



## Case report

# Successful robotic proximal gastrectomy with side overlap esophagogastrostomy following preoperative chemotherapy: A case report

Kazuaki Tanabe<sup>a,\*</sup>, Yoshihiko Saeki<sup>b</sup>, Hiroshi Ohta<sup>b</sup>, Hideki Ohdan<sup>b</sup>

<sup>a</sup> Department of Perioperative and Critical Care Management, Graduate School of Biomedical and Health Sciences, Hiroshima University, 1-2-3, Kasumi, Minami-ku, Hiroshima 734-8551, Japan

<sup>b</sup> Department of Department of Gastroenterological and Transplant Surgery, Graduate School of Biomedical and Health Sciences, Hiroshima University, 1-2-3, Kasumi, Minami-ku, Hiroshima 734-8551, Japan



## ARTICLE INFO

## Keywords:

Proximal gastrectomy  
Preoperative chemotherapy  
Robotic surgery

## ABSTRACT

**Introduction and importance:** Adenocarcinoma of the esophagogastric junction (AEJ) has been on the rise in recent years, but the technical aspects of reconstruction and reflux prevention are unsolved problems. This case report aimed to illustrate the usefulness of preoperative chemotherapy for tumor shrinkage and the advantage of robotic surgery for stable reconstruction with reflux prevention.

**Case presentation:** A 69-year-old male patient was diagnosed with AEJ cT3N0M0 cStage IIB. Three courses of doublet chemotherapy with 80 mg/m<sup>2</sup>/day of S-1 on days 1–14 and 100 mg/m<sup>2</sup> of oxaliplatin on day 1 were administered every 3 weeks before surgery. After chemotherapy, the tumor shrank, and the proximal margin changed from 1.5 cm above the esophagogastric junction (EGJ) to be the gastric side of the EGJ. A radical robotic proximal gastrectomy with D2 lymphadenectomy was performed. Since sufficient length of the esophagus was secured in the hiatus due to tumor shrinkage, reconstruction was performed by the side-overlap esophagogastrostomy (mSOFY) method. The postoperative course was uneventful with no reflux symptoms two months after surgery, even without medication.

**Clinical discussion:** Preoperative chemotherapy is expected to improve the rates of complete resection and survival. In the present case, preoperative treatment with SOX resulted in tumor shrinkage, which enabled reconstruction using the mSOFY method. Robotic surgery may be useful for such complex reconstruction procedures. **Conclusion:** To our knowledge, this is the first report of robotic reconstruction using the mSOFY method after proximal gastrectomy for AEG tumors. This work was reported in line with the SCARE 2020 criteria.

## 1. Introduction

Despite a decrease in the incidence of gastric adenocarcinoma over the last decade, adenocarcinoma of the esophagogastric junction (AEJ) has been on the rise in recent years [1,2]. Intrathoracic or transhiatal approaches are needed for the reconstruction of Siewert type II tumors; however, researchers are divided on which procedure is the best, especially for Siewert type II tumors [3,4]. Furthermore, in recent years, several surgical procedures involving anti-reflux techniques have been developed for Siewert type III tumors, but applying these methods remains problematic in terms of the technical aspects of reconstruction and reflux prevention. Here, we report a case in which preoperative chemotherapy resulted in tumor shrinkage, thus enabling robotic proximal gastrectomy with side-overlap esophagogastrostomy to

prevent postoperative reflux. The work has been reported in line with the SCARE 2020 criteria [5].

## 2. Case report

A 69-year-old male was referred to our department for AEJ detected during a regular medical examination. The patient had no significant medical or treatment history. As for his family history, the patient's brother had died of gastric cancer.

On upper gastrointestinal endoscopy, a 30 mm-sized ulcerative lesion in the esophagogastric junction (EGJ) was revealed (Fig. 1a), and biopsy indicated a well-differentiated adenocarcinoma. The proximal end was found to be 1.5 cm above the EGJ (Siewert type II) on gastric fluoroscopy (Fig. 1b). On computed tomography (CT) of the thorax and

\* Corresponding author.

