RESEARCH ARTICLE

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Intraperitoneal Irrigation Chemotherapy with Lobaplatin in Locally Advanced Gastric Cancer: A Special Type of Abdominal Chemotherapy

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Abstract

Background: This study evaluated the safety and efficiency of intraperitoneal irrigation chemotherapy with lobaplatin for the treatment of advanced gastric cancer (GC). **Methods:** A total of 56 locally advanced GC patients (experimental group) who received intraoperative intraperitoneal irrigation chemotherapy in addition to undergoing radical D2 surgery were matched 1:1 based on 8 covariates to 56 patients without drug treatment (control group). Clinical data were collected and analyzed. **Result:** The two groups were well balanced in basic characteristics and had comparable clinical indices. All patients had similar time to first flatus (2.8 ± 0.3 vs. 2.9 ± 0.3 d, P = 0.076), time to first oral intake (3.5 ± 3.4 vs. 4.1 ± 4.6 d, P = 0.439), and duration of postoperative hospitalization (9.1 ± 3.2 vs. 9.6 ± 4.0 d, P = 0.446). There were no significant differences in postoperative complications including anastomotic and duodenal stump leakage, abdominal and anastomotic bleeding, seroperitoneum, and incision infection between the experimental and control groups (P > 0.05). The rates of chemotherapy-related side effects including allergic reaction, neurotoxicity, diarrhea, and nausea/vomiting were also similar between the two groups, and there were no abnormalities in leukocyte and platelet levels and liver and renal function during the first 5 days after surgery. **Conclusion:** Intraperitoneal irrigation chemotherapy with lobaplatin is safe for patients with advanced gastric cancer.

Keywords: Advanced gastric cancer- Lobaplatin- Irrigation chemotherapy- Safety

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Introduction

Although the incidence has been decreasing in recent years, gastric cancer (GC) is among the most common malignancies of the digestive system in China [1-3]. Surgery combined with other treatments is the most effective intervention for early- and middle-stage disease [4]. Intraperitoneal implantation is one of the most common metastatic routes in advanced GC, accounting for up to 40%–50% of distant metastases, and is associated with very poor prognosis, with a median survival of 6 months [5-9].

Despite these advances in surgical and systemic treatment strategies, recurrence remains a major challenge, particularly for patients with advanced gastric cancer. The search for more effective therapies has led to the development of targeted approaches designed to combat the specific pathways involved in gastric cancer progression. One such innovation has been the adaptation of intraperitoneal therapies, which aim to directly attack cancer cells within the abdominal cavity, a common site for gastric cancer metastasis. This direct method not only increases the drug concentration at the tumor site but also minimizes systemic exposure and associated toxicities, potentially offering a lifeline to patients with poor prognoses.

Compared to peripheral intravenous chemotherapy, intraperitoneal chemotherapy has the advantages of delivering a high local concentration of drug, a longer drug action time, and lower systemic toxicity [10, 11]. In GC patients with intraperitoneal implantation metastasis, intraperitoneal chemotherapy after cytoreductive surgery can significantly improve prognosis [12-14]. We previously reported that prophylactic hyperthermic intraperitoneal chemotherapy (HIPEC) with lobaplatin was safe for the treatment of advanced GC and improved 3-year disease-free survival [15]. However, some patients are resistant to HIPEC, so intraperitoneal irrigation chemotherapy was carried out as a possible alternative for the treatment of locally advanced GC. In the present study, its safety and efficacy was explored.

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Materials and Methods

Patients

Patients who underwent radical surgery and intraperitoneal irrigation chemotherapy with lobaplatin (experimental group) and those who had radical surgery only (control group) were matched 1:1 according to sex, age, body mass index (BMI), American Society of Anesthesiologists (ASA) score, preoperative anemia, operative approach, surgical procedure, and pathologic tumor–node–metastasis (pTNM) stage.

