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**Minimally invasive surgery in gastric cancer**

Son Sy *et al*. Minimally invasive surgery in gastric cancer

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**Abstract**

Minimally invasive surgery for gastric cancer has rapidly gained popularity due to the early detection of early gastric cancer. As advances in instruments and the accumulation of laparoscopic experience increase, laparoscopic techniques are being used for less invasive but highly technical procedures. Recent evidence suggests that the short- and long-term outcomes of minimally invasive surgery for early gastric cancer and advanced gastric cancer are comparable to those of conventional open surgery. However, these results should be confirmed by large-scale multicenter prospective randomized controlled clinical trials.

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**Key words:** Gastric cancer; Minimally invasive surgery; Laparoscopic gastrectomy

**Core tip:** Minimally invasive surgery has become an alternative modality for the treatment of gastric cancer.

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**INTRODUCTION**

Gastric cancer is the second leading cause of cancer-related death and the fourth most common cancer worldwide; nevertheless, its incidence has decreased substantially in most parts of the world. A total of 989600 new cases and 738000 deaths are estimated to have occurred in 2008, accounting for 8% of the total cancer cases and 10% of total cancer deaths. Nearly 70% of new cases and deaths occur in developing countries, and about 40% occur in Eastern Asia[1,2]. The highest incidence of gastric cancer is found in South Korea at 41.4 per 100000, including both sexes[3]. Due to health screening programs and improved diagnostic techniques, diagnoses of early gastric cancer (EGC) have steadily increased, accounting for nearly 50% of all gastric cancers in Japan and Korea[4,5].

As the incidence of EGC has increased in Eastern Asia, so has minimally invasive surgery (MIS), including laparoscopy- or robot-assisted surgery. According to the tenth national survey by the Japan Society of Endoscopic Surgery, 7341 laparoscopic gastrectomies were performed during 2009, which was an approximately ten-fold increase over a decade and accounted for approximately 25% of gastric cancer surgeries that year[6]. In South Korea, 3083 laparoscopic gastrectomies (26% of gastric cancer surgeries) were performed in 2009, which was an almost five-fold increase over a 5-year period [[4](#_ENREF_4)]. Recently, laparoscopic gastric surgery has spread rapidly and has been adopted in China (fourth-highest prevalence of gastric cancer and the largest population in the world). Furthermore, the publication of Chinese studies on the topic is rapidly increasing[7].

Laparoscopic surgery, a type of MIS, has been used for the treatment of gastric cancer since the 1990s. Ohgami *et al*[8] first developed laparoscopic wedge resection of the stomach using a lesion-lifting method in 1991. Kitano *et al*[9] and Nagai *et al*[10] reported the success of laparoscopy-assisted distal gastrectomy (LADG) for EGC in 1994 and 1995. In the early 2000s, robot-assisted surgery emerged as one of the treatment modalities for EGC, and the first robot-assisted gastrectomy (RAG) for EGC was reported by Hashizume *et al*[11] in 2003. In 2011, single-incision laparoscopic surgery was described for EGC[12]. MIS has revolutionized the surgical approach to gastric cancer for the past two decades, leading to improvements in patients’ quality of life by producing less pain, less blood loss, earlier postoperative recovery, and a shorter hospital stay[13-19].

Currently, MIS is evolving in two major directions[20]. First, MIS techniques are being used in more radical but less invasive procedures, such as totally laparoscopic distal gastrectomy or laparoscopic total gastrectomy with D1+ or D2 lymphadenectomy. These procedures are comparable to conventional open surgery and can be performed even in patients with advanced gastric cancer (AGC)[21-23]. Second, MIS is being employed for function-preserving surgery, including pylorus-preserving gastrectomy (PPG), proximal gastrectomy, and limited gastrectomy with sentinel node navigation surgery. These procedures can assist in improving patients’ late postoperative function and quality of life[20,24-26].

**RECENT ADVANCES IN LAPAROSCOPIC GASTRECTOMY**

As advances in instruments and the accumulation of laparoscopic experience increase, laparoscopic techniques are being used for less invasive but highly technical procedures. Totally laparoscopic gastrectomy (TLG) is one example. TLG has gained popularity since Kanaya *et al*[21] reported the first delta-shaped anastomosis[27]. A recent meta-analysis (five studies, 652 patients) showed that totally laparoscopic distal gastrectomy has less bleeding, shorter time to first flatus, and lower rates of postoperative complications than LADG. Various intracorporeal anastomoses have been introduced for TLG, such as the Billroth II anastomosis using linear staplers, the beta-shaped Roux-en-Y reconstruction, the semi-loop and overlap method after total gastrectomy, and the inverted T-shaped anastomosis using linear staplers[28-32].

