World Journal of Gastroenterology

Online Submissions: http://www.wjgnet.com/esps/
bpgoffice@wjgnet.com
doi:10.3748/wjg.v19.i47.9119

World J Gastroenterol 2013 December 21; 19(47): 9119-9126
ISSN 1007-9327 (print) ISSN 2219-2840 (online)

META-ANALYSIS

Fast-track rehabilitation *vs* conventional care in laparoscopic colorectal resection for colorectal malignancy: A meta-analysis

Ping Li, Fang Fang, Jia-Xun Cai, Dong Tang, Qing-Guo Li, Dao-Rong Wang

Ping Li, Fang Fang, Jia-Xun Cai, Dong Tang, Qing-Guo Li, Dao-Rong Wang, Department of Gastrointestinal Surgery, Subei People's Hospital of Jiangsu Province, the First Affiliated Hospital of Yang Zhou University, Yangzhou 225001, Jiangsu Province, China
Qing-Guo Li, Department of Colorectal Surgery, Cancer Hospital Fudan University, Department of Oncology, Shanghai Medical College, Fudan University, Shanghai 200433, China
Author contributions: Li P, Fang F and Li QG contributed equally to this study; Li P conceived and designed the review, conducted the statistical analyses and contacted authors of included studies to obtain additional information, and drafted the manuscript; Li QG and Wang DR provided supervision; Li P, Cai JX, Fang F and Tang D identified and acquired reports of trials, analyzed the data and assessed the risk of bias; All the authors contributed to the interpretation of the data, critically revised the manuscript, and approved the final version of the manuscript submitted for publication and are guarantors for the study.
Supported by The National Natural Science Foundation of China, No. 81201885 and No. 81172279
Correspondence to: Dao-Rong Wang, MD, Department of Gastrointestinal Surgery, Subei People's Hospital of Jiangsu Province, the First Affiliated Hospital of Yang Zhou University, 98 Nantong West Road, Yangzhou 225001, Jiangsu Province, China. 734909944@qq.com
Telephone: +86-514-87373282 Fax: +86-514-87373282
Received: June 2, 2013 Revised: August 10, 2013
Accepted: September 15, 2013
Published online: December 21, 2013

Abstract

AIM: To evaluate the fast-track rehabilitation protocol and laparoscopic surgery (LFT) *vs* conventional care strategies and laparoscopic surgery (LCC).

METHODS: Studies and relevant literature comparing the effects of LFT and LCC for colorectal malignancy were identified in MEDLINE, the Cochrane Central Register of Controlled Trials and EMBASE. The complications and re-admission after approximately 1 mo were assessed.

RESULTS: Six recent randomized controlled trials (RCTs) were included in this meta-analysis, which related to 655 enrolled patients. These studies demonstrated that compared with LCC, LFT has fewer complications and a similar incidence of re-admission after approximately 1 mo. LFT had a pooled RR of 0.60 (95%CI: 0.46-0.79, $P < 0.001$) compared with a pooled RR of 0.69 (95%CI: 0.34-1.40, $P > 0.5$) for LCC.

CONCLUSION: LFT for colorectal malignancy is safe and efficacious. Larger prospective RCTs should be conducted to further compare the efficacy and safety of this approach.

Key words: Laparoscopic surgery; Fast-track rehabilitation; Enhanced recovery; Colorectal surgery; Complications; Readmission

Core tip: Fast-track rehabilitation in laparoscopic colorectal resection has become the most fashionable way to treat colorectal malignancy. Complications after fast-track rehabilitation protocol and laparoscopic surgery (LFT) and conventional care strategies and laparoscopic surgery (LCC) of colorectal resection have generally been discussed in China, as well as in other countries. This study clarified that compared with LCC, LFT has fewer complications and has a similar incidence of re-admission after approximately 1 mo.

Li P, Fang F, Cai JX, Tang D, Li QG, Wang DR. Fast-track rehabilitation *vs* conventional care in laparoscopic colorectal resection for colorectal malignancy: A meta-analysis. *World J Gastroenterol* 2013; 19(47): 9119-9126 Available from: URL: http://www.wjgnet.com/1007-9327/full/v19/i47/9119.htm DOI: http://dx.doi.

org/10.3748/wjg.v19.i47.9119

INTRODUCTION

Fast-track rehabilitation in laparoscopic colorectal resection has become the most fashionable way of treating colorectal malignancy. During the mid-1990s, fast-track rehabilitation, involving dieticians, nurses, surgeons and anesthesiologists, was developed by Kehlet *et al*[1,2], Wilmore *et al*[3] and Basse *et al*[4]. Common to the other enhanced recovery rehabilitations, it is an attempt to reduce the stress response, decrease complications, speed up recovery, shorten the hospital stay and reduce health costs, all without compromising patient safety. The laparoscopic approach to colorectal surgery has been shown to accelerate dietary intake and return of bowel function[5], to facilitate postoperative mobilization[6], to reduce the length of stay in hospital[5,7] and to have a positive effect on postoperative mortality[5,7-9].

Recently, laparoscopic surgery has been generally applied in the treatment of gastrointestinal cancer, which can significantly attenuate trauma and accelerate the rehabilitation of patients after surgery. It was reported that the hospital stay time is shorter and the complication and readmission rate are lower after laparoscopic surgery[10,11].

