Laparoscopic Surgery for Colorectal Cancer in Korea: Nationwide Data from 2008 ~ 2013

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The aim of this study was to report nationwide data on the current practice of laparoscopic colorectal cancer (CRC) surgery in Korea. Nationwide surgical data for colorectal cancer from 2008 to 2013 were obtained from the Health Insurance Review & Assessment Service database and a retrospective analysis of CRC surgery patients was conducted. The trends in laparoscopy use for each procedure of colorectal resection over six years were evaluated. From 2008 to 2013, a total of 105,305 patients nationwide underwent resection for CRC, and 55.3% of the cases underwent laparoscopic surgery. The proportion of laparoscopic resection increased from 42.6% in 2008 to 64.7% in 2013. The most common site of colon cancer was sigmoid, followed by ascending, and rectosigmoid junction, which together accounted for 64.9% of all colon cancer cases. The three leading procedures were low anterior resection, hemicolectomy, and anterior resection, which together accounted for 87.3% of all CRCs. For low anterior resection, the rate of laparoscopy increased from 44.8% in 2008 to 69.8% in 2013. The percentage of abdominoperineal resection for rectal cancer continued to decrease from 10.6% in 2008 to 7.5% in 2013. Over the six years, a total of 2520 robotic surgeries for CRC were performed. The number of robotic surgeries for rectal cancer showed a steady increase, whereas that for colon cancer decreased. Overall, the rate of minimally invasive surgeries for CRC was 43.5% in 2008 and increased to 65.7% in 2013. The laparoscopic resection rate for CRC in Korea is very high and continues to show a steady increase.

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INTRODUCTION

More than 28,000 new colorectal cancer (CRC) cases are diagnosed in Korea each year.¹ The increase in CRC incidence in Korea might reflect changes in risk factors associated with Westernization such as increased obesity and smoking prevalence.² Along with steady increases in the CRC incidence rate, the number of deaths caused by cancer has also continued to increase due to the country's aging population and changing lifestyles.¹ However, the relative survival for CRC

in Korea has improved with year of diagnosis: a five-year relative survival rate of 54.8% in patients diagnosed from 1993 to 1995 was increased to 73.8% in those diagnosed from 2007 to 2011.¹ The improving survival rates are most likely attributed to CRC screening and improved treatments.^{3,4}

The Korean government started the First 10-Year Plan for National Cancer Control in 1996 as part of the nationwide effort to fight cancer. In 2006, the Second 10-Year Plan for National Cancer Control was announced and is currently being driven by public and private sectors.⁵ Although assessment of

the effectiveness of the screening program is necessary, CRC screening can result in early detection and a migration toward earlier tumor stage, which contribute to improved survival. Also, in 2000, the Korean Laparoscopic Colorectal Surgery Study Group was established in order to share, standardize, and spread the technique of laparoscopic colorectal resection and to conduct prospective multicenter trials.⁶ For distribution of laparoscopic colorectal resection across all hospital types, continued education and training of surgeons are being performed at the academic society level.

However, despite the increasing uptake of laparoscopic resection for CRC in Korea, there is a lack of nationwide data about the extent to which laparoscopic colorectal resections are used. We evaluated the current practice of laparoscopic colorectal surgery in the Republic of Korea.

