



Personalized Neoadjuvant Intra-Arterial Chemotherapy for Gastric Cancer

Efimochkin O. E., PhD ^{1*}, Pivovarov R. A ², Dotsenko D. N ³

- 1. Candidate of medical sciences, member of the Association of Oncologists of Russia, surgeon-oncologist of the highest category.*
- 2. Roman Aleksandrovich Pivovarov, physician of interventional oncology and minimally invasive treatment, member of the Association of Oncologists of Russia.*
- 3. Dotsenko Dmitry Nikolaevich, endoscopist, member of the Association of Oncologists of Russia.*

***Correspondence to: Efimochkin Oleg Evgenievich**, Candidate of medical sciences, member of the Association of Oncologists of Russia, surgeon-oncologist of the highest category.

Copyright.

© 2026 **Efimochkin Oleg Evgenievich**, This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Received: 18 January 2026

Published: 01 February 2026

DOI: <https://doi.org/10.5281/zenodo.18391143>

Acquaintance

The problem of treating locally advanced gastric cancer, as well as stage IV gastric cancer, is currently far from being solved [7, 8, 10, 13-15].

Patients with stage IV disease and stage IV gastric cancer often do not receive sufficient specialized medical care and are transferred for further treatment and observation to palliative care and symptomatic treatment groups [15, 19, 22].

The Republican Oncology Center named after Professor G.V. Bondar in Donetsk, which provides medical care in a region comparable in number of people to the state of Norway, has accumulated sufficient experience in treating patients with malignant gastric lesions [2].

In the 1960s, Academician G.V. Bondar proposed and implemented a method of esophagojejunostomy after gastrectomy, and this method remains one of the most reliable, as anastomotic suture failure is the most severe complication after gastrointestinal surgery (the anastomotic area is additionally covered by an afferent loop of the small intestine) [6, 11]. We practically never encounter the problem of esophagojejunostomy suture failure in routine practice.

There are unresolved issues regarding the treatment tactics for patients with tumor stenosis of the gastric outlet, anemia, intoxication, and chemo-refractory gastric cancer.

The authors will attempt in this publication to propose a solution to some of these problems [7, 8, 10, 14, 19].

Methods

In 2006, under the leadership of Academician G.V. Bondar, we administered neoadjuvant intra-arterial chemotherapy courses using a 5-FU regimen of up to 7.5 grams per course in combination with leucovorin, using the right gastroepiploic artery, to treat stage IV gastric cancer. With the state-of-the-art technology, we achieved no therapeutic effect.

In 2018, with the new level of technological development and the possibility of using progressive chemotherapy regimens, we returned to the development of a personalized approach in the treatment of patients with stage IV gastric cancer, including those with locally advanced growth, tumor stenosis, cancer intoxication, and chemo-refractory gastric cancer [1, 2].

Due to the peculiarities of the gastric blood supply, intra-arterial chemotherapy administered only through the celiac trunk does not improve treatment results, since the concentration of chemotherapy drugs in different parts of the stomach will vary significantly, which affects the therapeutic effect.

With (superselective) intra-arterial administration of a chemotherapeutic drug into the left gastric artery, the maximum accumulation of the drug in the mucous membrane of the lesser curvature of the stomach and in the lymph nodes of the lesser omentum is determined to be 18 times higher (tested using radioisotope preparations)

compared to that with intravenous administration [1].

When administered intravenously, the concentration of the drug in the target organ is the same as the concentration in the peripheral plasma. The distribution of the drug in the target organ depends mainly on the amount of drug-containing blood passing through the target organ [23].

Therefore, to achieve the planned therapeutic effect, we additionally used other arteries for superselective administration of drugs (gastroduodenal and splenic) [1, 2].

We used the implementation of intra-arterial chemotherapy selectively into the celiac trunk and superselectively into the corresponding gastric artery related to the corresponding anatomical region of the stomach (left gastric artery, splenic, gastroduodenal) in a proportion of 50% of the dose of chemotherapy drugs for selective and superselective administration of chemotherapy drugs in patients.

The method is carried out as follows.

In the preoperative period, under local anesthesia, the patient undergoes puncture and catheterization of one of the femoral arteries using the Seldinger technique [23]. Under radiographic control, selective catheterization of the celiac trunk is performed and angiography (celiacography) is performed.