We retrospectively reviewed the cases of 112 consecutive patients with locally advanced GC who underwent radical D2 gastrectomy without (n=56) or with (n=56) intraperitoneal irrigation chemotherapy with lobaplatin at National Cancer Center/National Clinical Research Center for Cancer/Cancer Hospital, Chinese Academy of Medical Sciences from February 2019 to October 2020. Inclusion criteria were as follows: 1. age 18–70 years old; 2. clinical stage T4 with or without lymphatic metastasis; 3. without free abdominal cancer cells, Eastern Cooperative Oncology Group score of 0–1; 4. and without distant metastasis. Exclusion criteria were as follows: 1. patients who underwent neoadjuvant chemoradiotherapy; 2. untreated diabetes or other diseases such as kidney and immune system diseases; 3. emergency surgery caused by bleeding, perforation, or obstruction; 4. intraoperative discovery of M1 disease, including with free abdominal cancer cells; 5. hepatitis with abnormal liver function; 6. and kidney diseases with abnormal renal function.

The advantages and disadvantages of intraperitoneal irrigation chemotherapy were explained to patients (and their families), who consented to the procedure in writing. GC staging was based on the 8th edition American Joint Committee on Cancer (AJCC) TNM criteria. This study was approved by the ethics committee of National Cancer Center/Cancer Hospital, Chinese Academy of Medical Sciences (approval No. 19-061/1846), and conformed to the ethical standards of the Helsinki Declaration. The informed consent to participate in the study has been obtained from the research subjects prior to study commencement. The study participants gave consent to have their data published.

Surgical procedure

Patients were routinely treated with laparoscopic surgery, although some were switched to open surgery. The 5-hole method was used for laparoscopy. The tumor-containing specimen was removed through an incision ~5 cm long in the middle of the upper abdomen, followed by anastomosis. For open surgery, an incision ~20 cm long was made in the middle of the upper abdomen. Before the operation, the abdominal cavity was rinsed with normal saline, and then at least 100 ml of the abdominal cavity rinse solution was collected. The cytological examination was performed to determine whether there were free abdominal cancer cells.

All patients underwent radical D2 surgery. For mostly proximal gastrectomy, the dissected lymph nodes were nos. 1, 2, 3, 4Sa, 4Sb, 7, 8a, 9, 10, and 11. For mostly distal gastrectomy, the dissected lymph nodes were nos. 1, 3, 4Sb, 4d, 5, 6, 7, 8a, 9, 11p, and 12a, and Billroth I or II anastomosis was performed. For total gastrectomy, the dissected lymph nodes were nos. 1, 2, 3, 4Sa, 4Sb, 4d, 5, 6, 7, 8a, 9, 10, 11, and 12a. Drainage tubes were routinely placed on the left and right sides after rinsing the abdominal cavity with plenty of sterilizing water, and the abdomen was closed layer by layer. Lobaplatin (60 mg) dissolved in 500 ml of 5% glucose solution was injected into the operative region via the drainage tube in the experimental group. Bilateral drainage tubes were clamped for 6h and then released.

Definitions

Routine blood, liver and kidney function tests were performed on postoperative day (POD)1, POD3, and POD5. At our center, the normal range for leukocyte level is 4–10×109/L and the normal range for platelet level is 100–300×109/L. Abnormal renal function was defined as creatinine level >81 μmol/l, and abnormal liver function was defined as alanine or aspartic aminotransferase or total bilirubin level more than twice the normal upper limit (>80 U/L, >70 U/L, and >42 μmol/L, respectively). Anemia was defined as hemoglobin level <120 g/L in men and <110 g/L in women. Seroperitoneum referred to a moderate or large volume of fluid that was symptomatic and required additional treatment.

Statistical analysis

Propensity score matching and data analysis were performed using SPSS software (SPSS Inc, Chicago, IL, USA). Propensity score matching was utilized to account for potential confounding factors and to ensure comparability between the two patient groups. This method was particularly crucial in our study, given that no neoadjuvant therapies were involved, ensuring that any observed differences in outcomes could more likely be attributed to the investigated treatments rather than preoperative condition adjustments. Quantitative variables were presented as mean ± standard deviations and were compared with the Student's t test. Qualitative variables were presented as numbers and corresponding percentages and were compared with the chi-squared test or Fisher's exact test. A P value <0.05 was defined as the threshold for statistical significance.

Results

Basic characteristics of the study population

Patients in the experimental and control groups were matched 1:1; and their basic characteristics were shown in Table 1. The two groups were well balanced in terms of sex ratio, age, BMI, ASA score, preoperative anemia, operative approach, surgical procedure, and pTNM stage.

