

Systematic review of laparoscopic vs open surgery for colorectal cancer in elderly patients

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Abstract

AIM: To verify the safety and validity of laparoscopic surgery for the treatment of colorectal cancer in elderly patients.

METHODS: A meta-analysis was performed of a systematic search of studies on an electronic database. Studies that compared laparoscopic colectomy (LAC) in elderly colorectal cancer patients with open colectomy (OC) were retrieved, and their short and long-term outcomes compared. Elderly people were defined as 65 years old or more. Inclusion criteria were set at: Resection of colorectal cancer, comparison between laparoscopic and OC and no significant difference in backgrounds between groups.

RESULTS: Fifteen studies were identified for analysis. LAC was performed on 1436 patients, and OC performed on 1810 patients. In analyses of short-term outcomes, operation time for LAC was longer than for OC (mean difference = 34.4162, 95%CI: 17.8473-50.9851, $P < 0.0001$). The following clinical parameters were lower in LAC than in OC: Amount of estimated blood loss (mean difference = -93.3738, 95%CI: -132.3437 to -54.4039, $P < 0.0001$), overall morbidity (OR = 0.5427, 95%CI: 0.4425-0.6655, $P < 0.0001$), incisional surgical site infection (OR = 0.6262, 95%CI: 0.4310-0.9097, $P = 0.0140$), bowel obstruction and ileus (OR = 0.6248, 95%CI: 0.4519-0.8638, $P = 0.0044$) and cardiovascular complications (OR = 0.4767, 95%CI: 0.2805-0.8101, $P = 0.0062$). In analyses of long-term outcomes (median follow-up period: 36.4 mo in LAC, 34.3 mo in OC), there was no significant difference in overall survival (mean difference = 0.8321, 95%CI: 0.5331-1.2990, $P = 0.4187$) and disease specific survival (mean difference = 1.0254, 95%CI: 0.6707-1.5675, $P = 0.9209$). There was also no significant difference in the number of dissected lymph nodes (mean difference = -0.1360, 95%CI: -4.0553-3.7833, $P = 0.9458$).

CONCLUSION: LAC in elderly colorectal cancer patients had benefits in short-term outcomes compared with OC except operation time. The long-term outcomes and oncological clearance of LAC were similar to that of OC. These results support the assertion that LAC is an effective procedure for elderly patients with colorectal cancer.

Key words: Laparoscopic surgery; Systematic review; Meta-analysis; Colorectal cancer; Elderly patient

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Core tip: Safety and effectiveness of laparoscopic surgery (LAC) in elderly has been unknown. A meta-analysis was performed of a systematic search of studies on an electronic database. Studies that compared LAC in elderly colorectal cancer patients with open colectomy (OC) were retrieved, and their short and long-term outcomes compared. Fifteen studies which had 1436 LAC and 1810 OC were identified. In short-term outcomes, blood loss, morbidity, incisional surgical site infection, bowel obstruction and cardiovascular complications were superior in LAC except operation time. There was no significant difference in long-term outcomes. LAC is an effective procedure for elderly with colorectal cancer.

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INTRODUCTION

People are living longer across the globe. According to the World Health Organization, 6.9% of the world was over the age of 65 in 2000 with an estimated increase to 10.4% in 2025 and a further rise to 16.4% in 2050^[1]. This estimation is valid in all regions of the world. Average life expectancies in 2025 are estimated to be 77 years old in the Americas and Europe and 72 years old in Asia. Colorectal cancer is the third most common malignant neoplasm in the world and aging is assumed to be one of the risk factors for colorectal carcinogenesis^[2]. Elderly patients have a higher American Society of Anesthesiologists score, higher cardiac and pulmonary comorbidity rate and lower preoperative nutritional conditioning than younger patients^[3-5]. Therefore, there is a high risk associated with even minimally invasive surgery in elderly patients. Several studies have reported the benefits of laparoscopic colorectal surgery in elderly patients^[6-10]. Most studies concluded that laparoscopic surgery had a lower postoperative morbidity rate and shorter length of hospital stay when compared to open surgery. Several large-scale systematic reviews that

compare laparoscopic colorectal surgery with open surgery have been published in recent years^[11,12]. They report that laparoscopic surgery has lower mortality, lower overall morbidity, lower cardiac and respiratory complications, lower wound infection and shorter length of hospital stay. However, they analyzed both colorectal cancer and benign diseases together. The surgical procedure for colorectal cancer differs from that for benign disease because optimal lymph node dissection and resection, with a securing safety margin, are vital in malignant neoplasm surgery. Therefore, a study analyzing laparoscopic surgery that targeted only colorectal cancer was required.

Moreover, the results of previous reviews reported only short-term outcomes. The evaluation of long-term outcomes is very important in the analysis of treatment efficacy for malignant neoplasia. The purpose of the present review is to clarify the benefits of laparoscopic surgery in elderly patients with colorectal cancer. We analyzed not only short-term but also long-term outcomes.

MATERIALS AND METHODS

Eligibility criteria

Elderly people were defined as 65 years old or more, as outlined by the World Health Organization^[1]. All studies were limited to randomized controlled or comparative studies. The subject of each study was limited to colorectal cancer and studies that included any benign disease were excluded. Backgrounds were similar between both groups, and had at least 15 patients in one group. The results had to include a comparison between laparoscopic and open surgery.