The angioarchitecture of the celiac axis is assessed. Depending on the tumor location in a specific anatomical region of the stomach, the celiac axis is selectively catheterized, and the left gastric, splenic, or gastroduodenal artery is superselectively catheterized, with 50% of the chemotherapy dose administered for each of the selective and superselective chemotherapy routes.

We used AC or FLOT chemotherapy regimens, depending on the availability of chemotherapy drugs at the treatment facility.

Colleagues from the joint venture between Oxford University and the Sichuan Hospital Complex (China) used more chemotherapy options, but with any chemotherapy regimen, we obtain a higher concentration of the drug in the target organ when administering drugs intra-arterially [1, 17, 23].

Between 2018 and 2023, 8 patients were treated using the proposed technology.

All patients were examined by organs and systems using spiral computed tomography with intravenous enhancement of the chest and abdominal organs, endosonography of the stomach to determine the growth of the gastric tumor into adjacent organs.

When discussing the clinical case of patients with stage IV gastric cancer, the council determined the patient's condition according to the ECOG scale; in addition, an ultrasound examination of the vessels of the lower extremities was performed to identify contraindications to Seldinger artery catheterization.

All patients signed informed consent for treatment before each course of treatment and surgery.

Following the decision of the consultation, to achieve the desired therapeutic effect, patients underwent three courses of intra-arterial chemotherapy at 14-day intervals, followed by discharge from the hospital on the third

day. Fourteen days after the third course of neoadjuvant intra-arterial chemotherapy, patients underwent gastrectomy with grade II lymph node dissection [7, 8, 11, 18].

When deciding on the use of one of the intra-arterial treatment options, we always take into account the spread of the gastric cancer tumor process to adjacent organs (pancreas, liver, retroperitoneal space, the state of the peripheral lymph nodes, including the mediastinum), and at this point we determine the scope of subsequent surgical intervention and direct efforts in neoadjuvant treatment to reduce the potential volume of resected adjacent organs [9, 12].

All eight patients completed treatment without interruption and without serious hematologic complications, which were managed with standard doses of dexamethasone. No serious Clavien-Dindo complications were observed postoperatively.

All patients underwent marking of the anatomical areas of interest in the stomach and the resection zone, followed by histological examination and study of the therapeutic pathomorphosis [3].

Example.

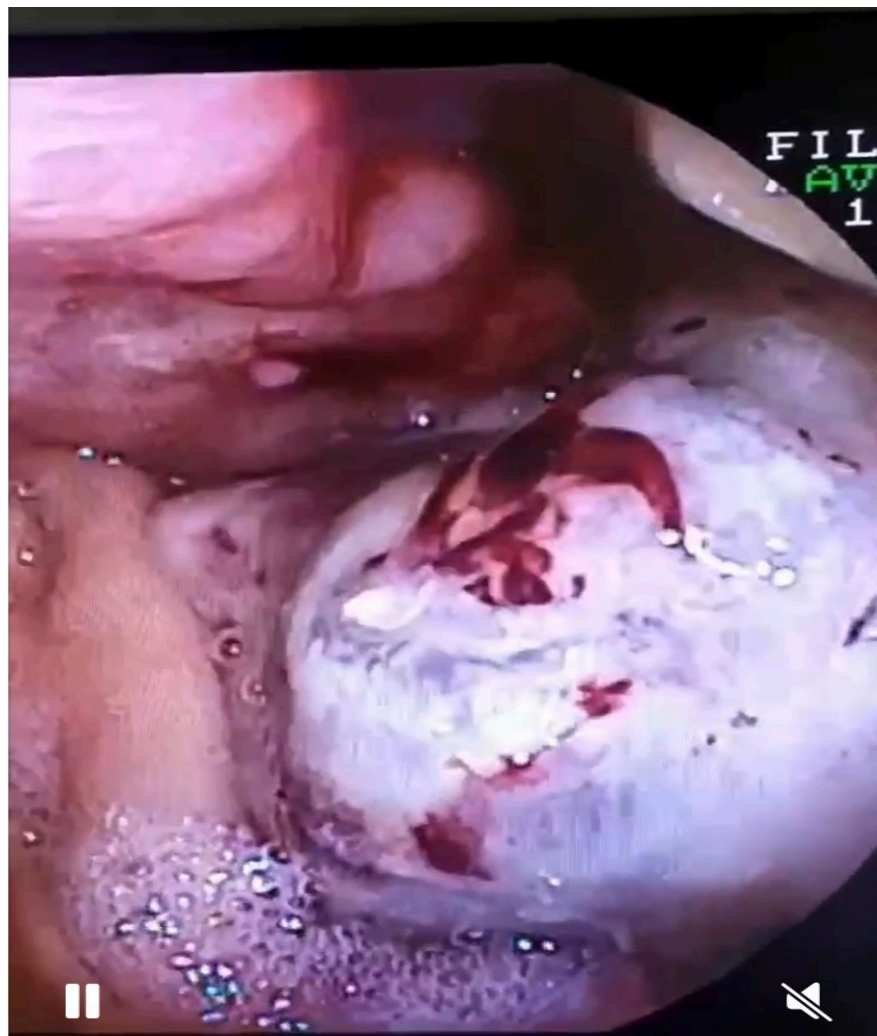
A 62-year-old patient with a diagnosis of: C A stomach subtotal lesion T 4 N 1 M 1 (mediastinal lymph nodes) G 4, clinical group II.