METHODS

The nationwide operation data for colorectal cancer from 2008 to 2013 were obtained from the Health Insurance Review & Assessment Service (HIRA) database. The data had information about the year of surgical treatment, gender, age group, main disease code, procedure fee code, number of procedures, total cost, and type of surgical procedure (laparoscopy or open surgery). Data collection criteria were as follows: (1) Based on the day of the surgical treatment covered by the health insurance, the data was electronically extracted, and HIRA completed the review and assessment process of the cost for all the individual medical services performed from January 2008 to December 2013. (2) Surgical procedures included all the various colectomies, colorectal resections, abdominoperineal resections, and total proctocolectomies with or without lymph node dissection. Thus, the procedure fee codes to be searched were QA671~673, QA679, QA921~926, Q1261~1262, Q2671~2673, Q2679, and Q2921~2927 based on the health insurance medical care benefit cost book (2014 Jan. ed., published by the Korean Hospital Association). (3) Cancer cases were classified according to the Korean Classification of Diseases and Related Health Problems, including colon cancers by location, rectosigmoid junction cancer, and rectal cancer (corresponding disease codes: C18.0~18.9, C19, and C20, respectively). Robotic surgery data for colorectal cancer from 2008 to 2013 were obtained from Intuitive Surgical Korea. These data included year of surgical treatment, and number and type of surgical procedure, which were calculated only as the total number of minimally invasive surgeries, not as laparoscopic surgery-related data. A retrospective analysis was conducted with the available data. The distributions of age, gender, tumor location, and rate of laparoscopic resection over the recent six years were evaluated.

RESULTS

From 2008 to 2013, a total of 105,305 patients underwent open or laparoscopic resection for colorectal cancer in Korea (Table 1). The number of cases performed slightly increased each year, starting at 15,197 cases in 2008 and increasing to 18,761 by 2013. Over the same period, 55.3% of all cases underwent laparoscopic surgery. The proportion of laparoscopic resection increased from 42.6% in 2008 to 64.7% in 2013. The proportion of laparoscopy for colon cancer increased from 43.5% in 2008 to 64.5% in 2013. For rectal cancer, this increase was from 41.0% to 65.3%.

The incidences of colorectal cancer increased gradually with age, and the incidences in female and male patients were highest in their 70s and 60s, respectively (Fig. 1). The ratio of rectal cancer to total colorectal cancer was 31.4%. The most common site of colon cancer was the sigmoid, followed by

Table 1. The numbers and percentage of laparoscopic resections for colorectal cancer, Korea, 2008 ~ 2013

Year	Location of cancer	No. of surgery	No. of laparoscopy	The rate of laparoscopy (%)
2008	Rectum	5,290	2,168	40.98
	Colon	9,907	4,305	43.45
	Total	15,197	6,473	42.59
2009	Rectum	5,586	2,728	48.84
	Colon	11,045	5,500	49.80
	Total	16,631	8,228	49.47
2010	Rectum	5,341	2,859	53.53
	Colon	11,654	6,179	53.02
	Total	16,995	9,038	53.18
2011	Rectum	5,696	3,251	57.08
	Colon	12,785	7,430	58.11
	Total	18,481	10,681	57.79
2012	Rectum	5,758	3,473	60.32
	Colon	13,482	8,233	61.07
	Total	19,240	11,706	60.84
2013	Rectum	5,395	3,524	65.32
	Colon	13,366	8,623	64.51
	Total	18,761	12,147	64.75
Total	Rectum	33,066	18,003	54.45
	Colon	72,239	40,270	55.75
	Total	105,305	58,273	55.34

Fig. 1. The incidences of colorectal cancer by age and gender in Korea (2008 ~ 2013).

Fig. 2. Tumor locations in patients with colorectal cancer in Korea (2008 ~ 2013).

Fig. 3. Surgical procedures for patients with colorectal cancer in Korea (2008 ~ 2013).

Fig. 4. The rate of laparoscopy for three leading procedures in Korea (2008 ~ 2013). AR = anterior resection; LAR = low anterior resection; Hemi = right or left hemicolectomy.

Fig. 5. Abdominoperineal resection and low anterior resection for rectal cancer in Korea (2008 ~ 2013).

ascending, and rectosigmoid junction, which together accounted for 64.9% of all colon cancers (Fig. 2). The three leading procedures were low anterior resection, hemicolectomy (right or left), and anterior resection, which together accounted for 87.3% of all colorectal cancers (Fig. 3). The rate of laparoscopy for low anterior resection procedure increased from 44.8% in 2008 to 69.8% in 2013 (Fig. 4). For hemicolectomy and anterior resection, this increase was from 38.2% to 61.6% and from 63.1% to 78.6%, respectively. The number of abdominoperineal resection procedures has shown a downward trend over the past six years, whereas that of low anterior resection is on the rise (Fig. 5). The percentage of abdominoperineal resection for rectal cancer decreased from 10.6% in 2008 to 7.5% in 2013.

