focal cancers. This study reviews the literature on gastric metastases in terms of diagnosis, treatment, and outcomes. The intended goal of this study was to provide clinicians with a reliable and beneficial source to understand gastric metastases arising from various primary tumors and to present the growing literature in an easily accessible form by reviewing the case reports of different primary tumors separately with consideration of diagnosis, treatment, and clinical presentation which may vary from patient to patient depending on primary site of the tumor.

Methods

This systematic review adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.¹⁷² A computerized literature search through MEDLINE/PubMed and Cochrane databases was conducted until May 2022.

The following combination of keywords was used for the search: (({gastric (MeSH Terms)} AND {neoplasm metastasis (MeSH Terms)}) OR (gastric metastasis)) OR {gastric metastases}) OR (metastasis to the stomach). The search was limited by filtering for “free full text” and “case reports.” After the decision of inclusion and exclusion criteria by the team, two of the reviewers independently screened and retrieved each report.

Hematogenous and lymphogenic metastases were included whereas direct tumoral invasion and seeding were excluded from the study. Articles other than the English language, letters to the editor, posters, and clinical images were excluded. After the studies were screened and separated based on the inclusion and exclusion criteria, reviewers were divided to groups based on primary tumor location. Each group contained two reviewers to collect the data from studies of its specific location for example metastasis from gynecologic cancers or lung cancers.

The following data were extracted from the databases: first author, number of cases, age, sex, site of the primary tumor, histology and treatment of primary tumor, treatment of metastasis, clinical presentation of gastric metastases (GM), synchronous or metachronous GM, the time between primary and secondary GM, diagnostic procedures, other metastasis, and overall survival.

Since the study only contains screening of case reports, assessment of bias risk was not performed and thus it is mentioned as a limitation of study in discussion section.

Results

The PRISMA flow chart below illustrates details about data collection (Figure 1).

In total, 1,521 publications were identified and 170 articles were finally included totaling 186 patients with GM (101 female and 85 male). The median age of patients was 62 years (IQR: 55-70.5). Gynecologic cancer (including breast cancer) was the most common cancer type causing GM (66 patients), followed by lung cancer (33 patients), renal cancer (20 patients), and melanoma (19 patients) (Figure 2). Results are presented below according to the origin of the primary tumor. The main treatment method performed for metastasis was resection surgery (n=62, total, subtotal or partial gastrectomy, proximal gastrectomy, radical total gastrectomy with Roux-en-Y, wedge gastrectomy, and laparoscopic resection of gastric metastasis), sometimes combined with chemotherapy (ChT) or immunotherapy. Chemotherapy was the other most used treatment method (n=78). Also, immunotherapy was among the most preferred treatment options after surgery and chemotherapy (n=10).

Gynecologic cancer

The median age of the 66 patients was 57 years. In total, 46 cases had metastases other than GM. Bone was the most common site of metastasis. Five cases had no other metastases. The total number of cases in the breast group was 54, and one of them was a male patient. The median age of the breast group is 56, the youngest patient was 36 years old and the oldest patient was 84 years old. Invasive lobular carcinoma (ILC) had the largest number of patients in comparison to ovarian and uterine groups. A total of 31 patients presented with ILC. The ovarian group had nine patients; the median age was 61 years. The oldest patient was 73 years old; the youngest patient was 47 years old. The uterine group had two patients with ages 49 and 80 years. In most cases, systemic therapy was more effective than surgery. Surgical treatment had a role in palliative treatment. As a systemic treatment, chemotherapy was the most utilized treatment. Overall survival

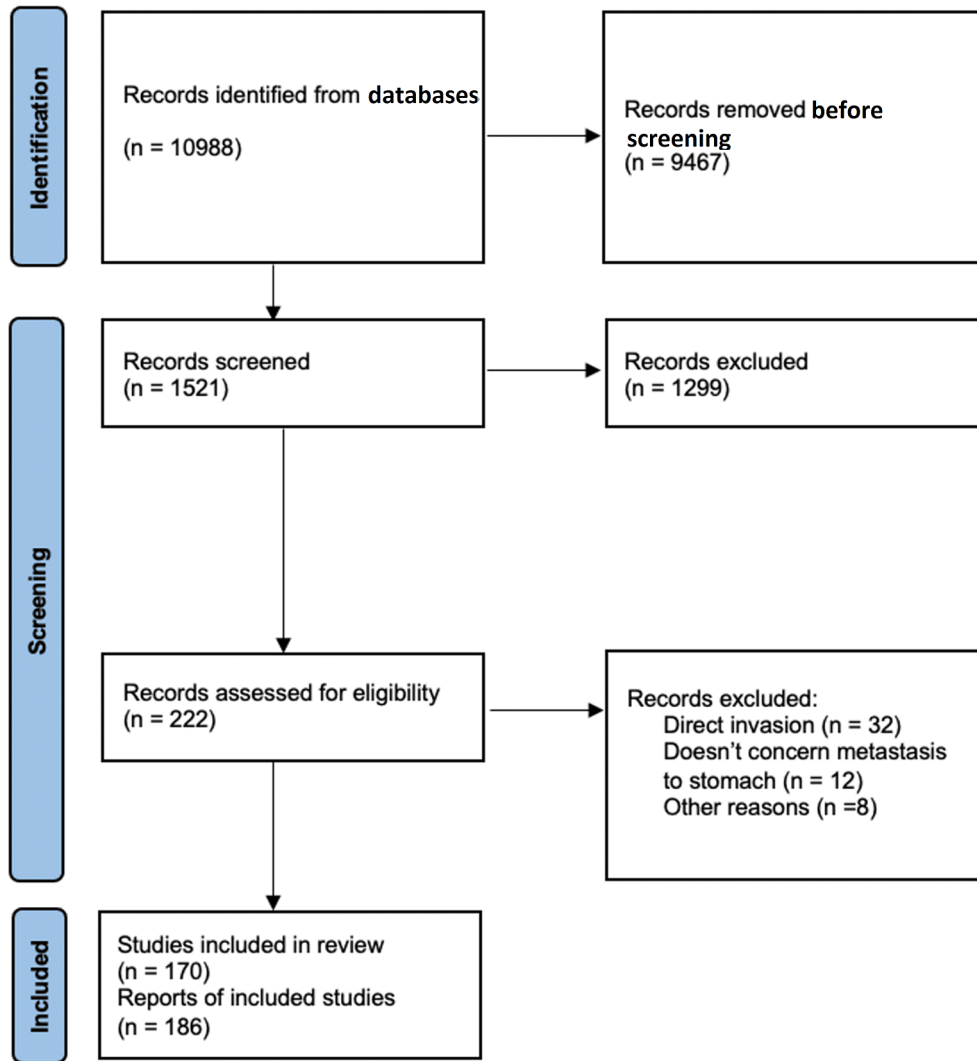


Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart.

