

A Comparison of Gastric Cancer Surgery Between Japan and China

Dapeng Liu,* Boxiang Zhang,* Tomoyuki Matsunaga,† Kozo Miyatani,† Yuji Shishido,† Yusuke Kono† and Yoshiyuki Fujiwara†

*Department of Thoracic Surgery, The First Affiliated Hospital of Xi'an Jiaotong University, Xi'an, 710061, P.R.China, and †Division of Surgical Oncology, Department of Surgery, School of Medicine, Tottori University Faculty of Medicine, Yonago 683-8504, Japan

ABSTRACT

Background The differences in gastric cancer between East and West have been frequently discussed. However, there are few studies that have compared Japan and China in Asia.

Methods Patient characteristics, surgical procedures and pathologic information were compared among gastric cancer patients who underwent curative-intent gastrectomy at two large volume cancer centers in China and Japan.

Results The median age of Japanese patients is 70 years, seven years older than those in China, and more than 25% of Japanese patients were older than 75. In China, the tumor was thicker, and lymph node metastasis was frequently observed. Total gastrectomy was more common in China (35.6% vs 21.9%). Distal gastrectomy rate was 56.0 percent in Japan, compared to 42.2 percent in China. The proportion of patients undergoing proximal gastrectomy was almost equal in China and Japan. Further analysis of the characteristics of patients undergoing total gastrectomy revealed that in China, more advanced gastric cancer patients with larger tumors and more lymph node metastasis underwent total gastrectomy, while in Japan, more early stage gastric cancer patients underwent total gastrectomy.

Conclusion There are some differences in gastric cancer between Japan and China. China needs to learn from Japan by establishing some screening programs for the diagnosis and treatment of early gastric cancer.

Key words China; gastrectomy; gastric cancer; Japan

Although the incidence of gastric cancer in the world is declining year by year, gastric cancer remains the third leading cause of cancer death in the world and continues to be a major public health problem.¹ In Japan, gastric cancer is the second most common cancer, with nearly 46,000 deaths annually.² In China, every year there are

221,478 deaths due to gastric cancer, approximately half of the world's total gastric cancer deaths.³

Surgery is the most effective approach in increasing the long-term survival of gastric cancer patients.⁴ Surgeons in Japan mainly focus on the treatment of early stage gastric cancer, while in China, doctors are facing more advanced gastric cancer. As a result, the overall 5-year survival rate in China remains at 30%, while it has reached 63.8%–77.2% in Japan.^{5, 6}

Due to the different stages of gastric cancer, surgical skills of doctors and patients' different attitudes to the disease, there are some differences in gastric cancer surgery between China and Japan. We provided data of gastric cancer patients from two large institutions following radical resection to compare patient characteristics, surgical procedures and pathologic information in China and Japan.

MATERIALS AND METHODS

Patients

All patients were diagnosed and treated at Tottori University from 2005 to 2013 and the first affiliated hospital of Xi'an Jiaotong University from 2018 to 2019. Both institutions maintain databases of gastric cancer patients which collect variables including age, sex, surgical procedure, tumor size, depth of invasion, number of positive and retrieved lymph nodes, distance metastasis. According to the sixth edition of TNM classification system (AJCC/UICC, 2002), the TNM stage was reconfirmed with original information.⁷

Surgical procedures and pathological examination

Curative resection was performed with a negative margin, usually 3 cm or more. Frozen section pathology was selectively used during operation. Intraoperative finding of peritoneal metastasis indicated palliative resection. Pathological review was performed by at least two dedicated gastric cancer pathologists at both centers.

