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**Appraisal of gastric stump carcinoma and current state of affairs**

Shukla A *et al.* Gastric stump carcinoma

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**Abstract**

Gastric stump carcinoma, also known as remnant gastric carcinoma, is a malignancy arising in the remnant stomach following gastrectomy for a benign or malignant condition. Enterogastric reflux and preexisting risk factors in a patient with gastric cancer are the major contributors to the development of gastric stump carcinoma. The occurrence of gastric stump carcinoma is time-dependent and seen earlier in patients operated on for malignant rather than benign diseases. The tumor location is predominantly at the anastomotic site towards the stomach. However, it can occur anywhere in the remnant stomach. The pattern of lymph node involvement and the type of surgery required is distinctly different compared to primary gastric cancer. Gastric stump carcinoma is traditionally considered a malignancy with a dismal outcome. However, recent advances in diagnostic and therapeutic strategies have improved outcomes. Recent advances in molecular profiling of gastric stump carcinoma have identified distinct molecular subtypes, thereby providing novel therapeutic targets. Also, reports of gastric stump carcinoma following pancreatoduodenectomy and bariatric surgery highlight the need for more research to standardize the diagnosis, staging, and treatment of these tumors. The present review aims to provide an overview of gastric stump carcinoma highlighting the differences in clinicopathological profile and management compared to primary gastric carcinoma.

**Key Words:** Gastric cancer; Gastritis; Carcinoma; Endoscopic surveillance; Gastric stump cancer; Remnant gastric carcinoma

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**Core Tip:** Gastric stump carcinoma is a rare malignancy with many unanswered questions regarding precise staging, molecular subtyping, and surgical management. The spectrum of its incidence is changing due to better medical management of peptic ulcer disease, increased survival of patients with malignancies, and malignancy in gastric stump following various other surgeries. The altered pattern of lymphatic spread deems further research to develop a newer staging system. Endoscopic surveillance with early gastric stump carcinoma detection made endoscopic resection and minimally invasive surgery feasible in selected patients with improved quality of life.

**INTRODUCTION**

Gastric carcinoma, with an incidence of 5.6% and mortality of 7.7%, ranks fifth in incidence and fourth in mortality among all cancers, making it a worldwide health problem[1]. On the other hand, gastric stump or remnant gastric carcinoma is a less common entity and accounts for 2% to 6% of all gastric carcinoma and a pooled prevalence of 2.6%[2,3]. In 1922, Donald Church Balfour, a Canadian surgeon, first observed that patients undergoing gastric surgery for peptic ulcer disease had decreased survival due to the development of malignancy in the remnant stomach[4]. There has been a steady rise in gastric stump carcinoma from 1970 to the late twentieth century[5]. However, with a paradigm shift in the management of peptic ulcers to medical therapy, there is a decrease in the incidence of gastric stump carcinoma following benign disease. Surgical and systemic treatment advances have improved the postoperative survival of gastric carcinoma patients and those with pancreatic cancer who share similar risk factors due to changes in gastrointestinal continuity[5-7]. Also, screening programs for gastric cancer in high-incidence areas allowed early detection and better management of early gastric carcinoma. These factors could potentially increase the incidence of gastric stump carcinoma. Also, reports of gastric stump carcinoma in patients undergoing bariatric surgery could further increase the incidence of gastric stump carcinoma[8,9]. Compared to primary gastric carcinoma, gastric stump carcinoma is usually described as a malignancy with a dismal outcome with low resectability rates. The present review aims to highlight etiopathogenesis, the differences in the clinicopathological features, and the management of gastric stump carcinoma compared to primary gastric carcinoma. Also, recent advances in molecular typing of gastric stump carcinoma might open newer therapeutic options in the future[10].

***Definition***

Various definitions and nomenclature have been used for defining gastric stump carcinoma concerning the type of previous gastric surgery and the interval between the index gastric surgery and the development of malignancy. Some authors describe it as gastric cancer detected more than five years following gastric cancer surgery, while others recommend using a ten-year interval[11,12]. A few included all carcinoma arising in the remnant stomach regardless of the initial disease or duration following previous surgery as gastric stump carcinoma[13]. In Chinese literature, gastric stump carcinoma is defined as new cancer occurring in the residual stomach more than five or ten years after gastrectomy for benign diseases or gastric cancer, respectively[14]. The Japanese literature defines it as cancer in the remnant stomach following gastrectomy for benign disease or gastric cancer at least five years after the primary surgery[15]. As there is no consensus on the definition it is imperative to have uniform definition to address various issues related to gastric stump carcinoma.

***Etiopathogenesis***

Pathogenesis of gastric stump carcinoma is multifactorial and influenced by the indication for index gastric surgery and type of reconstruction[16-20]. Stump carcinoma tends to develop in a shorter period following index gastric surgery for a malignant etiology than benign causes. On average, it takes approximately 300 mo for benign gastroduodenal diseases and 100 mo for gastric cancer to turn into gastric stump carcinoma following primary gastric surgery[5,21]. However, irrespective of the initial gastric pathology, the shorter duration between index gastric surgery and the onset of stump carcinoma worsens the outcome[22-24]. In gastric carcinoma patients with a single lesion during index surgery, the transformation rate to gastric stump carcinoma has been reported to be 1.9% in 4 years[22]. A few studies have shown that Billroth II reconstruction has more preponderance for gastric stump carcinoma than Billroth I reconstruction[18-20]. While gastric stump carcinoma is commonly reported at the anastomotic site, it can occur anywhere in the remnant stomach[25]. Anastomotic site gastric stump carcinoma is common following Billroth II reconstruction, whereas it can occur anywhere in the gastric stump after Billroth I reconstruction[23,25]. However, a meta-analysis and a study from Sweden have documented that reconstruction type does not affect the risk of gastric stump cancer development, highlighting the multifactorial pathways in the genesis of gastric stump carcinoma[26,27].

Various physiological and anatomical alterations after partial gastric resection account for the occurrence of gastric stump carcinoma. Increased enterogastric reflux, and bacterial overgrowth secondary to vagotomy-induced achlorhydria are two dominant factors implicated in the pathogenesis. Bacterial overgrowth reduces dietary nitrates to nitrites resulting in overexposure of gastric mucosa to nitrosamines leading to metaplasia and dysplasia[28,29]. Hypochlorhydria also increases epithelial cell proliferation rendering the mucosa more susceptible to DNA damage[30,31]. Kaminishi *et al*[32] showed that the denervation of gastric mucosa encourages carcinogenesis in a rat model. Miwa *et al*[31], documented that enterogastric reflux has carcinogenic potential in rats. It has been suggested that the hydrophobic nature of bile acids causes stress-induced oxidative DNA damage and reduces DNA repair in epithelial cells[33-35]. Enterogastric reflux changes the physiological environment and pH of the remnant stomach, making it susceptible to Epstein-Barr virus infection and facilitating entry into epithelial cells, which is associated with the development of gastric stump carcinoma[36]. A few studies have documented Epstein-Barr virus infection rate of 22.2% to 41.2% in all patients following distal gastrectomy, with higher incidence following Billroth II compared to Billroth I reconstruction[23,37,38]. Higher frequency of Epstein–Barr virus infection that occurs in gastric stump carcinoma compared to primary gastric cancer is an area of intense research.