Outcomes

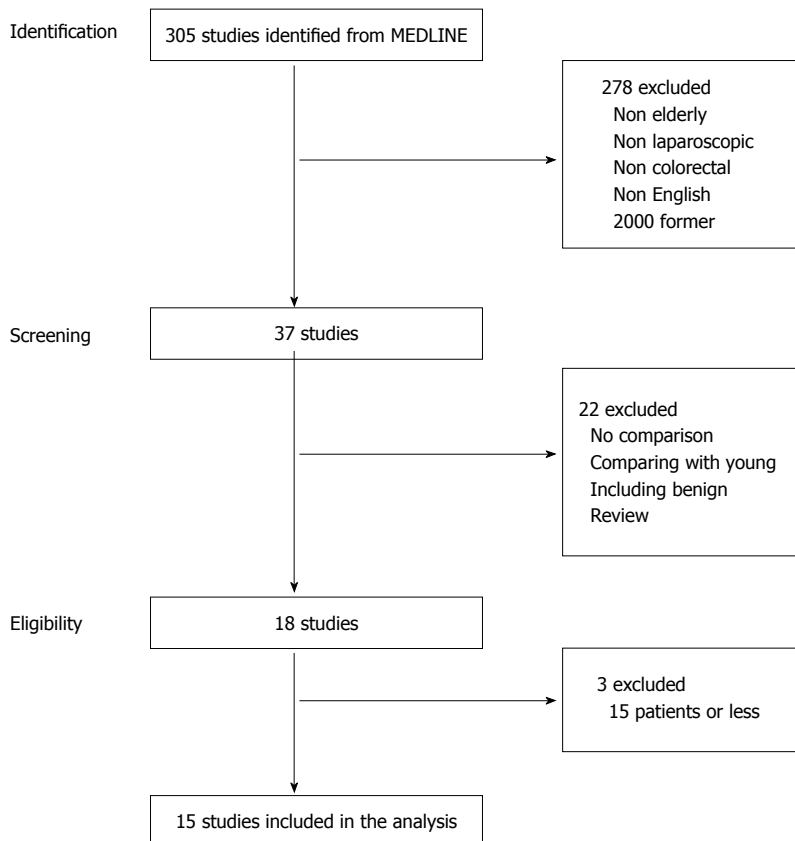
Short-term outcomes analyzed in the present study were as follows: Operative time, amount of estimated blood loss, mortality, overall morbidity, incisional surgical site infection, deep surgical site infection, anastomotic leakage, bowel obstruction and ileus, pneumonia, cardiovascular complication, time of normal bowel function and length of postoperative hospital stay. Duration of short-term was defined after the operation within 30 d.

The overall and disease specific survival rates were measured as long-term outcomes.

The number of dissected lymph nodes was used as an indicator of oncological clearance.

Study selection

The literature search was performed electronically using PubMed (MEDLINE). The search terms were as follows: Elderly or old, colorectal cancer or colon cancer, and laparoscopic surgery or laparoscopic colectomy (LAC) in combination with Boolean operators AND or OR. The language was limited to English. Studies were selected from those published after 2000 because they included the long-term results of several randomized



controlled studies that compared laparoscopic and open surgery^[13-18]. Moreover, developments in laparoscopic surgery instrumentation might influence short-term results in studies conducted in more recent years.

Assessment of study quality

The number of randomized controlled study was only one in this meta-analysis^[19]. The randomized controlled study was assessed for methodological quality using the Cochrane Handbook^[20]. Five of six items were at low risk of bias. Blinding of the study was not possible.

The comparative studies were assessed by the Newcastle-Ottawa Quality Assessment Scale (NOS)^[21]. Twelve of 14 studies had 6 or more star points on the NOS scale.

Statistical analysis

The odds ratios (ORs) for each study and 95% CIs were calculated from event numbers of categorical variables of short-term results. Pooled ORs were calculated using a random effect model. The mean value difference between continuous variables of short-term results and the number of dissected lymph nodes was also calculated using a random effect model. In the analysis of long-term results, 95% CIs of survival comparison and the number of patients in each study were synthesized using a random effect model. Synthesis of data was performed using the DerSimonian-Laird method^[22]. Study heterogeneity was checked by means of Cochran's *Q* statistic. If the *P* value of the heterogeneity test was

less than 0.05 in significance level, a null hypothesis of homogeneity was dismissed and study heterogeneity was proved. Publication bias among the studies was checked using the Egger test or Begg test accordingly. If the *P* value for publication bias was less than 0.10 a null hypothesis of no bias was dismissed and publication bias was confirmed.

RESULTS

Study profile

Thirty seven studies were identified by the first screening of MEDLINE. The reviews and studies that included benign disease cases or no data comparison between laparoscopic and open surgery were excluded. Finally, 15 studies were selected for analysis (Figure 1)^[19,23-36]. The types of studies were as follows: 1 randomized controlled, 2 case-matched, 1 prospective comparative and 11 retrospective comparative studies. In total, 1436 laparoscopic surgeries and 1810 open surgeries were analyzed. Conversion to open surgery was described in 9 studies. The range of conversion rate was between 0% and 13.9%, and the incidence of total patients was 4.5%. A summary of study characteristics is shown in Table 1.

