Research Article

Contrast of Mastoscopic and Conventional Axillary Lymph Node Dissection of Patients With Breast Cancer: Meta-Analysis

Cancer Control
Volume 27: 1-8

DOI: 10.1177/1073274820932987
journals.sagepub.com/home/ccx
SAGE

Hanchu Xiong, MD, PhD[1,2], Zihan Chen, MD[3], Ling Xu, MD[1], Cong Chen, MD[1], Qingshuang Fu, MD[4], Rongyue Teng, MD[1], Jida Chen, MD, PhD[1], Shuduo Xie, MD, PhD[1], Linbo Wang, MD, PhD[1], Xiao-Fang Yu, MD, PhD[2], and Jichun Zhou, MD, PhD[1]

Abstract

Mastoscopic axillary lymph node dissection (MALND) is a currently used and safe surgical treatment option for breast cancer. However, the extensive application of MALND is still debatable because of the use of conventional axillary lymph node dissection (CALND). Therefore, in the current study, we aimed to compare the efficacy and safety of MALND and CALND for obtaining evidence-based conclusions about the short-term and long-term outcomes of MALND for patients with breast cancer. PubMed, Web of Science, Cochrane Library, and CNKI were comprehensively searched for articles published between January 1998 and January 2019. Then Newcastle-Ottawa scale was used for quality assessment. The Review Manager software version 5.0 was utilized for generating forest maps and funnel plots. Twelve studies including 2157 patients were selected for the meta-analysis. There were no significant differences in the number of lymph node dissections, tumor recurrence rate, axillary drainage, post-operative hospitalization time, and tumor size between the MALND and CALND groups ($P > .05$). In the MALND group, the surgery time was longer, while the incidence of intraoperative bleeding was lesser and the duration of drainage was shorter than those in the CALND group ($P < .01$). The complications in the MALND group were also fewer than those in the CALND group ($P < .05$). The results of the current study showed that MALND is reliable and feasible for breast cancer owing to the lesser incidence of intraoperative bleeding, shorter drainage duration, and lower incidence of complications compared to CALND.

Keywords

breast cancer, mastoscopic, lymph node dissection, meta-analysis, women health

Received December 05, 2019. Received revised April 03, 2020. Accepted for publication May 06, 2020.

Introduction

Breast cancer (BC) is the most frequently diagnosed cancer in women and the major cause of cancer death among women in most countries.[1] When axillary lymph node metastasis occurs, axillary lymph node dissection is an essential procedure during the surgical treatment of BC, as well as a key step for evaluating the clinical stages and prognosis of patients with BC.[2] Conventional axillary lymph node dissection (CALND) results in obvious damage to the body, such as the presence of a large incision scar in the axilla that affects the appearance, and the incidence of complications is quite high.[3] Currently, the

[1] Department of Surgical Oncology, Sir Run Run Shaw Hospital, Zhejiang University, Hangzhou, Zhejiang, China
[2] Cancer Institute, Second Affiliated Hospital, School of Medicine, Zhejiang University, Hangzhou, Zhejiang, China
[3] Surgical Intensive Care Unit, First Affiliated Hospital, Zhejiang University, Hangzhou, Zhejiang, China
[4] Rui An Hospital of Traditional Chinese Medicine, Wenzhou, Zhejiang, China

Corresponding Authors:
Xiao-Fang Yu, Cancer Institute, Second Affiliated Hospital, School of Medicine, Zhejiang University, Hangzhou, Zhejiang 310016, China.
Email: xfyu1@zju.edu.cn
Linbo Wang and Jichun Zhou, Department of Surgical Oncology, Sir Run Run Shaw Hospital, Zhejiang University, Hangzhou, Zhejiang, 310016, China.
Emails: linbowang@zju.edu.cn; jichun-zhou@zju.edu.cn