Operative outcomes

The operative outcomes of the two patient groups were shown in Table 2. All patients underwent radical D2 surgery. Operating time was similar in the two groups (196.1 ± 21.4 vs. 191.9 ± 16.2 min, P = 0.243). There was no significant difference in estimated blood loss (87.8 ±

Table 1. Basic Characteristics of the Study Population.

Characteristic	Experimental group (N=56)	Control group (N=56)	P
Sex(%)			0.703
Male	31 (55.4)	33 (58.9)	
Female	25 (44.6)	23 (41.1)	
Age(%)			0.383
≤60 years	40 (71.4)	44 (78.6)	
>60 years	16 (28.6)	12 (21.4)	
BMI, kg/m^2 (range)	24.1±1.9 (19.8–28.7)	24.0±1.8 (20.5–31.2)	0.644
ASA score (%)			0.835
1	10 (17.9)	8 (14.3)	
2	23 (41.1)	25 (44.6)	
3	23 (41.1)	23 (41.1)	
Preoperative anemia (%)	13 (23.2)	10 (17.9)	0.483
Operative approach (%)			0.45
Open	8 (14.3)	11 (19.6)	
Laparoscopy	48 (85.7)	45 (80.4)	
Surgical procedure (%)			0.751
Proximal gastrectomy	11 (19.6)	8 (14.3)	
Distal gastrectomy	27 (48.2)	29 (51.8)	
Total gastrectomy	18 (32.1)	19 (33.9)	
pTNM stage (%)			0.701
II	22 (39.3)	24 (42.9)	
III	34 (60.7)	32 (57.1)	

Notes: All patients underwent radical D2 surgery, and in the experimental group, 60 mg lobaplatin was injected into the operated region via the drainage tube. Abbreviations: ASA, American Society of Anesthesiologists; BMI, body mass index; pTNM, pathologic tumor–node–metastasis.

36.2 vs. 81.0 ± 22.3 ml, P = 0.235). Four patients in each group were switched to open surgery (P = 1.000).

Postoperative recovery outcomes

Postoperative recovery outcomes were shown in Table 3. The two groups had comparable time to first flatus (2.8 ± 0.3 vs. 2.9 ± 0.3 d, P = 0.076), time to first oral intake (3.5 ± 3.4 vs. 4.1 ± 4.6 d, P = 0.439), and re-operation rate (5.4% vs. 3.6%, P = 1.000). One patient in the control group died from anastomotic leakage. The two groups had approximately equal length of postoperative hospital stay (9.1 ± 3.2 vs. 9.6 ± 4.0 d, P = 0.446).

Table 2. Operative Outcomes

Variable	Experimental group (N=56)	Control group (N=56)	P
Operating time, min (range)	196.1±21.4 (150–235)	191.9±16.2 (160–240)	0.243
Estimated blood loss, ml (range)	87.8±36.2 (50–300)	81.0±22.3 (55–185)	0.235
Blood transfusion (%)	9 (16.1)	7 (12.5)	0.589
Conversion to open surgery (%)	4 (7.1)	4 (7.1)	1

Table 3. Postoperative Recovery Outcome

Variable	Experimental group (N=56)	Control group (N=56)	P
Time to first flatus, days (range)	2.8±0.3 (2.3–3.8)	2.9±0.3 (2.5–3.6)	0.076
Time to first oral intake, days (range)	3.5±3.4 (2.4–23.0)	4.1±4.6 (2.5–25)	0.439
Re-operation (%)	3 (5.4)	2 (3.6)	1
Perioperative death (%)	0 (0)	1 (1.8)	1
Postoperative hospitalization, days (range)	9.1±3.2 (6–26)	9.6±4.0 (6–28)	0.446
Postoperative complications (%)			
Anastomotic leakage	2 (3.6)	3 (5.4)	1
Duodenal stump leakage	0 (0)	1 (1.8)	1
Lymphatic leakage	1 (1.8)	1 (1.8)	1
Abdominal bleeding	2 (3.6)	2 (3.6)	1
Anastomotic bleeding	1 (1.8)	0 (0)	1
Seroperitoneum	3 (5.4)	1 (1.8)	0.611
Gastrointestinal dysfunction	0 (0)	1 (1.8)	1
Incision infection	3 (5.4)	4 (7.1)	1
Intestinal obstruction	0 (0)	0 (0)	n/a