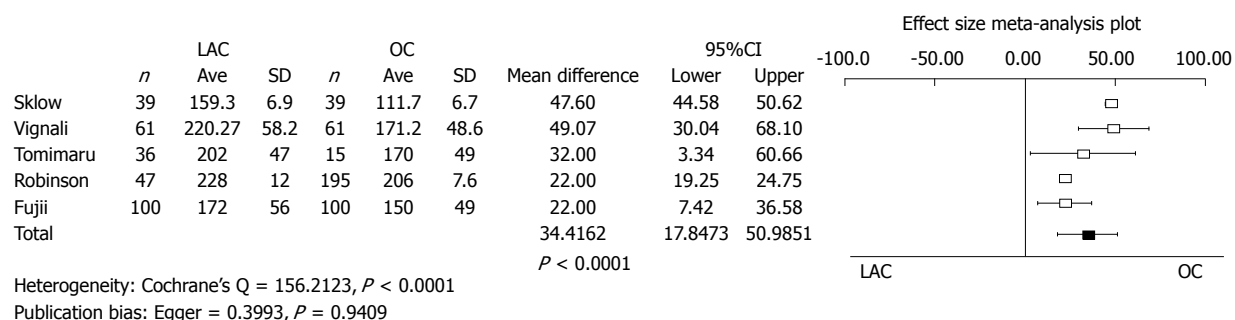
Short-term outcomes

Operation time: Five studies reported operative time as the mean value with standard deviation. The operation time of LAC was significantly longer than OC (mean difference = 34.4162, 95%CI: 17.8473-50.9851, *P* <

Table 1 Characteristics of studies

Ref.	Year	Study type	Age	Age		Patient	No. of LAC	No. of OC	Convert (%)	ASA (1-2/3-4)		Gender (M/F)		NOS
				LAC	OC					LAC	OC	LAC	OC	
Sklow <i>et al</i> ^[23]	2003	Case-matched	76	81.4 ± 0.83	81.8 ± 0.91	All cancer	39	39		19/20	10/29	22/17	21/18	6
Vignali <i>et al</i> ^[24]	2005	Case-matched	80	82.3 ± 2.3	83.1 ± 3.1	All cancer	61	61	4 (6.6)	2.5 ± 0.1	2.6 ± 0.6	29/32	29/32	6
Feng <i>et al</i> ^[25]	2006	Retro, comparative	71	77.8 ± 5.1	76.9 ± 6.1	All cancer	51	102	2 (3.9)					5
Tei <i>et al</i> ^[26]	2009	Retro, comparative	71	75.5 (71-89)	76.0 (71-93)	All cancer	51	78	3 (5.9)	Apr-37	63/15	32/19	43/35	6
Akiyoshi <i>et al</i> ^[27]	2009	Retro, comparative	75	79 (75-90)	79 (75-86)	Rectal cancer	44	43	0 (0)	Jun-38	Jul-36	21/23	23/20	3
Tomimaru <i>et al</i> ^[28]	2011	Retro, comparative	76	82.0 ± 4.6	81.9 ± 5.7	Colon cancer	36	15	5 (13.9)	20/16	8/7	13/23	7/8	8
Robinson <i>et al</i> ^[29]	2011	Retro, comparative	65	74 (65-86)	75 (65-91)	All cancer	47	195		1/46	9/162	47/0	191/4	8
She <i>et al</i> ^[30]	2013	Retro, comparative	75	80 (75-94)	80 (75-95)	All cancer	189	245	9 (4.8)	122/66	134/101	90/99	120/125	6
Scarpa <i>et al</i> ^[31]	2013	Retro, comparative	70	77 (74-80)	75 (72-80)	All cancer	33	24				14/19	8/16	6
Fujii <i>et al</i> ^[19]	2014	RCT	75	79.8 ± 3.6	80.1 ± 4.2	All cancer	100	100	3 (3)	Sep-91	85/15	50/50	60/40	NA
Hinoi <i>et al</i> ^[32]	2014	Retro, comparative	80	83 (81-85)	83 (81-85)	All cancer	459	459		362/107	355/104	215/244	222/237	8
Miyasaka <i>et al</i> ^[33]	2014	Retro, comparative	70	75 (70-86)	78 (70-94)	All cancer	28	79		6/22	48/31	13/15	27/52	6
Vallribera Valls <i>et al</i> ^[34]	2014	Prospective, comparative	75			All cancer	134	133		59/75	71/62	88/46	88/45	8
Zeng <i>et al</i> ^[35]	2015	Retro, comparative	70	74 (70-87)	74 (70-88)	Rectal cancer	112	182	7 (6.3)	66/46	92/90	62/50	98/84	6
Shigeta <i>et al</i> ^[36]	2015	Retro, comparative	80	82 (81-84)	83 (81-87)	All cancer	52	55	0 (0)	Apr-48	Apr-81	28/24	26/29	7

LAC: Laparoscopic surgery; OC: Open surgery; NOS: Newcastle-Ottawa scale stars.