E-mail address: [ktanabe2@hiroshima-u.ac.jp](mailto:ktanabe2@hiroshima-u.ac.jp) (K. Tanabe).

<https://doi.org/10.1016/j.ijscr.2022.107040>

Received 4 March 2022; Received in revised form 2 April 2022; Accepted 3 April 2022

Available online 14 April 2022

2210-2612/© 2022 The Authors. Published by Elsevier Ltd on behalf of IJS Publishing Group Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

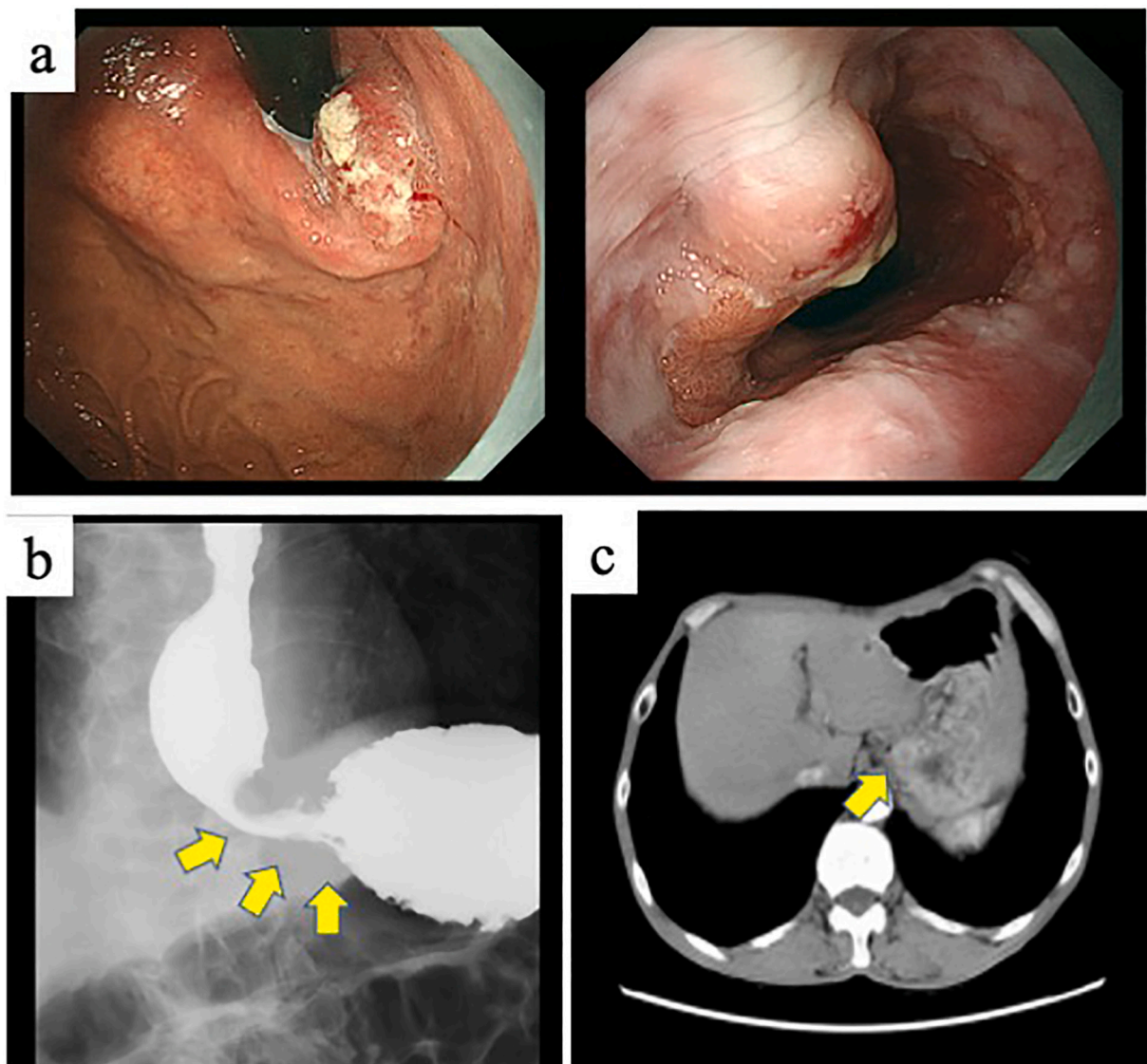
abdomen, the main lesion was visualized as a lesion with a contrast effect, and there were no lymph node or distant metastases (Fig. 1c). Serum carcinoembryonic antigen and carbohydrate antigen 19-9 levels were normal. The patient was diagnosed with AEG, GE, AntPost, Type 2, cT3N0M0, cStageIIB. We decided to perform preoperative chemotherapy to secure an oral free margin for the cancer and enable intraperitoneal esophagogastric anastomosis. We initiated preoperative chemotherapy with oxaliplatin 100 mg/m<sup>2</sup> on day 1 in combination with S-1 80 mg/m<sup>2</sup>/day for days 1–14 every three weeks (SOX regimen).