The role of *Helicobacter pylori* in gastric stump carcinoma is questionable because gastroduodenal reflux hampers the growth of bacteria in the gastric stump[11,30]. However, some studies suggest that *Helicobacter pylori*-induced gastritis, in combination with bile reflux, stimulates cellular proliferation in the remnant stomach[39,40]. Hence, the role of *Helicobacter pylori* as a risk factor for gastric stump carcinoma remains an area of debate[41]. Attempts have been made to reduce the risk of gastric stump carcinoma by connecting the afferent and efferent limbs of the Billroth II reconstruction distal to gastrojejunostomy (Braun’s anastomosis) to reduce the reflux. However, nuclear studies have revealed that Braun’s anastomosis is inadequate in suppressing the biliopancreatic reflux in the fasting state as well as following fatty meals[42]. Also, the use of Roux-en-Y reconstruction, or placing a jejunal interposition graft, to reduce reflux have reduced but does not entirely eliminate the risk, as cases of gastric stump carcinoma have been reported even after these reconstructions[43-45]. In addition to the aforementioned risk factors, patients who underwent gastrectomy for malignancy have a gastric microenvironment that is already conducive to the development of remnant gastric carcinomas like atrophic gastritis and intestinal metaplasia[2]. Also, patients undergoing proximal gastrectomy for gastric cancer have more risk of gastric stump carcinoma compared to those undergoing distal gastrectomy[22,23].

***Molecular biology***

Detailed molecular characteristics of gastric stump carcinoma remain to be clarified because of its rarity. Studies have shown that Programmed death ligand 1 (PD-L1) expression in gastric stump carcinoma tumor cells is lesser than in primary gastric cancer. However, PDL-1 expression in tumor-infiltrating immune cells is higher in gastric stump carcinoma than in primary gastric cancer[33,46]. In patients with gastro-enteric reconstruction, PD-L1 overexpression in inflammatory cells is aimed at suppressing inflammation. However, it also contributes to the immune escape of tumor cells in patients with gastric stump carcinoma. As the expression of epidermal growth factor and human epidermal growth factor receptor 2 (HER2) is less, HER2-targeted therapy may not frequently be applicable for treating gastric stump carcinoma[46]. Some authors reported that microsatellite instability was more common in gastric stump carcinoma compared to sporadic carcinoma stomach[33]. Also, the inactivation of hMLH1 and hMSH2 is more in Billroth II compared to Billroth I reconstruction[33,34]. Microsatellite instability and high PD-L1 expression suggest immunotherapy's role in managing gastric stump carcinoma. Also, C promoter polymorphism (IL-1B-31T) is associated with gastric stump carcinoma, with the T allele offering protection against gastric stump carcinoma[47]. A comprehensive understanding of molecular characteristics of gastric stump carcinoma may enable the selection of effective treatment options and the development of novel therapeutic strategies.

***Histological transformation***

According to the Lauren classification, two histological types of gastric carcinoma have been identified using hematoxylin and eosin staining, namely diffuse and intestinal type[48]. In gastric stump carcinoma, the histology of the tumor depends upon the location. Patients with tumors at the anastomotic site often have diffuse-type gastric cancer. Biliopancreatic reflux results in adenocystic proliferation of the gastric glands at the anastomotic site leading to a diffuse type of carcinoma[11]. Intestinal type is common in patients with gastric stump carcinoma located other than the anastomotic site. In the body of the remnant stomach, dysplasia ensues, leading to loss of gastric phenotype and resulting in intestinal type of carcinoma, which is attributed to the denervation of the gastric stump[32]. Another salient feature noticed on histology is that adjacent gastric mucosa in gastric stump carcinoma is less atrophic compared to proximal gastric carcinoma patients signifying a difference in the pathogenesis of gastric stump carcinoma[49]. Also, serosal tumor involvement seen in 37% to 48% of patients with remnant gastric carcinoma is significantly higher compared to 19% in proximal gastric carcinoma[50].

***Pattern of lymph node involvement***

The involvement of lymph nodes in gastric stump carcinoma is peculiar due to anatomical changes occurring after the type of primary surgery. Also, the pattern of lymph node spread is influenced by the indication of index gastric surgery. The lymphatic trunks are transected during the primary surgery, altering the lymphatic drainage pathways. Proximal gastric carcinoma normally drains along the celiac artery *via* lesser curvature, left gastric artery, and right cardiac lymph nodes. However, post-primary surgery, the draining pathway is through greater curvature, posterior gastric, and splenic artery lymph nodes[11,16,51]. Tumors in the gastrojejunal anastomotic site tend to have higher jejunal mesentery lymph nodal involvement, which ranges between 7% and 46.8%. Also, they tend to have a higher stage at presentation and poor outcomes[15,52-54]. Overall proportion of patients with splenic hilar node involvement is significantly higher in gastric stump carcinoma compared to primary gastric cancer. Jejunal mesentery lymph node involvement is primarily encountered after Billroth II reconstruction[15,51]. Though mediastinal and paraaortic lymph nodal spread is reported, the exact incidence is not known, as clearance of these nodes is not routine for gastric stump carcinoma[51,55-57].

The total number of lymph nodes harvested following surgery for remnant gastric carcinoma is significantly less than primary gastric carcinoma, especially if the prior surgery was for gastric malignancy, as the nodes would have already been removed. Hence, the lymph node grouping used in the TNM classification for primary gastric carcinoma may not be appropriate for staging remnant gastric carcinoma[58]. Some authors have advocated the use of the lymph node ratio as a better prognostic marker and for selecting adjuvant therapy[58,59]. However, the lymph node ratio determined by dividing the number of positive lymph nodes by the total harvested nodes has different cut-off values in different studies[60-62]. Lack of standardization, primarily due to the limited sample size in the reported studies, limits the widespread use of lymph node ratio in gastric stump carcinoma. Hence, a novel staging system is required for gastric stump carcinoma, which considers the alterations of primary surgery and the type of reconstruction to accurately predict outcomes in these patients.

***Management principles***

The primary treatment of gastric stump carcinoma is radical surgical resection with lymphadenectomy and en bloc resection of involved adjacent organs[63-65]. As it is difficult to differentiate between tumor infiltration and inflammatory adhesions, en bloc resection of the involved adjacent organ is recommended. Most commonly resected adjacent organs are the spleen, transverse colon, jejunum, and distal pancreas[66]. In patients with gastric stump carcinoma following Billroth II reconstruction, a minimum of 10 cm of the jejunum distal to anastomosis is resected along with the ligament of Treitz and jejunal mesentery for better oncological outcomes[66-69]. Stump carcinoma infiltrating the esophagus requires cardiac, infradiaphragmatic, supradiaphragmatic, esophageal hiatal and lower thoracic lymphadenectomy. A few authors recommend splenic and paraaortic lymph node dissection for advanced gastric stump carcinoma when they are involved[51,54,69,70]. However, the standard lymph node dissection in gastric stump carcinoma is yet to be defined. Major factors influencing overall survival in gastric stump carcinoma are T stage, R0 resection and the time interval between primary gastrectomy and remnant gastrectomy[24].