Laparoscopic surgery is now also being used even for advanced cancers or remnant gastric cancer. Son *et al*[33] reported three cases of laparoscopic para-aortic lymphadenectomy after palliative chemotherapy for AGC with isolated para-aortic lymph node metastasis. The mean operation time was 365 min, and the mean estimated blood loss was 158 mL. The mean number of retrieved para-aortic lymph nodes was nine. Shinohara *et al*[34] reported the first series of successful totally laparoscopic completion total gastrectomy (TLCG) for remnant gastric cancer. The mean operation time of the five TLCGs was 360 min, and the mean blood loss was 20 mL. The mean number of retrieved lymph nodes was 19.

Single port surgery is increasingly being used to treat EGC. Omori *et al*[12] first reported single-incision laparoscopic distal gastrectomy in seven patients with EGC: the median operation time was 344 min, the median estimated blood loss was 25 mL, and the median number of retrieved lymph nodes was 67. Recently, Ahn *et al*[35] reported the first case of single-incision laparoscopic total gastrectomy for proximal EGC.

**CURRENT STATUS OF ONCOLOGICAL SAFETY IN LAPAROSCOPIC GASTRECTOMY**

Laparoscopic surgery for EGC has gained popularity based on evidence from six prospective randomized controlled trials (RCTs) that it can achieve comparable oncological outcomes to open surgery[13,14,17,36-38]. However, the majority of these trials were limited by a small sample size, using patients from a single center, and having a short-term follow-up period.

Recently, several long-term outcome studies of laparoscopic gastrectomy were published (Table 1). Zeng *et al*[39] conducted a meta-analysis using five RCTs and 17 non-RCTs with 3411 patients, and reported that LADG may reduce intraoperative blood loss, postoperative analgesic consumption, and hospital duration, without increasing the total hospitalization costs and cancer recurrence rate. In relation to oncological safety, they reported that the mean number of retrieved lymph nodes in LADG was similar to that in open distal gastrectomy (ODG), and the long-term survival rate of patients was similar between both groups. Vinuela *et al*[40] and Jiang *et al*[41] also conducted meta-analyses and reported the superiority of laparoscopic gastrectomy in postoperative recovery. Kim *et al*[42] reported the long-term outcomes of a prospective RCT (COACT 0301) with 164 patients and median follow-up period of 74.3 mo. They reported that the LADG and ODG groups showed similar survival (5-year disease-free survival: 98.8% in LADG *vs* 97.6% in ODG, *P* = 0.514; 5-year overall survival: 97.6 % in LADG *vs* 96.3% in ODG, *P* = 0.721) with reductions in mild complications observed with LADG (23.2% in LADG *vs* 41.5% in ODG, *P* = 0.012). In relation to patient quality of life, LADG showed better short-term functional and symptom scores, but no long-term advantages.

Currently, two large-scale multicenter RCTs are underway to elucidate the long-term oncological results of laparoscopic gastrectomy: the KLASS-01 and Japanese Clinical Oncology Group (JCOG) 0912 trials (Table 2). The Korean Laparoscopic Gastrointestinal Surgery Study (KLASS) trial is the first multicenter (13 institutions) randomized controlled clinical trial to compare open and laparoscopic surgery in patients with clinical stage I gastric cancer. The primary endpoint is overall survival, and secondary endpoints are disease-free survival, morbidity and mortality, quality of life, inflammatory and immune responses, and cost-effectiveness. From 2006 to 2010, 1415 patients (704 patients in LADG and 711 patients in ODG) were enrolled, and the final results are expected to be reported in 2015[43]. In 2010, the JCOG also started a multicenter RCT to compare ODG and LADG in 920 patients with stage I gastric cancer accrued from 33 institutions. The primary endpoint of JCOG 0912 is overall survival, and the secondary endpoints are relapse-free survival, proportion of LADG completion and conversion to open surgery, adverse events, short-term clinical outcomes, and postoperative quality of life[44].