He was generally going well after chemotherapy except for anorexia (Grade 1) and leukopenia (Grade1). After three courses of preoperative chemotherapy as planned, gastrointestinal endoscopy and fluoroscopy revealed that the main tumor had shrunk, and the proximal stump appeared to be near the gastric side of the EGJ (Fig. 2a, b). The tumor was difficult to identify on CT thorax and abdomen, with no evidence of metastasis (Fig. 2c). Therefore, radical robotic proximal gastrectomy was performed using the da Vinci Surgical System (Intuitive Surgical, Sunnyvale, CA, USA) along with D2 lymphadenectomy, according to the Japanese gastric cancer treatment guidelines [6]. The surgery was performed by a qualified surgeon accredited with the Endoscopic Surgical

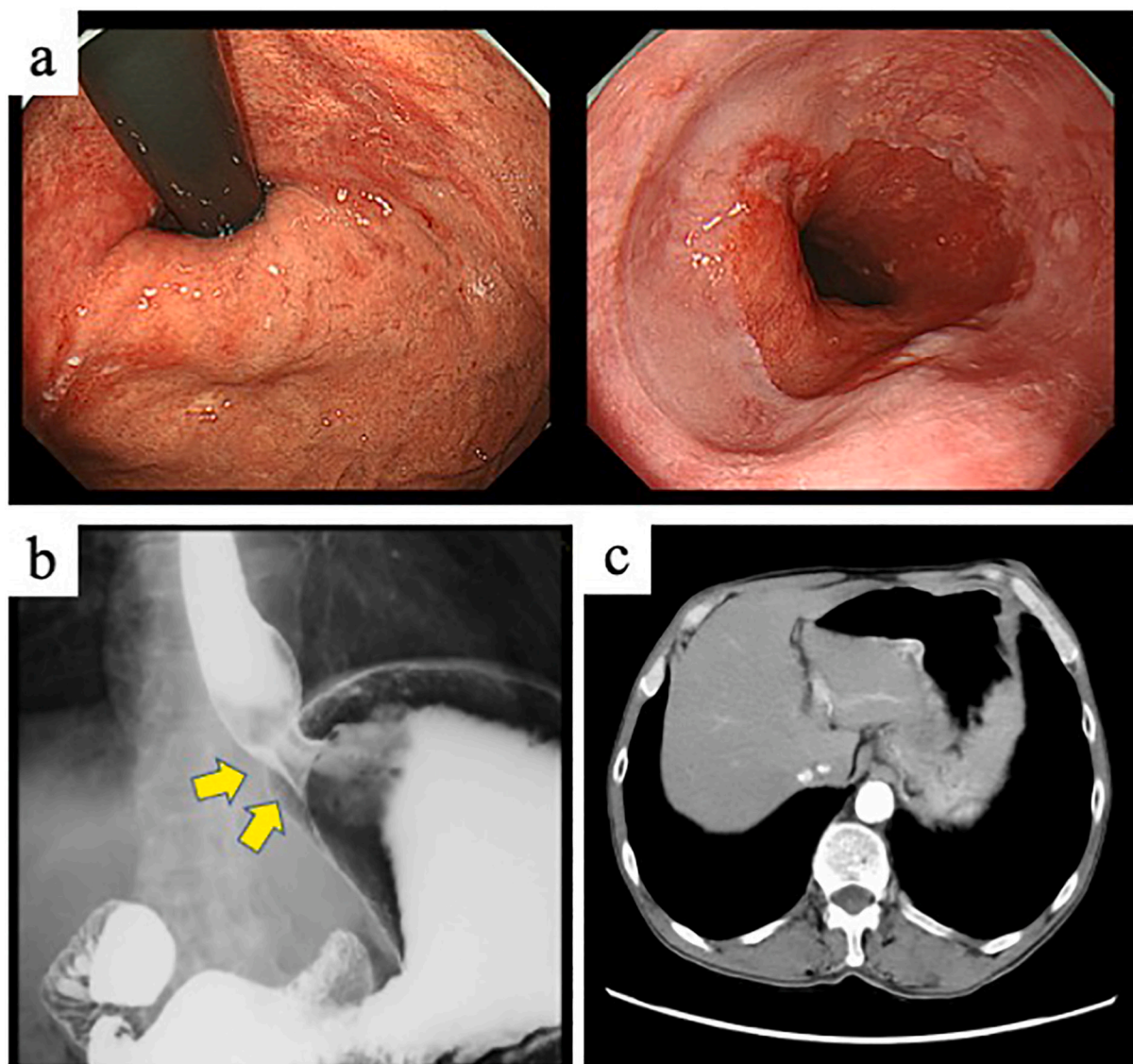
Skill Qualification System with surgical experience of more than 40 robotic surgeries.