Conventionally, gastric stump carcinoma is managed with open surgical approach. However, recently minimally invasive approaches have been used to resect these tumors. Compared to open surgery, minimally invasive surgery is associated with less blood loss, decreased morbidity, and similar 5 year survival rates[67,68]. Also the feasibility and comparable long term outcomes with endoscopic resection of early gastric stump carcinoma has been recently reported[71]. The overall survival and disease specific survival rates of 87.3% and 100% respectively was reported with endoscopic resection[71].

***Current status of diagnosis***

The poor outcome in patients with gastric stump carcinoma is primarily due to late diagnosis resulting in a presentation at an advanced stage with a poor resectability rate. As symptoms of gastric stump carcinoma are non-specific and often resemble the postgastrectomy symptoms, active endoscopic surveillance is an option for early diagnosis[72-74]. A few authors have suggested annual endoscopic surveillance from one-year post gastric cancer surgery to at least ten years. While surveillance endoscopy has been suggested following gastrectomy for the benign disease, it should be kept in mind that the primary diagnosis of a benign disease makes patients less compliant for future endoscopies[5,75]. Early detection of gastric stump carcinoma does not always require macroscopic lesions. Recent advances in endoscopic diagnostic techniques for diagnosis have resulted in the detection of early gastric carcinoma at an earlier stage, thereby facilitating endoscopic resection[76-80].

***Appraisal of future perspectives***

Several studies have documented en bloc resection and complete resection rates of 91% to 100% and 74% to 94%, respectively, for endoscopic submucosal dissection (Table 1)[71,80-84]. Some authors have tried endoscopic submucosal dissection with insulated tipped diathermic knife with good results, however operative time was more[85]. Comparing endoscopic mucosal dissection to endoscopic mucosal resection the former has significantly higher resection rates[86]. Though endoscopic mucosal dissection is difficult in the upper part of stomach, it have been found to be safe and feasible[87]. Perforation is relatively common after endoscopic gastric stump carcinoma resection and usually occurs at the anastomotic site[84,88]. As previously mentioned minimally invasive approach is increasingly used for gastric stump carcinoma. Studies comparing laparoscopic and open total gastrectomy for stump carcinoma have shown that laparoscopic surgery has less blood loss, more lymph node harvest, early post-operative recovery and lower complication rates[67,68,89-93]. However, all studies reported prolonged operative time compared to open surgery (Table 2). Although 5 year survival rates were equivalent between both groups, most studies had short follow up[67,91,93].

Recently more studies are showing the association of gastric stump carcinoma with various other surgeries like pancreatoduodenectomy, bariatric surgery, and following gastric pull-up, though the numbers are not alarming[7,94-96]. Enterogastric reflux is the primary mechanism. Gastric stump carcinoma post pancreatoduodenectomy usually occurs at the gastrojejunostomy site and is frequently poorly differentiated[96]. Some authors have reported cases of remnant gastric carcinoma even after pylorus preserving pancreatoduodenectomy at the pancreaticogastrostomy site[97]. A few researchers consider pancreatoduodenectomy an emerging risk factor for gastric stump carcinoma as the survival post pancreatic cancer surgery is increasing[7,98]. Sleeve gastrectomy is one of the most common procedures performed for managing morbid obesity. A few studies have reported remnant gastric carcinoma 15 to 25 years after bariatric surgery[8,99]. Gastric stump carcinoma after Roux-en-Y gastric bypass is often reported in the excluded antrum followed by body, pylorus and fundus[45]. As the reported number of gastric stump carcinoma cases post-bariatric surgery is less, more studies are needed to document whether bariatric surgery represents a true risk factor for gastric stump carcinoma. However, it is reasonable to suggest post-bariatric surgery endoscopic surveillance in gastric cancer endemic regions. Well-designed epidemiologic studies are needed to investigate these new associations with gastric stump carcinoma thoroughly.

With the rise of targeted therapy in gastric carcinoma, the interest of researchers has grown in gastric stump carcinoma, too. High incidence of microsatellite instability and PD-L1 expression in gastric stump carcinoma suggests a possible role of immunotherapy in these patients[100,101]. Prevalence of PTEN and SMAD 4 mutations in gastric stump carcinoma could also provide therapeutic targets[101]. The widespread availability of next-generation sequencing could facilitate molecular profiling of gastric stump cancer and the development of novel therapeutic strategies in the future.

**CONCLUSION**

Gastric stump carcinoma will not remain a rare clinical problem and may be more frequently encountered in the future. This entity still needs introspection and research concerning precise definition, appropriate staging and management. Owing to recent advances in diagnostic and therapeutic options, gastric stump carcinoma can be detected early and have survival equivalent to primary gastric carcinoma. Endoscopic management and minimally invasive surgery feasible in selected patients may offer a better quality of life. Recent advances in the molecular biology of gastric stump carcinoma may help to develop novel therapeutic strategies.

**REFERENCES**

1 **Sung H**, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, Bray F. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. *CA Cancer J Clin* 2021; **71**: 209-249 [PMID: 33538338 DOI: 10.3322/caac.21660]

2 **Hanyu T**, Wakai A, Ishikawa T, Ichikawa H, Kameyama H, Wakai T. Carcinoma in the Remnant Stomach During Long-Term Follow-up After Distal Gastrectomy for Gastric Cancer: Analysis of Cumulative Incidence and Associated Risk Factors. *World J Surg* 2018; **42**: 782-787 [PMID: 28924721 DOI: 10.1007/s00268-017-4227-9]

3 **Mak TK**, Guan B, Peng J, Chong TH, Wang C, Huang S, Yang J. Prevalence and characteristics of gastric remnant cancer: A systematic review and meta-analysis. *Asian J Surg* 2021; **44**: 11-17 [PMID: 32253109 DOI: 10.1016/j.asjsur.2020.03.012]

4 **Balfour DC**. FACTORS INFLUENCING THE LIFE EXPECTANCY OF PATIENTS OPERATED ON FOR GASTRIC ULCER. *Ann Surg* 1922; **76**: 405-408 [PMID: 17864703 DOI: 10.1097/00000658-192209000-00014]

5 **Ohashi M**, Katai H, Fukagawa T, Gotoda T, Sano T, Sasako M. Cancer of the gastric stump following distal gastrectomy for cancer. *Br J Surg* 2007; **94**: 92-95 [PMID: 17054314 DOI: 10.1002/bjs.5538]

6 **Fujita T**, Gotohda N, Takahashi S, Nakagohri T, Konishi M, Kinoshita T. Relationship between the histological type of initial lesions and the risk for the development of remnant gastric cancers after gastrectomy for synchronous multiple gastric cancers. *World J Surg* 2010; **34**: 296-302 [PMID: 20012285 DOI: 10.1007/s00268-009-0325-7]

7 **Bouquot M**, Dokmak S, Barbier L, Cros J, Levy P, Sauvanet A. Gastric stump carcinoma as a long-term complication of pancreaticoduodenectomy: report of two cases and review of the English literature. *BMC Gastroenterol* 2017; **17**: 117 [PMID: 29166862 DOI: 10.1186/s12876-017-0682-x]

8 **De Roover A**, Detry O, Desaive C, Maweja S, Coimbra C, Honoré P, Meurisse M. Risk of upper gastrointestinal cancer after bariatric operations. *Obes Surg* 2006; **16**: 1656-1661 [PMID: 17217643 DOI: 10.1381/096089206779319419]