treatment for BC has transformed from performing the "maximum tolerable treatment" to performing the "minimal effective treatment" while improving the survival rate; in addition, we emphasize more on enhancing the quality of life (QOL) of patients,[4-6] but the trauma and complications of CALND seriously affect the QOL of patients.[7,8] The mastoscopic technique was first introduced in the 1990s and it covers almost all aspects of breast surgery, such as breast-conserving surgery, mastectomy, breast reconstruction, and sentinel lymph node and axillary lymph node dissection. Moreover, mastoscopic axillary lymph node dissection (MALND) is among the most widely used breast minimally invasive surgeries.[4,9,10] Although many studies have evaluated the safety and effectiveness of MALND, in the era of evidence medicine, only limited meta-analyses have compared MALND and CALND.[11,12] Therefore, we performed the current meta-analysis of 12 studies including 2157 patients to compare the efficacy and safety of MALND and CALND. The results of the current research would provide evidence-based conclusions regarding the short-term and long-term outcomes of MALND for patients with BC, thus providing useful information to guide clinicians in their decision-making.

Materials and Methods

Search Strategy

PubMed, Web of Science, Cochrane Library, and CNKI were comprehensively searched for articles published between January 1998 and January 2019. We used the following terms: [Breast Neoplasms (MeSH) OR mammary carcinoma] AND [Mastoscopic axillary lymph node dissection OR Endoscopic axillary lymphadenectomy OR minimal invasive surgery] AND [conventional axillary lymph node dissection OR open axillary lymphadenectomy OR open resection]. The language of the published articles was limited to Chinese or English according to the reviewers' language competence. Chinese terms were utilized when we searched the Chinese database (CNKI).

Study Selection

The articles were selected according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement.[13] Three authors were responsible for reviewing the titles, abstracts, and full text, and any disagreements about study inclusion were resolved by discussions among all the authors. The inclusion criteria for including meta-analysis in this study were as follows: (1) the study should have compared MALND and CALND for patients with BC; (2) the article must be a full-text article; and (3) the study was observational studies or randomized controlled trials (RCTs). Studies that met the following exclusion criteria were excluded: (1) studies that were abstracts, expert opinions, case reports, reviews, letters, editorials, or technical notes; (2) studies that included other endoscopic auxiliary methods instead of full-cavity mirror technology or other irrelevant types of surgical options; and (3) screened articles from which it was very difficult to extract the complete and appropriate information needed for meta-analysis.

Data Extraction and Quality Assessment

We extracted the baseline information from the articles, including the first author, publication date, study period, geographical region, number and demographic characteristics of patients, and tumor characteristics. Crucial indicators were also extracted, such as the number of lymph node dissections, tumor recurrence rate, axillary drainage, postoperative hospitalization time, tumor size, surgery duration, intraoperative bleeding, complications, and drainage duration. The data were extracted by 3 independent reviewers. Disagreements were resolved by discussions among all the authors. The methodological quality of the cohort studies and case–control studies were assessed using the Newcastle-Ottawa scale (NOS).[14] The NOS scale utilizes a "star" rating system to evaluate the quality by considering the following 3 aspects of the selected study: the selection of the study groups, the comparability of the study groups, and the assessment of the outcomes; the maximum number of stars a research might receive in each aspect is 3, 2, and 3, respectively.

Statistical Analysis

Long-term complications were classified as surgical complications including wound hematoma, lymph node injury, edema, limb movement disturbance on the affected side, paresthesia, and incision infection. This classification system was based on the Memorial Sloan-Kettering Cancer Center system for reporting complications.[15]

Statistical differences between the 2 groups were evaluated via the Fisher exact test for categorical data and by using the Student t test for continuous data. For dichotomous outcomes, we expressed results using odds ratios (ORs) with 95% CIs. For continuous outcomes, we expressed findings using the weighted mean differences (MDs) with 95% CIs. We evaluated the statistical heterogeneity using the χ^2 test and assessed the extent of inconsistency using the I^2 statistic. If heterogeneity was observed, data were finally analyzed using a random effects model; if no heterogeneity was observed, a fixed effects model was used. P values $<.05$ were considered to indicate statistical significance. The funnel plot method was utilized to evaluate the possible presence of publication bias.[16] Review Manager (RevMan) software version 5.0 (The Nordic Cochrane Center, The Cochrane Collaboration, Copenhagen, 2008) was used for data entry, forest plots, and statistical analysis.

