Cytoreductive Surgery and Hyperthermic Intraperitoneal Chemotherapy for Peritoneal Metastasis from Breast Cancer: A Preliminary Report on 4 Cases

Jun-Hui Yu
Department of Peritoneal Cancer Surgery, Beijing Shijitan Hospital, Capital Medical University
Yu Feng
Department of Breast Surgery, Beijing Shijitan Hospital, Capital Medical University
Xin-Bao Li
Department of Peritoneal Cancer Surgery, Beijing Shijitan Hospital, Capital Medical University
Cheng-Yan Zhang
Department of pathology, Beijing Shijitan Hospital, Capital Medical University
Feng Shi
Beijing Shijitan Hospital, Capital Medical University
Song-Lin An
Beijing Shijitan Hospital, Capital Medical University
Gang Liu
Beijing Shijitan Hospital, Capital Medical University
Yan-Bin Zhang
Beijing Shijitan Hospital, Capital Medical University
Kai Zhang
Beijing Shijitan Hospital, Capital Medical University
Zhong-He Ji
Beijing Shijitan Hospital, Capital Medical University
Bing Li
Beijing Shijitan Hospital, Capital Medical University
Guo-Jun Yan
Beijing Shijitan Hospital, Capital Medical University
Yan-Ping Li
Beijing Shijitan Hospital, Capital Medical University
Yan Li (liyansd2@163.com)
department of peritoneal cancer surgery, Beijing Shijitan Hospital affiliated to the captial medical university, Beijing, 100038,China

Research

Keywords: Breast cancer, Peritoneal carcinomatosis, Cytoreductive surgery, Hyperthermic intraperitoneal chemotherapy

Posted Date: May 29th, 2020

DOI: https://doi.org/10.21203/rs.3.rs-31253/v1

Version of Record: A version of this preprint was published at Gland Surgery on April 1st, 2021. See the published version at https://doi.org/10.21037/gs-20-893.

Abstract

Background: Breast cancer (BC) has been ranked as the first malignancy most common and the fifth in mortality rate among women in China [1]. Peritoneal metastases from BC is a rare disease and no guideline or international consensus for it.

Objective: To summarize our experiences in cytoreductive surgery (CRS) and hyperthermic intraperitoneal chemotherapy (HIPEC) to treat breast cancer peritoneal carcinomatosis (BC PC).

Methods: This is a retrospective study on the 4 BC PC patients underwent CRS+HIPEC at our center. The clinicopathological features and treatment details on the BC PC patients were analyzed.

Result: The average age at CRS+HIPEC was 59.8 years. The average duration of CRS+HIPEC was 8.8 h. The median number of resected organ areas was 7. Overall survival from CRS+HIPEC were 31, 28, 16 and 52 months. There were no serious adverse events (SAEs) during perioperative period.

Conclusions: The 4 cases provided evidence that integrated therapy with CRS+HIPEC may be a promising strategy to improve outcome for BC PC patients.

Background

Breast cancer (BC) has been ranked as the first malignancy in incidence and the fifth mortality rate among women in China [1]. The most common metastasis sites of primary BC with invasive ductal carcinoma (IDC) include regional lymph nodes, bones, liver, lung, brain, and skin and with invasive lobular carcinoma (ILC) frequently affect bones, gynecological organs, peritoneum, retroperitoneum and gastrointestinal (GI) tract [2–3]. While management of recurrent BC is a therapeutic challenge, 5-year survival has steadily been increasing [4–5] in recent years. But peritoneal metastasis from BC is a poorly defined entity [6]. Current literatures provide scarce information on its management and no guideline or international consensus for it.

Here we report 4 BC PC cases with multiple therapeutic modalities including cytoreductive surgery (CRS) and hyperthermic intraperitoneal chemotherapy (HIPEC). In order to determine the role of CRS+HIPEC in BC PC.

Patients And Methods

Clinical information

From January 2015 to March 2020, a total of 893 BC patients have underwent radical resection at Beijing Shijitan Hospital, 17 of which have a progressive disease with PC. There are 4 BC PC patients underwent CRS + HIPEC enrolled in this retrospective study. The diagnosis of BC PC is confirmed by pathology in all patients.

The study design was approved by the Ethical Committee of the Beijing Shijitan Hospital. All patients and their authorized caretakers were well educated about the CRS + HIPEC procedures and standardized informed consent forms were signed from the patients or their authorized caretakers.

Major inclusion criteria: (1) patients had a clinical picture of BC PC and pathological confirmation; (2) Karnofsky performance status (KPS) score ≥ 60; (3) normal peripheral blood white blood cells count ≥ 3.5×10^9/L and platelet count ≥ 80×10^9/L; (4) acceptable liver function, with bilirubin ≤2 × the upper limit of normal (ULN) and aspartic aminotransferase and alanine aminotransferase ≤ 2 × ULN; (5) acceptable renal function, with serum creatinine ≤ 1.2 × ULN; and (6) cardiovascular pulmonary and other major organ functions could stand major operation. Major exclusion criteria: (1) serum bilirubin, aspartic aminotransferase and alanine aminotransferase level > 2 × ULN; (2) serum creatinine level > 1.2 × ULN; (3) imaging examination indicating significant mesenteric contracture; (4) the general status and major organ functions cannot stand major operation [7].