Despite all the major benefits of laparoscopy, elective colorectal resection is still associated with a morbidity rate between 20% and 30% and a postoperative hospital stay of 7-10 d[12]. Both laparoscopic surgery and FT perioperative care have been reported to be safe and effective, and to result in a shorter hospital stay with earlier recovery of gastrointestinal function[13-16] and lower morbidity than open colorectal surgery and standard care[17-19]. Many recently published randomized controlled trials are available that have compared fast-track rehabilitation to conventional care in laparoscopic colorectal resection for colorectal malignancy. The safety after fast-track rehabilitation protocol and laparoscopic surgery (LFT) of colorectal resection has generally been discussed; therefore, this study analyzed and compared the complications and re-admission between LFT and conventional care strategies and laparoscopic surgery (LCC). The primary aim of this meta-analysis was to evaluate LFT *vs* LCC; the secondary aim was to assess LFT.

MATERIALS AND METHODS

Publication search

PubMed, the Cochrane Central Register of Controlled Trials and EMBASE were searched for all relevant literature, including articles referenced in the publications. The medical subject headings (MeSH) and keywords collected for individually and in combination were as follows: "laparoscopic surgery" "open surgery" and "fast track" or "enhanced recovery" and "colorectal". The last search was done on May 10th, 2013. References, lists of retrieved articles, reviews and meta-analyses were then scanned for additional articles. Internet search engines were also used to perform a manual search for abstracts from international meetings, which were then downloaded and studied.

Inclusion and exclusion criteria

The inclusion criteria were as follows: (1) randomized controlled trials; (2) studies that provided information on at least one of the outcome measures; (3) studies published in English. When a study reporting the same patient cohort was included in several publications, only the most recent or complete study was selected; and (4) detailed patient information provided. The exclusion criteria were as follows: (1) case reports; (2) articles that were not full text, or non-comparative studies; and (3) open operations, not by laparoscopic surgery.

Study selection

The inclusion criteria were met in studies if they involved LFT for colorectal malignancy in adult patients (*i.e.*, those 18 years and older) and used LCC as a control. All studies that used chemotherapy, or a rehabilitation protocol had to include less than seven of the seventeen FT items among the interventions in the FT group (programs using epidural or local anesthesia, minimally invasive techniques, optimal pain control and aggressive postoperative care) to achieve early recovery after colorectal surgery; and more than two of the conventional care strategies were included, were excluded. Studies that could not provide actual frequencies of complications or re-admission after approximately 1 mo were also excluded. Both full-length publications and abstract publications were selected. Letters, reviews without original data, non-English papers and animal studies were excluded. If any doubt regarding the suitability remained after the abstract was examined, the full manuscript was obtained.

Data extraction

All included studies were assessed for the quality of their methodology and relevance to the objective of our meta-analysis. Conduct and reporting were in accordance with the QUOROM statement. Data on complications or re-admission approximately 1 mo from each trial were extracted and compared independently by the two investigators.

Statistical analysis

In statistical analysis, Review Manager (RevMan) software version 5.0.0 was used (The Nordic Cochrane Centre, The Cochrane Collaboration, Copenhagen, Denmark). A pooled RR and a pooled Mean Difference with 95%CI were used to assess the outcomes of the studies. Statistical heterogeneity was tested by the χ^2 test. According to the forest plot, heterogeneity was limited, so the Mantel-Haenszel fixed effect model was adopted. The significance of the pooled RR was determined by the Z test and statistical significance was considered at $P < 0.05$. Publication bias was estimated by the use of a funnel plot with an Egger's linear regression test, and funnel plot

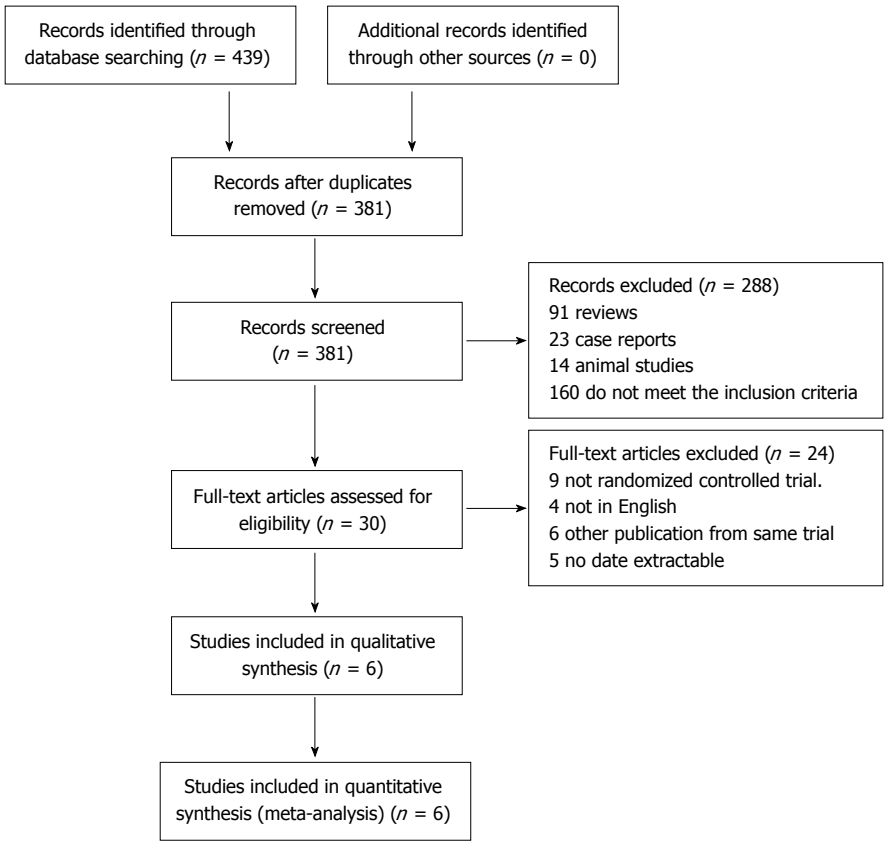

Figure 1 Selection of studies.