There is also notable interest in the application of MIS for AGC. As the accumulation of laparoscopic experience increases, some experienced surgeons are extending the indication of laparoscopic gastrectomy to locally AGC. There is also evidence that MIS is feasible for AGC. Recently, Choi *et al*[45] conducted a meta-analysis using one RCT and nine non-RCTs with 1,819 patients (960 patients in the open group and 859 patients in the laparoscopy group), and reported that there was no statistical difference in overall survival and disease-free survival between laparoscopic gastrectomy and open gastrectomy. Shinohara *et al*[46] reported the results of a retrospective cohort study in 336 patients (150 open and 186 laparoscopy) who underwent gastrectomy with D2 lymph node dissection for cT2-T4 cancers. Laparoscopic D2 gastrectomy showed significantly less operative blood loss and shorter hospital stay, but there was no difference in the morbidity and mortality rates between both groups. The 5-year disease-free and overall survival rate were 65.8% and 68.1% in the laparoscopic group and 62.0% and 63.7% in the open group (*P* = 0.737 and *P* = 0.968, retrospectively). Moreover, there were no differences in the patterns of recurrence between both groups. In the laparoscopic group, 53 patients (28.4%) developed tumor recurrence: 29 (54.7%) peritoneal recurrences, 23 (43.4%) distant or hematogenous recurrences, and 15 (28.3%) locoregional or lymphatic recurrences *vs* 17 (50%), 15 (44.1%), and 11 (32.6%), respectively, in the open group. Park *et al*[47] reported the long-term outcomes of 239 laparoscopic gastrectomies for AGC. These patients were preoperatively diagnosed with EGC but diagnosed with AGC on final pathological examination from a multicenter retrospective study. They reported that the overall 5-year survival rates were 90.5% in stage IB, 86.4% in IIA, 52.8% in IIIA, 52.9% in IIIB, and 37.5% in IIIC, and the results were comparable to the previous reports for open gastrectomy. Lee *et al*[23] reported the short-term outcomes of a prospective phase II trial. A total of 157 patients with cT2N0-T4aN2 gastric cancer were finally enrolled in this study. The mean number of retrieved lymph nodes was 52.7 for LADG and 63.8 for laparoscopy-assisted total gastrectomy (LATG). The complication rate was 25.5% and local and systemic complication rates (more than grade II on the Clavien-Dindo classification) were 8.3% and 3.2%. They concluded that laparoscopic gastrectomy with D2 lymph node dissection was safe and technically feasible for the treatment of AGC, with an acceptable rate of morbidity and mortality.

There are presently three large-scale multicenter trials underway for AGC, being conducted in three different countries. The KLASS-02 trial is a phase III study to evaluate the efficacy of LADG with D2 lymph node dissection for AGC. The estimated sample size is 1050 and the primary endpoint is 3-year disease-free survival. For quality control, all surgeons are required to be standardized and are qualified through a review of six unedited videos of their procedures (3 laparoscopic and 3 open procedures) by independent reviewers. The Japanese Laparoscopic Surgery Study Group (JLSSG) launched a multicenter phase II/III study, entitled JLSSG 0901, to compare LADG and ODG in patients with cT2-T4aM0 gastric cancer. After the accrual of 180 patients, the incidence of major complications will be assessed. If an early-stopping rule does not apply due to a high complication rate, the trial will continue accrual until 500 patients are enrolled[48]. Recently, the Chinese laparoscopic gastrointestinal Surgical Study (CLASS) group started a phase III study, which is entitled “CLASS-01” and the study design is similar to that of the KLASS-02 trial.

**LAPAROSCOPIC FUNCTION-PRESERVING SURGERY**

PPG was originally used for the treatment of peptic ulcer, and it has been introduced as a surgical therapy for EGC that is designed to preserve function and maintain a better quality of life[49-53]. By preserving pyloric function, it has several nutritional advantages and has less postgastrectomy-related disorders, such as dumping syndrome and alkaline reflux, a lower incidence of disturbed bowel habits, and a reduced flatus frequency[26,54,55].