From 2008 to 2013, a total of 2520 robotic surgeries for CRC were performed in Korea (Fig. 6). There were 250 surgeries performed for patients with CRC in 2008, and this increased

Fig. 6. Robotic surgery for colorectal cancer in Korea (2008 ~ 2013).

steeply to 490 patients in 2010 and then reached a plateau. However, the number of robotic surgeries for rectal cancer steadily increased from 185 cases in 2008 to 490 cases in 2013, whereas that for colon cancer decreased from 110 cases in 2009 to 10 cases in 2013. Thus, the total rate of minimally invasive surgeries for CRC was 43.5% in 2008 and increased to 65.7% in 2013 (Fig. 7).

DISCUSSION

In Korea, about one-half of patients with CRC underwent laparoscopic surgery in 2009 compared to about two-thirds of patients in 2013. Data in this study was based on all the surgical treatments covered by the Korean National Health Insurance system. The extent of the missing data was estimated to be about 3% because the percentage of persons eligible for medical care assistance in Korea was reported to be 3.4% in 2009 and 3.0% in 2013.⁷ Although comparable nationwide data between countries are limited, which makes international comparison difficult, the percentage of laparoscopic resections for CRC in Korea is higher than in other countries. The rates of laparoscopic surgery for CRC were 41% in 2010 in the Netherlands,⁸ 44.8% in 2012 in the United Kingdom,⁹ and 35.4% (this figure also included benign diseases) in 2009 in the United States.¹⁰

Since the early 2000s in Korea, several academic conferences including a live broadcast of laparoscopic surgery have taken place annually at the instigation of academic organizations such as the Korean Society of Coloproctology and the Korean Society of Endoscopic & Laparoscopic Surgeons. Person to person communications with experts led to a great increase in laparoscopic education among university hospitals and specialized hospitals, which has extended to general hospitals in recent years. The rapid spread of laparoscopy in

Fig. 7. The rate of minimally invasive surgery for colorectal cancer in Korea (2008 ~ 2013).

a short time is attributable to easy access and a high passion for learning in Korea. However, laparoscopic colorectal surgery for CRC is a complicated procedure requiring a steep learning curve. Adequate education, training courses, and clinical experience are necessary for achieving competency, while ensuring that patient safety is a priority. Although there is limited evidence in the literature of how to undertake laparoscopy training, structured training and certification programs are used in some countries.¹¹⁻¹⁴ Rapid progress has been made in Korea in training programs for residents at the academic level, but extension of programs into fellowships or post-fellowship education seems to be relatively insufficient.

The COREAN trial is a good example of multicenter data on outcomes of laparoscopic rectal surgery in Korea.^{15,16} However, despite the increasing uptake of laparoscopic resection for CRC in Korea, more efforts are needed to reduce the variance in treatment among surgeons and hospitals while improving the quality of CRC treatment. Since 2011, the assessment of healthcare benefit appropriateness for CRC has been performed nationwide in Korea. We expect this service to act as a monitoring tool for quality improvement rather than simple quality control.

One strength of our study is that it is the first report based on nationwide laparoscopic data for almost all CRCs in Korea. However, our study has also some limitations. For example, it does not include detailed information on surgical or oncological outcomes of laparoscopic CRC surgery, laparoscopy rates across hospitals, or conversion rates. Unfortunately, such data were not available from the HIRA. In conclusion, the laparoscopic resection rate for CRC in Korea is very high and steadily continues to increase. However, a quality assurance system and national operation database for laparoscopy should be developed in the near future.

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