CRS + HIPEC procedure

All CRS + HIPEC procedures were conducted by a designated team focusing on PC treatment. After general anesthesia, the midline incisions were performed from the xiphoid to the pubic symphysis. And then the disseminated extent of peritoneal metastases was explored from diaphragm peritoneum to pelvic peritoneum. The detail contents consisting of the nature and amount of ascites, the location and size of the tumor, were recorded. Based on the above, peritoneal cancer index (PCI) was evaluated [8] (Fig. 1 A). Subsequently, maximal CRS was performed, including the curative or palliative resection of the metastasis tumor with acceptable margins, lymphadenectomy, peritonectomies where peritoneal surfaces were involved by tumor, according to the peritonectomy procedures by Sugarbaker [9]. After CRS, completeness of cytoreduction (CC) was evaluated based on the size of residual tumor [10](Fig. 1 B). HIPEC was implemented by the open Colliseum technique with each drug dissolved into 3 L of heated saline with temperature 43 ± 0.5 ℃, the duration of HIPEC for each drug was 30 min with a flow rate of 400 ml/min. The HIPEC regimen consisted of cisplatin 120 mg plus docetaxel 120 mg.

The reconstruction of the digestive tract or urinary tract, and the intestinal stoma, would be performed after HIPEC. And then abdominal drainage tubes were placed, and the incision sutured with reduced tension.

Study endpoint

The primary endpoints of this study was the overall survival from CRS+HIPEC. The secondary endpoint was the perioperative safety of CRS+HIPEC in BC PC.

Definition

Overall survival (OS) was calculated from the day of CRS+HIPEC to the date of death related with BC PC or the last follow-up. Perioperative period was defined from the day of CRS+HIPEC to the postoperative 30th day.

Follow-up

The frequency of follow up was arranged as follows: (1) once three months within 2 years after CRS+HIPEC; (3) once six months beyond 2 years after CRS+HIPEC. The follow-up consisted of general status, tumor response evaluation and survival information. The last follow-up by telephone or outpatient clinic was on March 1, 2020, with the rate of 100%.

Results

Major clinicopathological characteristics

All 4 patients were female. The average age at CRS + HIPEC was 59.8 years (range: 50–65). In terms of pathology, there were 1 case with ILC and 3 cases with IDC. Molecular typing of primary tumors of all 4 cases was Luminal B. The major clinicopathological characteristics of 4 patients with primary breast tumor and peritoneal metastases were showed in Table 1.

Characteristics	Case 1	Case 2	Case 3	Case 4
Age at diagnosis of breast cancer, years	50	60	53	50
Gender	Female	Female	Female	Female
Breast tumor localization	Left	Right	Right	Left
Most extensively performed breast surgery	Modified radical mastectomy	Breast segment resection	Modified radical mastectomy	Modified radical mastectomy
Breast tumor histological subtype	ILC[1]	IDC[2]	IDC[2]	IDC[2]
Scarff-Bloom-Richardson grade			II	
Tumor stage	T2	T2	T2	T2
Nodal stage	N2	N2	N0	N0
Metastasis	0	1	0	1
TNM stage	IIIa	IV	IIa	IV
Estrogen receptor (Primary tumor/Metastasis tumor)	Positive / Positive	Positive / Positive	Positive / Positive	Positive / Positive
Progesterone receptor (Primary tumor/Metastasis tumor)	Positive / Positive	Positive / Negative	Negative / Negative	Negative / Positive
Her2/neu receptor (Primary tumor/Metastasis tumor)	Negative / Negative	Positive / Positive	Negative / Negative	Negative / Negative
Ki-67 (Primary tumor/Metastasis tumor) (%)	20/30	50/50	25/50	90/20
Molecular subtypes (Primary tumor)	Luminal B	Luminal B	Luminal B	Luminal B
Postoperative pathology	ILC[1]	IDC[2]	IDC[2]	IDC[2]
Age at diagnosis of peritoneal metastases, years	64	60	65	50
Time between breast cancer and peritoneal	174	0	120	0

metastases, months				
Clinical presentation	Abdominal distension	Frequent urination, constipation and abdominal pain	Abdominal pain and abdominal distension	Left breast mass and abdominal distension
Diagnosis of peritoneal metastasis	Postoperative pathology	Postoperative pathology	Postoperative pathology	Needle biopsy
1. Invasive lobular carcinoma 2. Invasive ductal carcinoma				

Table 1
Major clinicopathological characteristics of 4 patients with primary breast tumor and peritoneal metastases

Major CRS + HIPEC characteristics

The average duration of CRS + HIPEC was 8.8 h (range: 7 - 10.6 h). The median number of resected organs was 7 (range: 5 - 9). The average blood loss was 525 ml (range: 400 - 800 ml). The average ascites volume was 3,625 ml (range: 1,000 - 10,000 ml). In regard to HIPEC regimen, all 4 cases were with docetaxel 120 mg plus cisplatin 120 mg. The average PCI was 29.5 (range: 21 - 39). There were 2 cases with CC 0 and 2 cases with CC 3. The major clinicopathological characteristics of CRS+HIPEC were showed in Table 2.