**Figure 2** Forest plot of the mean difference for operative time. LAC: Laparoscopic surgery; OC: Open surgery.

0.0001). The heterogeneity was statistically significant (Cochrane's $Q = 156.2123$, $P < 0.0001$). Publication bias was not evident (Egger = 0.3993, $P = 0.9409$) (Figure 2).

Amount of estimated blood loss: Six studies reported the amount of estimated blood loss as a mean value with standard deviation. The operation time of LAC was significantly less than OC (mean difference = -93.3738, 95%CI: -132.3437 to -54.4039, $P < 0.0001$). Heterogeneity was statistically evident (Cochrane's $Q = 74.1364$, $P < 0.0001$). Publication bias was not evident (Egger = 0.9129, $P = 0.7776$) (Figure 3).

Mortality: Four studies reported mortality. There was no significant difference between LAC and OC in mortality (OR = 0.5052, 95%CI: 0.2438-1.0467, $P = 0.0662$). Heterogeneity and publication bias were not evident (Cochrane's $Q = 2.0911$, $P = 0.5537$, Egger = -0.6646, $P = 0.5883$).

Overall morbidity: Thirteen studies reported incidence of overall morbidity. The overall morbidity of LAC was significantly less than for OC (OR = 0.5427, 95%CI: 0.4425-0.6655, $P < 0.0001$). Heterogeneity was not evident (Cochrane's $Q = 14.7867$, $P = 0.2533$). Publication

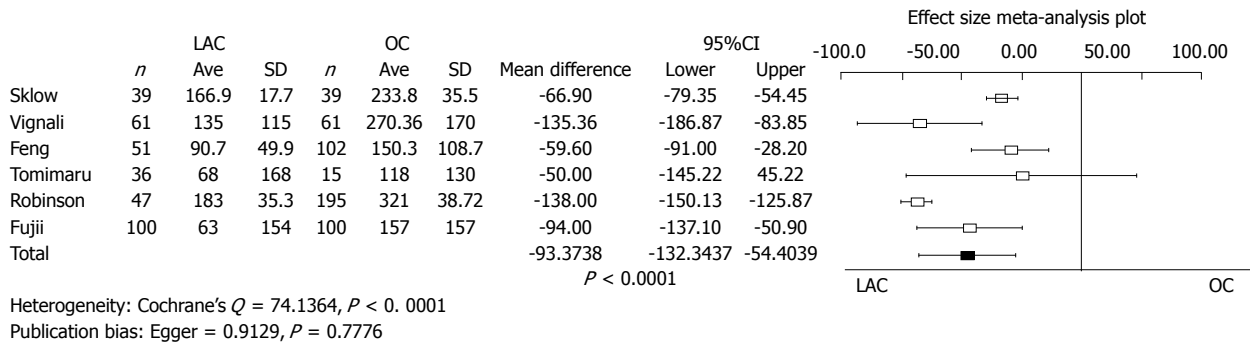


Figure 3 Forest plot of the mean difference for amount of estimated blood loss. LAC: Laparoscopic surgery; OC: Open surgery.

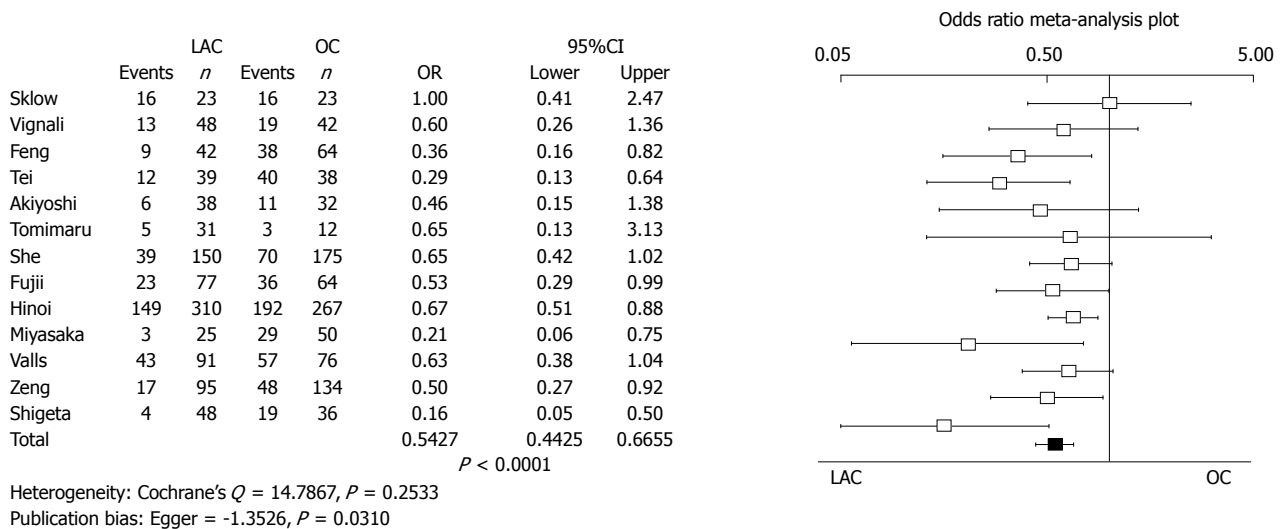


Figure 4 Forest plot of the odds ratio for overall morbidity. LAC: Laparoscopic surgery; OC: Open surgery.

bias was statistically evident (Egger = -1.3526, $P = 0.0310$) (Figure 4).