Statistical Analysis

All analyses were performed using SPSS 16.02 (SPSS, Chicago, IL). A chi-square test or a Wilcoxon rank sum test was used to compare patient demographic, surgical and pathological variables. *P* values less than 0.05 were

Corresponding author: Yoshiyuki Fujiwara, MD, PhD

y-fujiwara@tottori-u.ac.jp

Received 2019 August 21

Accepted 2019 October 2

Online published 2019 November 22

Abbreviations: AJCC, the American Joint Committee; UICC, Union for International Cancer Control

Table 1. Comparison of Patient Demographics

| | Country | | P-value |
|-----------------|------------|------------|----------|
| | China | Japan | |
| No. of patients | 436 | 452 | |
| Male | 345 (79.1) | 330 (73.0) | 0.033* |
| Female | 91 (20.9) | 122 (27.0) | |
| Age (yr) | | | |
| < 30 | 2 (0.5) | 3 (0.7) | < 0.001† |
| 30–75 | 410 (94.0) | 331 (73.2) | |
| > 75 | 24 (5.5) | 118 (26.1) | |
| Median (range) | 63 (26–82) | 70 (28–93) | |

*Chi-square test used for categorical variables

†Wilcoxon rank sum test used for continuous variables

yr, years.

considered statistically significant.

RESULTS

Patient characteristics

A total of 452 Japanese and 436 Chinese patients who underwent R0 resection were identified. The majority of enrolled patients were male. The number of male patients in China was slightly higher than those in Japan. Patients in Japan had a median age of 70 years, seven years older than those in China, and more than 25% of Japanese patients were older than 75, while in China, it was only 5.5% (Table 1).

Pathological characteristics

There were significant differences in terms of tumor size, T stage, N stage and TNM stage between Japan and China. In China, the tumor was larger, thicker, and more frequent lymph node metastasis was observed. Early stage gastric cancer was 15.4 percent in China and 68.6 percent in Japan. There was no significant difference in lymphadenectomy between Japan and China (Table 2).

Surgical characteristics

Total gastrectomy was more common in China (35.6% vs 21.9%). Distal gastrectomy rate was 56.0 percent in Japan, compared with 42.2 percent in China. The proportion of patients undergoing proximal gastrectomy was comparable between the two institutions (Table 3).

Surgical characteristics patients undergoing total gastrectomy

Further analysis of the characteristics of patients undergoing total gastrectomy revealed that in China, more

advanced gastric cancer patients with larger tumors and more lymph node metastasis underwent total gastrectomy, while in Japan, more early stage gastric cancer patients underwent total gastrectomy (Table 4).

DISCUSSION

By comparing the two large gastric cancer hospitals in Japan and China, we found some significant differences in patient characteristics, surgical procedures and pathological information. In our reports of both Japan and China, there are more men with gastric cancer, which may be caused by diet, work stress, genetic background, drinking, and smoking.^{8, 9} In addition, older people were dominant in the stomach cancer population in Japan compared to China, which may be partly because in China, older patients with gastric cancer do not choose surgical treatment for various reasons, such as economic and physical condition, and family members' choice.¹⁰

In Japan, early stage gastric cancers accounted for 68.6 percent of patients, much higher than 15.4 percent in China. More and more studies highlighted the importance of the access to diagnostic and therapeutic facilities in developing countries.^{11–13} Analysis among Japanese patients also indicated that improving survival rate is closely related to more detection of early-stage gastric cancer patients.¹⁴ Unfortunately, Chinese patients, especially those in rural areas, they don't attach importance to physical examinations and are unwilling to see a doctor until the appearance of severe symptoms.

Lymph node status is one of the most important clinical outcome determinants in gastric cancer patients. There was more total gastrectomy in China (35.6% vs 21.9%) due to the later stage of gastric cancer. In Japan,