Table 1 Main characteristics of the six included studies

	n		Age (yr)		Sex (male/female)	
	LFT	LCC	LFT	LCC	LFT	LCC
Wang *et al*[20]	41	42	57.2 ± 18.1	55.4 ± 16.8	24/17	25/17
Vlug *et al*[21]	93	98	66 ± 10.3	66 ± 7.1	54/39	59/39
van Bree *et al*[22]	18	18	64 ± 10.1	66 ± 6.9	11/7	11/7
Veenhof *et al*[23]	17	20	65	68	9/8	14/6
Wang *et al*[24]	40	38	71	72	22/18	20/18
Wang *et al*[25]	106	104	57	55	65/41	60/44

LFT: Fast-track rehabilitation protocol and laparoscopic surgery; LCC: Conventional care strategies and laparoscopic surgery.

asymmetry on the natural logarithm scale of the RR was measured by a linear regression approach.

RESULTS

Search results

A total of 439 references were identified from medical journal databases. Upon examination of the abstracts, 409 articles were rejected based on the rejection criteria outlined in Figure 1. A study of the complete manuscripts for the 30 remaining articles led to elimination of 14 papers that contained no data pertaining to the outcome of LFT for colorectal resection, four papers not in English and six papers explaining the effect of analgesia. The remaining six non-duplicated randomized controlled trials (RCTs) that compared LFT with LCC were included in the meta-analysis.

Characteristics of the selected RCTs

Characteristics of the six RCTs[20-25] included in the meta-analysis are summarized in Table 1. These studies were published between 1985 and 2013 and investigated a total of 665 patients: 323 received LFT and 332 received LCC.

Meta-analysis results

Complication: Data were collected from six studies (655 patients) on complications for LFT *vs* LCC. In the LFT group, 19.81% patients (64/323) had complications, while in the LCC group, 33.13% patients (110/332) had complications. Pooling the results indicated that LFT could significantly reduce complications compared with LCC. The weighted mean difference (WMD) was 0.60 (95%CI: 0.46-0.79, $P < 0.05$), $\chi^2 = 12.33$ ($P = 0.03$) and $I^2 = 59\%$, indicating heterogeneity among the studies.

Anastomotic leak: Data were collected from four studies (497 patients) on anastomotic leak for LFT *vs* LCC. 4.94% (12/243 patients) had an anastomotic leak in the LFT group and 4.72% (12/254) in the LCC group. Pooling the results indicated that LFT and LCC had similar risks of anastomotic leak. The WMD was 1.07 (95%CI: 0.50-2.32, $P > 0.05$, Figure 2), $\chi^2 = 2.13$ ($P = 0.55$) and $I^2 = 0\%$, which excludes heterogeneity among the studies.