Complications: subcompensated stenosis of the gastric outlet. Moderate anemia.

Concomitant diagnosis:

Ischemic heart disease: atherosclerotic cardiosclerosis with signs of arterial hypertension, heart failure -0.

Chronic drug- induced hepatitis.



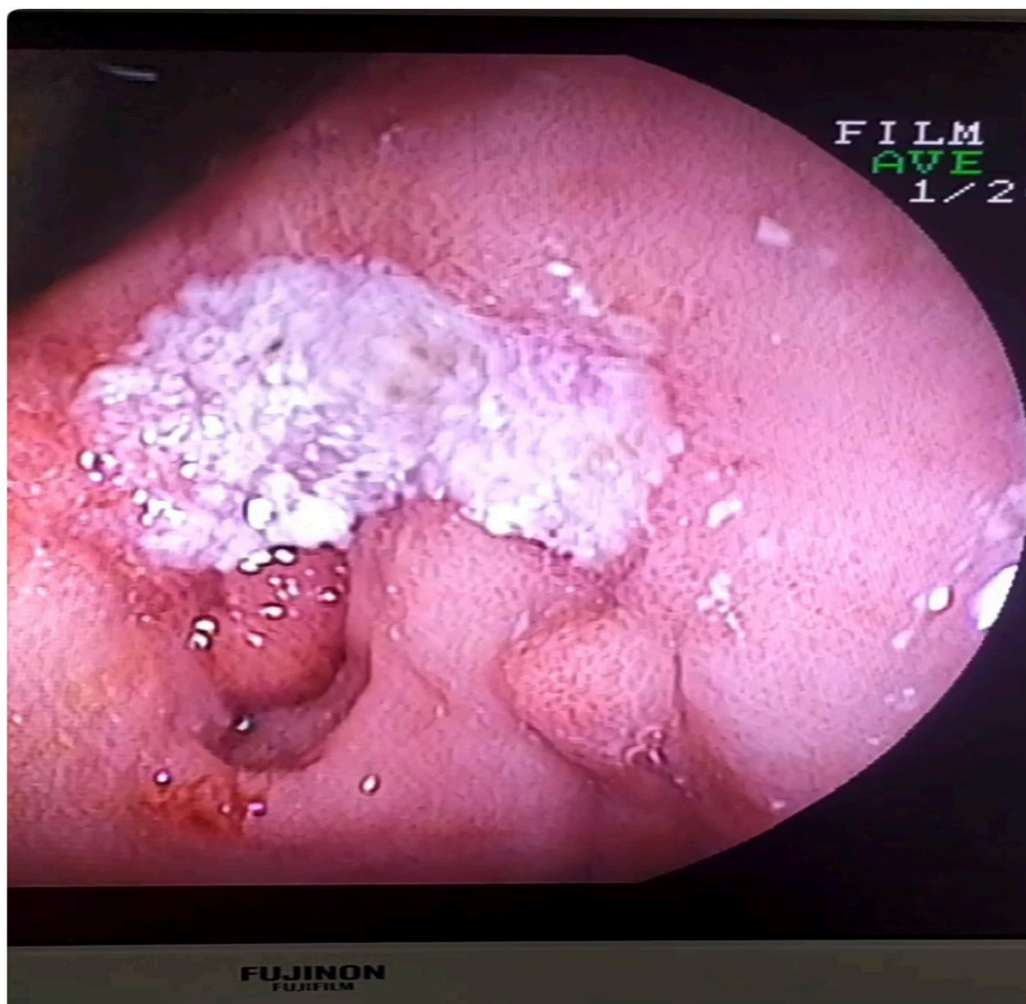
“Due to tumor stenosis of gastric cancer, insertion of an endoscope into the duodenum is impossible due to the risk of bleeding”

Video file #1 (before treatment)

Upon admission to the hospital, the patient underwent an examination of organs and systems: spiral computed tomography of the chest and abdominal cavity with intravenous contrast, fibrocolonoscopy, video esophagofibrogastrroduodenoscopy with biopsy of the stomach tumor to verify the diagnosis.