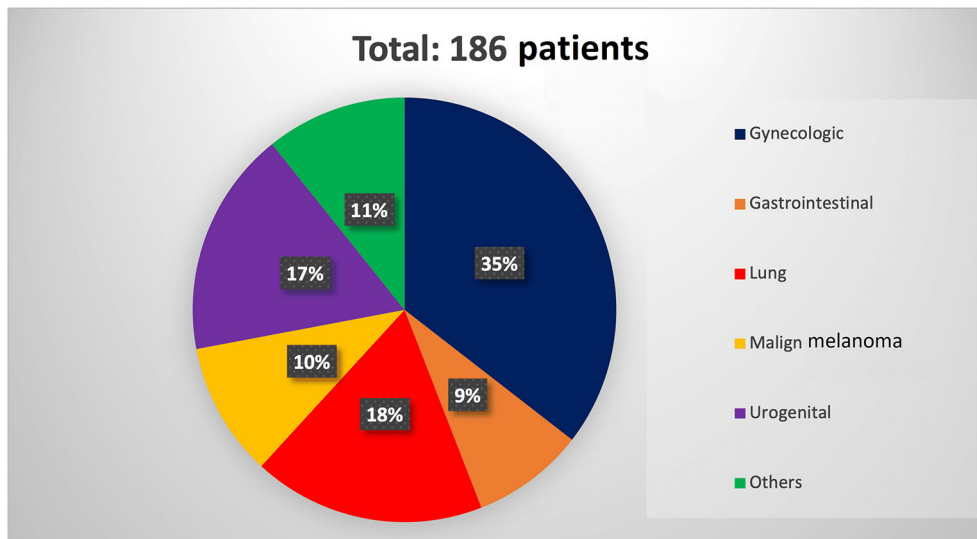


Figure 2. Pie chart demonstrating percentages of primary tumor sites of patients with metastasis to stomach.

was given in only 25 cases and ranged from a few days to nine years. Six of the total patients are still alive. [Table 1^{2–56}](#) summarizes the findings of included studies regarding gynecologic cancers.

Gastrointestinal cancer

Median age of the 16 patients (11 male, five female) was 69 years, ranging from 22 years to 85 years. Overall survival of the seven patients whose data were given ranged from two months to 16 months. Although, there were six cases who were still alive and the survival of three cases was not reported. Among histological types of gastrointestinal cancers, adenocarcinoma (Adeno Ca) was the most common cancer type (seven patients), followed by hepatocellular cancer (HCC) (four patients) and squamous cell carcinoma (two patients). Endoscopy is the most frequently used method in the diagnosis of metastases. Methods such as computer tomography (CT), positron emission tomography and computed tomography (PET-CT), and endoscopic ultrasound were also used for diagnosis. One patient underwent laparotomy and biopsy. According to this research nine of these patients had surgery. Transcatheter left gastric artery embolization was performed in one patient. On the other hand, seven patients received chemotherapy and one patient had palliative radiotherapy. Nevertheless, one patient is unknown. Findings regarding gastrointestinal cancers are summarized in [Table 2.^{57–72}](#)

Lung cancer

The median age of the 33 patients (25 male, eight female) was 62, ranging from 39 years to 78 years. Twenty-seven of the total cases had other metastases in addition to gastric ones. The survival time of the 22 patients whose data were given ranged from two weeks to 30 months. Yet, there were two cases that were still alive four and five years after metastases were found, respectively. Among histological types of primary lung cancers that lead to gastric metastases, adenocarcinoma was the most typical diagnosis (13 patients), followed by small cell lung cancer (SCLC) and squamous cell carcinoma (SCC). Regarding the treatment of GM, different combinations of chemotherapy were the most common choice (15 patients). On the other hand, seven of the total cases received surgical treatment (one esophagogastrostomy, two total, and four partial gastrectomies). However, since one patient's metastasis was diagnosed after an autopsy, he could not receive any gastric treatment. Moreover, one patient refused any metastasis treatment, while six other cases' treatments are unknown. Data pertaining to GM originating from primary lung cancers are summarized in [Table 3.^{73–102}](#)

Malign melanoma

The median age of the 19 patients (seven female, 12 male) was 67, ranging from 28 years to 89 years. In 16 patients, other organ metastases were also discovered in addition to malign melanoma. Overall survival was not mentioned in 10 cases. Two of these cases deceased two and four days after hospital admission respectively, and one patient died after a year. Moreover, one of these patients was alive at five years, and another was alive at six months. Overall survival of three cases is three, 27, and four months, respectively. One of these patients refused treatment, and one of them did not receive treatment. However, immunotherapy was applied to six patients, surgery to five patients, radiotherapy to two patients, and only supportive treatment to three patients. In addition, the treatment of GM was not mentioned in three cases. [Table 4](#) summarizes the findings of included studies regarding malign melanoma.^{103–121}

Urogenital cancers

The median age of 20 patients (11 male and nine female) with kidney cancer was 68.5 years old. A total of 11 patients had metastases other than GM. Overall survival was mentioned only in four cases and ranged from two months to one year. One of the 20 patients did not receive any therapy for GM, whereas 13 patients underwent surgical treatment (four endoscopic mucosal resections, nine gastrectomies), four patients had chemotherapy and one patient was treated with radiotherapy. Regarding prostate cancer, the median age of the affected individuals was 67 years old. Concerning the GM treatment four patients received chemotherapy, one patient underwent mucosal resection, and one patient refused treatment. Overall survival was mentioned for three patients ranging from four months to 19 months. All four patients with testis cancer had other metastases and two of them received chemotherapy. One study included bladder cancer without other metastases and the patient was referred to palliative care. Data pertaining to gastric metastases originating from primary urogenital cancers are summarized in [Table 5.^{71,122–151}](#)

Others

The median age of the four patients with Merkel cell carcinoma was 73 years old. Two patients had other metastases in addition to GM. Three patients underwent surgery, chemotherapy, and radiotherapy, whereas one patient was treated with chemotherapy and radiotherapy. One patient with squamous cell carcinoma had other metastases in addition to GM and received chemotherapy and radiotherapy for the primary tumor.

Regarding bone cancers (n=3) one of the patients was 14 years old and stood out as the youngest patient in this group. Concerning the GM therapy, one of the patients with a known treatment underwent surgery and chemotherapy the other

Table 1. Illustrating the data regarding metastasis from gynecologic cancers.

First author	No of cases	Age	Sex	Site of primary tumor	Histology type of primary	Treatment of primary	Treatment of metastasis	Clinical presentation of GM
Fousekis et al. ²	1	64	F	Breast	Lobular Ca	ChT	ChT	Dysphagia, dyspepsia
Watanabe et al. ³	1	71	F	Breast	Ductal Ca	Mastectomy and axillary lymph adenectomy, ChT	Endocrine therapy	Asymptomatic
Husain et al. ⁴	1	47	F	Left breast	Ductal Ca	Neoadjuvant ChT, mastectomy with a left axillary lymph adenectomy, adjuvant endocrine therapy	N/S	Dyspepsia, weight loss, vomiting
Zhang et al. ⁵	1	46	F	Bilateral breast	Lobular Ca	N/A	N/A	Epigastric discomfort
Jabi et al. ⁶	1	60	F	Right breast	Lobular Ca	Palliative ChT	Palliative ChT	Epigastralgia, gastric bleeding, Anemia
Johnson et al. ⁷	1	50	F	Breast	Ductal Ca	Lumpectomy, adjuvant RT, ChT	N/S	N/S
Okamoto et al. ⁸	1	51	F	Breast	Ductal Ca	ChT	ChT	Melena, presyncope
Nehmeh et al. ⁹	1	58	F	Right breast	Ductal Ca	Right modified mastectomy, left prophylactic mastectomy, adjuvant ChT	N/S	Perforated ulcer
Hanafiah et al. ¹⁰	1	71	F	Left breast	Lobular Ca	Left mastectomy, axillary clearance, ChT, RT	Ch	Hoarseness, weight loss, early satiety
Teixeira et al. ¹¹	1	40	F	Right breast	Lobular Ca	Neoadjuvant ChT, RT, conservative surgery for right breast and right axillary lymph node	Total gastrectomy	Nausea, epigastric discomfort, early satiety, weight loss
Kutasovic et al. ¹²	1	52	F	Left breast	Invasive Ca of no special type	Local excision, adjuvant RT, ChT, hormone therapy	Subtotal gastrectomy	N/S
Abdallah et al. ¹³	1	53	F	Breast	Lobular Ca	ChT, hormone therapy	N/S	Abdominal pain, diffuse tenderness, abdominal distention