Characteristics	Case 1	Case 2	Case 3	Case 4
Peritoneal cancer index (PCI)	39	28	21	30
Completeness of cytoreduction (CC)	3	3	0	0
Karnofsky performance status (KPS)	80	80	80	80
Blood loss (ml)	400	800	400	500
Rang of operation	Omentum, uterus, bilateral fallopian tubes, ovary, bladder tumor, hepatic round ligament, abdominal wall mass	abdominal wall tumor, intestinal repair, omentum, retroperitoneal tumor , breast segment	rectal, mesenteric, appendectomy, small bowel, diaphragm lesions, omentum lesion, total hysterectomy, bowel repair, omentectomy and pelvic lymphadenectomy	total uterus, double attachment, omentum, para-aortic lymph nodes, pelvic lymph nodes
Chemotherapy drugs for HIPEC	Docetaxel + Cisplatin	Docetaxel + Cisplatin	Docetaxel + Cisplatin	Docetaxel + Cisplatin
Operation duration (h)	7.0	10.6	9.0	8.5
HIPEC duration (min)	60	60	60	60
Ascites volume (ml)	10000	2000	1000	1500
Ascites properties	Light yellow slightly turbid	Light yellow	Yellow turbid	Light yellow
Postoperative treatment	Letrozole	Docetaxel Trastuzumab Letrozole	Docetaxel plus carboplatin IV Letrozole	Paclitaxel+ carboplatin IP Chest wall radiotherapy Letrozole
Operative complications	NO	NO	NO	NO
Average hospital stay after CRS + HIPEC (d)	15	10	21	12

Overall survival from diagnosis BC (OS_1) (month)	205	28	136	52
Overall survival from CRS+HIPEC (OS_2) (month)	31	28	16	52

Table 2
Major clinicopathological characteristics of CRS+HIPEC

OS and safety analysis

All 4 patients were alive and overall survival from CRS+HIPEC were 31, 28, 16 and 52 months, respectively. Overall survival from diagnosis BC was 205, 28, 136 and 52 months, respectively. (Table 2)

There were no serious adverse events (SAEs) during perioperative period.

Discussion

Our study demonstrates that patients with BC PC can benefit from CRS+HIPEC. CRS+HIPEC not only improves quality of life, but also extends overall survival. There are no SAEs during CRS+HIPEC perioperative period.

PC usually originated from gastrointestinal tumor and female gynecological tumor. Typical metastasis sites of BC were bones, lungs, liver and brain. Many other sites had been described in the literatures, including the peritoneal metastases [11], with 0.7% of the prevalence of peritoneal metastases [12]. The data about peritoneal and gastrointestinal metastases of BC was lack in the literatures.

ILC accounts for 6% to 10% of all BCs. It has a different metastatic pattern if compared with IDCs, probably due to the loss of E-cadherin expression on tumor cell membrane that promotes tumor cell migration and prevents cell to cell adhesion [13]. Peritoneal metastases was a significant cause of morbidity and mortality from both IDC and ILC. Compared to 3% of patients diagnosed with IDC, up to 11% of ILC patients had peritoneal metastases diagnosed with CT and operative reports ($P = 0.006$) [14].

In this study, there were 3 patients with IDC and 1 patients with ILC of the primary BC (Fig. 2 - 4). The metastasis tumor was the same as the primary tumor.

For what concerns the prognosis of metastatic BC, peritoneal metastases showed a very poor survival. The median survival from diagnosis of the patients with metastatic BC was 20.5 months but the median survival of patients with peritoneal metastases was extremely poor at only 1.56 months [15]. Another

study showed the overall survival from the diagnosis of metastases was 5.8 months in patients with peritoneal metastases as compared to 22.6 months in metastatic BC patients with no peritoneal involvement. Patients with metachronous metastases had significantly poorer survival than patients with synchronous metastases [16].

There were 2 cases with metachronous metastases and 2 case with synchronous metastases in our study. The OS of the synchronous metastases' patients had reached 28 months and the longest OS of the metachronous metastases had reached 52 months to March, 2020.

BC PC caused abdominal distension, abdominal pain or severe intestinal obstruction. And all patients in our study had at least one of the above symptoms. However, there were no effective treatments to relieve these symptoms and chronic malnutrition caused poor prognosis. The traditional treatment methods for BC PC were chemotherapy or radiotherapy and patients had poor survival. The treatment of BC PC in this study was chemotherapy combined with CRS+HIPEC. In order to achieve a radical CRS, the median number of resected organs were 7 and 2 patients reached CC 0. The tolerance to hyperthermia was higher in normal tissue than the tumor tissue. HIPEC could prevent the adhesion postoperatively, as well as decrease the accelerative effect of healing on tumor cell entrapment by killing the granulocytes and monocytes. The synergistic anti-cancer effect could be dramatically increased at 43℃. Hyperthermia could increase the response rates of cancer cells to HIPEC drugs, and the depth of HIPEC drugs into the tumor tissues. At last, loosening the adhesion of the intestine or ileostomy could relieve intestinal obstruction. In our study, one case underwent loosening the adhesion of the intestine, and another underwent ileostomy, the abdominal distension or bowel obstruction of which relieved completely. All patients received adjuvant chemotherapy and endocrine therapy pre- and post-CRS+HIPEC, with 32 months of the average OS, which was better than literatures.