The case was considered inoperable at the time of hospitalization and the patient underwent a treatment program: he received 2 red blood cell transfusions followed by 3 courses of intra-arterial polychemotherapy according to the FLOT regimen - 50% of the drug dose selectively into the celiac trunk and 50% of the dose superselectively into the gastroduodenal artery.

The patient received treatment at 14-day intervals. Before surgery, a repeat video esophagogastroduodenoscopy was performed.

Video file #2 (after treatment)

Comparing the clinical presentation of the gastric disease with the video data (1, 2), we see that after 1.5 months of neoadjuvant treatment using the proposed technology, we achieved an outstanding result. According to current oncology guidelines, this patient should have undergone a feeding enterostomy, followed by courses of chemotherapy, and a predictable outcome.

On March 11, 2021, 14 days after the 3rd course of treatment, the patient underwent surgery: gastrectomy with lymph node dissection. D II, resection of the duodenum. Resection boundaries - R0.

March 17, 2021, pathohistological report No. 11665-11682: foci of undifferentiated (G 4) polymorphic cell carcinoma with a scirrhous growth pattern in the submucosal, muscular, and serous layers of the gastric wall, against a background of severe sclerosis of the stoma. The gastric resection margins and omental tissue are of typical structure. Retroperitoneal tissue shows sclerosis and xanthomatosis.

The duodenal walls show sclerosis and severe hypertrophy of the muscular layer. Lipomatosis is present in the lymph node groups sent. Therapeutic pathomorphism (TRG) II – therapeutic pathomorphosis Becker). The postoperative period was uneventful, and the wound healed by primary intention. Clinical and biochemical tests were within normal limits. The patient was discharged from the department in satisfactory condition on the eighth day after surgery. He subsequently received three more courses of adjuvant treatment. All surgeries were performed openly, as robotics and laparoscopy are feasible. However, after neoadjuvant treatment, severe fibrosis is observed in the abdominal tissues in the surgical area (tumor regression and replacement by scar tissue), complicating differential diagnosis between true tumor invasion into adjacent organs and fibrosis following treatment. Therefore, intraoperative manual exploration of the abdominal organs is essential for differential diagnosis.

We avoided the use of modern, expensive medications, which reduces the financial burden on the medical facility's budget. This technology can be used in any medical facility with the appropriate specialists (interventional oncology and minimally invasive treatment).

Conclusions

From 2018 to 2023, 8 patients were treated using the proposed method with a total survival time of 55-61 months, with good quality of life in patients, assessed using the EORTC questionnaire. QLQ -30.

Statistical analysis was not performed due to the small group of patients (8 patients).

Due to military operations in the region, further work in this direction has been suspended.

The authors are pleased to provide the results of their work for the further development of oncology.

The authors have not received external funding and have no conflicts of interest.

References

1. Gasparyan S.A., Trapeznikov N.N. and others. "Regional long-term Intra-arterial chemotherapy of malignant tumors. " – Moscow, 1970, p . 57;
2. Patent for invention of the Russian Federation No. 2797397 “Method of personalized neoadjuvant intra-arterial chemotherapy for gastric cancer” dated 2023.06.05;
3. Clinical guidelines for gastric cancer (approved by the Russian Ministry of Health), Appendix G5. Becker scale for assessing the degree of therapeutic pathomorphism in gastric cancer , 2020;