Wound infection: Data were collected from four stud-

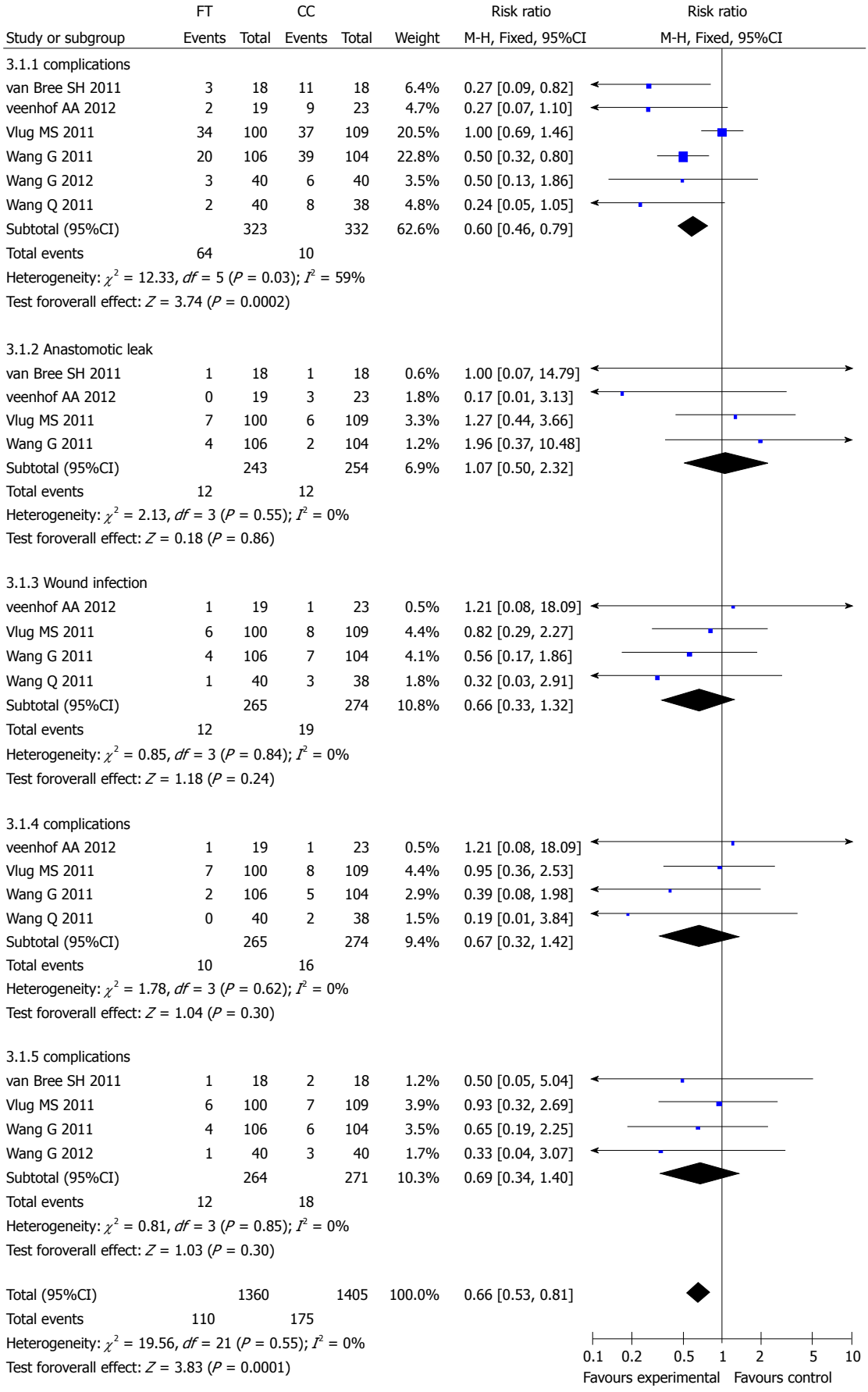

Figure 2 Forest plot comparing fast-track rehabilitation protocol and laparoscopic surgery *vs* conventional care strategies and laparoscopic surgery in colorectal resection, outcome: complications. LFT: Fast-track rehabilitation protocol and laparoscopic surgery; LCC: Conventional care strategies and laparoscopic surgery.

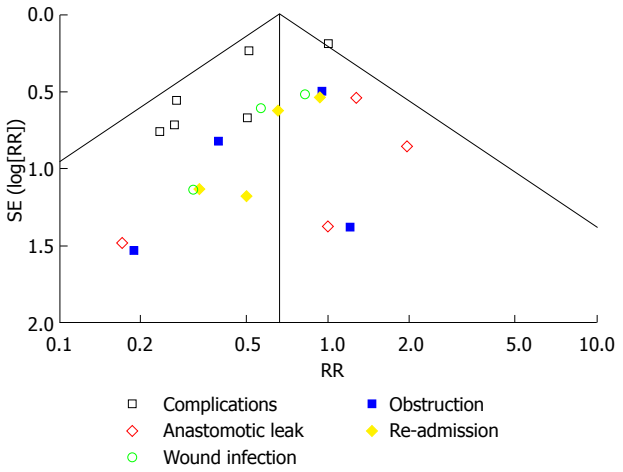

Figure 3 Comparison between the fast-track rehabilitation protocol and laparoscopic surgery, and conventional care strategies and laparoscopic surgery in laparoscopic colorectal resection for colorectal malignancy, outcome: complications.

ies (539 patients) on wound infection for LFT *vs* LCC; 4.53% (12/265 patients) had wound infection in the LFT group and 6.93% (19/274) in the LCC group. Pooling the results indicated that LFT did not significantly reduce wound infections compared with LCC. The WMD was 0.66 (95%CI: 0.33-1.32, $P > 0.05$), $\chi^2 = 0.85$ ($P = 0.84$) and $I^2 = 0\%$, which excludes statistical heterogeneity among the studies.

Obstruction: Data were collected from four studies (539 patients) on obstruction for LFT *vs* LCC. 3.77% (10/265 patients) had obstructions in the LFT group and 5.84% (16/274) in the LCC group. Pooling the results indicated no significant difference in the risk of obstruction. The WMD was 0.67 (95%CI: 0.32-1.42, $P > 0.05$), $\chi^2 = 1.78$ ($P = 0.62$) and $I^2 = 0\%$, which excludes heterogeneity among the studies.

Re-admission: Data were collected from four studies (535 patients) on re-admission for LFT *vs* LCC. 4.55% (12/264 patients) were readmitted in the LFT group and 6.64% (18/271) in the LCC group. Pooling the results indicated no apparent difference in re-admission. The WMD was 0.69 (95%CI: 0.34-1.4, $P > 0.05$), $\chi^2 = 0.81$ ($P = 0.85$) and $I^2 = 0\%$, which excludes heterogeneity among the studies.

Publication bias

Funnel plots were created to access the publication bias of the literature. The shapes of the funnel plots did not show any obvious asymmetry (Figure 3).

DISCUSSION

The straightforward conclusion from the six included studies is that LFT is a more reliable treatment for colorectal malignancy, compared with LCC. LFT reduced complications, but carried similar risks of anastomotic leak, wound infection, obstruction and re-admission.