Estrogen played an important stimulatory role in the normal breast and in the development and progression of BC. The estrogen receptor (ER) was one of the most important prognostic biomarkers in BC [17]. ER- and progesterone receptor (PR)- positive cases had the best outcome usually [18]. Human epidermal growth factor receptor 2 (HER–2, erbB–2) was a transmembrane tyrosine kinase receptor that regulates cell growth, proliferation, and survival [19]. HER–2 gene amplification was a strong prognostic biomarker for an aggressive clinical course [20]. Ki–67 was a nuclear proliferation marker. In general, BC with high levels of Ki67 correlated with worse outcomes [21]. In our study, two patients with synchronous BC PC, one with Ki–67 80–90% and another with HER–2 positive, may be one of the reasons for the early peritoneal metastasis. The other two cases received standard adjuvant therapy after the primary lesion. All patents received tamoxifen treatment for 5 years and metastasis occurred after 5 years of discontinuation (all 4 cases had positive estrogen receptors). So it was important for hormone receptor positive BC PC patients. At present, all the 4 patients had received letrozole orally after CRS+HIPEC and chemotherapy. No tumor progression occurred at the time of follow-up.

The average PCI was 29.5, which heralded the difficulty of CRS. The average duration was 8.8 h, the median number of resected organs was 7, the average blood loss was 525 ml and the average ascites

volume was 3,625 ml. While there were no SAEs during perioperative period and the average hospital stay was 15 d. The safety of CRS+HIPEC was accepted. It was important that a designated team focusing on PC treatment implemented standardized CRS+HIPEC. Otherwise you maybe come to the opposite conclusion that CRS+HIPEC were not the treatment of choice [22]. This article provided new ideas and methods for the treatment of a large number of BC PC patients.

The disadvantage of this study was that the number of patients was too small to perform statistical analysis. The follow up time was short. Therefore, these findings in this study required more confirmations from large sample of evidence.

Conclusions

This paper reported 4 typical cases of BC PC successfully treated by a radical comprehensive treatments with CRS + HIPEC. These patients kept in good condition till now, with 32 months of mean overall survival since CRS+HIPEC. The 4 cases provided evidence that integrated therapy with CRS+HIPEC may be a promising strategy to improve outcome for BC PC patients.

List Of Abbreviations

Abbreviations	Full name
BC	Breast cancer
CRS	Cytoreductive surgery
HIPEC	Hyperthermic intraperitoneal chemotherapy
PC	Peritoneal carcinomatosis
BC PC	Breast cancer peritoneal carcinomatosis
SAEs	Serious adverse events
IDC	Invasive ductal carcinoma
ILC	Invasive lobular carcinoma
GI	Gastrointestinal
KPS	Karnofsky performance status
ULN	Upper limit of normal
PCI	Peritoneal cancer index
CC	Completeness of cytoreduction
OS	Overall survival
ER	Estrogen receptor
PR	Progesterone receptor
HER-2	Human epidermal growth factor receptor 2

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Written informed consent was obtained from the 4 patients for publication of this article and accompanying images. A copy of these written consent is available for review by the Editor-in-Chief of this journal.

Availability of data and material

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

This work was supported by the Beijing Municipal Administration of Hospital Ascent Plan (DFL20180701); Beijing Municipal Grant for Medical Talents Group on Peritoneal Surface Oncology (2017400003235J007) (both to Yan Li).

Authors' contributions

Jun-hui Yu organized the patient's medical records and was the major contributor in writing the manuscript.

Yu Feng, Xin-bao Li and Yan-Ping Li collected the patient's medical records.

Cheng-Yan Zhang and Feng Shi collected the patient's pathological pictures.

Song-Lin An, Gang Liu, Yan-Bin Zhang, Kai Zhang, Zhong-He Ji, Bing Li and Guo-Jun Yan conducted the procedures of CRS + HIPEC.

Yan Li designed the project, monitored project progress, and contributed to data evaluation of the manuscript.

Acknowledgement

Not applicable.

References

1. Chen W, Zheng R, Baade PD, Zhang S, Zeng H, Bray F, Jemal A, Yu XQ, He J. Cancer statistics in China, 2015. CA Cancer J Clin. 2016; 66: 115-32.
2. Solomayer EF, Diel IJ, Meyberg GC, Gollan C, Bastert G. Metastatic breast cancer: clinical course, prognosis and therapy related to the first site of metastasis. Breast Cancer Res Treat. 2000; 59(3): 271-8.