Although there were some serious complications in both groups, the overall incidence was not high. Anastomotic leakage occurred in 2 cases in the experimental group and 3 cases in the control group (P = 1.000). Although the incidence of seroperitoneum was higher in the experimental group than in the control group (5.4% vs. 1.8%), the difference was not statistically significant

Table 4. Chemotherapy-Related Side Effects

Variable	Experimental group (N=56)	Control group (N=56)	P
Allergic reaction (%)	1 (1.8)	0 (0)	1
Fever of unknown cause (%)	3 (5.4)	1 (1.8)	0.611
Neurotoxicity (%)	1 (1.8)	0 (0)	1
Diarrhea (%)	2 (3.6)	2 (3.6)	1
Nausea/vomiting (%)	3 (5.4)	1 (1.8)	0.611
Leukocyte level <4×109/l (%)			
POD1	0 (0)	0 (0)	n/a
POD3	3 (5.4)	0 (0)	0.243
POD5	1 (1.8)	0 (0)	1
Platelet level <100×109/l (%)			
POD1	0 (0)	0 (0)	n/a
POD3	2 (3.6)	1 (1.8)	1
POD5	1 (1.8)	0 (0)	1
Abnormal liver function (%)			
POD1	0 (0)	1 (1.8)	1
POD3	2 (3.6)	1 (1.8)	1
POD5	1 (1.8)	0 (0)	1
Abnormal renal function (%)			
POD1	1 (1.8)	1 (1.8)	1
POD3	0 (0)	0 (0)	n/a
POD5	0 (0)	0 (0)	n/a

Abbreviations: n/a, not available; POD, postoperative day

(P = 0.611). There were no significant differences in the incidence of abdominal bleeding, gastrointestinal dysfunction, and intestinal obstruction between the two groups (all P > 0.05).

Chemotherapy-related side effects

Chemotherapy-related side effects were shown in Table 4. In the experimental group, one patient had anaphylaxis and one had neurotoxicity. There were no significant differences between groups in the rates of diarrhea and nausea/vomiting (P > 0.05). By POD5, 3 patients had leukocyte levels <4×109/L and one had a platelet level <100×109/L. In the experimental group, 3 patients developed abnormal liver function and one developed abnormal kidney function by POD5; however, the rates did not differ significantly from those in the control group (P > 0.05).

Discussion

Intraperitoneal implantation metastasis is one of the main reasons for performing nonradical resection in advanced GC and the peritoneum is a common site of recurrence after radical resection [6-8]. In the past, intraperitoneal implantation metastasis often resulted in death even after extensive peritoneal resection. However, when no other distant metastases are present, intraperitoneal metastasis is treated as a malignant lesion confined to the abdominal cavity and more active interventions can be adopted such as (prophylactic) HIPEC and cytoreductive surgery with HIPEC.

HIPEC has a satisfactory outcome in a variety of abdominal malignancies including GC, colorectal cancer, appendiceal mucinous adenocarcinoma, and gynecologic cancers [16-18]. Adjuvant HIPEC was shown to reduce the absolute risk of peritoneal carcinomatosis in patients with T4 or perforated colon cancer from 25% to 10% [16]; it also reduced the incidence of metachronous peritoneal metastases compared to surgery alone (12.8% vs. 27.6%) and improved 3-year progression-free survival (47% vs. 27%) in serosa-invasive GC [17]. HIPEC extended recurrence-free survival and overall survival compared to surgery alone in stage III epithelial ovarian cancer [18]. However, HIPEC is often used to treat cases that have already developed intraperitoneal implantation metastasis and is administered after cytoreductive surgery, and is less acceptable to patients without abdominal implantation metastasis.

Intraperitoneal irrigation chemotherapy differs from HIPEC in that the fluid containing the chemotherapeutic drugs is infused directly into the operative area and does not require heating to 43°C, thus reducing discomfort for the patient. In our study, patients in the treatment group received 60 mg lobaplatin dissolved in 500 ml of 5% glucose solution. In terms of postoperative complications in our cohort, although 2(3.6%) patients in the experimental group had anastomotic leakage and 2(3.6%) had abdominal bleeding, the rates were similar to those in the control group and to those observed in our previous investigation of prophylactic HIPEC with lobaplatin in advanced GC patients [15]. In a study evaluating the safety of intraperitoneal irrigation chemotherapy with lobaplatin after radical colorectal cancer surgery, there was only 1(2%) case with intra-abdominal hemorrhage, 1(2%) case with anastomotic leakage, and 1(2%) case with adhesive intestinal obstruction and no significant increase in the total incidence of postoperative complications [19], which were similar to our results.