Recently, laparoscopy-assisted PPG (LAPPG) has been attempted as both a function-preserving and minimally invasive technique, with reported benefits over conventional PPG. Jiang *et al*[56] reported the short-term outcomes of 307 LAPPGs. The mean operation time was 229.4 min, the estimated blood loss was 49.1 mL, and the mean total number of dissected lymph nodes was 31.6. Major complications developed in four patients (1.3%), and gastric stasis was the most common complication, occurring in 19 patients (6.2%). The mean serum total protein and albumin levels did not change significantly after surgery, so the authors concluded that LAPPG is a safe operation with a notable reduction in major complications in patients with EGC in the middle third of the stomach. Recently, Suh *et al*[26] compared the surgical, oncological, nutritional, and functional benefits between 116 LAPPGs and 176 LADGs. They reported that delayed gastric emptying was less frequent in LADG than in LAPPG (1.7% *vs* 7.8%, *P* = 0.015), but the rate of other complications was significantly higher in LADG than in LAPPG (17.0% *vs* 7.8%, *P* = 0.023). The 3-year recurrence-free survival was similar between LADG and LAPPG (98.8% *vs* 98.2%, *P* = 0.702), but decrease in serum protein and albumin levels at 1 to 6 mo postoperation and abdominal fat volumes at 1 year postoperation were significantly greater in LADG than in LAPPG. They concluded that for middle-third EGC, LAPPG can be considered a superior treatment option over LADG in terms of nutritional advantage and a lower incidence of gallstone.

As the incidence of proximal gastric cancer has recently increased, proximal gastrectomy (PG) is widely accepted as a function-preserving surgery for proximal EGC[57-59]. In spite of functional benefits such as improved postoperative nutrition, preventing anemia, and release of gut hormones, PG has not gained in popularity, mainly due to postoperative complications such as esophageal reflux and anastomotic stricture[60-64]. To overcome these complications, various reconstruction methods and esophagojejunostomies have been developed, including jejunal interposition and double tract reconstruction, which are considered to be superior to esophagogastrostomy in preventing postoperative esophageal reflux. Recently, these procedures have been performed laparoscopically with demonstrated clinical efficacy. Kinoshita *et al*[24] compared 22 laparoscopic proximal gastrectomies (LPGs) with 68 open proximal gastrectomies (OPGs), both with jejunal interposition. The operation time was longer in the LPG group, but estimated blood loss was significantly less in the LPG group. The average number of harvested lymph nodes did not differ and there was no difference in complication rates, including leakage of the esophagojejunostomy. Ahn *et al*[65] reported the short-term outcomes of LPG with double tract reconstruction for proximal EGG in 43 patients from June 2009 to April 2012. The mean surgical time was 180.7 min, and the estimated blood loss was 120.4 mL. During the mean follow-up period of 21.6 mo, two patients had esophagojejunostomy stenosis, but they were successfully treated with fluoroscopic balloon dilatations. In addition, two patients had Visick grade II reflux symptoms (4.6%), but were effectively managed by medication.

**LAPAROSCOPIC SENTINEL NODE NAVIGATION SURGERY**

Sentinel node (SN) biopsy was widely used in patients with melanoma and breast cancer[66,67]. The SNs are the lymph nodes associated with the primary site of a tumor that are thought to be the first possible micrometastasis site along the lymphatic drainage pathway from the tumor[66]. The concept of SN biopsy revolutionized the approach to the surgical treatment in both melanoma and breast cancer.

The clinical application of SN biopsy for EGC has been controversial due to its low sensitivity and accuracy[68-70]. Recently, however, SN biopsy detection and accuracy rates of 90% to 100% have been achieved[71-77]. According to a recent meta-analysis that included 38 studies (2128 patients), the pooled SN identification rate, sensitivity, negative predictive value, and accuracy were 93.7%, 76.9%, 90.3%, and 92.0%, respectively. In a subgroup analysis, early T stage, combined tracers, a submucosal injection method, conventional open surgery, and usage of immuno-histochemistry were associated with a higher SN identification rate and sensitivity. The authors concluded that SN biopsy in gastric cancer is technically feasible, especially in cases with early T stage, and when combined tracers and submucosal injection methods are employed[78]. A study group in the Japan Society of Sentinel Node Navigation Surgery recently conducted a multicenter, single-arm, phase II study of SN mapping using a standardized dual-tracer method. The inclusion criterion was untreated stage cT1-2 adenocarcinoma with tumor size less than 4 cm in gross diameter. SN biopsy was performed in 397 eligible patients. The SN detection rate was 97.5% and the accuracy of nodal evaluation for metastasis was 99%[79].