3. Arrangoiz R, Papavasiliou P, Dushkin H, Farma M. Case report and literature review: metastatic lobular carcinoma of the breast an unusual presentation. Int J Surg Case Rep. 2011; 2(8): 301-5.
4. Ghoncheh M, Pournamdar Z, Salehiniya H. Incidence and mortality and epidemiology of breast cancer in the world. Asian Pac J Cancer Prev. 2016; 17(3): 43-6.
5. Kouloulias V, Triantopoulou S, Uzunoglou N, Pistevou-Gompaki K, Barich A, Zygogianni A, Kyrgias G, Kardamakis D, Pectasidis D, Kouvaris J, Greek Society of Hyperthermic Oncology. Hyperthermia is now included in the NCCN clinical practice guidelines for breast cancer recurrences: an analysis of existing data. Breast Care. 2015; 10(2): 109-16.
6. Saranovic D, Kovac JD, Knezevic S, Susnjar S, Stefanovic AD, Saranovic DS, Obradovic V, Masulovic D, Micev M, Pesko P. Invasive lobular breast cancer presenting an unusual metastatic pattern in the form of peritoneal and rectal metastases: a case report. J Breast Cancer. 2011; 14(3): 247-50.
7. Yang XJ, Huang CQ, Suo T, Mei LJ, Yang GL, Cheng FL, Zhou YF, Xiong B, Yonemura Y, Li Y. Cytoreductive surgery and hyperthermic intraperitoneal chemotherapy improves survival of patients with peritoneal carcinomatosis from gastric cancer: final results of a phase III randomized clinical trial. Ann Surg Oncol. 2011; 18(6): 1575-81.
8. Jacquet P, Sugarbaker PH. Clinical research methodologies in diagnosis and staging of patients with peritoneal carcinomatosis. Cancer Treat Res. 1996; 82: 359-74.
9. Sugarbaker PH. Peritonectomy procedures. Ann Surg. 1995; 221(1): 29-42.
10. Sugarbaker PH. Cytoreductive surgery and peri-operative intraperitoneal chemotherapy as a curative approach to pseudomyxoma peritonei syndrome. Eur J Surg Oncol. 2001; 27(3): 239-43.
11. Pasqual EM, Bertozzi S, Londero AP, Brandolin D, Mariuzzi L, De Pellegrin A, Bacchetti S, Zoratti L, Petri R, Della Bianca C, Snidero D, Terrosu G, Uzzau A, Risaliti A, Di Loreto C, Pizzolitto S, Zilli M, de Manzoni G. Microscopic peritoneal carcinomatosis in gastric cancer: prevalence, prognosis and predictive factors. Oncol Lett. 2018; 15(1): 710-6.
12. Bertozzi S, Londero AP, Cedolini C, Uzzau A, Seriau L, Bernardi S, Bacchetti S, Pasqual EM, Risaliti A. Prevalence, risk factors, and prognosis of peritoneal metastasis from breast cancer. Springerplus. 2015; 4(1): 688.
13. Ciriello G, Gatza ML, Beck AH, Wilkerson MD, Rhie SK, Pastore A, Zhang H, McLellan M, Yau C, Kandoth C, Bowlby R, Shen H, Hayat S, Fieldhouse R, Lester SC, Tse G, Factor RE, Collins LC, Allison KH, Chen YY, Jensen K, Johnson NB, Oesterreich S, Mills GB, Cherniack AD, Robertson G, Benz C, Sander C, Laird PW, Hoadley KA, King TA, Perou CM. Comprehensive molecular portraits of invasive lobular breast cancer. Cell. 2015; 163(2): 506-19.
14. Inoue M, Nakagomi H, Nakada H, Furuya K, Ikegame K, Watanabe H, Omata M, Oyama T. Specific sites of metastases in invasive lobular carcinoma: a retrospective cohort study of metastatic breast cancer. Breast Cancer. 2017; 24(5): 667-72.
15. Tuthill M, Pell R, Guiliani R, et al. Peritoneal disease in breast cancer: a specific entity with an extremely poor prognosis. Eur J Cancer. 2009; 45(12): 2146-9.

16. Flanagan M, Solon J, Chang KH, et al. Peritoneal metastases from extra-abdominal cancer - a population-based study. Eur J Surg Oncol. 2018; 44(11): 1811-7.
17. Fragomeni S M, Sciallis A, Jeruss J S. Molecular subtypes and local-regional control of breast cancer. Surg Oncol Clin N Am. 2018; 27(1): 95-120.
18. Oudanonh T, Nabi H, Ennour-Idrissi K, Lemieux J, Diorio C. Progesterone receptor status modifies the association between body mass index and prognosis in women diagnosed with estrogen receptor positive breast cancer. Int J Cancer. 2020; 146(10): 2736-45.
19. Kim MH, Kim GM, Kim JH, Kim JY, Park HS, Park S, Cho YU, Park BW, Kim SI, Sohn J. Intermediate HER2 expression is associated with poor prognosis in estrogen receptor-positive breast cancer patients aged 55 years and older. Breast Cancer Res Treat. 2020; 179(3): 687-97.
20. Harbeck N, Gnant M. Breast cancer. Lancet. 2017; 389(10074): 1134-50.
21. Dumanskiy YV, Bondar OV, Stoliarchuk EA. The Ki-67 marker for assessing the effectiveness of systemic or regional neoadjuvant polychemotherapy in patients with locally advanced breast cancer. Exp Oncol. 2019; 41(2): 176-8.
22. Beniey M. Peritoneal metastases from breast cancer: a scoping review. Cureus. 2019; 11(8): e5367.