Complications after LFT and LCC of colorectal resection have generally been discussed in China, as well as in other countries. A recently published multivariate analysis identified male gender[26], preoperative education, anesthesia[27] and early postoperative oral nutrition[28] as potential risk factors for complications after colorectal surgery. In addition, some studies have found an increased risk of anastomotic leaks in males, which is consistent with the results of this study (10.1% of the men required re-operation for anastomotic leak *vs* 3.3% of the women)[29-32].

Preoperative education of patients has a crucial role in LFT. It is necessary to demonstrate the detailed treatment program, the different steps of fast-track rehabilitation program and relevant measures for the patients to make them better understand and accept the fast-track rehabilitation program.

Better cooperation of patients can bring better outcomes of LFT. Generally, since the gastric emptying time of solid meal and fluid are 6 and 2 h, respectively[33], the patients should be encouraged to have liquid meal 2 h before the operation instead of fasting. It has been shown that preoperative oral carbohydrate is safe and can efficiently reduce complications[34-36].

The role of epidural anesthesia or regional anesthesia in LFT should be stressed. Postoperative epidural analgesia can avoid stress-induced neurological, endocrinological and homeostatic changes or the blocking of sympathetic nerve-related surgical stress response, reduce complications such as nausea, vomiting and enteroparalysis after operation, promote early ambulation, improve the intestinal function and shorten the hospital stay time of patients after resection of colorectal cancer[26,37-42].

Early postoperative oral nutrition is regarded as an essential part of LFT. Food intake can stimulate gastrointestinal peristalsis, and early feeding during the first 24 h after surgery promotes the recovery of an obstruction. It has been illustrated that early postoperative oral nutrition attenuates catabolism and potentially decreases infectious complications[27,43].

Several studies have shown that American Society of Anesthesiologists grade Ⅲ or higher is associated with increased postoperative morbidity[44-46].

LFT can improve the rehabilitation of patients after resection of colorectal cancer better than LCC, thus benefiting their surgery, anesthesia, pain management, physical therapy and social work. The primary work of LFT is the preoperative education of patients to make them understand the whole plan and the aim of each stage. Therefore, it is vital to obtain cooperation from the nursing staff.

However, we should still regard these outcomes with caution and evaluate them critically for the following reasons. Firstly, although there was no detectable publication bias, as tested by the funnel plots, the overall methodological quality and reporting of the included studies were poor. Secondly, the number of studies found was relatively low, and the aforementioned quality issues may have biased the results significantly. Therefore, more

large trials with better separation between LFT and LCC for colorectal malignancy seem necessary. Furthermore, in light of current evidence, LFT should not yet be considered the new standard for colorectal malignancy. Long-term data on outcome, as well as important other factors in making a decision for an intervention, are also lacking. Quality of life data and data on physiological performance after 5 years have never been described, nor have data on cost-effectiveness or economic evaluations of LFT. These parameters may play an important part in recommending LFT treatment in colorectal resection. However, we believe that, with greater awareness and the increasing popularity of LFT, more long-term follow-up reports will eventually be published.

There have been eight previously published systematic reviews, including meta-analyses on this topic[16,17,47-52]. These included three reviews of controlled clinical trials and randomized controlled trials[17,47,49], and five reviews of randomized controlled trials only[47,50-52]. The present study is the first meta-analysis to compare fast-track rehabilitation with conventional care in laparoscopic colorectal resection for colorectal malignancy. This also the first meta-analysis of patients undergoing elective colorectal surgery to demonstrate that LFT is associated with a significant reduction in postoperative complications, but no significant reduction in readmission rates. The increased number of included studies supported the quality of the evidence from the present study.

In conclusion, this meta-analysis demonstrated that LFT is safe and feasible for colorectal surgery. As LFT comes into even wider use, additional large, prospective RCTs should be conducted to further compare the efficacy and safety of this approach.

COMMENTS

Background

Fast-track rehabilitation in laparoscopic colorectal resection has become the most fashionable way of treating colorectal malignancy. Complications after fast-track rehabilitation protocol and laparoscopic surgery (LFT) and conventional care strategies and laparoscopic surgery (LCC) of colorectal resection have generally been discussed in China, as well as in other countries.

Research frontiers

Over the past three decades, many studies have assessed the performance of LFT. However, comparisons of LFT and LCC have not been published.

Innovations and breakthroughs

Based on this meta-analysis, LFT for colorectal malignancy is safe and efficacious. Similar associations were indicated in subgroup analyses of East Asian, Western, cohort, and high-quality studies. These findings were not presented clearly in previous systematic reviews.

Applications

LFT appears to be neither directly nor indirectly associated with risk. Further studies should seek to clarify this conclusion.

Peer review

LFT is rapidly becoming the focal point of attraction for specialists worldwide. This article shows the advantages of the procedure. This analysis has great practical value for clinicians.