Intraoperatively, the esophagus was transected 2 cm above the EGJ, and the specimen was removed from the abdomen via a small, expanded wound at the umbilical port to confirm that the proximal stump was properly excised. Since about 5 cm of the esophagus can be pulled into the abdominal cavity, we decided to reconstruct it robotically by side-overlap esophagogastrostomy, the so-called modified side overlap with fundoplication by Yamashita (mSOFY) method devised by Yamashita Y [7] (Fig. 3). After the central apex of the remnant stomach was fixed to the crus of the diaphragm on the dorsal side of the esophagus, the right side of the esophageal stump and the center of the remnant gastric wall were anastomosed using a SureForm® linear stapler. The entry hole was closed by robotic surgery, and the left side of the esophagus was fixed to the gastric wall with three sutures so that the esophagus was opposed flat against the gastric wall. The operative time was 438 min, and the amount of blood loss was 30 ml.

After the absence of leakage was confirmed on postoperative fluoroscopy, oral ingestion was initiated on postoperative day 5. Esophagogastrography showed no anastomotic stenosis or regurgitation of the



**Fig. 1.** Pretreatment findings. (a) Endoscopic findings: A type 3 lesion is noted in the esophagogastric junction (EGJ). (b) Gastric fluoroscopy findings: The tumor was classified as Siewert type II (yellow arrow) and the proximal margin of the tumor was considered 1.5 cm above the EGJ. (c) Abdominal contrast-enhanced computed tomography findings: The tumor was visualized as a lesion with a contrast effect (yellow arrow).



**Fig. 2.** Post-chemotherapy findings. (a) Endoscopic findings: The tumor significantly shrank by chemotherapy. (b) Gastric fluoroscopy findings: The proximal margin of tumor changed to be around the esophagogastric junction. (c) Computed tomography findings: The tumor lost its contrast effect and became difficult to point out.

contrast agent into the esophagus. Histopathological examination of the resected specimens revealed a well-differentiated adenocarcinoma with submucosal invasion. No metastasis was observed in any of the retrieved lymph nodes. The final stage was ypT1bN0M0, ypStage I according to the Japanese Classification of Gastric Carcinomas. The pathological effects of chemotherapy were classified as grade IB.