Figures

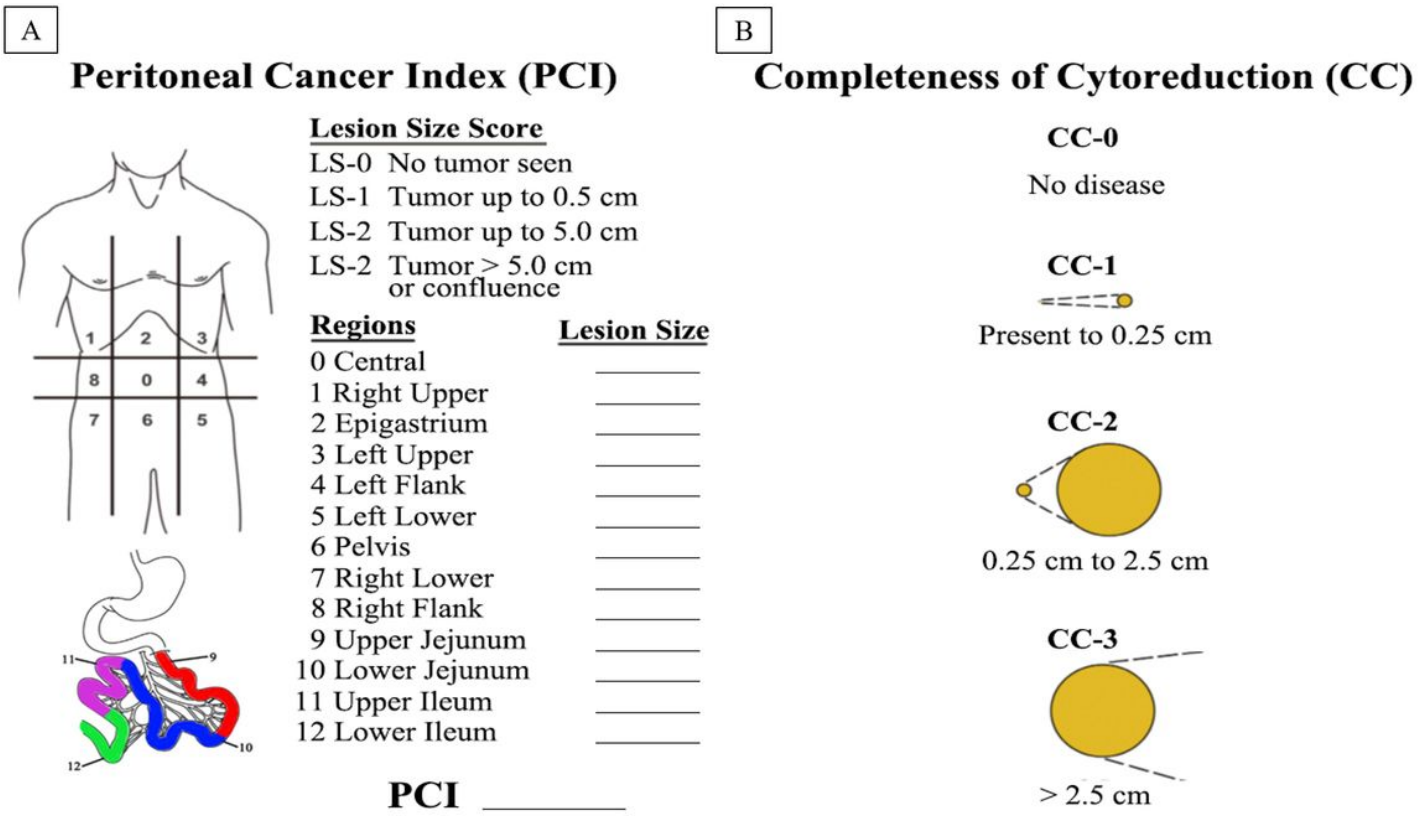

Figure 1

Peritoneal cancer index score (A) and completeness of cytoreduction score (B).