REFERENCES

1 **Kehlet H**. Fast-track colorectal surgery. *Lancet* 2008; **371**: 791-793 [PMID: 18328911 DOI: 10.1016/S0140-6736(08)60357-8]

2 **Kehlet H**, Wilmore DW. Evidence-based surgical care and the evolution of fast-track surgery. *Ann Surg* 2008; **248**: 189-198 [PMID: 18650627 DOI: 10.1097/SLA.0b013e31817f2c1a]

3 **Wilmore DW**, Kehlet H. Management of patients in fast track surgery. *BMJ* 2001; **322**: 473-476 [PMID: 11222424]

4 **Basse L**, Thorbøl JE, Løssl K, Kehlet H. Colonic surgery with accelerated rehabilitation or conventional care. *Dis Colon Rectum* 2004; **47**: 271-217; discussion 277-278 [PMID: 14991487]

5 **Abraham NS**, Byrne CM, Young JM, Solomon MJ. Meta-analysis of non-randomized comparative studies of the short-term outcomes of laparoscopic resection for colorectal cancer. *ANZ J Surg* 2007; **77**: 508-516 [PMID: 17610681]

6 **Reza MM**, Blasco JA, Andradas E, Cantero R, Mayol J. Systematic review of laparoscopic versus open surgery for colorectal cancer. *Br J Surg* 2006; **93**: 921-928 [PMID: 16845692]

7 **Lourenco T**, Murray A, Grant A, McKinley A, Krukowski Z, Vale L. Laparoscopic surgery for colorectal cancer: safe and effective? - A systematic review. *Surg Endosc* 2008; **22**: 1146-1160 [PMID: 18071810]

8 **Aziz O**, Constantinides V, Tekkis PP, Athanasiou T, Purkayastha S, Paraskeva P, Darzi AW, Heriot AG. Laparoscopic versus open surgery for rectal cancer: a meta-analysis. *Ann Surg Oncol* 2006; **13**: 413-424 [PMID: 16450220]

9 **Basse L**, Jakobsen DH, Bardram L, Billesbølle P, Lund C, Mogensen T, Rosenberg J, Kehlet H. Functional recovery after open versus laparoscopic colonic resection: a randomized, blinded study. *Ann Surg* 2005; **241**: 416-423 [PMID: 15729063]

10 **Kim HJ**, Lee IK, Lee YS, Kang WK, Park JK, Oh ST, Kim JG, Kim YH. A comparative study on the short-term clinicopathologic outcomes of laparoscopic surgery versus conventional open surgery for transverse colon cancer. *Surg Endosc* 2009; **23**: 1812-1817 [PMID: 19263150 DOI: 10.1007/s00464-009-0348-z]

11 **Steele SR**, Brown TA, Rush RM, Martin MJ. Laparoscopic vs open colectomy for colon cancer: results from a large nationwide population-based analysis. *J Gastrointest Surg* 2008; **12**: 583-591 [PMID: 17846852]

12 **Carli F**, Charlebois P, Baldini G, Cachero O, Stein B. An integrated multidisciplinary approach to implementation of a fast-track program for laparoscopic colorectal surgery. *Can J Anaesth* 2009; **56**: 837-842 [PMID: 19639371 DOI: 10.1007/s12630-009-9159-x]

13 **Delaney CP**, Marcello PW, Sonoda T, Wise P, Bauer J, Techner L. Gastrointestinal recovery after laparoscopic colectomy: results of a prospective, observational, multicenter study. *Surg Endosc* 2010; **24**: 653-661 [PMID: 19688390 DOI: 10.1007/s00464-009-0652-7]

14 **Story SK**, Chamberlain RS. A comprehensive review of evidence-based strategies to prevent and treat postoperative ileus. *Dig Surg* 2009; **26**: 265-275 [PMID: 19590205 DOI: 10.1159/000227765]

15 **Veldkamp R**, Kuhry E, Hop WC, Jeekel J, Kazemier G, Bonjer HJ, Haglind E, Påhlman L, Cuesta MA, Msika S, Morino M, Lacy AM. Laparoscopic surgery versus open surgery for colon cancer: short-term outcomes of a randomised trial. *Lancet Oncol* 2005; **6**: 477-484 [PMID: 15992696]

16 **Wind J**, Polle SW, Fung Kon Jin PH, Dejong CH, von Meyenfeldt MF, Ubbink DT, Gouma DJ, Bemelman WA. Systematic review of enhanced recovery programmes in colonic surgery. *Br J Surg* 2006; **93**: 800-809 [PMID: 16775831]

17 **Gouvas N**, Tan E, Windsor A, Xynos E, Tekkis PP. Fast-track vs standard care in colorectal surgery: a meta-analysis update. *Int J Colorectal Dis* 2009; **24**: 1119-1131 [PMID: 19415308 DOI: 10.1007/s00384-009-0703-5]

18 **Guillou PJ**, Quirke P, Thorpe H, Walker J, Jayne DG, Smith AM, Heath RM, Brown JM. Short-term endpoints of conventional versus laparoscopic-assisted surgery in patients with

colorectal cancer (MRC CLASICC trial): multicentre, randomised controlled trial. *Lancet* 2005; **365**: 1718-1726 [PMID: 15894098]

19 **Muller S**, Zalunardo MP, Hubner M, Clavien PA, Demartines N. A fast-track program reduces complications and length of hospital stay after open colonic surgery. *Gastroenterology* 2009; **136**: 842-847 [PMID: 19135997 DOI: 10.1053/j.gastro.2008.10.030]

20 **Wang G**, Jiang Z, Zhao K, Li G, Liu F, Pan H, Li J. Immunologic response after laparoscopic colon cancer operation within an enhanced recovery program. *J Gastrointest Surg* 2012; **16**: 1379-1388 [PMID: 22585532 DOI: 10.1007/s11605-012-1880-z]

21 **Vlug MS**, Wind J, Hollmann MW, Ubbink DT, Cense HA, Engel AF, Gerhards MF, van Wagensveld BA, van der Zaag ES, van Geloven AA, Sprangers MA, Cuesta MA, Bemelman WA. Laparoscopy in combination with fast track multimodal management is the best perioperative strategy in patients undergoing colonic surgery: a randomized clinical trial (LAFA-study). *Ann Surg* 2011; **254**: 868-875 [PMID: 21597360 DOI: 10.1097/SLA.0b013e31821fd1ce]