Table 1. Continued

First author	No of cases	Age	Sex	Site of primary tumor	Histology type of primary	Treatment of primary	Treatment of metastasis	Clinical presentation of GM
Liu et al. ¹⁴	1	82	F	Left breast	Phyllodes tumors	Total mastectomy for recurrent tumor local excision, RT	Excision surgery, RT	Anemia, melena
Tang et al. ¹⁵	1	67	F	Left breast	Ductal Ca	Left breast-conserving surgery, axillary lymphadenectomy, adjuvant ChT, RT	N/S	Stomach pain
De Gruttola et al. ¹⁶	1	61	F	Breast	Lobular Ca	Mastectomy, adjuvant ChT, RT	Total gastrectomy due to gastric perforation	Gastric perforation
Mohy-Ud-Din et al. ¹⁷	1	83	F	Breast	Lobular Ca	Mastectomy, sentinel lymph nodes excision, adj. ChT	N/A	Nausea, vomiting
Güler et al. ¹⁸	1	42	F	Breast	Ductal Ca	N/A	Total gastrectomy due to gastric perforation, ChT	Acute Abdomen
Cui et al. ¹⁹	1	42	F	Endometrium	Endometrial Aca	Total hysterectomy, bilateral salpingo-oophorectomy, pelvic and para-aortic lymphadenectomy	Neoadjuvant ChT, partial gastrectomy	N/S
Asmar et al. ²⁰	1	84	F	Breast	Lobular Ca	Left mastectomy, adjuvant ChT, RT, hormone therapy	Hormone therapy	Dyspepsia
Klair et al. ²¹	1	60	F	Ovary	Ovarian granulosa cell tumor	Total hysterectomy, bilateral salpingo-oophorectomy	N/A	Reflux, abdominal pain, nausea, anorexia
Yang ²²	1	47	F	Ovary	Ovarian serous cystadenocarcinoma	Total hysterectomy, bilateral salpingo-oophorectomy, pelvic and paraaortic lymphadenectomy, total omentectomy	Laparoscopic resection, adjuvant ChT	Abdominal pain
Bushan et al. ²³	1	68	F	Left breast	Lobular Ca	Wide excision of breast lesion, ChT, RT, hormone therapy	Distal gastrectomy with D2 lymphadenectomy, left axillary excision, ChT	Weight loss, dysphagia

Table 1. Continued

First author	No of cases	Age	Sex	Site of primary tumor	Histology type of primary	Treatment of primary	Treatment of metastasis	Clinical presentation of GM
Zhang et al. ²⁴	2	45	F	Breast	Lobular Aca	Lumpectomy, RT, ChT	N/S	N/S
Jin et al. ²⁵	1	64	F	Breast	Lobular Aca	N/A	N/A	Weight loss
		55	F	Breast	Lobular Ca	Neoadjuvant ChT, radical mastectomy, ChT, RT	ChT	N/S
Buka et al. ²⁶	1	58	F	Breast	Invasive lobular Ca	ChT, hormone therapy, RT	Neoadjuvant ChRT, total gastrectomy, adjuvant ChT	Abdominal pain, weight loss
Dória et al. ²⁷	1	66	F	Breast	Invasive lobular Ca	Letrozole	Total gastrectomy, lymphadenectomy, esophagojejunostomy with a Roux loop technique	Epigastric pain, vomiting, weight loss
Hwangbo et al. ²⁸	1	73	F	Ovary	Serous Aca	Cytoreductive surgery, adjuvant ChT	Distal gastrectomy with Billroth I anastomosis, lymphadenectomy	Epigastric pain, dyspepsia
Shetty et al. ²⁹	2	56	F	Breast	Invasive ductal Ca	Breast conservation therapy, adjuvant ChT	ChT	Epigastric discomfort, non-bilious vomiting
		61	F	Breast	Invasive ductal Ca	Left breast modified radical mastectomy, adjuvant RT	Palliative ChT	Abdominal pain, melena, abdominal distension
Geredeli et al. ³⁰	1	47	F	Breast	Invasive lobular Ca	Palliative ChT	Subtotal stomach resection, ChT	Asymptomatic
Kim et al. ³¹	1	58	F	Ovary	Serous Aca	Total hysterectomy with salpingo-oophorectomy, lymphadenectomy with total omentectomy, adjuvant ChT	Subtotal gastrectomy, lymphadenectomy, ChT	Asymptomatic

Table 1. Continued

First author	No of cases	Age	Sex	Site of primary tumor	Histology type of primary	Treatment of primary	Treatment of metastasis	Clinical presentation of GM
Fernandes et al. ³²	1	51	F	Breast	Invasive lobular Ca	Quadrantectomy, adjuvant ChT, hormone therapy	Total gastrectomy, adjuvant ChT, hormone therapy	Dyspepsia
Moldovan et al. ³³	1	49	F	Cervix uteri	SCC	Surgery, ChRT	Subtotal gastrectomy, lymphadenectomy D2, anastomotic layout shaped as Y Roux, omentectomy, adjuvant ChRT	Pyloric stenosis, epigastric pains, late postprandial emesis, weight loss
Zhou and Miao ³⁴	1	61	F	Ovary	Serous Aca	Optimal debulking cytoreductive surgery, adjuvant ChT	Gastric antrectomy	Asymptomatic
Critchley et al. ³⁵	1	62	F	Breast	Invasive lobular Ca	Mastectomy, level 2 axillary clearance, adjuvant ChT, adjuvant RT, adjuvant hormone therapy	ChT	Loose stool, normocytic anemia, weight loss
Hara et al. ³⁶	1	74	F	Breast	Invasive ductal Ca	Breast-conserving surgery	Paclitaxel	Chronic gastritis
Ciulla et al. ³⁷	1	70	F	Breast	Lobular Ca	Postoperative hormone therapy	Total gastrectomy, lymphadenectomy R1, esophagojejunostomy with Roux loose technique	Asymptomatic
Jones et al. ³⁸	2	51	F	Breast	Lobular Ca	Wide local excision, axillary dissection, adjuvant RT	Total gastrectomy with Roux-en-Y reconstruction, hormone therapy	Weight loss, epigastric pain
Yim et al. ³⁹	1	48	F	Breast	SRCC	Mastectomy, axillary dissection, adjuvant ChT, RT, tamoxifen	ChT, RT	Progressive dysphagia, weight loss
Wong et al. ⁴⁰	1	72	F	Breast	Invasive lobular Ca	Wide local excision, adjuvant RT	ChT	Epigastric discomfort
							Hormone therapy	Acute abdomen, rebound tenderness, generalized peritonitis

Table 1. Continued

First author	No of cases	Age	Sex	Site of primary tumor	Histology type of primary	Treatment of primary	Treatment of metastasis	Clinical presentation of GM
Ricciuti et al. ⁴¹	1	65	M	Breast	Invasive ductal Ca	Total mastectomy, complete axillary dissection, adjuvant hormone therapy	Gastrectomy with Roux-en-Y esophagojejunostomy anastomosis	Hematemesis, epigastric pain
Fernandes et al. ⁴²	4	56 (the mean age)	F	Breast	Invasive lobular Ca	ChT, hormone therapy	Total gastrectomy	Ulcerated lesion, major bleeding
		56 (the mean age)	F	Breast	Invasive lobular Ca	ChT, RT, hormone therapy	ChRT	Diffuse infiltration
		56 (the mean age)	F	Breast	Invasive ductal Ca	ChT, hormone therapy	ChT	Infiltrative, ulcerated, stenotic lesion
		56 (the mean age)	F	Breast	Invasive ductal Ca	ChT, hormone therapy	ChRT	Flat erosive lesion
Zullo et al. ⁴³	3	49	F	Ovary	Serous Aca	Hysterectomy, bilateral salpingo-oophorectomy, pelvic lymphadenectomy, adjuvant ChT	ChT	Abdominal pain, vomiting, weight loss
		80	F	Cervix uteri	Leiomyosarcoma	Total hysterectomy, bilateral salpingo-oophorectomy, pelvic lymphadenectomy, adjuvant ChT	N/A	Epigastric pain
Villa Guzman et al. ⁴⁴	1	70	F	Breast	N/A	Radical left mastectomy, adjuvant ChT	ChT	Dysphagia, epigastric pain
		58	F	Breast	Invasive lobular Ca	Quadrantectomy, lymphadenectomy, adjuvant ChT, RT	ChT, hormone therapy	Nausea, epigastric pain
Mizuguchi et al. ⁴⁵	1	71	F	Ovary	Serous Aca	Total hysterectomy, bilateral salpingo-oophorectomy, omentectomy, ChT	ChT, hormone therapy	Asymptomatic