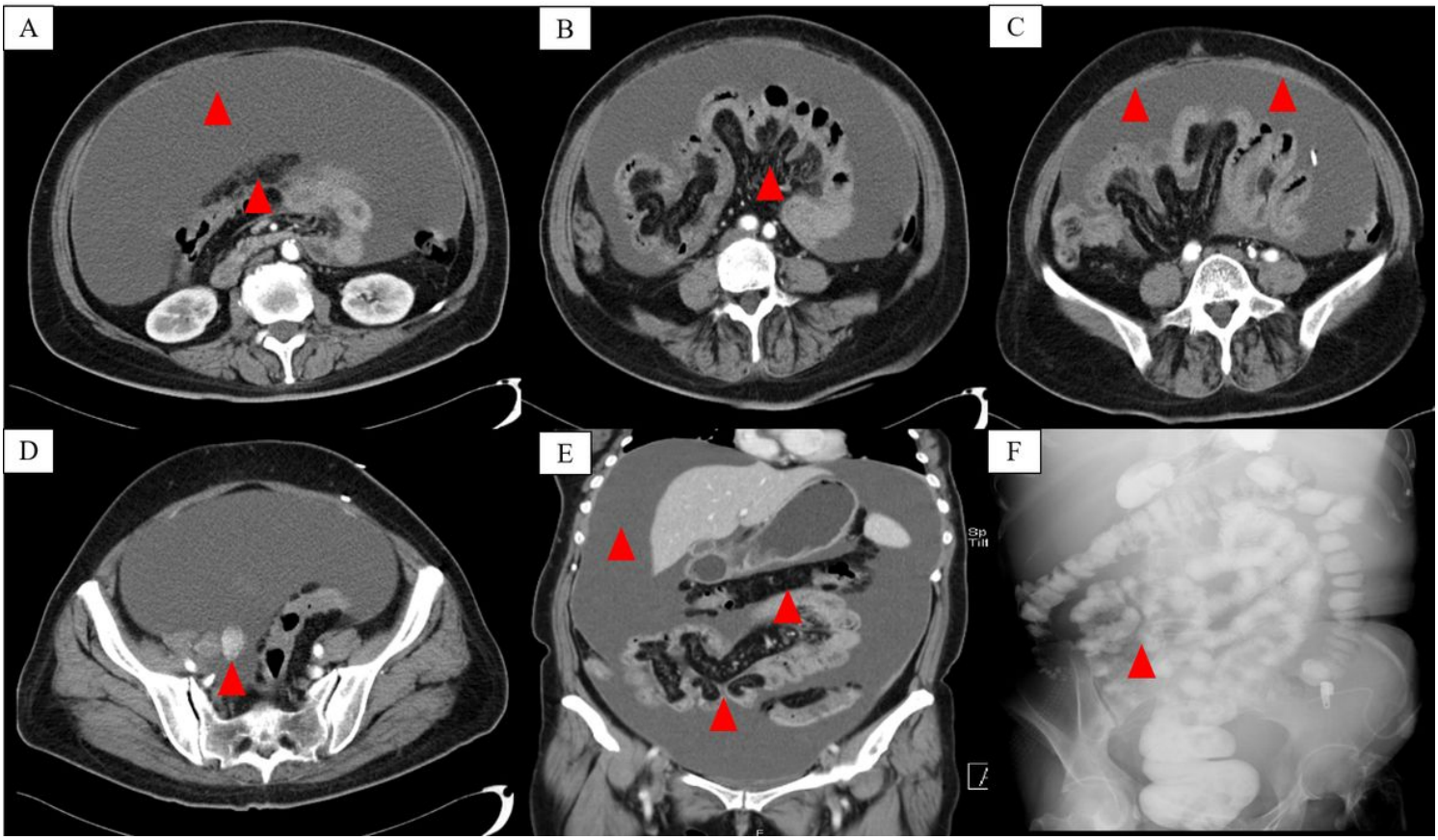

Figure 2

Preoperative image examination. A: Massive ascites and omentum contraction; B: Small intestine contraction; C: Peritoneal thickening; D: Pelvic tumor with contrast enhancement; E: Coronal showed Massive ascites; omentum contraction and small intestine contraction; F: Total gastrointestinal angiography showed the gathered small intestine.