Table 2. Pathologic and surgical characteristics

| | Country | | <i>P</i> -value |
|------------------------|-------------------------|-------------------------|-----------------|
| | China (<i>N</i> = 436) | Japan (<i>N</i> = 452) | |
| Tumor size (cm) | | | |
| < 4 | 71 (16.3) | 278 (61.5) | < 0.001 |
| 4–7 | 173 (39.7) | 125 (27.7) | |
| > 7 | 192 (44.0) | 49 (10.8) | |
| T stage | | | |
| T1 | 47 (10.8) | 284 (62.8) | < 0.001 |
| T2 | 92 (21.1) | 54 (11.9) | |
| T3 | 100 (22.9) | 88 (19.5) | |
| T4 | 197 (45.2) | 26 (5.8) | |
| N stage | | | |
| N0 | 96 (22.0) | 344 (76.1) | < 0.001 |
| N1 | 37 (8.5) | 35 (7.7) | |
| N2 | 190 (43.6) | 45 (10.0) | |
| N3 | 113 (25.9) | 28 (6.2) | |
| TNM stage | | | |
| I | 67 (15.4) | 310 (68.6) | < 0.001 |
| II | 92 (21.1) | 82 (18.2) | |
| III | 271 (62.1) | 53 (11.7) | |
| IV | 6 (1.4) | 7 (1.5) | |
| Lymphadenectomy | | | |
| D1 | 254 (58.3) | 267 (59.2) | 0.249 |
| D2 | 132 (30.3) | 125 (27.7) | |
| Others | 8 (1.8) | 18 (4.0) | |
| Unknown | 42 (9.6) | 41 (9.1) | |

Table 3. Surgical characteristics

| | Country | | <i>P</i> -value |
|---------------------------|-------------------------|-------------------------|-----------------|
| | China (<i>N</i> = 436) | Japan (<i>N</i> = 452) | |
| Surgical procedure | | | |
| Distal gastrectomy | 184 (42.2) | 253 (56.0) | < 0.001 |
| Total gastrectomy | 155 (35.6) | 99 (21.9) | |
| Proximal gastrectomy | 93 (21.3) | 90 (19.9) | |
| Others | 4 (0.9) | 10 (2.2) | |

more patients with early gastric cancer underwent total gastrectomy because of the location of the tumor, while in China, more patients with gastric cancer underwent total gastrectomy because of the size of the tumors. But how much benefit total gastrectomy can bring to patients with advanced gastric cancer remains to be

confirmed.

There are still several limitations in our study. Firstly, due to its retrospective nature, our study may have a selection bias. Moreover, our data do not include operative time, bleeding volume and surgical approach (thoracotomy or laparotomy) to further analysis. Finally,

Table 4. Surgical characteristics patients undergoing total gastrectomy

| | Country | | P-value |
|------------------------|-----------------|----------------|---------|
| | China (N = 155) | Japan (N = 99) | |
| Tumor size (cm) | | | |
| < 4 | 7 (4.5) | 39 (39.4) | < 0.001 |
| 4–7 | 41 (26.5) | 36 (36.4) | |
| > 7 | 107 (69.0) | 24 (24.2) | |
| T stage | | | |
| T1 | 3 (1.9) | 41 (41.4) | < 0.001 |
| T2 | 13 (8.4) | 9 (9.1) | |
| T3 | 60 (38.7) | 32 (32.3) | |
| T4 | 79 (51.0) | 17 (17.2) | |
| N stage | | | |
| N0 | 8 (5.2) | 63 (63.6) | < 0.001 |
| N1 | 15 (9.7) | 10 (10.1) | |
| N2 | 61 (39.3) | 9 (9.1) | |
| N3 | 71 (45.8) | 17 (17.2) | |
| TNM stage | | | |
| I | 6 (3.9) | 48 (48.5) | < 0.001 |
| II | 16 (10.3) | 24 (24.2) | |
| III | 128 (82.6) | 22 (22.2) | |
| IV | 5 (3.2) | 5 (5.1) | |

our study did not include follow-up data and we could not assess the outcomes of treatment.

In conclusion, earlier diagnosis of gastric cancer can improve survival rate. China needs to learn from Japanese experience by establishing some screening programs for the diagnosis and treatment of early gastric cancer. Furthermore, in order to reduce the incidence rate of gastric cancer, it is essential to change the traditional routine and lifestyle in China, especially in the rural areas. Finally, cooperation between Chinese and Japanese doctors is important to improve therapeutic effect of gastric cancer

The authors declare no conflict of interest.