Incisional surgical site infection: Twenty studies reported the incidence of incisional surgical site infection. The incisional surgical site infection of LAC was significantly less than for OC (OR = 0.6262, 95%CI: 0.4310-0.9097, $P = 0.0140$). Heterogeneity and publication bias were not evident (Cochrane's $Q = 15.2636$, $P = 0.1707$, Egger = -0.3638, $P = 0.6557$) (Figure 5).

Deep surgical site infection: Four studies reported the incidence of deep surgical site infection. There was no significant difference between LAC and OC in deep surgical site infection (OR = 0.8234, 95%CI: 0.3298-2.0556, $P = 0.6771$). Heterogeneity and publication bias were not evident (Cochrane's $Q = 6.3512$, $P = 0.0957$, Egger = -3.0524, $P = 0.1922$).

Anastomotic leakage: Twenty studies reported the incidence of anastomotic leakage. There was no significant difference between LAC and OC in anastomotic leakage (OR = 0.9138, 95%CI: 0.5667-1.4735, $P =$

0.7115). Heterogeneity and publication bias were not evident (Cochrane's $Q = 8.0075$, $P = 0.7126$, Egger = 0.0396, $P = 0.9632$) (Figure 6).

Bowel obstruction and ileus: Ten studies reported the incidence of bowel obstruction and ileus. Bowel obstruction and ileus of LAC was significantly less than for OC (OR = 0.6248, 95%CI: 0.4519-0.8638, $P = 0.0044$). Heterogeneity and publication bias were not evident (Cochrane's $Q = 8.7612$, $P = 0.4596$, Egger = -1.1383, $P = 0.1602$) (Figure 7).

Pneumonia: Three studies reported the incidence of pneumonia. There was no significant difference between LAC and OC in the incidence of pneumonia (OR = 0.4526, 95%CI: 0.1976-1.0365, $P = 0.0608$). Heterogeneity and publication bias were not evident (Cochrane's $Q = 2.3251$, $P = 0.3127$, Egger = 0.1846, $P = 0.9743$).

Cardiovascular complication: Eight studies reported the incidence of cardiovascular complication. Cardiovascular complications of LAC was significantly less than for OC (OR = 0.4767, 95%CI: 0.2805-0.8101, $P = 0.0062$). Heterogeneity was not evident (Cochrane's Q

	LAC		OC			95%CI	
	Events	<i>n</i>	Events	<i>n</i>	OR	Lower	Upper
Sklow	3	36	3	36	1.00	0.19	5.29
Vignali	5	56	9	52	0.52	0.16	1.64
Tei	4	47	25	53	0.18	0.06	0.56
Akiyoshi	3	41	2	41	1.50	0.24	9.45
Tomimaru	3	33	1	14	1.27	0.12	13.32
Robinson	9	38	38	157	0.98	0.44	2.20
She	6	183	4	241	1.98	0.55	7.10
Fujii	5	95	10	90	0.47	0.16	1.44
Hinoi	37	422	43	416	0.85	0.54	1.34
Miyasaka	1	27	10	69	0.26	0.03	2.09
Valls	4	130	10	123	0.38	0.12	1.24
Zeng	8	104	31	151	0.37	0.17	0.85
Total					0.6262	0.4310	0.9097

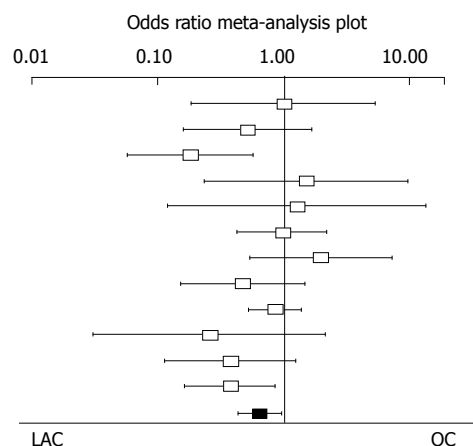
 $P = 0.0140$ Heterogeneity: Cochrane's $Q = 15.2636$, $P = 0.1707$ Publication bias: Egger = -0.3638, $P = 0.6557$ 

Figure 5 Forest plot of the odds ratio for incisional surgical site infection. LAC: Laparoscopic surgery; OC: Open surgery.

	LAC		OC			95%CI	
	Events	<i>n</i>	Events	<i>n</i>	OR	Lower	Upper
Vignali	4	57	3	58	1.36	0.29	6.33
Tei	2	49	2	76	1.55	0.21	11.38
Akiyoshi	1	43	2	41	0.48	0.04	5.46
Robinson	2	45	6	189	1.40	0.27	7.17
She	1	188	2	243	0.65	0.06	7.18
Scarpa	1	32	3	21	0.22	0.02	2.25
Fujii	5	95	8	92	0.61	0.19	1.92
Hinoi	8	451	2	457	4.05	0.86	19.19
Miyasaka	1	27	1	78	2.89	0.17	47.80
Valls	7	127	9	124	0.76	0.27	2.10
Zeng	2	110	6	176	0.53	0.11	2.69
Shigeta	1	51	2	53	0.52	0.05	5.91
Total					0.9138	0.5667	1.4735