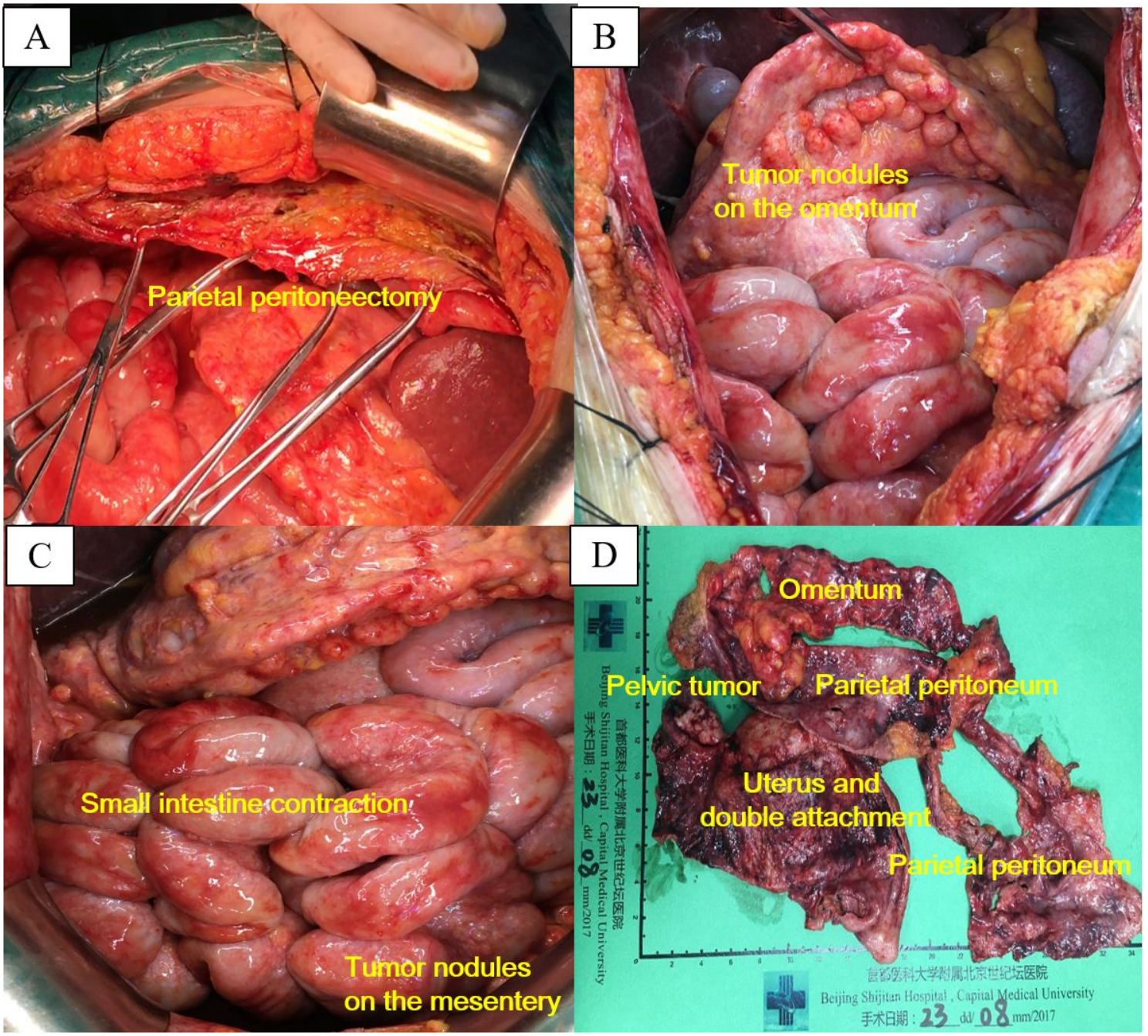

Figure 3

CRS intraoperative and postoperative specimens. A: Omentum contraction; B: Tumor nodules on the omentum; C: Small intestine contraction and tumor nodules on the mesentery; D: Postoperative specimens.

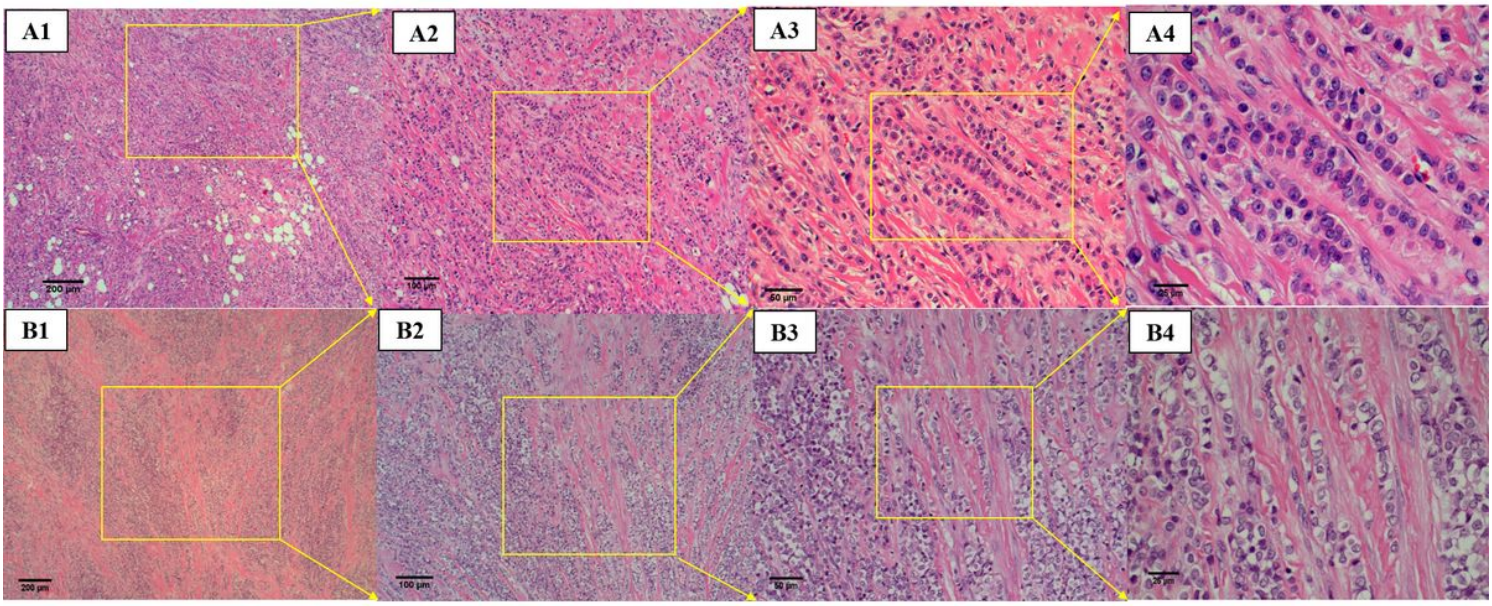

Figure 4

Pathological classification of primary (A1 - A4) and metastasis (B1 - B4) breast tumors (hematoxylin-eosin staining). A1: Invasive lobular carcinoma of the breast; A2: Tumor cells have poor adhesion and scattered in a single or single row of infiltrating interstitium; A3: Tumor cells infiltrate the stroma in a single row and forming a linear structure; A4: Tumor cells have smaller but the same size. Some cytoplasm contains eosinophilic globules and the nucleus is eccentric, round, small nucleolus and pathological mitosis is rare. B1: Invasive lobular carcinoma metastasizes to the abdominal cavity and infiltrates into the peritoneal fibrous connectives; B2: Tumor cells have poor adhesion, diffuse, scattered in a single or single row of infiltrating interstitium; B3: Tumor cells infiltrate the stroma in a single row and forming a linear structure; B4: Tumor cells have the same size, nuclear round, small nucleoli are common and pathological mitosis is rare. The magnification of the pictures of the two line from the left to right are ×50, ×100, ×200 and ×400, respectively.