Table 1. Continued

First author	No of cases	Age	Sex	Site of primary tumor	Histology type of primary	Treatment of primary	Treatment of metastasis	Clinical presentation of GM
Jmour et al. ⁴⁶	4	51	F	Breast	Mixed	Radical mastectomy with lymphadenectomy	ChT, RT	Nausea, vomiting, abdominal pain
		47	F	Breast	Lobular infiltrating Ca	Radical mastectomy with lymphadenectomy	ChT, RT	Nausea, vomiting, abdominal pain
		51	F	Breast	Ductal infiltrating Ca	N/A	ChT, RT	Nausea, vomiting, abdominal pain
		36	F	Breast	Lobular infiltrating Ca	Radical mastectomy with lymphadenectomy	ChT, RT	Nausea, vomiting, abdominal pain
Yim ⁴⁷	1	65	F	Breast	Invasive lobular Ca	Modified radical mastectomy, adjuvant ChT, adjuvant RT	ChT	Dyspepsia, anorexia, indigestion, epigastric discomfort, early satiety, weight loss
Choi et al. ⁴⁸	1	44	F	Breast	Phyllodes tumor	Right lumpectomy, axillary lymphadenectomy, RT, right total mastectomy	Endoscopic hemostasis with cauterization	Dizziness, anemia, melena
Khan et al. ⁴⁹	1	56	F	Breast	Signet ring Aca	ChT	ChT	Anemia
Mullally et al. ⁵⁰	1	46	F	Breast	Invasive ductal Ca	Left mastectomy, adjuvant ChT, hormone therapy, RT	Palliative laparoscopic gastroduodenostomy, hormone therapy, palliative ChT	Epigastric and left shoulder pain, epigastric tenderness, upper abdominal rigidity
Kliger and Gorbaty ⁵¹	1	60	F	Breast	Invasive ductal Aca	Systemic therapy, ChT	N/A	Nausea, diarrhea, vomiting, weight loss

Table 1. *Continued*

First author	No of cases	Age	Sex	Site of primary tumor	Histology type of primary	Treatment of primary	Treatment of metastasis	Clinical presentation of GM
Antonini et al. ⁵²	1	61	F	Ovary	Serous Ca	ChT, cytoreductive surgery	ChT	Dyspepsia
Kono et al. ⁵³	1	64	F	Ovary	Mucinous Ca	Bilateral salpingo-oophorectomy, simple hysterectomy, pelvic and para-aortic lymphadenectomy, partial omental resection	ChT	Back pain
Kim et al. ⁵⁴	1	39	F	Breast	Invasive lobular Ca	Right breast-conserving surgery, lymphadenectomy	Duodenal stent; systemic ChT	Upper abdominal discomfort and pain, indigestion
Woo et al. ⁵⁵	1	51	F	Breast	Invasive lobular Ca	Bilateral modified radical mastectomy, ChT, RT	Radical subtotal gastrectomy with Billroth II anastomosis, D2 lymphadenectomy, ChT	Epigastric pain
Ulmer et al. ⁵⁶	1	55	F	Breast	Invasive lobular Ca	Bilateral mastectomy, adjuvant ChT, RT, hormone therapy	Palliative pyloric stent	Nausea, vomiting, early satiety, weight loss

Aca: adenocarcinoma; Ca: carcinoma; SCC: squamous cell carcinoma; GM: gastric metastasis; RT: radiotherapy; SRCC: signet ring cell adenocarcinoma; ER: estrogen receptor; HER: human epidermal growth factor receptor; PGR: progesterone receptor; Syn: synchronous; Met: metachronous; EGD: esophagogastroduodenoscopy; FNA: fine-needle aspiration.

Table 2. Illustrating data regarding metastasis from gastrointestinal cancers.

First author	No of cases	Age	Sex	Site of primary tumor	Histology type of primary	Treatment of primary	Treatment of metastasis	Clinical presentation of GM
Iwai et al. ⁵⁷	1	76	F	Transverse colon	Poorly differentiated Aca with a partial component of signet-ring Ca	ChT	ChT	Anemia, anorexia
Yang et al. ⁵⁸	1	74	F	Head of pancreas	Poorly differentiated invasive Aca	ChT	ChT	RUQ pain
Lee and Lee ⁵⁹	1	82	M	Right colon	Moderately differentiated Aca	Extended right hemicolectomy (declined adjuvant ChT)	Radical total gastrectomy (declined adjuvant ChT) with Roux-en-Y and D2 dissection	Asymptomatic

Table 2. Continued

First author	No of cases	Age	Sex	Site of primary tumor	Histology type of primary	Treatment of primary	Treatment of metastasis	Clinical presentation of GM
Rothermel et al. ⁶⁰	1	61	M	Body of pancreas	Well-differentiated ductal Aca	Distal pancreatectomy, splenectomy, adjuvant ChT	ChT, palliative radiation, and wedge gastrectomy	Asymptomatic
Terashima et al. ⁶¹	1	61	F	Transverse colon	Poorly differentiated Aca	Extended right hemicolectomy, ChT	Partial gastrectomy and D3 dissection, ChT	Diarrhea, vomiting
Sasajima et al. ⁶²	1	72	M	Head and tail of pancreas	IPMN	ChT	ChT (terminated after 2 courses)	N/A
Tomonari et al. ⁶³	1	78	M	Body and distal pancreas	Moderately differentiated Aca T3N0M0	Surgery, adjuvant ChT	Subtotal gastrectomy	Follow-up
Adachi ⁶⁴	1	67	F	Pancreas	Well-differentiated SCC	Distal pancreatectomy and splenectomy	Total gastrectomy	Anorexia, back pain
Nakazawa et al. ⁶⁵	1	59	M	Esophagus	Mucosal SCC	Subtotal esophagectomy, left lateral segmentectomy of liver, pancreatosplenectomy, adjuvant ChT	Proximal gastrectomy	Asymptomatic
Abouzi et al. ⁶⁶	1	69	M	Liver	HCC	Right hepatectomy	ChT	Iron-deficiency anemia
Ito et al. ⁶⁷	1	78	M	Liver	ICC	Lateral hepatectomy	Proximal gastrectomy and lymphadenectomy	Fatigue
Imai et al. ⁶⁸	1	62	M	Liver	HCC	N/A	Transcatheter left gastric artery embolization	Abdominal mass
Kim et al. ⁶⁹	1	75	M	Liver	HCC	Right hemihepatectomy, TACE	Gastric wedge resection	Melena, mild dyspnea
Peng et al. ⁷⁰	1	22	M	Liver	HCC	Right hemihepatectomy combined with left lateral tumor local resection, cholecystectomy, splenectomy	Gastric tumor local resection	Anemia, FOBT 4+
Kanthan et al. ⁷¹	1	85	M	Colon	Aca	N/A	N/A	Anemia
Wang et al. ⁷²	1	63	F	Gallbladder	Melanoma	Surgery, ChT	ChT	Postprandial nausea, vomiting

Aca: adenocarcinoma; IPMN: intraductal papillary mucinous neoplasm; HCC: hepatocellular carcinoma; ChT: chemotherapy; RUQ pain: right upper quadrant pain; Syn: synchronous; EUS: endoscopic ultrasound; EUS-FNA: endoscopic ultrasound fine-needle aspiration; Ca: carcinoma; SCC: squamous cell carcinoma; ICC: intrahepatic cholangiocarcinoma; TACE: trans arterial chemoembolization; FOBT: fecal occult blood test; Met: metachronous; EGD: esophagogastroduodenoscopy; FDG: fluorodeoxyglucose; PET: positron emission tomography.