22 **van Bree SH**, Vlug MS, Bemelman WA, Hollmann MW, Ubbink DT, Zwinderman AH, de Jonge WJ, Snoek SA, Bolhuis K, van der Zanden E, The FO, Bennink RJ, Boeckxstaens GE. Faster recovery of gastrointestinal transit after laparoscopy and fast-track care in patients undergoing colonic surgery. *Gastroenterology* 2011; **141**: 872-880.e1-4 [PMID: 21699777 DOI: 10.1053/j.gastro.2011.05.034]

23 **Veenhof AA**, Vlug MS, van der Pas MH, Sietses C, van der Peet DL, de Lange-de Klerk ES, Bonjer HJ, Bemelman WA, Cuesta MA. Surgical stress response and postoperative immune function after laparoscopy or open surgery with fast track or standard perioperative care: a randomized trial. *Ann Surg* 2012; **255**: 216-221 [PMID: 22241289 DOI: 10.1097/SLA.0b013e31824336e2]

24 **Wang Q**, Suo J, Jiang J, Wang C, Zhao YQ, Cao X. Effectiveness of fast-track rehabilitation vs conventional care in laparoscopic colorectal resection for elderly patients: a randomized trial. *Colorectal Dis* 2012; **14**: 1009-1013 [PMID: 21985126 DOI: 10.1111/j.1463-1318.2011.02855.x]

25 **Wang G**, Jiang ZW, Xu J, Gong JF, Bao Y, Xie LF, Li JS. Fast-track rehabilitation program vs conventional care after colorectal resection: a randomized clinical trial. *World J Gastroenterol* 2011; **17**: 671-676 [PMID: 21350719 DOI: 10.3748/wjg.v17.i5.671]

26 **Kirchhoff P**, Dincler S, Buchmann P. A multivariate analysis of potential risk factors for intra- and postoperative complications in 1316 elective laparoscopic colorectal procedures. *Ann Surg* 2008; **248**: 259-265 [PMID: 18650636 DOI: 10.1097/SLA.0b013e31817bbe3a]

27 **Wu CL**, Cohen SR, Richman JM, Rowlingson AJ, Courpas GE, Cheung K, Lin EE, Liu SS. Efficacy of postoperative patient-controlled and continuous infusion epidural analgesia versus intravenous patient-controlled analgesia with opioids: a meta-analysis. *Anesthesiology* 2005; **103**: 1079-1088; quiz 1109-1110 [PMID: 16249683]

28 **Gatt M**, MacFie J. Randomized clinical trial of the impact of early enteral feeding on postoperative ileus and recovery (Br J Surg 2007; 94: 555-561). *Br J Surg* 2007; **94**: 1044-1045 [PMID: 17636524]

29 **Kingham TP**, Pachter HL. Colonic anastomotic leak: risk factors, diagnosis, and treatment. *J Am Coll Surg* 2009; **208**: 269-278 [PMID: 19228539 DOI: 10.1016/j.jamcollsurg.2008.10.015]

30 **Lipska MA**, Bissett IP, Parry BR, Merrie AE. Anastomotic leakage after lower gastrointestinal anastomosis: men are at a higher risk. *ANZ J Surg* 2006; **76**: 579-585 [PMID: 16813622]

31 **Rullier E**, Laurent C, Garrelon JL, Michel P, Saric J, Parneix M. Risk factors for anastomotic leakage after resection of rectal cancer. *Br J Surg* 1998; **85**: 355-358 [PMID: 9529492]

32 **Taflampas P**, Christodoulakis M, Tsiftsis DD. Anastomotic leakage after low anterior resection for rectal cancer: facts, obscurity, and fiction. *Surg Today* 2009; **39**: 183-188 [PMID: 19280275 DOI: 10.1007/s00595-008-3835-2]

33 **Ljungqvist O**, Søreide E. Preoperative fasting. *Br J Surg* 2003; **90**: 400-406 [PMID: 12673740]

34 **Reissman P**, Teoh TA, Cohen SM, Weiss EG, Nogueras JJ, Wexner SD. Is early oral feeding safe after elective colorectal surgery? A prospective randomized trial. *Ann Surg* 1995; **222**: 73-77 [PMID: 7618972]

35 **Lewis SJ**, Egger M, Sylvester PA, Thomas S. Early enteral feeding versus "nil by mouth" after gastrointestinal surgery: systematic review and meta-analysis of controlled trials. *BMJ* 2001; **323**: 773-776 [PMID: 11588077]

36 **Feo CV**, Romanini B, Sortini D, Ragazzi R, Zamboni P, Pansini GC, Liboni A. Early oral feeding after colorectal resection: a randomized controlled study. *ANZ J Surg* 2004; **74**: 298-301 [PMID: 15144242]

37 **Carli F**, Mayo N, Klubien K, Schricker T, Trudel J, Belliveau P. Epidural analgesia enhances functional exercise capacity and health-related quality of life after colonic surgery: results of a randomized trial. *Anesthesiology* 2002; **97**: 540-549 [PMID: 12218518]

38 **Clemente A**, Carli F. The physiological effects of thoracic epidural anesthesia and analgesia on the cardiovascular, respiratory and gastrointestinal systems. *Minerva Anestesiol* 2008; **74**: 549-563 [PMID: 18854796]