The patient was satisfied with the series of treatments and was discharged from the hospital on the 10th postoperative day with good postoperative recovery. He had not experienced heart burn even without medication. Upper gastrointestinal endoscopy showed no reflux and CT showed no recurrence 2 months after the surgery.

### 3. Discussion

The goals of AEJ treatments not only include oncological safety but also better quality of life (QOL). Here, we report a case of robotic proximal gastrectomy done using the mSOFY method. Additionally, tumor shrinkage following preoperative chemotherapy enabled safe reconstruction with an anti-reflux mechanism.

The optimal surgical procedure for AEJ remains unclear, especially for Siewert type II tumors. Gastric surgeons prefer an abdominal

approach with transhiatal gastrectomy (THG), while esophageal surgeons prefer thoracoabdominal esophagectomy (TAE) [8–10]. The Japan Clinical Oncology Group (JCOG) conducted a multicenter trial (JCOG9502) in Japan to evaluate the survival benefits of the TAE approach compared to the THG approach for Siewert type II and III AEJ tumors [11]. This study revealed that the TAE approach did not improve overall survival and disease-free survival. Furthermore, the morbidity was worse after TAE than after THG. Therefore, the authors concluded that the TAE approach should be avoided for Siewert type II and III tumors.

The THG approach includes total gastrectomy and proximal gastrectomy. There are various reconstruction methods available for both procedures, but proximal gastrectomy is better than total gastrectomy in terms of body weight loss as per many reports. However, there are still problems in terms of the postoperative QOL, including the presence of reflux [12–14]. Therefore, total gastrectomy is often performed instead of proximal gastrectomy. Many reconstruction procedures to improve the QOL after proximal gastrectomy have been attempted. Esophagogastrostomy is the simplest method, but reflux esophagitis frequently occurs without ingenuity [15]. Double-tract and jejunal interposition methods are also used; however, it is not clear whether these methods