4. Trends in Clinicopathologic and Treatment Outcomes in Patients with Gastric Adenocarcinoma in the United States Between 2004 and 2021, Ali Esparham, Jennifer Whittington, +1 author Zahra Shafae Published in *Annals of Surgical Oncology* 13 November 2025, <https://pubmed.ncbi.nlm.nih.gov/41233709/>;
5. Trends in Clinicopathologic and Treatment Outcomes in Patients with Gastric Adenocarcinoma in the United States Between 2004 and 2021 Ali Esparham 1, Jennifer Whittington 2 3, George Agriantonis 2 3, Zahra Shafae 4 5 <https://www.semanticscholar.org/paper/Trends-in-Clinicopathologic-and-Treatment-Outcomes-Esparham-Whittington/82ac9792a2706fcd17b5b27c2e13aaa99740b1>
6. Current status of treatment for esophagojejunostomy leakage after total gastrectomy in patients with gastric cancer: a multicenter retrospective study in Korea Min-Chan Kim, Mi Ran Jung, +23 authors Kwang Hee Kim Published in *Journal of Minimally Invasive...* 15 December 2025, <https://www.semanticscholar.org/paper/Current-status-of-treatment-for-esophagojejunostomy-Kim-Jung/3fb614969e2f58bda2ec6a59ee3df7c2853448e6>;
7. Laparoscopic versus open distal gastrectomy with D2 lymphadenectomy following neoadjuvant chemotherapy for locally advanced gastric cancer (CLASS-03b): protocol for a multicentre, randomised, controlled, non-inferiority trial Yidi Liang, Xiao-Long Chen, +28 authors Jiankun Hu Published in *BMJ Open* 1 December 2025, <https://www.semanticscholar.org/paper/Laparoscopic-versus-open-distal-gastrectomy-with-D2-Liang-Chen/ba466bc46cb35169a909822c24906c26f8aec119>;
8. Safety, survival outcomes, and prognostic factors in conversion surgery for advanced gastric cancer: a sub-analysis of Japanese patients in the CONVO-GC-1 study, Itaru Yasufuku, Takahiro Kinoshita, +9 authors M. Terashima Published in *Gastric Cancer* 18 November 2025, <https://pubmed.ncbi.nlm.nih.gov/41251880/>;
9. Analysis of the efficacy and safety of extended lymph node dissection in gastric cancer surgery: association with dissection quantity, inflammatory response, and complications, Huangzhen Wang, Jien He, +3 authors Yu Zhang Published in *American journal of...* 2025, <https://www.semanticscholar.org/paper/Analysis-of-the-efficacy-and-safety-of-extended-in-Wang-He/f651ced26ad1b1c25a76c2ea52eee00d6fe36aef>;

10. Is Surgery Necessary for Stage IVB Gastric Cancer Showing Clinical Complete Response to Chemotherapy or Systemic Cancer Therapy? Takumi Habu, Shinpei Ushiyama, +6 authors Takahiro Kinoshita Published in *Annals of Surgical Oncology* 30 October 2025 <https://www.semanticscholar.org/paper/Is-Surgery-Necessary-for-Stage-IVB-Gastric-Cancer-Habu-Ushiyama/662d5ad0f83f58c609f68733c1cf9d10ffd49248>;
11. Advancing gastric cancer surgery: Oncological outcomes and novel approaches in laparoscopic D2 gastrectomy, Deniz Öcal Published in *Laparoscopic Endoscopic...* 2025 <https://www.semanticscholar.org/paper/Advancing-gastric-cancer-surgery%3A-Oncological-and-Öcal/2d3b55c1f53228f763398c9240146b2ade53f89e>;
12. Reduced Long-Term Survival After Postoperative Complications in Major Gastrointestinal Surgery, Daantje N Gratama, Laurence Weinberg, +10 authors Dong-Kyu Lee Published in *Therapeutics and Clinical...* 1 October 2025 <https://www.semanticscholar.org/paper/Reduced-Long-Term-Survival-After-Postoperative-in-Gratama-Weinberg/884c7e3ba1259c73ed876abd990795dd64c0cc1f>;
13. Survival Analysis of Optimal Management in Incurable Gastric Cancer with Gastric Outlet Obstruction: A Two-Center Retrospective Study in Thailand Puripat Pornwissanukul Published in *Journal of the Medical...* 20 October 2025 <https://www.semanticscholar.org/paper/Survival-Analysis-of-Optimal-Management-in-Gastric-Pornwissanukul/d34f60afd16c25cee842fff21088726928bf563d>;
14. Stage-dependent survival in gastric cancer: a Danish nationwide cohort study O. Kempf, Lise Bech Jellesmark Thorsen, +8 authors Michael P. Achiam Published in *Langenbeck's archives of...* 23 October 2025 <https://www.semanticscholar.org/paper/Stage-dependent-survival-in-gastric-cancer%3A-a-study-Kempf-Thorsen/9e885396d2ebe2085f8a494aeed817c374572304>;
15. Underutilization of Staging Laparoscopy Prior to Neoadjuvant Systemic Therapy in Gastric Cancer A. Ostowari, Kathryn T. Chen, +11 authors M. Senthil Published in *Annals of Surgical Oncology* 17 October 2025 <https://www.semanticscholar.org/paper/Underutilization-of-Staging-Laparoscopy-Prior-to-in-Ostowari-Chen/bc37299ac20dd0eb5fecc19f7d4cb6b3078d1fb5>;
16. Clinical impact of gastrectomy in surgically proven stage IV gastric cancers: retrospective analysis from Korean multicenter dataset (PASS-META). Ho-Jung Shin, Jeong Ho Song, +6 authors Hoon Hur Published in *Gastric Cancer* 19 October 2025 <https://www.semanticscholar.org/paper/Clinical-impact-of-gastrectomy-in-surgically-proven-Shin-Song/9b82f85950a81c144e9ef994009b5d9483b558c6>;