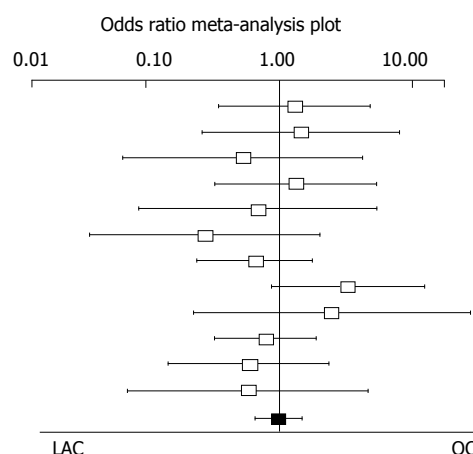
 $P = 0.7115$ Heterogeneity: Cochrane's $Q = 8.0075$, $P = 0.7126$ Publication bias: Egger = 0.0396, $P = 0.9632$ 

Figure 6 Forest plot of the odds ratio for anastomotic leakage. LAC: Laparoscopic surgery; OC: Open surgery.

= 6.6316, $P = 0.4682$). Publication bias was statistically evident (Egger = 1.5152, $P = 0.0521$) (Figure 8).

Recovery time of normal bowel function: Five studies reported the recovery time of normal bowel function as the mean value with standard deviation. There was no significant difference in the recovery time to normal bowel function between LAC and OC (mean difference = -0.8573, 95%CI: -1.8778 to 0.1632, $P = 0.0997$). Heterogeneity was statistically evident (Cochrane's $Q = 379.9427$, $P < 0.0001$). Publication bias was not evident (Egger = 5.4503, $P = 0.5226$).

Length of postoperative hospital stay: Three studies reported the length of postoperative hospital stay as mean value with standard deviation. There was no significant difference in the length of postoperative hospital stay between LAC and OC (mean difference = -1.3336, 95%CI: -3.3995 to 0.7322, $P = 0.2058$).

Heterogeneity was not evident (Cochrane's $Q = 3.9019$, $P = 0.1421$). Publication bias was statistically evident (Egger = -1.4308, $P = 0.0689$).

Long-term outcomes

Overall survival: Hinoi *et al.*^[32] reported overall survival in colon and rectal cancer separately. Three analyses of two studies reported the overall survival with 95%CI. There was no significant difference in the overall survival between LAC and OC (mean difference = 0.8321, 95%CI: 0.5331 to 1.2990, $P = 0.4187$). Heterogeneity and publication bias were not evident (Cochrane's $Q = 3.3977$, $P = 0.1829$, Egger = -1.9819, $P = 0.3846$) (Figure 9).

Disease specific survival: Hinoi *et al.*^[32] reported disease specific survival in colon and rectal cancer separately. Three analyses of two studies reported the disease specific survival with 95%CI. There was no

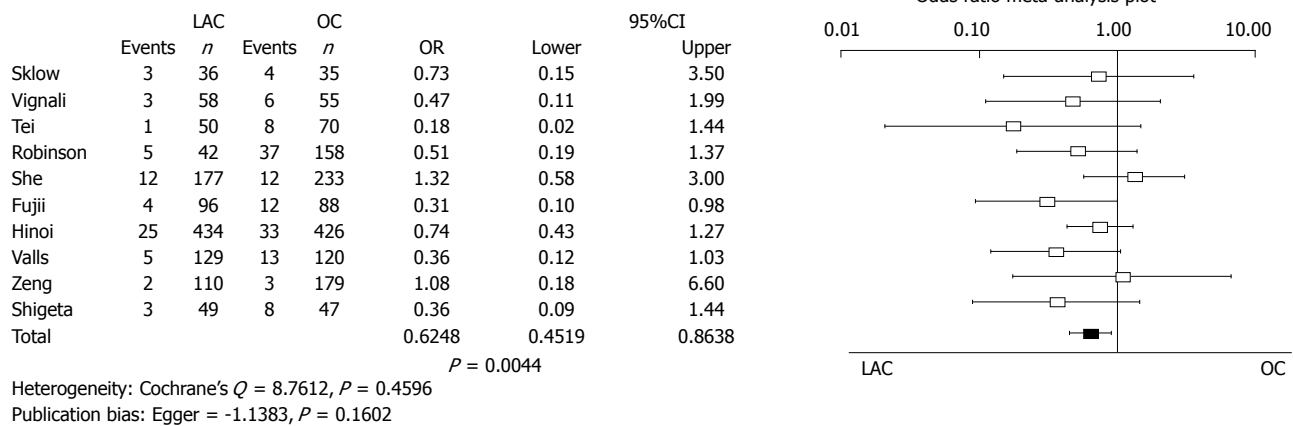


Figure 7 Forest plot of the odds ratio for bowel obstruction and ileus. LAC: Laparoscopic surgery; OC: Open surgery.