We also examined the hematologic toxicity of intraperitoneal irrigation chemotherapy with lobaplatin. Although it was previously reported that abnormal platelet levels occurred at a higher rate on POD3 with lobaplatin treatment (14.6% vs. 1.9%) [20], we observed the opposite, a lower incidence rate (3.6%) of platelet level <100×109/L on POD3. This may be because the study by Pei et al. [20] included patients with stage IV colorectal cancer who were generally in poor condition. A few patients in our experimental group developed mild hematologic abnormalities but recovered with symptomatic treatment and there were no deaths, which is consistent with previous findings [19, 20]. While some of our statistical results approached significance, it is important to distinguish these findings in a clinical context, especially in the absence of neoadjuvant therapy, which might otherwise influence the severity and presentation of the disease at the time of treatment.

This was a retrospective cohort study, so there was inevitable selection bias in our patient population. This study did not incorporate neoadjuvant chemoradiotherapy, which is often considered to enhance treatment outcomes by downstaging tumors and potentially affecting lymph node status. The absence of such therapy may limit the generalizability of our findings to all gastric cancer cases, as the effects of neoadjuvant treatments on surgical outcomes and long-term survival were not evaluated. However, the two groups were well-matched and all patients had complete data. Despite these shortcomings, our study provides evidence for the safety of intraperitoneal irrigation chemotherapy with lobaplatin in the treatment of advanced GC, although additional randomized controlled trials are needed to confirm its safety. The focus of our future work is to investigate the effectiveness of this approach in preventing abdominal metastasis.

Author Contribution Statement

JZ and PW conceived and designed the study, YS contributed to data collection, YS and XB were involved in data analysis, and drafting the manuscript. YZ contributed to data analysis, interpretation of the findings, and critically revised the manuscript. All authors read and approved the final manuscript.

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Ethical approval

The ethics committee of the Peking Union Medical

College / National Cancer Center / Chinese Academy of Medical Sciences granted approval for this study, and it adhered to the ethical standards outlined in the Declaration of Helsinki by the World Medical Association.

Informed consent

Written consent was obtained from each participant prior to their inclusion in the study.

Data availability

We provide all the underlying data in the tables of the manuscript.