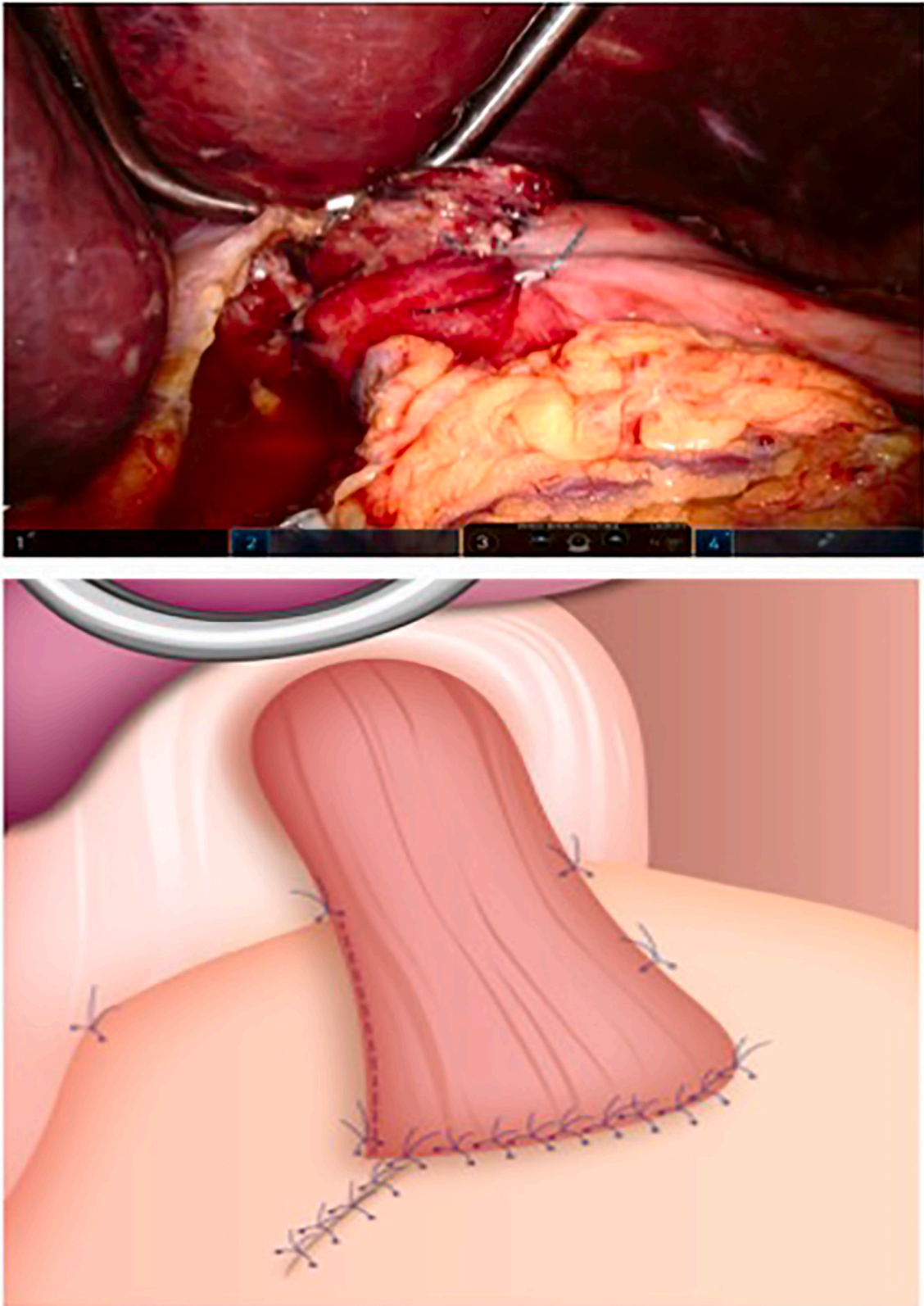


Fig. 3. Anastomosis after the mSOFY method.

have any advantages in terms of QOL and postoperative nutrition. In recent years, promising esophagogastronomy methods have been developed to prevent reflux [16–18]. These procedures prevent reflux by increasing the intragastric pressure as food enters the stomach. However, they require advanced techniques in laparoscopic surgery,

especially at more proximal locations in the esophageal hiatus.

The mSOFY method can be performed relatively easily using the laparoscopic approach and a solid valve structure to prevent reflux. When PubMed was searched with the keywords “side overlap esophagogastronomy,” “SOFY,” and “side overlap with fundoplication,” no

reports of robotic reconstruction with mSOFY were found. At present, there are also no reports of long-term postoperative QOL; however, we chose this technique because we thought it would be useful for reconstruction after AEJ tumor resection. It also required many sutures, but it seems that robotic surgery enabled reliable and faster suturing.

Several randomized trials have assessed the role of preoperative chemotherapy in improving the rate of complete resection and survival rate in patients with advanced AEJ tumors. The Magic trial [19] compared overall survival between perioperative chemotherapy and surgery and surgery alone in those with Stage II tumors and above. The perioperative chemotherapy and surgery group showed higher overall survival (hazard ratio for death, 0.75; 95% confidence interval, 0.60–0.93;  $P = 0.009$ ; 5-year survival rate, 36%–23%). The subsequent FLOT trial showed promising results as well. This study showed the superiority of the FLOT regimen over the ECF regimen that was used in the MAGIC trial [20]. The JCOG is currently conducting a randomized trial, JCOG1509. This study was designed to investigate the efficacy of the preoperative SOX regimen in patients with stage III (cT3-4N1-3) tumors [21]. SOX is the standard regimen for stage IV gastric cancer in Japan, with a response rate as high as 55.7% [22]. Thus, in this report, we used SOX as the preoperative chemotherapy regimen.

To be able to perform mSOFY reconstruction, the esophagus needs a relative length of 5 cm in the esophageal hiatus. In this case, tumor shrinkage due to preoperative chemotherapy likely ensured that a sufficient esophageal length was available. Thus, robot-assisted mSOFY reconstruction is one of optimal procedures that can be safely performed to maintain the QOL in patients with AEJ with an esophageal infiltration length of  $\leq 2$  cm.

#### 4. Conclusion

We report a surgical case in which function-preserving proximal gastrectomy was successfully performed robotically following preoperative chemotherapy.