Table 3. Illustrating data regarding metastasis from lung cancers.

First author	No of cases	Age	Sex	Site of primary tumor	Histology type of primary	Treatment of primary	Treatment of metastasis	Clinical presentation of GM
Catalano et al. ⁷³	1	78	M	Lung - right upper lobe	Poorly differentiated Aca	Upper right lobectomy	Total gastrectomy	Asymptomatic
Shih-Chun et al. ⁷⁴	1	55	M	Lung - right upper lobe	NSCLC	Concurrent chemoradiotherapy	Palliative total gastrectomy, ChT	Gastric bleeding, ulcerative mass
Das Majumdar et al. ⁷⁵	1	72	M	Lung	Poorly differentiated Aca	Palliative RT	Immunotherapy, ChT	Identified with body CT after pathological fracture
Liu et al. ⁷⁶	1	58	M	Lung	Aca	Middle right lobectomy, neoadjuvant therapy, ChT	ChT, partial gastrectomy	N/S
Nemoto et al. ⁷⁷	1	64	M	Lung - right lower lobe	SCC	Adjuvant ChT	Esophagogastrectomy	Epigastric pain, progressive dysphagia
He et al. ⁷⁸	1	61	M	Lung	SCLC	Left lower lobectomy	Cardia resection	Progressive dysphagia
Yang et al. ⁷⁹	1	59	M	Lung - left upper lobe	Poorly differentiated metastatic carcinoma	ChT	Anti-PD1 immunotherapy	Right upper limb pain, epigastric discomfort
Li et al. ⁸⁰	1	61	M	Lung - right lower lobe	SCC	ChT	ChT, gastrectomy	Progressive abdominal distention
Bhardwaj et al. ⁸¹	1	39	F	Lung	SCC	ChT, nivolumab	RT	Dizziness, melena
Badipatla et al. ⁸²	1	65	M	Lung	Aca	ChT, palliative care	ChT, palliative care	Bilateral flank pain, nausea, vomiting, change in bowel habit
Qasrawi et al. ⁸³	1	69	F	Lung - left upper lobe	Aca	RT	Hospice care	Melena, hypotension
Kim et al. ⁸⁴	1	70	F	Lung	Pleomorphic carcinoma	Right bronchial artery embolization, right upper lobectomy, adjuvant ChT	Partial gastrectomy, immunotherapy	Abdominal pain
Maeda et al. ⁸⁵	1	60	F	Lung	SCLC	ChT	N/A	Nausea, vomiting
Struyf et al. ⁸⁶	1	68	M	Lung	Aca	ChT	ChT	Severe epigastric pain
Altintas et al. ⁸⁷	1	55	M	Lung	Aca	ChT	ChT	Epigastric pain, hematemesis, melena
Casella et al. ⁸⁸	1	63	M	Lung	SCLC	Supportive care	Supportive care	Fever, weight loss, epigastric pain, constipation

Table 3. Continued

First author	No of cases	Age	Sex	Site of primary tumor	Histology type of primary	Treatment of primary	Treatment of metastasis	Clinical presentation of GM
Ohashi et al. ⁸⁹	1	62	M	Lung	Large cell carcinoma	Right upper lobectomy	ChT	Abdominal pain
Aokage et al. ⁹⁰	2	69	M	Lung - right upper lobe	Pleomorphic carcinoma	Right upper lobectomy, parietal pleura resection	Partial gastrectomy, splenectomy	Fatigue, anemia
		62	M	Lung - left upper lobe	Pleomorphic carcinoma	Left upper lobectomy	Distal gastrectomy, splenectomy	N/A
Katsenos and Archondakis ⁹¹	1	61	M	Lung - left upper lobe	Aca	ChT	ChT	Upper GIS bleeding
Diem et al. ⁹²	1	62	F	Lung - right upper lobe	Aca	N/A	ChT	Epigastric pain
Hu et al. ⁹³	1	54	M	Lung	SCC	RT, right middle lobectomy	None (patient refused)	Dysphagia
Koh et al. ⁹⁴	1	46	M	Lung	Pleomorphic carcinoma	Antibiotics	N/A	Abdominal pain, tenderness
Hung et al. ⁹⁵	1	47	M	Lung	SCC	RT, ChT	ChT	Weight loss, dysphagia
Taira et al. ⁹⁶	1	64	M	Lung	Pleomorphic carcinoma, Aca	Left upper lobectomy	ChT	Anemia
Gao et al. ⁹⁷	1	66	M	Lung	SCLC	ChT	ChT, supportive care	Epigastric pain
Kim et al. ⁹⁸	1	68	M	Lung	Poorly differentiated Aca	Left lower lobectomy, posterior segmentectomy right upper lobe (2004), left upper lobe wedge resection (2007), palliative chemotherapy	Palliative ChT	Epigastric pain, dyspepsia
Chen et al. ⁹⁹	1	59	F	Lung	Sarcomatoid carcinoma	Supportive treatment	Supportive treatment	Abdominal pain, anorexia, weight loss
Dong et al. ¹⁰⁰	1	60	F	Lung	Glomus tumor	N/A	N/A	Hemoptysis, melena, abdominal distension
Kim et al. ¹⁰¹	2	66	M	Lung	SCLC	N/A	N/A	Epigastric pain, epigastric tenderness, fatigue
		68	M	Lung	SCLC	N/A	N/A	Hemoptysis, weight loss
Del Rosario et al. ¹⁰²	1	77	F	Lung	Aca	ChT	Palliative care	N/A
Kanthan et al. ⁷¹	1	75	M	Lung	Aca	N/A	N/A	Epigastric pain, RUQ pain

Aca: adenocarcinoma; SCC: squamous cell carcinoma; RT: radiotherapy; GIS: gastrointestinal; EGD: esophagogastroduodenoscopy; EUS: endoscopic ultrasound; GDS: gastroduodenoscopy; NSCLC: non-small-cell lung cancer; SCLC: small-cell lung cancer; ChT: chemotherapy; USG: ultrasonography; Syn: synchronous; Met: metachronous.

Table 4. Illustrating data regarding metastasis from malignant melanoma.

First author	No of cases	Age	Sex	Site of primary tumor	Histology type of primary	Treatment of primary	Treatment of metastasis	Clinical presentation of GM
Zhu et al. ¹⁰³	1	36	M	Right plantar	Nodular	Mohs microsurgery	N/A	Anorexia, nausea, vomiting
Yoshimoto et al. ¹⁰⁴	1	82	F	Fourth left toe	Acral lentiginous	Surgery	Palliative RT	Melena
Okamoto et al. ¹⁰⁵	1	79	M	Esophagus	Pigmented submucosal tumor-like growth in the esophagus	Nivolumab	Nivolumab	Gross hematuria, weight loss, cough, exertional dyspnea
Cortellini et al. ¹⁰⁶	1	81	M	N/A	N/A	N/A	N/A	Weakness, hyporexia, anemia
Groudan et al. ¹⁰⁷	1	66	F	Vulva	N/A	N/A	Palliative RT, immunotherapy	Fatigue, exertional dyspnea, hematemesis, weight loss, nausea
Syed et al. ¹⁰⁸	1	49	F	Back	N/A	Surgery	Immunotherapy, supportive care, SRS	Anorexia, abdominal pain, fatigue, weight loss, nausea, vomiting
Genova et al. ¹⁰⁹	1	80	M	Scalp	Lentigo	RT	Immunotherapy	Hypochromic anemia
Wong et al. ¹¹⁰	1	81	F	Foot	Acral lentiginous	Amputation, CT	Denied the treatment	Dyspnea, fatigue, anemia
Grander et al. ¹¹¹	1	67	M	Right hypochondrium, back, scalp	Superficial spreading	Surgery	Total gastrectomy, radiosurgery	Melena
Carcelain et al. ¹¹²	1	65	F	N/A	N/A	Surgery	Surgery	N/S
Lestre et al. ¹¹³	1	67	M	Lower back	Superficial spreading	Excision, adjuvant immunotherapy	No	N/S
Rana et al. ¹¹⁴	1	72	M	N/A	N/A	N/A	N/A	Weight loss, anorexia
Rovere et al. ¹¹⁵	1	68	M	N/A	N/A	N/A	Supportive care	N/S
Eivazi-Ziaei et al. ¹¹⁶	1	56	M	Right heel-ALM	N/A	Surgery	Supportive care	Epigastric pain