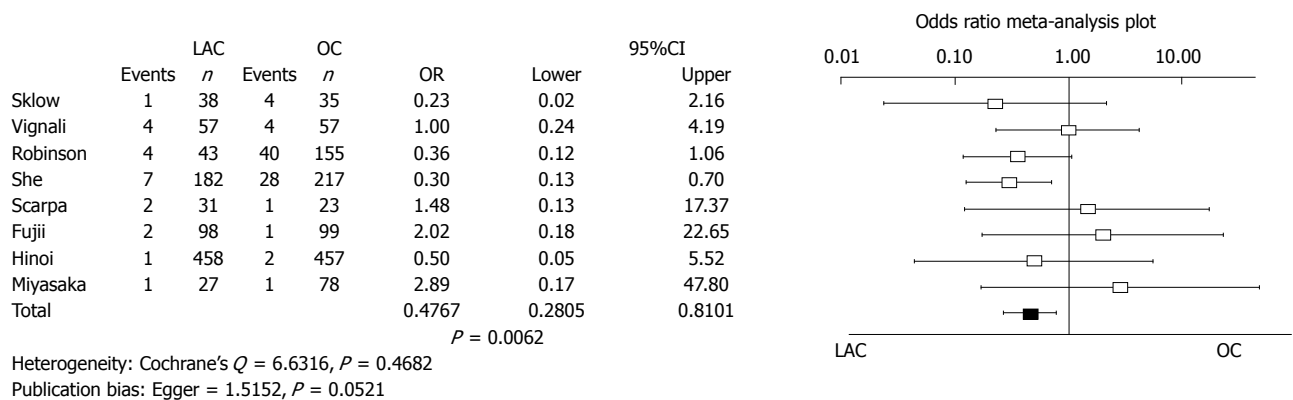


Figure 8 Forest plot of the odds ratio for cardiovascular complication. LAC: Laparoscopic surgery; OC: Open surgery.

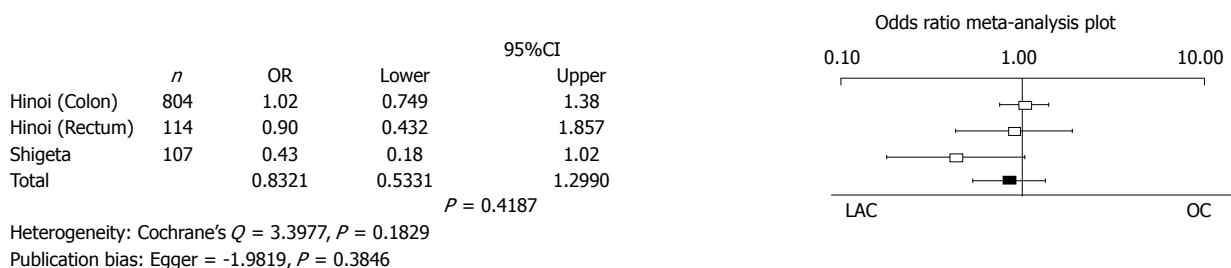


Figure 9 Forest plot of the odds ratio for overall survival. LAC: Laparoscopic surgery; OC: Open surgery.

significant difference in the disease specific survival between LAC and OC (mean difference = 1.0254, 95%CI: 0.6707 to 1.5675, $P = 0.9209$). Heterogeneity and publication bias were not evident (Cochrane's $Q = 0.1648$, $P = 0.9209$, Egger = -0.4921, $P = 0.1559$) (Figure 10).

Oncological clearance

The number of dissected lymph nodes: Two studies reported the number of dissected lymph nodes as the mean value with standard deviation. There was no significant difference in the number of dissected lymph nodes between LAC and OC (mean difference = -0.1360, 95%CI: -4.0553 to 3.7833, $P = 0.9458$). Heterogeneity

and publication bias were not evident (Cochrane's $Q = 3.2471$, $P = 0.0716$, Kendall tau rank correlation coefficient by Begg test = 1.0000, $P = 0.3173$).

Study quality

There was only one randomized controlled study^[19] which contained the following; random sequence generation, allocation concealment, blinding of participants, personnel and outcome assessors, incomplete outcome data, selective reporting and other potential threats to validity.

The study which had 5 or less star points on the NOS scale related to 5 short-term outcomes; amount of estimated blood loss, overall morbidity, incisional surgical site infection, anastomotic leakage and time of normal

	<i>n</i>	OR	Lower	Upper
Hinoi (Colon)	804	1.06	0.657	1.726
Hinoi (Rectum)	114	0.97	0.339	2.76
Shigeta	107	0.75	0.14	4.05
Total		1.0254	0.6707	1.5675

$P = 0.9209$

Heterogeneity: Cochrane's $Q = 0.1648$, $P = 0.9209$

Publication bias: Egger = -0.4921 , $P = 0.1559$

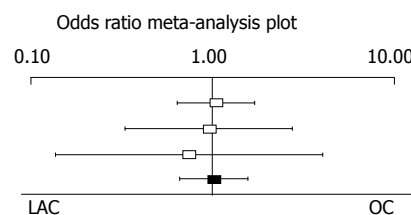


Figure 10 Forest plot of the odds ratio for disease specific survival. LAC: Laparoscopic surgery; OC: Open surgery.

bowel function. These outcomes were synthesized with studies which had 6 or more star points. Results were similar to the primary analyzed results and there was no conversion of interpretation.