Therefore, a dual-tracer method using radioactive colloids and blue dyes are currently considered the most reliable method for SN biopsy[74-77]. In recent years, computed tomography lymphagiography, infrared ray electronic endoscopy, and indocyanine green fluorescence imaging are emerging as new tracers for laparoscopic SN biopsy[71,80-84].

Furthermore, a multicenter prospective phase III trial (SENORITA) started last year with the aim of validating the clinical role of laparoscopic SN biopsy. The inclusion criterion was stage cT1N0 tumor of size less than 3 cm and the estimated sample size was 580. The results of this clinical trial are expected to provide perspectives on the future of laparoscopic SN navigation surgery for EGC.

**ROBOTIC SURGERY IN GASTRIC CANCER**

Robotic surgical systems were introduced in early 2000 to overcome the shortcomings of conventional laparoscopic surgery. They provide the surgeon with technical features such as three-dimensional vision and the elimination of physiologic tremor using a computerized mechanical interface. Moreover, the articulated arms provide natural movement similar to that of the human hand, thus facilitating straightforward manipulation[85].

Many studies have reported that RAG for gastric cancer has comparable short-term outcomes and oncological feasibility to laparoscopic gastrectomy, but there is no available long-term oncological or RCT data[86-88]. Recently, the Korean Robot Gastrectomy Study Group began a multicenter prospective, case-matched clinical trial to compare robotic *vs* laparoscopic gastrectomy for EGC. A total of 400 patients were enrolled and the study was completed in 2012. Surgical complications, quality of life, immunologic response, and cost-effectiveness will be analyzed[89].

Recently, a robotic system was introduced that included image-guided assistance. Kim *et al*[90] performed 12 robotic gastrectomies using intraoperative vascular images, which depicted vasculatures around the stomach. The authors reported that the use of image-guidance during the operation provided a vascular map and enabled the surgeon to avoid bleeding and damage to other organs by preventing vascular injury.

**ENDOSCOPIC SURGERY FOR GASTRIC CANCER**

Endoscopic resection has changed the main axis of treatment for patients with intramucosal gastric cancer in the past decade[91]. Because endoscopic resection provides the maintained volume and function of stomach even after curative resection of the tumor, the patient can avoid postgatrectomy complications and retain a good quality of life[92].

According to the Japanese gastric cancer guidelines, the indication of endoscopic resection is currently recommended in differentiated adenocarcinoma without ulcerative findings, of which the depth invasion is clinically diagnosed as T1a and the diameter is less than 2 cm[93]. Recently, many reports showed the superiority of endoscopic submucosal dissection (ESD) compared with endoscopic mucosal resection in terms of higher en bloc and complete resection rate[94-96], and this new technique and the advance of devices allowed to extend the indication of endoscopic resection, which included mucosal cancer without ulcerative findings regardless of tumor size or mucosal cancer with ulcerative findings less than 3 cm, or submocosal invasive cancer (less than 500 μm from the muscularis mucosae) less than 3cm[97-100].

Several studies reported acceptable results of the ESD in extended indication. Sanomura *et al*[101] reported that complete resection was achieved for 93.2% of the submocosal cancer (sm1, less than 500 μm) that met the extended criteria and there was neither lymph node metastasis nor local recurrence. An *et al*[102] reported that there was no difference in local recurrence rate between the absolute indication group and the extended indication group at a median follow-up of 32 mo (0.9% *vs* 1.1%, *P* = 0.006). Recently, two long-term outcomes of ESD in extended indication were reported and these studies demonstrated that there was no difference in disease-free survival between both indication groups[103,104].

However, some studies showed positive lymph node metastasis in patients with the extended criteria. Jee *et al*[105] reviewed 129 gastrectomies indicated for extended indication of endoscopic resection and they reported that there was lymph node metastasis in two patients (4%). An *et al*[106] reported 1.7% of lymph node metastasis even in submucosal cancer (sm1, less than 500 μm) less than 2 cm. Recently, Kang *et al*[107] reported that lymph node metastasis was found in 15% of intestinal-type submocosal cancers (sm1, less than 500 μm) less than 3 cm without lymphovascular invasion.