Table 4. Continued

First author	No of cases	Age	Sex	Site of primary tumor	Histology type of primary	Treatment of primary	Treatment of metastasis	Clinical presentation of GM
El-Sourani et al. ¹¹⁷	1	43	F	Right breast	N/A	Surgery	Sleeve gastrectomy after atypical resection, complete locoregional lymphadenectomy	Melena, anemia
Buissin et al. ¹¹⁸	1	63	M	Anorectal	Hyperplastic polyp	Abdominoperineal resection	Supportive care	Tenderness in the RUQ
Bankar et al. ¹¹⁹	1	41	F	N/A	N/A	N/A	Surgery	N/S
Mohan et al. ¹²⁰	1	28	M	N/A	N/A	N/A	Temozolomide	Abdominal pain, anorexia, weight loss
Farshad et al. ¹²¹	1	89	M	Chest wall	N/A	Local excision	Nivolumab	Fatigue, rigors, fever

ALM: acral lentiginous melanoma; ChT: chemotherapy; RUQ: right upper quadrant; EGD: esophagogastroduodenoscopy; NBI: narrow band imaging; RT: radiotherapy; SRS: stereotactic radiosurgery; IHC: immunohistochemistry; CT: computed tomography; EMG: electromyography; Syn: synchronous; Met: metachronous; FDG: fluorodeoxyglucose; PET: positron emission tomography.

Table 5. Illustrating data regarding metastasis from urogenital cancers.

First author	No of cases	Age	Sex	Site of primary tumor	Histology type of primary	Treatment of primary	Treatment of metastasis	Clinical presentation of GM
Tapasak and Mcguirt ¹²²	1	77	M	Kidney	RCC	Nephrectomy, ChT	Roux-en-Y gastric bypass	Gastrointestinal bleeding, anemia
Podzolkov et al. ¹²³	1	30	M	Testis	Choriocarcinoma	ChT	N/A	Epigastric pain, dyspnea
Koterazawa et al. ¹²⁴	1	70	F	Kidney	RCC	Nephrectomy	Endoscopic submucosal resection	Weight loss
Hakim et al. ¹²⁵	1	86	F	Kidney	RCC	Nephrectomy, ChT	RT	Gastrointestinal bleeding
Yoshida et al. ¹²⁶	1	85	F	Kidney	RCC	Nephrectomy	Endoscopic resection	Anemia, melena
Bernshteyn et al. ¹²⁷	1	68	M	Kidney	RCC	Nephrectomy	N/A	Dyspnea, melena
Weissman et al. ¹²⁸	2	70	M	Kidney	RCC	Nephrectomy	ChT	Dyspepsia, malaise, weight loss
		85	M	Kidney	RCC	Nephrectomy	ChT	Dyspepsia, malaise, weight loss

Table 5. Continued

First author	No of cases	Age	Sex	Site of primary tumor	Histology type of primary	Treatment of primary	Treatment of metastasis	Clinical presentation of GM
Chaar et al. ¹²⁹	1	30	M	Testis	Choriocarcinoma	Orchiectomy	ChT (patient refused)	Melena, anemia
Arakawa et al. ¹³⁰	1	80	F	Kidney	RCC	ChT	ChT	Anorexia, pyrexia, malaise
Uehara et al. ¹³¹	1	73	M	Kidney	RCC	Nephrectomy, ChT	Endoscopic mucosal resection, immunotherapy	Gastric mass
O'Reilly et al. ¹³²	1	59	F	Kidney	Clear cell RCC	Nephrectomy	Laparoscopic sleeve gastrectomy	Asymptomatic
Abu Ghanimeh et al. ¹³³	1	67	M	Kidney	Clear cell RCC	Nephrectomy	No treatment initiated	Gastrointestinal bleeding
Mazumdar et al. ¹³⁴	1	49	M	Testis	Seminoma	N/A	N/A	Abdominal pain
Barras et al. ¹³⁵	1	53	M	Kidney	RCC	Nephrectomy	Partial gastrectomy	Hematochezia
Rivello et al. ¹³⁶	1	68	M	Kidney	RCC	Nephrectomy	Gastrectomy, ChT	Melena, postural dizziness, weakness
Hong et al. ¹³⁷	1	60	M	Bladder	Clear cell urothelial Ca	ChT, RT	Palliative care	Projectile vomiting
Onitilo et al. ¹³⁸	2	57	M	Prostate	Aca	LHRH agonist	ChT	Weakness, nausea, vomiting, hematemeses
		89	M	Prostate	Aca	LHRH agonist	ChT	Weakness, nausea, vomiting, hematemeses
Tiwari et al. ¹³⁹	1	58	F	Kidney	Clear cell RCC	N/A	Roux-en-Y subtotal gastrectomy	Melena, hematemeses, fatigue
Yodonawa et al. ¹⁴⁰	1	73	M	Kidney	Leiomyosarcoma	Nephrectomy	Distal gastrectomy	Melena, weakness
Chibbar et al. ¹⁴¹	1	69	F	Kidney	Clear cell RCC	Nephrectomy	Endoscopic mucosal resection	Fatigue, lightheadedness, anemia
Sakurai et al. ¹⁴²	1	61	M	Kidney	RCC	Nephrectomy	Partial gastrectomy, ChT	Melena, anemia
Patel et al. ¹⁴³	1	71	M	Prostate	Aca	Surgery, RT	N/A	Weakness, dizziness, anemia

Table 5. Continued

First author	No of cases	Age	Sex	Site of primary tumor	Histology type of primary	Treatment of primary	Treatment of metastasis	Clinical presentation of GM
Sharifi et al. ¹⁴⁴	1	17	F	Kidney	Primitive neuroectodermal	ChT	ChT	Abdominal pain, distention
Greenwald et al. ¹⁴⁵	1	62	M	Kidney	Clear cell RCC	Nephrectomy	Partial gastrectomy	Testicular pain
Costa et al. ¹⁴⁶	1	66	F	Kidney	RCC	Nephrectomy	Palliative laparoscopic wedge resection	Anemia
Soe et al. ¹⁴⁷	1	64	M	Prostate	N/A	LHRH agonist	Palliative care (patient refused chemotherapy)	Anemia, melena
Bhandari and Pant ¹⁴⁸	1	58	M	Prostate	Aca	LHRH agonist	ChT	Abdominal pain
Lowe et al. ¹⁴⁹	1	18	M	Testis	Choriocarcinoma	ChT, orchidectomy	ChT	Melena, lethargy, dizziness
Inagaki et al. ¹⁵⁰	1	75	M	Prostate	Aca	LHRH agonist	Endoscopic mucosal resection, hormone therapy	Epigastric pain
Tavukcu et al. ¹⁵¹	1	67	M	Prostate	Mixed 55% ductal 45% acinar	Prostatectomy, RT	Androgen deprivation therapy, ChT	Ascites, vomit
Kanthan et al. ⁷¹	1	19	M	Testis	Predominantly choriocarcinoma, embryonal Ca	Orchiectomy	Partial gastrectomy ^聽	Melena, anemia