References

1. Xia C, Dong X, Li H, Cao M, Sun D, He S, et al. Cancer statistics in china and united states, 2022: Profiles, trends, and determinants. Chin Med J (Engl). 2022;135(5):584-90. https://doi.org/10.1097/cm9.0000000000002108.
2. Smyth EC, Nilsson M, Grabsch HI, van Grieken NC, Lordick F. Gastric cancer. Lancet. 2020;396(10251):635-48. https://doi.org/10.1016/s0140-6736(20)31288-5.
3. Ajani JA, D'Amico TA, Bentrem DJ, Chao J, Cooke D, Corvera C, et al. Gastric cancer, version 2.2022, nccn clinical practice guidelines in oncology. J Natl Compr Canc Netw. 2022;20(2):167-92. https://doi.org/10.6004/jnccn.2022.0008.
4. Joshi SS, Badgwell BD. Current treatment and recent progress in gastric cancer. CA Cancer J Clin. 2021;71(3):264-79. https://doi.org/10.3322/caac.21657.
5. Ando H, Fukushima M, Eshima K, Hasui T, Shimizu T, Ishima Y, et al. A novel intraperitoneal therapy for gastric cancer with dfp-10825, a unique rnai therapeutic targeting thymidylate synthase, in a peritoneally disseminated xenograft model. Cancer Med. 2019;8(17):7313-21. https://doi.org/10.1002/cam4.2598.
6. Solass W, Sempoux C, Carr NJ, Bibeau F, Neureiter D, Jäger T, et al. Reproducibility of the peritoneal regression grading score for assessment of response to therapy in peritoneal metastasis. Histopathology. 2019;74(7):1014-24. https://doi.org/10.1111/his.13829.
7. Nakamura M, Ojima T, Nakamori M, Katsuda M, Tsuji T, Hayata K, et al. Conversion surgery for gastric cancer with peritoneal metastasis based on the diagnosis of second-look staging laparoscopy. J Gastrointest Surg. 2019;23(9):1758-66. https://doi.org/10.1007/s11605-018-3983-7.
8. Kodera Y. Gastric cancer with minimal peritoneal metastasis: Is this a sign to give up or to treat more aggressively? Nagoya J Med Sci. 2013;75(1-2):3-10.
9. Ellebæk SB, Graversen M, Detlefsen S, Lundell L, Fristrup CW, Pfeiffer P, et al. Pressurized intraperitoneal aerosol chemotherapy (pipac) of peritoneal metastasis from gastric cancer: A descriptive cohort study. Clin Exp Metastasis. 2020;37(2):325-32. https://doi.org/10.1007/s10585-020-10023-5.
10. Ceelen W, Braet H, van Ramshorst G, Willaert W, Remaut K. Intraperitoneal chemotherapy for peritoneal metastases: An expert opinion. Expert Opin Drug Deliv. 2020;17(4):511-22. https://doi.org/10.1080/17425247.2020.1736551.
11. Kobayashi D, Kodera Y. Intraperitoneal chemotherapy for gastric cancer with peritoneal metastasis. Gastric Cancer. 2017;20(Suppl 1):111-21. https://doi.org/10.1007/s10120-016-0662-9.
12. Harada K, Yamashita K, Iwatsuki M, Baba H, Ajani JA. Intraperitoneal therapy for gastric cancer peritoneal carcinomatosis. Expert Rev Clin Pharmacol. 2022;15(1):43-9. https://doi.org/10.1080/17512433.2022.2044790.
13. Macrì A, Morabito F. The use of intraperitoneal chemotherapy for gastric malignancies. Expert Rev Anticancer Ther. 2019;19(10):879-88. https://doi.org/10.1080/14737140.2019.1671189.
14. Kakinuma D, Arai H, Yasuda T, Kanazawa Y, Matsuno K, Sakurazawa N, et al. Treatment of gastric cancer in japan. J Nippon Med Sch. 2021;88(3):156-62. https://doi.org/10.1272/jnms.JNMS.2021_88-315.
15. Zhong Y, Zhang J, Bai X, Sun Y, Liu H, Ma S, et al. Lobaplatin in prophylactic hyperthermic intraperitoneal chemotherapy for advanced gastric cancer: Safety and efficacy profiles. Cancer Manag Res. 2020;12:5141-6. https://doi.org/10.2147/cmar.S249838.
16. Klaver CE, Musters GD, Bemelman WA, Punt CJ, Verwaal VJ, Dijkgraaf MG, et al. Adjuvant hyperthermic intraperitoneal chemotherapy (hipec) in patients with colon cancer at high risk of peritoneal carcinomatosis; the colopec randomized multicentre trial. BMC Cancer. 2015;15:428. https://doi.org/10.1186/s12885-015-1430-7.
17. Reutovich MY, Krasko OV, Sukonko OG. Hyperthermic intraperitoneal chemotherapy in serosa-invasive gastric cancer patients. Eur J Surg Oncol. 2019;45(12):2405-11. https://doi.org/10.1016/j.ejso.2019.07.030.
18. van Driel WJ, Koole SN, Sikorska K, Schagen van Leeuwen JH, Schreuder HWR, Hermans RHM, et al. Hyperthermic intraperitoneal chemotherapy in ovarian cancer. N Engl J Med. 2018;378(3):230-40. https://doi.org/10.1056/NEJMoa1708618.
19. Zhou HT, Jiang J, Guan X, Su H, Liang JW, Pei W, et al. The short-term effect analysis of intraoperative intraperitoneal perfusion chemotherapy with lobaplatin for colorectal cancer. J buon. 2019;24(2):442-8.
20. Pei W, Zhou S, Zhang J, Zhou H, Chen H, Bi J, et al. Lobaplatin-based hyperthermic intraperitoneal chemotherapy for patients with peritoneal metastasis from appendiceal and colorectal cancer: Safety and efficacy profiles. Cancer Manag Res. 2020;12:12099-110. https://doi.org/10.2147/cmar.S281434.