9 **Nakayoshi T**, Tajiri H, Matsuda K, Kaise M, Ikegami M, Sasaki H. Magnifying endoscopy combined with narrow band imaging system for early gastric cancer: correlation of vascular pattern with histopathology (including video). *Endoscopy* 2004; **36**: 1080-1084 [PMID: 15578298 DOI: 10.1055/s-2004-825961]

10 **Ramos MFKP**, Pereira MA, de Castria TB, Ribeiro RRE, Cardili L, de Mello ES, Zilberstein B, Ribeiro-Júnior U, Cecconello I. Remnant gastric cancer: a neglected group with high potential for immunotherapy. *J Cancer Res Clin Oncol* 2020; **146**: 3373-3383 [PMID: 32671505 DOI: 10.1007/s00432-020-03322-7]

11 **Sinning C**, Schaefer N, Standop J, Hirner A, Wolff M. Gastric stump carcinoma - epidemiology and current concepts in pathogenesis and treatment. *Eur J Surg Oncol* 2007; **33**: 133-139 [PMID: 17071041 DOI: 10.1016/j.ejso.2006.09.006]

12 **Ahn HS**, Kim JW, Yoo MW, Park DJ, Lee HJ, Lee KU, Yang HK. Clinicopathological features and surgical outcomes of patients with remnant gastric cancer after a distal gastrectomy. *Ann Surg Oncol* 2008; **15**: 1632-1639 [PMID: 18379851 DOI: 10.1245/s10434-008-9871-8]

13 **Lu J**, Huang CM, Zheng CH, Li P, Xie JW, Wang JB, Lin JX, Chen QY, Cao LL, Lin M. Prognostic value of tumor size in patients with remnant gastric cancer: is the seventh UICC stage sufficient for predicting prognosis? *PLoS One* 2014; **9**: e115776 [PMID: 25549339 DOI: 10.1371/journal.pone.0115776]

14 **Gao Z**, Jiang K, Ye Y, Wang S. [Interpretation on Chinese surgeons' consensus opinion for the definition of gastric stump cancer (version 2018)]. *Zhonghua Wei Chang Wai Ke Za Zhi* 2018; **21**: 486-490 [PMID: 29774927]

15 **Shimada H**, Fukagawa T, Haga Y, Oba K. Does remnant gastric cancer really differ from primary gastric cancer? A systematic review of the literature by the Task Force of Japanese Gastric Cancer Association. *Gastric Cancer* 2016; **19**: 339-349 [PMID: 26667370 DOI: 10.1007/s10120-015-0582-0]

16 **Sasako M**, Maruyama K, Kinoshita T, Okabayashi K. Surgical treatment of carcinoma of the gastric stump. *Br J Surg* 1991; **78**: 822-824 [PMID: 1873711 DOI: 10.1002/bjs.1800780718]

17 **Newman E**, Brennan MF, Hochwald SN, Harrison LE, Karpeh MS Jr. Gastric remnant carcinoma: just another proximal gastric cancer or a unique entity? *Am J Surg* 1997; **173**: 292-297 [PMID: 9136783 DOI: 10.1016/S0002-9610(96)00403-5]

18 **Yamamoto M**, Yamanaka T, Baba H, Kakeji Y, Maehara Y. The postoperative recurrence and the occurrence of second primary carcinomas in patients with early gastric carcinoma. *J Surg Oncol* 2008; **97**: 231-235 [PMID: 18095298 DOI: 10.1002/jso.20946]

19 **Caygill CP**, Hill MJ, Kirkham JS, Northfield TC. Mortality from gastric cancer following gastric surgery for peptic ulcer. *Lancet* 1986; **1**: 929-931 [PMID: 2871238 DOI: 10.1016/s0140-6736(86)91041-x]

20 **Toftgaard C**. Gastric cancer after peptic ulcer surgery. A historic prospective cohort investigation. *Ann Surg* 1989; **210**: 159-164 [PMID: 2757419 DOI: 10.1097/00000658-198908000-00004]

21 **Komatsu S**, Ichikawa D, Okamoto K, Ikoma D, Tsujiura M, Nishimura Y, Murayama Y, Shiozaki A, Ikoma H, Kuriu Y, Nakanishi M, Fujiwara H, Ochiai T, Kokuba Y, Otsuji E. Progression of remnant gastric cancer is associated with duration of follow-up following distal gastrectomy. *World J Gastroenterol* 2012; **18**: 2832-2836 [PMID: 22719193 DOI: 10.3748/wjg.v18.i22.2832]

22 **Nozaki I**, Hato S, Kobatake T, Ohta K, Kubo Y, Nishimura R, Kurita A. Incidence of metachronous gastric cancer in the remnant stomach after synchronous multiple cancer surgery. *Gastric Cancer* 2014; **17**: 61-66 [PMID: 23624766 DOI: 10.1007/s10120-013-0261-y]

23 **Tanigawa N**, Nomura E, Lee SW, Kaminishi M, Sugiyama M, Aikou T, Kitajima M; Society for the Study of Postoperative Morbidity after Gastrectomy. Current state of gastric stump carcinoma in Japan: based on the results of a nationwide survey. *World J Surg* 2010; **34**: 1540-1547 [PMID: 20182716 DOI: 10.1007/s00268-010-0505-5]

24 **Ozgun YM,** Oter V, Piskin E, Colakoglu MK, Aydin O, Surel AA, Aksoy E, Bostanci EB. Is complete resection has a better survival in remnant gastric cancer and what are the prognositic factors affecting these results? *Indian J Surg* 2022; **84**: 55–62 [DOI: 10.1007/s12262-021-02801-6]

25 **Takeno S**, Noguchi T, Kimura Y, Fujiwara S, Kubo N, Kawahara K. Early and late gastric cancer arising in the remnant stomach after distal gastrectomy. *Eur J Surg Oncol* 2006; **32**: 1191-1194 [PMID: 16797159 DOI: 10.1016/j.ejso.2006.04.018]

26 **Tersmette AC**, Offerhaus GJ, Tersmette KW, Giardiello FM, Moore GW, Tytgat GN, Vandenbroucke JP. Meta-analysis of the risk of gastric stump cancer: detection of high risk patient subsets for stomach cancer after remote partial gastrectomy for benign conditions. *Cancer Res* 1990; **50**: 6486-6489 [PMID: 2145061]

27 **Lagergren J**, Lindam A, Mason RM. Gastric stump cancer after distal gastrectomy for benign gastric ulcer in a population-based study. *Int J Cancer* 2012; **131**: E1048-E1052 [PMID: 22532306 DOI: 10.1002/ijc.27614]

28 **Safatle-Ribeiro AV**, Ribeiro Júnior U, Sakai P, Iriya K, Ishioka S, Gama-Rodrigues J. Gastric stump mucosa: is there a risk for carcinoma? *Arq Gastroenterol* 2001; **38**: 227-231 [PMID: 12068532 DOI: 10.1590/s0004-28032001000400004]

29 **Sitarz R**, Maciejewski R, Polkowski WP, Offerhaus GJ. Gastroenterostoma after Billroth antrectomy as a premalignant condition. *World J Gastroenterol* 2012; **18**: 3201-3206 [PMID: 22783043 DOI: 10.3748/wjg.v18.i25.3201]