Ca: carcinoma; ChT: chemotherapy; EUS: endoscopic ultrasound; Aca: adenocarcinoma; RT: radiotherapy; EGD: esophagogastrroduodenoscopy; RCC: renal cell carcinoma; LHRH: luteinizing hormone releasing hormone; Syn: synchronous; Met: metachronous.

received only surgery. In all patients, GM was discovered metachronous. Three studies were included for soft tissue cancer. All three patients had metastases in addition to GM and underwent different types of GM treatment (including radiotherapy, chemotherapy, excision with snare, and cautery). For the thyroid cancer group, the median age was 71 years old. Overall survival (OS) was only mentioned for one patient (2.5 months). Regarding diffuse large B-cell lymphoma (DLBCL) (n=2), patients received chemotherapy for primary cancer and for GM. GM was discovered synchronously. Kovacs *et al.*, described the only case of GM from adrenocortical carcinoma of the adrenal gland.¹⁵² The patient underwent adrenalectomy for primary and total gastrectomy with splenectomy and end-to-side Roux-en-Y esophago-jejunal anastomosis for GM. One patient with choriocarcinoma from retroperitoneum underwent chemotherapy for primary cancer and GM. Table 6 summarizes the findings of included studies regarding gastrointestinal cancers.^{151–171}

Discussion

Gastric metastases are uncommon and give information about the progressed stage of malignant disease, with a reported incidence of 0.2-0.7% based on clinical and autopsy findings.¹ Furthermore, metastasis to the stomach frequently indicates short survival. These metastases are observed rarely due to clinical problems regarding their diagnosis and treatment.² Progressively, with improvements in prognosis for cancer patients, metastatic tumors in the stomach are being detected more frequently.¹ There are several symptoms of gastric metastases, such as abdominal pain, diarrhea, nausea, vomiting, weight loss, and dyspepsia. The most preferred treatment method for gastric metastasis is surgical resection of the tumor. Also, chemotherapy is the most applied alternative option.

This systematic review has a few potential limitations that need to be mentioned. As 172 case reports were screened in the systematic review from different journals the heterogeneity was inevitable. Some articles missed important information such as complete follow-up or clinical information. Moreover, since all of the included articles were case reports, quality or bias assessment could not be performed.

Gynecologic cancer

Gastric metastasis mainly occurs due to breast cancer. Both ovarian and uterine metastases are distinctly less frequent.³⁸ Invasive lobular carcinoma is the type with the highest affinity to the digestive system with an incidence of 4.5% compared to 0.2% in ductal carcinoma.²⁶ Breast cancer metastases to the gastrointestinal tract are rare, with a median time interval from the diagnosis of the primary tumor to metastasis up to seven years.²¹ The longest disease-free interval is 22 years after the initial diagnosis 17 of 24.¹⁰ Some metastatic tumors may have a similar presentation as primary gastric cancer.³⁸ The detailed immunohistochemical analysis will allow the most accurate diagnosis to differentiate between primary gastric cancer and gastric metastasis from breast cancer.²⁶ Most gastric metastatic breast cancers are estrogen receptor (ER)-positive, progesterone receptor (PR)-positive/negative, and human epidermal growth factor receptor (HER2)-negative. However, in primary gastric adenocarcinoma, ER and PR can be positively expressed in 20-28% of patients.¹⁹ In a few cases, metastatic breast cancer is negative for ER and PR, so a diagnosis cannot be made based on these two investigations alone.⁵⁹ ER and PR can be used as markers; however, they are not always suitable diagnostic markers to confirm if a tumor has originated.¹¹ Treatment of gastrointestinal metastases from breast cancer is discussed frequently in the literature. Systemic therapy is the first option.³⁶ The effective rate of systemic treatment is about 46%.⁶⁰ Surgical treatment may have a role in palliative treatment.³⁴ Surgical treatment is considered in cases with obstruction or bleeding.³⁶ Metastasis to the gastrointestinal tract can be the first presentation of breast cancer, therefore it is imperative to consider the possibility of breast cancer metastasis to the gastrointestinal metastasis.^{26,46}

Gastrointestinal cancer

Among cancers that metastasize to the stomach, gastrointestinal system cancers are encountered in a minority. Gastric metastases gave unspecific findings, such as anemia, bleeding, and pain. Pancreas, liver, and colon account for the majority of primary cancers. Nine of the cases had other metastases in addition to gastric ones. Since pancreatic cancers are usually caught at an advanced stage, the chances of surgical treatment and their response to treatment are low. We see that three of five patients died within a year.^{2,6,8} Among these cases, the prognosis of pancreatic head cancers was worse than body and tail cancers.

Lung cancer

In fact, lung cancer is the most mortal type of all cancers. However, the stomach is not a common site for primary lung cancers' metastases, especially compared with brain, liver, adrenal glands, and bones.⁷⁴ Yet, the expected lifespan after diagnosis of metastasis is found to be relatively low. The median survival time was four months (average 6.8 months) among 16 cases who died. On the other hand, data showed that endoscopy is the gold standard in diagnosis. In addition, pathology and immunohistochemistry are considered important factors to differentiate gastric metastases from primary cancers.⁸¹ Regarding the treatment of gastric metastases of the pulmonary origin, although non-invasive chemotherapy treatments were the most common choice, patients who received surgery, particularly partial gastrectomy, but also

Table 6. Illustrating data regarding metastasis from other cancers.

First author	No of cases	Age	Sex	Site of primary tumor	Histology type of primary	Treatment of primary	Treatment of Metastasis	Clinical presentation of GM
Kovecsi et al. ¹⁵²	1	71	M	Adrenal gland	Adrenocortical carcinoma	Right adrenalectomy	Total gastrectomy, splenectomy, with end-to-side Roux-en-Y esophageal anastomosis	Weight loss, epigastric pain, vomiting, fatigue
Koti et al. ¹⁵³	1	14	F	Bone	Ewing sarcoma	ChT, local excision	ChT, total gastrectomy, RT	Abdominal mass, low-grade fever, weight loss
Dodis et al. ¹⁵⁴	1	72	F	Bone	Ewing sarcoma	Total knee replacements, RT, ChT	N/A	Anemia
Urakawa et al. ¹⁵⁵	1	73	M	Bone	Osteosarcoma	ChT, surgery	Partial gastrectomy	Anemia, hematemesis
Shibuya et al. ¹⁵⁶	1	27	M	Extragenital retroperitoneal	Choriocarcinoma	ChT	ChT	Abdominal pain, melena, vomiting
Tarangelo et al. ¹⁵⁷	1	65	M	Head, neck	SCC	ChT, RT, robotic excision	N/A	Melenic bowel movements
Kamihara et al. ¹⁵⁸	1	70	M	Lymph nodes	DLBC	R-CHOP ChT	R-CHOP ChT	N/A
Zepeda-Gomez et al. ¹⁵⁹	1	39	F	Lymph nodes	DLBC	ChT, omeprazole	ChT	Melena, weight loss, retroperitoneal mass
Teh et al. ¹⁶⁰	1	37	F	Oropharynx	SCC	Surgery, adjuvant RT	Palliative RT	Weight loss, LUQ pain, melena
Elkafrawy et al. ¹⁶¹	1	67	M	Skin	MCC	Surgery, consolidative	Atezolizumab, RT	Melena
Ha et al. ¹⁶²	1	82	M	Skin	MCC	Surgery, RT	No	Anorexia, weight loss
Idowu et al. ¹⁶³	1	79	F	Skin	MCC	Surgery, ChT, RT	N/A	Anemia
Parikh et al. ¹⁶⁴	1	60	M	Skin	MCC	ChT, RT	ChT	Maroon colored stools
Subramanian et al. ¹⁶⁵	1	62	M	Soft tissue	Leiomyosarcoma	Surgery, RT	RT, ChT	Melena, abdominal pain, nausea, vomiting