#### Informed consent

Written informed consent was obtained from the patient for the publication of this case report and any accompanying images. A copy of the written consent form is available for review by the Editor-in-Chief of the journal.

#### Provenance and peer review

Not commissioned; externally peer-reviewed.

#### Ethical approval

Not applicable.

#### Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

#### Guarantor

Dr. Kazuaki Tanabe: [ktanabe2@hiroshima-u.ac.jp](mailto:ktanabe2@hiroshima-u.ac.jp).

#### Research registration number

1. Name of the registry: Research Registry
2. Unique identifying number or registration ID: researchregistry7768
3. Hyperlink to the registration: <https://www.researchregistry.com/browse-the-registry#user-researchregistry/registerresearchdetails/6245762a0a2f35001e75e95b/>.

#### CRedit authorship contribution statement

Kazuaki Tanabe, the corresponding author, performed the surgery and wrote the manuscript. Yoshihiro Saeki and Hiroshi Ohta participated in the surgery. Yoshihiko Saeki and Hideki Ohdan supervised the writing of the manuscript. All authors have read and approved the final manuscript.

#### Declaration of competing interest

The authors declare no conflicts of interest associated with this manuscript.

#### Acknowledgements

We would like to thank Editage ([www.editage.com](http://www.editage.com)) for English language editing.

#### References

- [1] F. Bray, J. Ferlay, I. Soerjomataram, R.L. Siegel, L.A. Torre, A. Jemal, Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries, *CA Cancer J. Clin.* 68 (2018) 394–424.
- [2] M. Chevallay, E. Bollschweiler, S.M. Chandramohan, T. Schmidt, O. Koch, G. Demanzoni, et al., Cancer of the gastroesophageal junction: a diagnosis, classification, and management review, *Ann. N. Y. Acad. Sci.* 1434 (2018) 132–138.
- [3] E. Jezerskyte, M.I. van Berge Henegouwen, M.A. Cuesta, S.S. Gisbertz, Gastroesophageal junction cancers: what is the best minimally invasive approach? *J. Thorac. Dis.* 9 (2017) S751–S760.
- [4] Y. Kurokawa, H. Takeuchi, Y. Doki, S. Mine, M. Terashima, T. Yasuda, et al., Mapping of lymph node metastasis from esophagogastric junction tumors: a prospective nationwide multicenter study, *Ann. Surg.* 274 (2021) 120–127.
- [5] R.A. Agha, T. Franchi, C. Sohrabi, G. Mathew, A. Kerwan, SCARE Group, The SCARE 2020 guideline: updating consensus surgical CAse REport (SCARE) guidelines, *Int. J. Surg.* 84 (2020) 226–230.
- [6] Japanese Gastric Cancer Association, Japanese Gastric Cancer Treatment Guidelines 2021, 6th edition, Kanehara Shuppan, Tokyo, 2021. Published in Japanese.
- [7] Y. Yamashita, A. Yamamoto, Y. Tamamori, M. Yoshii, Y. Nishiguchi, Side overlap esophagogastrectomy to prevent reflux after proximal gastrectomy, *Gastric Cancer* 20 (2017) 728–735.
- [8] F. Carbone, R. Lorusso, R. Santoro, P. Lepiane, P. Mancini, I. Sperduti, et al., Adenocarcinoma of the esophagogastric junction: the role of abdominal-transhiatal resection, *Ann. Surg. Oncol.* 16 (2009) 304–310.
- [9] J.T. Mullen, E.L. Kwak, T.S. Hong, What's the best way to treat GE junction tumors? Approach like gastric cancer, *Ann. Surg. Oncol.* 23 (2016) 3780–3785.
- [10] S. Blank, T. Schmidt, P. Heger, M.J. Strowitzki, L. Sisic, U. Heger, et al., Surgical strategies in true adenocarcinoma of the esophagogastric junction (AEG II): thoracoabdominal or abdominal approach? *Gastric Cancer* 21 (2018) 303–314.
- [11] M. Sasako, T. Sano, S. Yamamoto, M. Sairenji, K. Arai, T. Kinoshita, et al., Left thoracoabdominal approach versus abdominal-transhiatal approach for gastric cancer of the cardia or subcardia: a randomised controlled trial, *Lancet Oncol* 7 (2006) 644–651.
- [12] H. Yabusaki, Y. Kodera, N. Fukushima, N. Hiki, S. Kinami, M. Yoshida, et al., Comparison of postoperative quality of life among three different reconstruction methods after proximal gastrectomy: insights from the PGSAS study, *World J. Surg.* 44 (2020) 3433–3440.
- [13] C. Kunisaki, K. Yoshida, M. Yoshida, S. Matsumoto, T. Arigami, Y. Sugiyama, et al., Effects of proximal gastrectomy and various clinical factors on postoperative quality of life for upper-third gastric cancer assessed using the postgastrectomy syndrome assessment Scale-45 (PGSAS-45): a PGSAS NEXT study, *Ann. Surg. Oncol.* (2022), <https://doi.org/10.1245/s10434-021-11136-1>.
- [14] N. Takiguchi, M. Takahashi, M. Ikeda, S. Inagawa, S. Ueda, T. Nobuoka, et al., Long-term quality-of-life comparison of total gastrectomy and proximal gastrectomy by postgastrectomy syndrome assessment scale (PGSAS-45): a nationwide multi-institutional study, *Gastric Cancer* 18 (2015) 407–416.
- [15] M. Tokunaga, S. Ohyama, N. Hiki, E. Hoshino, S. Nunobe, T. Fukunaga, et al., Endoscopic evaluation of reflux esophagitis after proximal gastrectomy: comparison between esophagogastric anastomosis and jejunal interposition, *World J. Surg.* 32 (2008) 1473–1477.
- [16] Y. Kamikawa, K.T. S. Kamiyama, K. Satonaka, A new procedure of esophagogastrectomy to prevent reflux following proximal gastrectomy (in Japanese), *Shoukaikegaku* 24 (2001) 1053–1060.
- [17] H. Okabe, K. Obama, E. Tanaka, S. Tsunoda, M. Akagami, Y. Sakai, Laparoscopic proximal gastrectomy with a hand-sewn esophago-gastric anastomosis using a knifeless endoscopic linear stapler, *Gastric Cancer* 16 (2013) 268–274.
- [18] Y. Saeki, K. Tanabe, Y. Yamamoto, H. Ohta, R. Saito, H. Ohdan, Laparoscopic proximal gastrectomy with hinged double flap method using knotless barbed absorbable sutures: a case series, *Int. J. Surg. Case Rep.* 51 (2018) 165–169.