REFERENCES

- 1 Torre LA, Bray F, Siegel RL, Ferlay J, Lortet-Tieulent J, Jemal A. Global cancer statistics, 2012. *CA Cancer J Clin.* 2015;65:87-108. DOI: 10.3322/caac.21262, PMID: 25651787
- 2 Cancer Information Service [Internet]. Tokyo: National Cancer Center Japan [updated 2018 Sep 15; cited 2018 Nov 26]. Projected Cancer Statistics, 2018. Available from: https://ganjoho.jp/en/public/statistics/short_pred.html
- 3 Yang L, Zheng R, Wang N, Yuan Y, Liu S, Li H, et al. Incidence and mortality of stomach cancer in China, 2014. *Chin J Cancer Res.* 2018;30:291-8. DOI: 10.21147/j.issn.1000-9604.2018.03.01, PMID: 30046223
- 4 Van Cutsem E, Sagaert X, Topal B, Haustermans K, Prenen H. Gastric cancer. *Lancet.* 2016;388:2654-64. DOI: 10.1016/S0140-6736(16)30354-3, PMID: 27156933
- 5 Zhang XF, Huang CM, Lu HS, Wu XY, Wang C, Guang GX, et al. Surgical treatment and prognosis of gastric cancer in 2 613 patients. *World J Gastroenterol.* 2004;10:3405-8. DOI: 10.3748/wjg.v10.i23.3405, PMID: 15526356
- 6 Mafune KI. Surgery for advanced gastric cancer. In: Kamini-shi M, Takubo K, Mafune K, editors. The diversity of gastric carcinoma. Tokyo: Springer Japan; 2005. p. 271.
- 7 Wittekind C. The development of the TNM classification of gastric cancer. *Pathol Int.* 2015;65:399-403. DOI: 10.1111/pin.12306, PMID: 26036980
- 8 Lindblad M, Rodríguez LAG, Lagergren J. Body mass, tobacco and alcohol and risk of esophageal, gastric cardia, and gastric non-cardia adenocarcinoma among men and women in a nested case-control study. *Cancer Causes Control.* 2005;16:285-94. DOI: 10.1007/s10552-004-3485-7, PMID: 15947880
- 9 Tsugane S, Sasazuki S, Kobayashi M, Sasaki S. Salt and salted food intake and subsequent risk of gastric cancer among middle-aged Japanese men and women. *Br J Cancer.* 2004;90:128-34. DOI: 10.1038/sj.bjc.6601511, PMID: 14710219

- 10 Yang L. Incidence and mortality of gastric cancer in China. *World J Gastroenterol.* 2006;12:17-20. DOI: [10.3748/wjg.v12.i1.17](https://doi.org/10.3748/wjg.v12.i1.17), PMID: [16440411](https://pubmed.ncbi.nlm.nih.gov/16440411/)
- 11 Ono H. Early gastric cancer: diagnosis, pathology, treatment techniques and treatment outcomes. *Eur J Gastroenterol Hepatol.* 2006;18:863-6. DOI: [10.1097/00042737-200608000-00009](https://doi.org/10.1097/00042737-200608000-00009), PMID: [16825902](https://pubmed.ncbi.nlm.nih.gov/16825902/)
- 12 Rahman R, Asombang AW, Ibdah JA. Characteristics of gastric cancer in Asia. *World J Gastroenterol.* 2014;20:4483-90. DOI: [10.3748/wjg.v20.i16.4483](https://doi.org/10.3748/wjg.v20.i16.4483), PMID: [24782601](https://pubmed.ncbi.nlm.nih.gov/24782601/)
- 13 Redaniel MT, Laudico A, Mirasol-Lumague MR, Gondos A, Pulte D, Mapua C, et al. Cancer survival discrepancies in developed and developing countries: comparisons between the Philippines and the United States. *Br J Cancer.* 2009;100:858-62. DOI: [10.1038/sj.bjc.6604945](https://doi.org/10.1038/sj.bjc.6604945), PMID: [19240723](https://pubmed.ncbi.nlm.nih.gov/19240723/)
- 14 Kuwahara A, Takachi R, Tsubono Y, Sasazuki S, Inoue M, Tsugane S; JPHC Study Group. Socioeconomic status and gastric cancer survival in Japan. *Gastric Cancer.* 2010;13:222-30. DOI: [10.1007/s10120-010-0561-4](https://doi.org/10.1007/s10120-010-0561-4), PMID: [21128057](https://pubmed.ncbi.nlm.nih.gov/21128057/)