Table 6. Continued

First author	No of cases	Age	Sex	Site of primary tumor	Histology type of primary	Treatment of primary	Treatment of Metastasis	Clinical presentation of GM
Dent et al. ¹⁶⁶	1	60	M	Soft tissue	Sarcoma	Surgery	Remove with snare and cautery	Upper abdominal pain, melena
Samuel et al. ¹⁶⁷	1	56	M	Soft tissue	Synovial sarcoma	Surgery, RT	Doxorubicin	N/A
Thorburn et al. ¹⁶⁸	1	56	M	Supraglottic larynx, hypopharynx	Advanced SCC	Surgery, tracheostomy, radical RT	N/A	Anemia, hematemesis
Fuladi et al. ¹⁶⁹	1	71	F	Thyroid	Anaplastic carcinoma	Total thyroidectomy, left modified radical neck dissection, RT	N/A	Nausea, vomiting
Ayaz et al. ¹⁷⁰	1	72	M	Thyroid	Anaplastic carcinoma	N/A	N/A	Melena
Karrasch et al. ¹⁷¹	1	53	F	Thyroid	Medullary thyroid cancer	Complete thyroidectomy ChT	N/A	Fatigue, anorexia, epigastric pain radiating to the back

SCC: squamous cell carcinoma; MCC: merkel cell carcinoma; RT: radiotherapy; EGD: esophagogastroduodenoscopy; DLBC: diffuse large B cell; ChT: chemotherapy; LUQ: left upper quadrant; Met: metachronous; EGD: esophagogastroduodenoscopy; FDG: fluorodeoxyglucose; PET: positron emission tomography; Syn: synchronous.

esophagogastrectomy and laparotomy, tended to have relatively much longer survival time.^{77,90,95} However, this conclusion is not definitive, since in some cases surgeries may be avoided when the patient's condition is extremely severe and the number of cases with given surgical treatments is scarce. So the potential benefit of surgeries to the expected lifespan of the patients needs further investigation.

Malign melanoma

Although melanoma accounts for only 5% of cutaneous malignancies, it makes up nearly 75% of skin cancer-related deaths.^{103,107} Malignant melanoma ranks as the most common metastatic tumor of the gastrointestinal (GI) tract.^{103,110,120} It takes an average of 52 months for a primary cutaneous melanoma to spread to the gastrointestinal tract.^{107,110} Only 1-4% of patients with malignant melanoma deceased before gastrointestinal metastases are diagnosed. On the other hand, GI tract metastasis was observed in more than 60% of melanoma patients by autopsy.^{103,110,111,114,121} The most commonly involved sites include the small and large bowels and rectum; however, gastric metastasis is a rare case^{110,111,117,119,121} due to the non-specificity of its symptoms, such as epigastric discomfort, nausea, vomiting, weight loss, hematemesis, and melena.^{103,107,110,111,114,117,121} The average survival is four to six months.^{103,107,121} Endoscopy is an effective method for detecting melanoma metastases due to pigmentation, which can then be confirmed by histology and immunohistochemistry.^{114,121} Treatment options include surgical resection, immunotherapy, chemotherapy, and targeted therapy. If a patient is symptomatic, surgical excision can be a palliative technique that can also prolong survival.^{103,121}

Urogenital cancer

Regarding urogenital metastases GM is uncommon and the incidence is reported to vary between 0.2% and 0.7%.¹²³ The most common clinical presentations are gastrointestinal bleeding (melena and hematemesis), anemia, and malaise. Whereas two patients had no symptoms associated with the gastrointestinal system.^{131,140} Esophagogastroduodenoscopy is often necessary for diagnosis and localized treatment.¹³¹ The presence of gastric metastases is considered an important indicator of advanced disease.¹⁴⁹ Treatment options varied depending on the stage of the metastasis including endoscopic resection, partial or total gastrectomy, chemotherapy, and palliative care. Even though overall survival seems to be longer in patients who underwent surgery, the main reason for this may be that these patients have early-stage diseases suitable for surgery. Therefore, treatment options should be decided upon the stage of the disease and the general well-being of the patient.

Others

The most common symptoms, in terms of frequency, are melena, abdominal pain, vomiting, weight loss, anemia, fatigue, and loss of appetite. Gastrointestinal endoscopy plays an important role in the diagnosis of GM if suspected.¹⁶² Tumor seeding after endoscopic gastrostomy tube replacement was observed in two cases.^{161,169} Even though surgery is the frequent treatment for solid organ cancer metastasis, chemotherapy is the chosen treatment for DLBCL, skin cancer, and sarcoma. Overall survival was only mentioned for four cases; therefore, it is difficult to comment on which treatment method is more beneficial. Metastasis to the stomach is not reported frequently. Thus, determining the prognosis and planning the treatment based on scientific evidence seems to be problematic for clinicians.

In conclusion, among 172 case reports reviewed, resection surgery was performed the most for treatment and was sometimes combined with chemotherapy and immunotherapy. However, the literature regarding the management of patients with secondary gastric cancer is limited. Therefore, further multi-centric research to reach a consensus about what type of treatment has the best outcomes for patients with gastric metastases is needed.

Data availability

Underlying data

All data underlying the results are available as part of the article and no additional source data are required.

Extended data

OSF: Tables for 'Metastasis to the stomach: a systematic review'. <https://doi.org/10.17605/OSF.IO/Y4QD5>.¹⁷²

Reporting guidelines

OSF: PRISMA checklist for 'Metastasis to the stomach: a systematic review'. <https://doi.org/10.17605/OSF.IO/Y4QD5>.¹⁷²

Data are available under the terms of the [Creative Commons Zero "No rights reserved" data waiver](#) (CC0 1.0 Public domain dedication).

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I found Ibrahimii et al.'s manuscript on systematically reviewing stomach metastasis quite compelling. Their study stands out for its clarity and significance within its research domain. While I have some minor suggestions for the authors, such as delving deeper into the heterogeneity noted across the included studies and exploring its implications for managing gastric metastasis, I also recommend addressing the variations in terminology among studies, particularly in distinguishing between the term "studies" and "case reports". This attention to detail will enhance the coherence and applicability of their findings, advancing our understanding of the underlying biology of this neoplastic process.

Are the rationale for, and objectives of, the Systematic Review clearly stated?

Yes

Are sufficient details of the methods and analysis provided to allow replication by others?

Yes

Is the statistical analysis and its interpretation appropriate?

Yes

Are the conclusions drawn adequately supported by the results presented in the review?

Yes

If this is a Living Systematic Review, is the 'living' method appropriate and is the search schedule clearly defined and justified? ('Living Systematic Review' or a variation of this term should be included in the title.)

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: My primary area of research lies in investigating cancers originating from unrelated histologies as intricate systems. I am particularly driven by the pursuit of novel prognostic, predictive, and therapeutic biomarkers.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 02 January 2024

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Murat Sari 

Marmara University, Istanbul, Turkey

The stomach is a rare organ in terms of metastasis sites. It would be valuable to write a review evaluating this issue. The review is clearly the result of extensive research. Figures and tables are adequate and informative. Therefore, acceptance of this article will provide impact and citations to the journal.

Are the rationale for, and objectives of, the Systematic Review clearly stated?

Yes

Are sufficient details of the methods and analysis provided to allow replication by others?

Yes

Is the statistical analysis and its interpretation appropriate?

Yes

Are the conclusions drawn adequately supported by the results presented in the review?

Yes

If this is a Living Systematic Review, is the 'living' method appropriate and is the search schedule clearly defined and justified? ('Living Systematic Review' or a variation of this term should be included in the title.)

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Medical oncology

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

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