- [19] D. Cunningham, W.H. Allum, S.P. Stenning, J.N. Thompson, C.J. Van de Velde, M. Nicolson, et al., Perioperative chemotherapy versus surgery alone for resectable gastroesophageal cancer, *N. Engl. J. Med.* 355 (2006) 11–20.
- [20] S.E. Al-Batran, N. Homann, C. Pauligk, T.O. Goetze, J. Meiler, S. Kasper, et al., Perioperative chemotherapy with fluorouracil plus leucovorin, oxaliplatin, and docetaxel versus fluorouracil or capecitabine plus cisplatin and epirubicin for locally advanced, resectable gastric or gastro-oesophageal junction adenocarcinoma (FLOT4): a randomised, phase 2/3 trial, *Lancet* 393 (2019) 1948–1957.
- [21] M. Tokunaga, Y. Sato, M. Nakagawa, T. Aburatani, T. Matsuyama, Y. Nakajima, et al., Perioperative chemotherapy for locally advanced gastric cancer in Japan: current and future perspectives, *Surg. Today* 50 (2020) 30–37.
- [22] Y. Yamada, K. Higuchi, K. Nishikawa, M. Gotoh, N. Fuse, N. Sugimoto, et al., Phase III study comparing oxaliplatin plus S-1 with cisplatin plus S-1 in chemotherapy-naive patients with advanced gastric cancer, *Ann. Oncol.* 26 (2015) 141–148.