30 **Păduraru DN**, Nica A, Ion D, Handaric M, Andronic O. Considerations on risk factors correlated to the occurrence of gastric stump cancer. *J Med Life* 2016; **9**: 130-136 [PMID: 27453741]

31 **Miwa K**, Hasegawa H, Fujimura T, Matsumoto H, Miyata R, Kosaka T, Miyazaki I, Hattori T. Duodenal reflux through the pylorus induces gastric adenocarcinoma in the rat. *Carcinogenesis* 1992; **13**: 2313-2316 [PMID: 1473239 DOI: 10.1093/carcin/13.12.2313]

32 **Kaminishi M**, Shimizu N, Shiomoyama S, Yamaguchi H, Ogawa T, Sakai S, Kuramoto S, Oohara T. Etiology of gastric remnant cancer with special reference to the effects of denervation of the gastric mucosa. *Cancer* 1995; **75**: 1490-1496 [PMID: 7889480 DOI: 10.1002/1097-0142(19950315)75:6+<1490::aid-cncr2820751518>3.0.co;2-3]

33 **Aya M**, Yashiro M, Nishioka N, Onoda N, Hirakawa K. Carcinogenesis in the remnant stomach following distal gastrectomy with billroth II reconstruction is associated with high-level microsatellite instability. *Anticancer Res* 2006; **26**: 1403-1411 [PMID: 16619551]

34 **Nakachi A**, Miyazato H, Shimoji H, Hiroyasu S, Isa T, Shiraishi M, Muto Y. Microsatellite instability in patients with gastric remnant cancer. *Gastric Cancer* 1999; **2**: 210-214 [PMID: 11957100 DOI: 10.1007/s101200050065]

35 **Payne CM**, Bernstein C, Dvorak K, Bernstein H. Hydrophobic bile acids, genomic instability, Darwinian selection, and colon carcinogenesis. *Clin Exp Gastroenterol* 2008; **1**: 19-47 [PMID: 21677822 DOI: 10.2147/ceg.s4343]

36 **Lu C**, Zhang H, Zhou W, Wan X, Li L, Yu C. Epstein-Barr virus infection and genome polymorphisms on gastric remnant carcinoma: a meta-analysis. *Cancer Cell Int* 2020; **20**: 401 [PMID: 32843851 DOI: 10.1186/s12935-020-01498-z]

37 **Nishikawa J**, Yanai H, Hirano A, Okamoto T, Nakamura H, Matsusaki K, Kawano T, Miura O, Okita K. High prevalence of Epstein-Barr virus in gastric remnant carcinoma after Billroth-II reconstruction. *Scand J Gastroenterol* 2002; **37**: 825-829 [PMID: 12190097 DOI: 10.1080/gas.37.7.825.829]

38 **Kaizaki Y**, Hosokawa O, Sakurai S, Fukayama M. Epstein-Barr virus-associated gastric carcinoma in the remnant stomach: de novo and metachronous gastric remnant carcinoma. *J Gastroenterol* 2005; **40**: 570-577 [PMID: 16007390 DOI: 10.1007/s00535-005-1590-3]

39 **Seoane A**, Bessa X, Alameda F, Munné A, Gallen M, Navarro S, O'Callaghan E, Panadès A, Andreu M, Bory F. Role of Helicobacter pylori in stomach cancer after partial gastrectomy for benign ulcer disease. *Rev Esp Enferm Dig* 2005; **97**: 778-785 [PMID: 16438621 DOI: 10.4321/s1130-01082005001100002]

40 **Leivonen M**, Nordling S, Haglund C. Does Helicobacter pylori in the gastric stump increase the cancer risk after certain reconstruction types? *Anticancer Res* 1997; **17**: 3893-3896 [PMID: 9427799]

41 **Lynch DA**, Mapstone NP, Clarke AM, Jackson P, Dixon MF, Quirke P, Axon AT. Cell proliferation in the gastric corpus in Helicobacter pylori associated gastritis and after gastric resection. *Gut* 1995; **36**: 351-353 [PMID: 7698691 DOI: 10.1136/gut.36.3.351]

42 **Vogel SB**, Drane WE, Woodward ER. Clinical and radionuclide evaluation of bile diversion by Braun enteroenterostomy: prevention and treatment of alkaline reflux gastritis. An alternative to Roux-en-Y diversion. *Ann Surg* 1994; **219**: 458-65; discussion 465-6 [PMID: 8185396 DOI: 10.1097/00000658-199405000-00003]

43 **Chan DC**, Fan YM, Lin CK, Chen CJ, Chen CY, Chao YC. Roux-en-Y reconstruction after distal gastrectomy to reduce enterogastric reflux and Helicobacter pylori infection. *J Gastrointest Surg* 2007; **11**: 1732-1740 [PMID: 17876675 DOI: 10.1007/s11605-007-0302-0]

44 **Hollands MJ**, Filipe I, Edwards S, Brame K, Maisey M, Owen WJ. Clinical and histological sequelae of Roux-en-Y diversion. *Br J Surg* 1989; **76**: 481-484 [PMID: 2736362 DOI: 10.1002/bjs.1800760518]

45 **Tornese S**, Aiolfi A, Bonitta G, Rausa E, Guerrazzi G, Bruni PG, Micheletto G, Bona D. Remnant Gastric Cancer After Roux-en-Y Gastric Bypass: Narrative Review of the Literature. *Obes Surg* 2019; **29**: 2609-2613 [PMID: 31001760 DOI: 10.1007/s11695-019-03892-7]

46 **Tanigawa H**, Uesugi H, Mitomi H, Saigenji K, Okayasu I. Possible association of active gastritis, featuring accelerated cell turnover and p53 overexpression, with cancer development at anastomoses after gastrojejunostomy. Comparison with gastroduodenostomy. *Am J Clin Pathol* 2000; **114**: 354-363 [PMID: 10989635 DOI: 10.1093/ajcp/114.3.354]

47 **Sitarz R**, de Leng WW, Polak M, Morsink FH, Bakker O, Polkowski WP, Maciejewski R, Offerhaus GJ, Milne AN. IL-1B -31T>C promoter polymorphism is associated with gastric stump cancer but not with early onset or conventional gastric cancers. *Virchows Arch* 2008; **453**: 249-255 [PMID: 18688641 DOI: 10.1007/s00428-008-0642-5]

48 **Lauren P**. The two histological main types of gastric carcinoma: Diffuse and so-called intestinal-type carcinoma. An attempt at a HISTO-clinical classification. *Acta Pathol Microbiol Scand* 1965; **64**: 31-49 [PMID: 14320675 DOI: 10.1111/apm.1965.64.1.31]

49 **Sasaki K**, Fujiwara Y, Kishi K, Motoori M, Yano M, Ohigashi H, Ohue M, Noura S, Maruhashi S, Takahashi H, Gotoh K, Shingai T, Yamamoto T, Tomita Y, Ishikawa O. Pathological findings of gastric mucosa in patients with gastric remnant cancer. *Hepatogastroenterology* 2014; **61**: 251-254 [PMID: 24895831]