39 **Steinberg RB**, Liu SS, Wu CL, Mackey DC, Grass JA, Ahlén K, Jeppsson L. Comparison of ropivacaine-fentanyl patient-controlled epidural analgesia with morphine intravenous patient-controlled analgesia for perioperative analgesia and recovery after open colon surgery. *J Clin Anesth* 2002; **14**: 571-577 [PMID: 12565114]

40 **Taqi A**, Hong X, Mistraletti G, Stein B, Charlebois P, Carli F. Thoracic epidural analgesia facilitates the restoration of bowel function and dietary intake in patients undergoing laparoscopic colon resection using a traditional, nonaccelerated, perioperative care program. *Surg Endosc* 2007; **21**: 247-252 [PMID: 17160649]

41 **Marret E**, Remy C, Bonnet F. Meta-analysis of epidural analgesia versus parenteral opioid analgesia after colorectal surgery. *Br J Surg* 2007; **94**: 665-673 [PMID: 17514701]

42 **Augestad KM**, Delaney CP. Postoperative ileus: impact of pharmacological treatment, laparoscopic surgery and enhanced recovery pathways. *World J Gastroenterol* 2010; **16**: 2067-2074 [PMID: 20440846]

43 **Andersen HK**, Lewis SJ, Thomas S. Early enteral nutrition within 24h of colorectal surgery versus later commencement of feeding for postoperative complications. *Cochrane Database Syst Rev* 2006; (**4**): CD004080 [PMID: 17054196]

44 **Ragg JL**, Watters DA, Guest GD. Preoperative risk stratification for mortality and major morbidity in major colorectal surgery. *Dis Colon Rectum* 2009; **52**: 1296-1303 [PMID: 19571708 DOI: 10.1007/DCR.0b013e3181a0e639]

45 **Skala K**, Gervaz P, Buchs N, Inan I, Secic M, Mugnier-Konrad B, Morel P. Risk factors for mortality-morbidity after emergency-urgent colorectal surgery. *Int J Colorectal Dis* 2009; **24**: 311-316 [PMID: 18931847 DOI: 10.1007/s00384-008-0603-0]

46 **Hightower CE**, Riedel BJ, Feig BW, Morris GS, Ensor JE, Woodruff VD, Daley-Norman MD, Sun XG. A pilot study evaluating predictors of postoperative outcomes after major abdominal surgery: Physiological capacity compared with the ASA physical status classification system. *Br J Anaesth* 2010; **104**: 465-471 [PMID: 20190255 DOI: 10.1093/bja/aeq034]

47 **Eskicioglu C**, Forbes SS, Aarts MA, Okrainec A, McLeod RS. Enhanced recovery after surgery (ERAS) programs for patients having colorectal surgery: a meta-analysis of randomized trials. *J Gastrointest Surg* 2009; **13**: 2321-2329 [PMID:

19459015 DOI: 10.1007/s11605-009-0927-2]
48 **Walter CJ**, Collin J, Dumville JC, Drew PJ, Monson JR. Enhanced recovery in colorectal resections: a systematic review and meta-analysis. *Colorectal Dis* 2009; **11**: 344-353 [PMID: 19207699 DOI: 10.1111/j.1463-1318.2009.01789.x]
49 **Gatt M**, Khan S, MacFie J. In response to: Varadhan KK, Neal KR, Dejong CH, Fearon KC, Ljungqvist O, Lobo DN. The enhanced recovery after surgery (ERAS) pathway for patients undergoing major elective open colorectal surgery: a meta-analysis of randomized controlled trials. Clin Nutr 29 (2010) 434-440. *Clin Nutr* 2010; **29**: 689-90; author reply 691-692 [PMID: 20619512 DOI: 10.1016/j.clnu.2010.06.005]
50 **Adamina M**, Kehlet H, Tomlinson GA, Senagore AJ, Delaney CP. Enhanced recovery pathways optimize health outcomes and resource utilization: a meta-analysis of randomized controlled trials in colorectal surgery. *Surgery* 2011; **149**: 830-840 [PMID: 21236454 DOI: 10.1016/j.surg.2010.11.003]
51 **Spanjersberg WR**, Reurings J, Keus F, van Laarhoven CJ. Fast track surgery versus conventional recovery strategies for colorectal surgery. *Cochrane Database Syst Rev* 2011; (**2**): CD007635 [PMID: 21328298 DOI: 10.1002/14651858]
52 **Zhuang CL**, Ye XZ, Zhang XD, Chen BC, Yu Z. Enhanced recovery after surgery programs versus traditional care for colorectal surgery: a meta-analysis of randomized controlled trials. *Dis Colon Rectum* 2013; **56**: 667-678 [PMID: 23575408 DOI: 10.1097/DCR.0b013e3182812842]

P- Reviewers: Lohsiriwat V, Samuel JC **S- Editor**: Zhai HH
L- Editor: Stewart G **E- Editor**: Ma S

百世登

Baishideng®

Published by **Baishideng Publishing Group Co., Limited**
Flat C, 23/F., Lucky Plaza,
315-321 Lockhart Road, Wan Chai, Hong Kong, China
Fax: +852-65557188
Telephone: +852-31779906
E-mail: bpgoffice@wjgnet.com
http://www.wjgnet.com

ISSN 1007-9327