17. FLOT vs DOS neoadjuvant chemotherapy in locally advanced gastric cancer: propensity score analysis Lu-Yang Zhang, Sen Zhang, +5 authors Abe Fingerhut Published in International Journal of... 7 October 2025 <https://www.semanticscholar.org/paper/FLOT-vs-DOS-neoadjuvant-chemotherapy-in-locally-Zhang-Zhang/a4d66f25114e5bef1724820692ccd5f0794482e6>;
18. Preoperative chemotherapy with a modified docetaxel, cisplatin, and S-1 regimen, followed by gastrectomy and lymphadenectomy for gastric cancer with bulky lymph nodes. Vo Duy Long, Dang Quang Thong, +7 authors Nguyen Hoang Bac Published in Surgery today (Print) 25 August 2025 <https://www.semanticscholar.org/paper/Preoperative-chemotherapy-with-a-modified-and-S-1-Long-Thong/b13f2547792d9ac4c6c3f8ea93aa4c89c72c0d20>;
19. Immune checkpoint inhibitors combined with chemotherapy in conversion therapy for stage IV gastric cancer: a multicenter retrospective cohort study Xingmao Huang, Xiangliu Chen, +8 authors Ling Huang Published in Cancer Immunology and... 11 September 2025 <https://www.semanticscholar.org/paper/Immune-checkpoint-inhibitors-combined-with-in-for-a-Huang-Chen/dea40f2def08124025b2e935c2ee292a4ae5350d>;
20. Conversion therapy with sintilimab combined with chemotherapy and apatinib in stage IV gastric cancer Yong Liu, Q. Xue, +15 authors Han Liang Published in International Journal of... 2 July 2025 <https://www.semanticscholar.org/paper/Conversion-therapy-with-sintilimab-combined-with-in-Liu-Xue/3f9536db707eb0b230a21438ed92c4d9cab12ef3>;
21. Trends and Perioperative Outcomes in Gastric Cancer Surgery in Switzerland: A National Inpatient Database Analysis (1998–2021) J. Gerber, Y. Borbely, +1 author D. Kröll Published in British Journal of Surgery 1 May 2025 <https://www.semanticscholar.org/paper/Trends-and-Perioperative-Outcomes-in-Gastric-Cancer-Gerber-Borbely/25d2daf00be401e46f8117e016b96ec1526af499>;
22. Conversion Therapy for Stage IV Gastric Cancer: Report From the Expert Consensus Meeting at KINGCA WEEK 2024 Tae-Han Kim, I. Uyama, +14 authors Hur Hoon Published in Journal of Gastric Cancer 1 January 2025 <https://www.semanticscholar.org/paper/Conversion-Therapy-for-Stage-IV-Gastric-Cancer%3A-the-Kim-Uyama/d806826d7a528c1da1e2ce0950e29efb4a716f31>;

23. Application of Regional Arterial Infusion Chemotherapy in Advanced Gastric Cancer, Hao Xu, Weicheng Wang, Xiaoming Zhang, Yi Zhou, Jing Zheng, Cui Yang, Lin Yang, Journal of Cancer Therapy, 118-129, 2018, 9, <https://www.scirp.org/journal/paperinformation?paperid=82381>, <https://doi.org/10.4236/jct.2018.92013>



Medtronic