50 **Tokunaga M**, Sano T, Ohyama S, Hiki N, Fukunaga T, Yamada K, Yamaguchi T. Clinicopathological characteristics and survival difference between gastric stump carcinoma and primary upper third gastric cancer. *J Gastrointest Surg* 2013; **17**: 313-318 [PMID: 23233273 DOI: 10.1007/s11605-012-2114-0]

51 **Han SL**, Hua YW, Wang CH, Ji SQ, Zhuang J. Metastatic pattern of lymph node and surgery for gastric stump cancer. *J Surg Oncol* 2003; **82**: 241-246 [PMID: 12672008 DOI: 10.1002/jso.10228]

52 **Chowdappa R**, Tiwari AR, Ranganath N, Kumar RV. Is there difference between anastomotic site and remnant stump carcinoma in gastric stump cancers?-a single institute analysis of 90 patients. *J Gastrointest Oncol* 2019; **10**: 307-313 [PMID: 31032099 DOI: 10.21037/jgo.2018.12.03]

53 **Di Leo A**, Pedrazzani C, Bencivenga M, Coniglio A, Rosa F, Morgani P, Marrelli D, Marchet A, Cozzaglio L, Giacopuzzi S, Tiberio GA, Doglietto GB, Vittimberga G, Roviello F, Ricci F. Gastric stump cancer after distal gastrectomy for benign disease: clinicopathological features and surgical outcomes. *Ann Surg Oncol* 2014; **21**: 2594-2600 [PMID: 24639193 DOI: 10.1245/s10434-014-3633-6]

54 **Komatsu S**, Ichikawa D, Okamoto K, Ikoma D, Tsujiura M, Shiozaki A, Fujiwara H, Murayama Y, Kuriu Y, Ikoma H, Nakanishi M, Ochiai T, Kokuba Y, Otsuji E. Differences of the lymphatic distribution and surgical outcomes between remnant gastric cancers and primary proximal gastric cancers. *J Gastrointest Surg* 2012; **16**: 503-508 [PMID: 22215245 DOI: 10.1007/s11605-011-1804-3]

55 **Ohashi M**, Morita S, Fukagawa T, Kushima R, Katai H. Surgical treatment of non-early gastric remnant carcinoma developing after distal gastrectomy for gastric cancer. *J Surg Oncol* 2015; **111**: 208-212 [PMID: 25175816 DOI: 10.1002/jso.23774]

56 **Li F**, Zhang R, Liang H, Liu H, Quan J, Zhao J. The pattern of lymph node metastasis and the suitability of 7th UICC N stage in predicting prognosis of remnant gastric cancer. *J Cancer Res Clin Oncol* 2012; **138**: 111-117 [PMID: 22048654 DOI: 10.1007/s00432-011-1034-9]

57 **Yonemura Y**, Ninomiya I, Tsugawa K, Masumoto H, Takamura H, Fushida S, Yamaguchi A, Miwa K, Miyazaki I. Lymph node metastases from carcinoma of the gastric stump. *Hepatogastroenterology* 1994; **41**: 248-252 [PMID: 7959547]

58 **Wang H**, Qi H, Liu X, Gao Z, Hidasa I, Aikebaier A, Li K. Positive lymph node ratio is an index in predicting prognosis for remnant gastric cancer with insufficient retrieved lymph node in R0 resection. *Sci Rep* 2021; **11**: 2022 [PMID: 33479327 DOI: 10.1038/s41598-021-81663-0]

59 **Costa-Pinho A**, Pinto-de-Sousa J, Barbosa J, Costa-Maia J. Gastric stump cancer: more than just another proximal gastric cancer and demanding a more suitable TNM staging system. *Biomed Res Int* 2013; **2013**: 781896 [PMID: 24151622 DOI: 10.1155/2013/781896]

60 **Deng J**, Liang H, Wang D, Sun D, Ding X, Pan Y, Liu X. Enhancement the prediction of postoperative survival in gastric cancer by combining the negative lymph node count with ratio between positive and examined lymph nodes. *Ann Surg Oncol* 2010; **17**: 1043-1051 [PMID: 20039218 DOI: 10.1245/s10434-009-0863-0]

61 **Son SY**, Kong SH, Ahn HS, Park YS, Ahn SH, Suh YS, Park DJ, Lee HJ, Kim HH, Yang HK. The value of N staging with the positive lymph node ratio, and splenectomy, for remnant gastric cancer: A multicenter retrospective study. *J Surg Oncol* 2017; **116**: 884-893 [PMID: 28650587 DOI: 10.1002/jso.24737]

62 **Nakagawa M**, Choi YY, An JY, Hong JH, Kim JW, Kim HI, Cheong JH, Hyung WJ, Choi SH, Noh SH. Staging for Remnant Gastric Cancer: The Metastatic Lymph Node Ratio vs. the UICC 7th Edition System. *Ann Surg Oncol* 2016; **23**: 4322-4331 [PMID: 27370654 DOI: 10.1245/s10434-016-5390-1]

63 **Thorban S**, Böttcher K, Etter M, Roder JD, Busch R, Siewert JR. Prognostic factors in gastric stump carcinoma. *Ann Surg* 2000; **231**: 188-194 [PMID: 10674609 DOI: 10.1097/00000658-200002000-00006]

64 **Mezhir JJ**, Gonen M, Ammori JB, Strong VE, Brennan MF, Coit DG. Treatment and outcome of patients with gastric remnant cancer after resection for peptic ulcer disease. *Ann Surg Oncol* 2011; **18**: 670-676 [PMID: 21063791 DOI: 10.1245/s10434-010-1425-1]

65 **Li F**, Zhang R, Liang H, Zhao J, Liu H, Quan J, Wang X, Xue Q. A retrospective clinicopathologic study of remnant gastric cancer after distal gastrectomy. *Am J Clin Oncol* 2013; **36**: 244-249 [PMID: 22495457 DOI: 10.1097/COC.0b013e3182467ebd]

66 **Nakafusa Y**, Tanaka T, Tanaka M, Kitajima Y, Sato S, Miyazaki K. Comparison of multivisceral resection and standard operation for locally advanced colorectal cancer: analysis of prognostic factors for short-term and long-term outcome. *Dis Colon Rectum* 2004; **47**: 2055-2063 [PMID: 15657654 DOI: 10.1007/s10350-004-0716-7]

67 **Kwon IG**, Cho I, Guner A, Choi YY, Shin HB, Kim HI, An JY, Cheong JH, Noh SH, Hyung WJ. Minimally invasive surgery for remnant gastric cancer: a comparison with open surgery. *Surg Endosc* 2014; **28**: 2452-2458 [PMID: 24622766 DOI: 10.1007/s00464-014-3496-8]

68 **Booka E**, Kaihara M, Mihara K, Nishiya S, Handa K, Ito Y, Shibutani S, Egawa T, Nagashima A. Laparoscopic total gastrectomy for remnant gastric cancer: A single-institution experience. *Asian J Endosc Surg* 2019; **12**: 58-63 [PMID: 29745474 DOI: 10.1111/ases.12495]

69 **Kunisaki C**, Shimada H, Nomura M, Hosaka N, Akiyama H, Ookubo K, Moriwaki Y, Yamaoka H. Lymph node dissection in surgical treatment for remnant stomach cancer. *Hepatogastroenterology* 2002; **49**: 580-584 [PMID: 11995502]