Therefore, the selection of appropriate lesion for endoscopic resection still remains controversial and more long-term follow-up data are needed to achieve a concensus of endoscopic indication for early gastric cancer.

**CONCLUSION**

Recent evidence suggests that the short- and long-term outcomes of MIS for EGC and AGC are comparable to those of conventional open surgery. However, further Level 1 evidence is required to confirm the suitability of MIS for gastric cancer, as well as the appropriate indications for its use. The ongoing large-scale multicenter RCTs are expected to clarify the oncologic safety of MIS in the near future.

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**Table 1 Long-term outcomes of laparoscopic gastrectomy for gastric cancer *n* (%)**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Author** | **Year** | **Patients (*n*)** | | **Follow-up period** | **Inclusion** | **Lymphadenectomy** | **5-yr survival** | | ***P*** | **Recurrence** | |
| **LG** | **OG** | **LG** | **OG** | **LG** | **OG** |
| Lee *et al*[18] | 2009 | 106 | 105 | 55 | cT1 | D2 | 95.9% | 94.9% | NS | 1 (0.94) | 1 (0.95) |
| Ahn *et al*[108] | 2010 | 42 | 162 | 35 | pT1N+ | D1+β, D2 | 89.7% | 89.9% | NS | 4 (9.5) | 14 (8.6) |
| Jeong *et al*[109] | 2011 | 138 | 261 | 36.8 | ≤ cT3N1 | D1+β, D2 | Median OS: 30 mo | |  | 35 (13.4) | 30 (21.7) |
| MacLellan *et al*[110] | 2012 | 21 | 182 | 21.3 | StageI-IV | - | 69.5%  (3YSR) | 65.6%  (3YSR) | NS | 8 (38.1) | 67 (36.8) |
| Hamabe *et al*[111] | 2012 | 66 | 101 | 30.4 (LG)  53.3 (OG) | cT1 | D2 | 94.4% | 78.5% | NS | 4 (6.0) | 22 (21.7) |
| Moisan *et al*[22] | 2012 | 31 | 31 | 50 | - | D1+α, D1+β, D2 | 74%  (3YSR) | 75%  (3YSR) | NS | 5 (16.1) | 4 (12.9) |
| Shinohara *et al*[46] | 2013 | 186 | 150 | 48.8 | cT2-4 | D2 | 68.1% | 63.7% | NS | 53 (28.4) | - |
| Kim *et al*[42] | 2013 | 82 | 82 | 74.3 | ≤ cT1N1 | D2 | 97.6% | 96.3% | NS | 1 (1.2) | 2 (2.4) |

LG: Laparoscopic gastrectomy; OG: Open gastrectomy; OS: Overall survival.

**Table 2 Ongoing prospective randomized controlled trials** **in gastric cancer surgery**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Study** | **Country** | **Start year** | **Phase** | **Study design** | **Inclusion** | **Sample size** | **Primary endpoint** |
| KLASS-01 | South Korea | 2006 | III | LADG *vs* ODG | cT1-2/N0 | 1,400 | Overall survival |
| JCOG 0912 | Japan | 2010 | III | LADG *vs* ODG | cT1-2/N0 | 920 | Overall survival |
| JLSSG 0901 | Japan | 2010 | II/III | LADG *vs* ODG | cT2-4a/N0-2/M0 | II: 180  III: 500 | II: Morbidity  III: Relapse-free survival |
| KLASS-02 | South Korea | 2011 | III | LADG *vs* ODG | cT2-4a/N0-4a/M0 | 1050 | 3-yr DFS |
| CLASS-01 | China | 2012 | III | LADG *vs* ODG | cT2-4a/N0-4a/M0 | 1056 | 3-yr DFS |
| COACT 1001 | South Korea | 2010 | III | LADG *vs* ODG | cT2-4a/N0-3a/M0 | 204 | Noncompliance rate |
| KRGS | South Korea | 2011 | II | Robot *vs* Laparoscopy | cT1-3/M0 | 1700 | Surgical outcomes |
| SENORITA | South Korea | 2012 | III | Laparoscopic SNNS | cT1-2/N0/size < 4cm | 160 | Safety/efficacy |

LADG: Laparoscopy-assisted distal gastrectomy; ODG: Open distal gastrectomy; SNNS: Sentinel node navigation surgery; DFS: Disease-free survival.