DISCUSSION

Two systematic reviews that compare LAC with OC report benefits in short-term outcome. Grailey *et al.*^[11] report that LAC reduces the length of hospital stay, intraoperative blood loss, pneumonia, time to normal bowel function, cardiac complication and wound infection. Antoniou *et al.*^[12] report that LAC had a decreased risk for mortality, overall morbidity, plus cardiac and respiratory complications. Their results are similar to those reported in this review. However, they included analyses for both colorectal cancer and benign disease. Large scale, randomized studies and reviews that compare long-term results between LAC and OC in all generations report no difference in colon cancer patients^[37]. However, long-term results of randomized studies and reviews with elderly patient have not yet been reported. This meta-analysis, which compared LAC and OC in elderly colorectal cancer patients, demonstrates advantages in short-term and equivalency with respect to long-term outcomes and oncological clearance. These results will be useful in informing the selection of operative approach in elderly patients.

In analyses of the amount of estimated blood loss, overall morbidity, incisional surgical site infection and cardiovascular complication were all reduced in LAC. These results are similar to previous reports^[11,12]. It has been suggested that decreases in blood loss and postoperative pain reduce the stress of surgery, and therefore reduce overall morbidity. The reduction in cardiovascular complications might also be due to decrease in blood loss. Bowel obstruction and ileus was also reduced in LAC. Bowel obstruction and ileus were not distinguished in this analysis, because the definition was not clear in some studies and data was assigned to both conditions. This was not shown in previous reviews and it is supposed that the incidence of ileus increase is due to the extent of lymph node dissection in colorectal cancer. The exposure of intestines and major trauma to the abdominal wall might explain the increase in incidence of bowel paralysis and adhesion in OC.

The operative time of LAC was longer than OC. This

result was consistent with past reports, too. However, pneumonia was not increased and overall morbidity was decreased in LAC. Mean difference in operative time was about 34 min. The increase in operative time and pneumoperitoneum may not cause adverse effects on postoperative morbidity.

In this meta-analysis, there were no significant differences in mortality, incidence of pneumonia and recovery time of normal bowel function, which is not consistent with past reports. However, all LAC results tended to be lower than OC and p-values were close to being significantly different (mortality; OR = 0.5052, 95%CI: 0.2438- 1.0467, $P = 0.0662$, pneumonia; OR = 0.4526, 95%CI: 0.1976-1.0365, $P = 0.0608$, recovery time of normal bowel function; mean difference = -0.8573 , 95%CI: -1.8778 to 0.1632 , $P = 0.0997$). These inconsistent results may be due to the fact that patients who underwent elective colorectal surgery could be considered to be at relatively low risk. The reason for there being no significant difference in recovery time of normal bowel function is unknown. There might have been a significant difference if the time period of the data collection was a number of days not hours.

The incidences of deep surgical site infection and anastomotic leakage were similar between LAC and OC (deep surgical site infection; OR = 0.8234, 95%CI: 0.3298-2.0556, $P = 0.6771$, anastomotic leakage; OR = 0.9138, 95%CI: 0.5667-1.4735, $P = 0.7115$). It has been suggested that surgical invasiveness of the retroperitoneal dissection and anastomotic procedure are similar between LAC and OC in colorectal cancer surgery.

There was no significant difference in length of postoperative hospital stay.

This may be due to differences in the standard for hospital discharge in each study and may also be related to differences in the insurance systems in each country. Thus there might be a large bias in social factors between studies.

In analyses of long-term outcomes, both overall and disease specific survival rates were similar. There was also no significant difference in the number of dissected lymph nodes. This reveals the fact that LAC had similar treatment success to OC. The results of randomized studies and Cochrane review were also supported by this meta-analysis in elderly colorectal cancer surgery

patients^[13-18,37].

The limitation of this review is that it consists of only one randomized controlled study. Thus there were publication biases in analyses of overall morbidity, cardiovascular complication and length of postoperative hospital stay. Analysis of high risk elderly patients with impaired cardiac and pulmonary function might be required in the future. A secondary limitation of this study is that long-term outcomes were limited to three data sets from two studies. The analysis of more long-term results, that include details on the specific form of relapse, may thus be required.

LAC in elderly colorectal cancer patients had benefits in short-term outcomes such as amount of estimated blood loss, overall morbidity, incidences of incisional surgical site infection, bowel obstruction and ileus and cardiovascular complications. The only area where LAC did not show a benefit over OC was for operative time. The long-term outcomes and oncological clearance of LAC were similar to that of OC. These results support the view that LAC is an effective and safe procedure for elderly patients with colorectal cancer.

COMMENTS

Background

Laparoscopic surgery for colorectal cancer is increasing rapidly, particularly among elderly patients. However, neither the safety nor the effectiveness of laparoscopic surgery in this demographic has yet been determined.

Research frontiers

Some systematic reviews that compare laparoscopic colectomy (LAC) with open colectomy for elderly had reported benefits in short-term outcome.

Innovations and breakthroughs

However, past reports included benign diseases, and no report about long-term results. The authors analyzed for elderly colorectal cancer only and long-term outcomes.

Applications

Some short-term outcomes were superior in LAC except operation time. There was no significant difference in long-term outcomes. LAC is an effective procedure for elderly with colorectal cancer.

Terminology

LAC: Laparoscopic colectomy.

Peer-review

Good review article, scientific and rigorous analysis.

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