70 **Watanabe M**, Kinoshita T, Morita S, Yura M, Tokunaga M, Otsuki S, Yamagata Y, Kaito A, Yoshikawa T, Katai H. Clinical impact of splenic hilar dissection with splenectomy for gastric stump cancer. *Eur J Surg Oncol* 2019; **45**: 1505-1510 [PMID: 30940422 DOI: 10.1016/j.ejso.2019.03.030]

71 **Nonaka S**, Oda I, Makazu M, Haruyama S, Abe S, Suzuki H, Yoshinaga S, Nakajima T, Kushima R, Saito Y. Endoscopic submucosal dissection for early gastric cancer in the remnant stomach after gastrectomy. *Gastrointest Endosc* 2013; **78**: 63-72 [PMID: 23566640 DOI: 10.1016/j.gie.2013.02.006]

72 **Orlando R 3rd**, Welch JP. Carcinoma of the stomach after gastric operation. *Am J Surg* 1981; **141**: 487-491 [PMID: 6164300 DOI: 10.1016/0002-9610(81)90145-8]

73 **Ovaska JT**, Havia TV, Kujari HP. Retrospective analysis of gastric stump carcinoma patients treated during 1946-1981. *Acta Chir Scand* 1986; **152**: 199-204 [PMID: 3716739]

74 **Kodera Y**, Yamamura Y, Torii A, Uesaka K, Hirai T, Yasui K, Morimoto T, Kato T, Kito T. Gastric stump carcinoma after partial gastrectomy for benign gastric lesion: what is feasible as standard surgical treatment? *J Surg Oncol* 1996; **63**: 119-124 [PMID: 8888805 DOI: 10.1002/(SICI)1096-9098(199610)63:2<119::AID-JSO9>3.0.CO;2-H]

75 **Ojima T**, Iwahashi M, Nakamori M, Nakamura M, Naka T, Katsuda M, Iida T, Tsuji T, Hayata K, Takifuji K, Yamaue H. Clinicopathological characteristics of remnant gastric cancer after a distal gastrectomy. *J Gastrointest Surg* 2010; **14**: 277-281 [PMID: 19911236 DOI: 10.1007/s11605-009-1090-5]

76 **Hosokawa O**, Kaizaki Y, Watanabe K, Hattori M, Douden K, Hayashi H, Maeda S. Endoscopic surveillance for gastric remnant cancer after early cancer surgery. *Endoscopy* 2002; **34**: 469-473 [PMID: 12048630 DOI: 10.1055/s-2002-32007]

77 **Pointner R**, Schwab G, Königsrainer A, Bodner E, Schmid KW. Early cancer of the gastric remnant. *Gut* 1988; **29**: 298-301 [PMID: 3356360 DOI: 10.1136/gut.29.3.298]

78 **Sowa M**, Onoda N, Nakanishi I, Maeda K, Yoshikawa K, Kato Y, Chung YS. Early stage carcinoma of the gastric remnant in Japan. *Anticancer Res* 1993; **13**: 1835-1838 [PMID: 8267389]

79 **Podzimek A**, Valenta J, Novák V, Fessl V, Klecka J, Opatrný K, Karlícek V, Topolcan O, Petrácková E. [Experience with renal transplantation (author's transl)]. *Cas Lek Cesk* 1975; **114**: 1115-1121 [PMID: 1102091]

80 **Nishide N**, Ono H, Kakushima N, Takizawa K, Tanaka M, Matsubayashi H, Yamaguchi Y. Clinical outcomes of endoscopic submucosal dissection for early gastric cancer in remnant stomach or gastric tube. *Endoscopy* 2012; **44**: 577-583 [PMID: 22402983 DOI: 10.1055/s-0031-1291712]

81 **Tanigawa N**, Nomura E, Niki M, Shinohara H, Nishiguchi K, Okuzawa M, Toyoda M, Morita S. Clinical study to identify specific characteristics of cancer newly developed in the remnant stomach. *Gastric Cancer* 2002; **5**: 23-28 [PMID: 12021856 DOI: 10.1007/s101200200003]

82 **An JY**, Choi MG, Noh JH, Sohn TS, Kim S. The outcome of patients with remnant primary gastric cancer compared with those having upper one-third gastric cancer. *Am J Surg* 2007; **194**: 143-147 [PMID: 17618792 DOI: 10.1016/j.amjsurg.2006.10.034]

83 **Schaefer N**, Sinning C, Standop J, Overhaus M, Hirner A, Wolff M. Treatment and prognosis of gastric stump carcinoma in comparison with primary proximal gastric cancer. *Am J Surg* 2007; **194**: 63-67 [PMID: 17560911 DOI: 10.1016/j.amjsurg.2006.12.037]

84 **Takenaka R**, Kawahara Y, Okada H, Tsuzuki T, Yagi S, Kato J, Ohara N, Yoshino T, Imagawa A, Fujiki S, Takata R, Nakagawa M, Mizuno M, Inaba T, Toyokawa T, Sakaguchi K. Endoscopic submucosal dissection for cancers of the remnant stomach after distal gastrectomy. *Gastrointest Endosc* 2008; **67**: 359-363 [PMID: 18226704 DOI: 10.1016/j.gie.2007.10.021]

85 **Hirasaki S**, Kanzaki H, Matsubara M, Fujita K, Matsumura S, Suzuki S. Treatment of gastric remnant cancer post distal gastrectomy by endoscopic submucosal dissection using an insulation-tipped diathermic knife. *World J Gastroenterol* 2008; **14**: 2550-2555 [PMID: 18442204 DOI: 10.3748/wjg.14.2550]

86 **Hoteya S**, Iizuka T, Kikuchi D, Yahagi N. Clinical advantages of endoscopic submucosal dissection for gastric cancers in remnant stomach surpass conventional endoscopic mucosal resection. *Dig Endosc* 2010; **22**: 17-20 [PMID: 20078659 DOI: 10.1111/j.1443-1661.2009.00912.x]

87 **Lee JY**, Choi IJ, Cho SJ, Kim CG, Kook MC, Lee JH, Ryu KW, Kim YW. Endoscopic submucosal dissection for metachronous tumor in the remnant stomach after distal gastrectomy. *Surg Endosc* 2010; **24**: 1360-1366 [PMID: 19997930 DOI: 10.1007/s00464-009-0779-6]

88 **Tanaka S**, Toyonaga T, Morita Y, Fujita T, Yoshizaki T, Kawara F, Wakahara C, Obata D, Sakai A, Ishida T, Ikehara N, Azuma T. Endoscopic submucosal dissection for early gastric cancer in anastomosis site after distal gastrectomy. *Gastric Cancer* 2014; **17**: 371-376 [PMID: 23868403 DOI: 10.1007/s10120-013-0283-5]

89 **Otsuka R**, Hayashi H, Sakata H, Uesato M, Hayano K, Murakami K, Kano M, Fujishiro T, Toyozumi T, Semba Y, Matsubara H. Short-term clinical outcomes of laparoscopic gastrectomy for remnant gastric cancer: A single-institution experience and systematic review of the literature. *Ann Gastroenterol Surg* 2019; **3**: 181-186 [PMID: 30923787 DOI: 10.1002/ags3.12221]

90 **Kim HS**, Kim BS, Lee IS, Lee S, Yook JH, Kim BS. Laparoscopic gastrectomy in patients with previous gastrectomy for gastric cancer: a report of 17 cases. *Surg Laparosc Endosc Percutan Tech* 2014; **24**: 177-182 [PMID: 24686356 DOI: 10.1097/SLE.0b013e31828f6bfb]

91 **Nagai E**, Nakata K, Ohuchida K, Miyasaka Y, Shimizu S, Tanaka M. Laparoscopic total gastrectomy for remnant gastric cancer: feasibility study. *Surg Endosc* 2014; **28**: 289-296 [PMID: 24013469 DOI: 10.1007/s00464-013-3186-y]

92 **Tsunoda S**, Okabe H, Tanaka E, Hisamori S, Harigai M, Murakami K, Sakai Y. Laparoscopic gastrectomy for remnant gastric cancer: a comprehensive review and case series. *Gastric Cancer* 2016; **19**: 287-292 [PMID: 25503677 DOI: 10.1007/s10120-014-0451-2]

93 **Son SY**, Lee CM, Jung DH, Lee JH, Ahn SH, Park DJ, Kim HH. Laparoscopic completion total gastrectomy for remnant gastric cancer: a single-institution experience. *Gastric Cancer* 2015; **18**: 177-182 [PMID: 24477417 DOI: 10.1007/s10120-014-0339-1]

94 **Orlando G**, Pilone V, Vitiello A, Gervasi R, Lerose MA, Silecchia G, Puzziello A. Gastric cancer following bariatric surgery: a review. *Surg Laparosc Endosc Percutan Tech* 2014; **24**: 400-405 [PMID: 25238176 DOI: 10.1097/SLE.0000000000000050]

95 **Dunn LJ**, Shenfine J, Griffin SM. Columnar metaplasia in the esophageal remnant after esophagectomy: a systematic review. *Dis Esophagus* 2015; **28**: 32-41 [PMID: 24224923 DOI: 10.1111/dote.12129]

96 **Kassahun WT**, Lamesch P, Wittekind C, Neid M, Schneider JP, Mössner J, Hauss J. Signet-ring cell carcinoma arising in the gastric stump after duodenopancreatectomy for ductal adenocarcinoma of the pancreas: a case report. *Clin Med Oncol* 2008; **2**: 109-112 [PMID: 21892272 DOI: 10.4137/cmo.s384]

97 **Mihara Y**, Kubota K, Nemoto T, Rokkaku K, Yamamoto S, Tachibana M, Sakuma A, Ohkura Y, Fujimori T. Gastric cancer developing in the stomach after pylorus-preserving pancreaticoduodenectomy with pancreaticogastrostomy: case report and review of the literature. *J Gastrointest Surg* 2005; **9**: 498-502 [PMID: 15797230 DOI: 10.1016/j.gassur.2004.10.007]

98 **Pflüger MJ**, Felsenstein M, Schmocker R, Wood LD, Hruban R, Fujikura K, Rozich N, van Oosten F, Weiss M, Burns W, Yu J, Cameron J, Pratschke J, Wolfgang CL, He J, Burkhart RA. Gastric cancer following pancreaticoduodenectomy: Experience from a high-volume center and review of existing literature. *Surg Open Sci* 2020; **2**: 32-40 [PMID: 32954246 DOI: 10.1016/j.sopen.2020.06.003]

99 **Angrisani L**, Santonicola A, Iovino P, Vitiello A, Zundel N, Buchwald H, Scopinaro N. Bariatric Surgery and Endoluminal Procedures: IFSO Worldwide Survey 2014. *Obes Surg* 2017; **27**: 2279-2289 [PMID: 28405878 DOI: 10.1007/s11695-017-2666-x]

100 **Kuboki Y**, Yamashita S, Niwa T, Ushijima T, Nagatsuma A, Kuwata T, Yoshino T, Doi T, Ochiai A, Ohtsu A. Comprehensive analyses using next-generation sequencing and immunohistochemistry enable precise treatment in advanced gastric cancer. *Ann Oncol* 2016; **27**: 127-133 [PMID: 26489445 DOI: 10.1093/annonc/mdv508]

101 **Watanabe M**, Kuwata T, Setsuda A, Tokunaga M, Kaito A, Sugita S, Tonouchi A, Kinoshita T, Nagino M. Molecular and pathological analyses of gastric stump cancer by next-generation sequencing and immunohistochemistry. *Sci Rep* 2021; **11**: 4165 [PMID: 33603111 DOI: 10.1038/s41598-021-83711-1]

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**Table 1 Summary of endoscopic submucosal dissection for early gastric stump carcinoma, *n* (%)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Ref.** | **Number of patients (number of lesion)** | ***En bloc* resection** | **Complete resection** | **Perforation** | **Bleeding** |
| Takenaka *et al*[91], 2008 | 31 | 30 (97) | 23 (74) | 4 (13) | 0 |
| Hirasaki *et al*[92], 2008 | 17 | 17 (100) | 14 (82) | 0 | 3 (18) |
| Hoteya *et al*[93],2010 | 40 | - | 38 (95) | 1 (2.5) | 2 (5) |
| Lee *et al*[94], 2010 | 13 | 13 (100) | 12 (92.3) | 0 | 0 |
| Nonaka *et al*[78], 2013 | 139 | 131 (94) | 118 (85) | 2 (14) | 2 (14) |
| Tanaka *et al*[95], 2013 | 33 | 33 (100) | 31 (94) | 3 (9) | 1(3) |
| Nishide *et al*[87], 2012 | 58 (62) | 59 (95) | 53 (85) | 11 (18) | 5 (8) |

**Table 2 Overview of minimally invasive and open surgery for gastric stump carcinoma**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Ref.** | **Country** | **No of patients (Lap/open/robotic)** | **Operative time (Lap/open)** | **Blood loss (Lap/open)** | **Postoperative hospital stay (Lap/open)** | **Conversion to open** | **Number of lymph nodes retrieved (Lap/open)** |
| Son *et al*[100], 2013 | Korea | 17/17/0 | 234.4/170 minutes | 227.6/184.1 ml | 9.3/9.3 days | 8 | 18.8/22.3 |
| Nagai *et al*[98], 2014 | Japan | 12/10/0 | 362.3/270.5 minutes | 65.8/746.3 ml | 11.3/24.9 days | NA | 23.7/15.9 |
| Kwon *et al*[74],2014 | Korea | 10/58/8 | 266.2/203.3 minutes | 182.2/193.1 ml | 6/9 days | 1 | 8/7 |
| Kim *et al*[97], 2014 | Korea | 17/50/0 | 197.2/149.3 minutes | NA | 11.1/13.8 days | 0 | 12.9/NA |
| Tsunoda *et al*[99], 2014 | Japan | 10/6/0 | 325/289 minutes | 55/893 ml | 13/24 days | 0 | 22/7 |
| Otsuka *et al*[96], 2018 | Japan | 7/20/0 | 364/309 minutes | 70/1066 ml | 13/27 days | 0 | 22/12 |
| Booka *et al*[75], 2019 | Japan | 23/8/0 | 307.5/295.8 minutes | 135.5/568.3 ml | 10.6/21.3 days | 2 | 8.8/6 |

Lap: Laparoscopic; ml: Milliliter; NA: Not applicable.



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