Results

Selection of Studies

The initial search included 194 potentially related articles, of which 53 articles were eliminated, as they were

duplicates. Among the remaining 141 articles, 85 articles were eliminated after reading the title and abstract. Then, the remaining 56 studies were obtained and reviewed, of which 44 articles were excluded because of major data were not available (n = 36) or because the full English article was not available (n = 8). Finally, 12 observational studies were eventually included,[12,17-27] and the complete text for all the articles was accessible. Eight articles were published in English and 4 in Chinese. A flow diagram of the search strategies along with the reasons for elimination is shown in Figure 1.

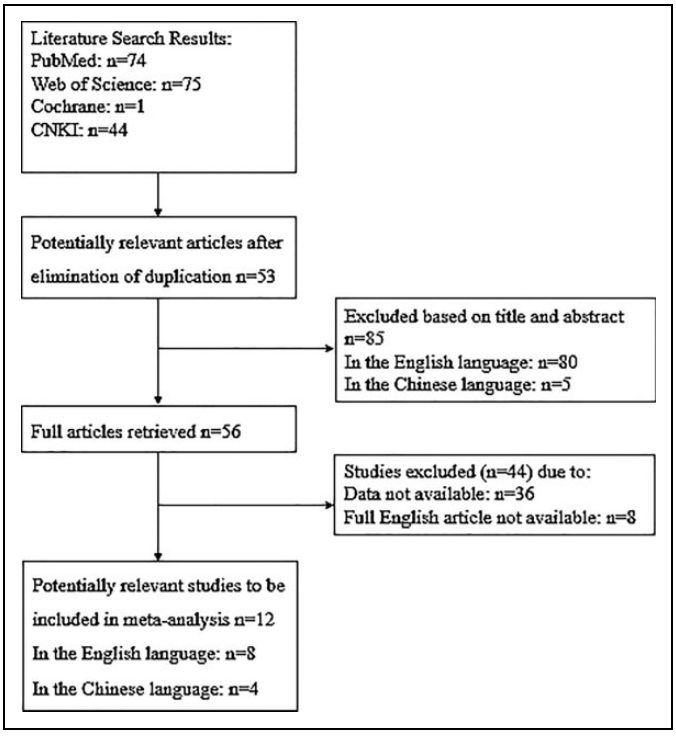

Figure 1. Flowchart showing the search strategy and selection of studies in the meta-analysis.

Characteristics and Quality of the Included Studies

A total of 2157 participants were included in the 12 studies: 1097 (50.9%) in the MALND group and 1060 (49.1%) in the CALND group; the 12 studies were mainly from 6 different countries (5 studies were from China, 3 from Italy, and 1 each from Japan, France, Germany, and Egypt). On using the NOS, 3 of the 12 studies received 6 stars, 8 articles received 7 stars, and 1 article received 8 stars. All the studies included in the current meta-analysis were prospective cohort studies. The characteristics and the quality of studies are summarized in Table 1.

Meta-Analysis of the Surgical Outcomes

In 3 studies, the tumor size was compared between the MALND and CALND groups, and there was no significant heterogeneity between the groups ($P = .28$, $I^2 = 21\%$).[23,25,26] The results showed no significant difference between the 2 groups considering tumor size (MD = −0.15, 95% CI: −0.97 to 0.67, $P = .72$; Figure 2). Surgery time was significantly different ($P < .001$, $I^2 = 99\%$) among 9 studies[12,17,20-26]; the surgery duration was significantly longer in the MALND group than in the CALND group (MD = 18.56, 95% CI: 6.92-30.20, $P < .01$; Figure 2). Six studies compared the amount of blood loss during the 2 surgical procedures[20,22-26]; the results showed that there was significantly less blood loss in the MALND group than in the CALND group (MD = −97.93, 95% CI: −169.71 to −26.14, $P < .01$; Figure 2). Nine studies provided data about the number of lymph node dissections during MALND and CALND,[12,17,21-27] with significant heterogeneity among the studies ($P < .001$, $I^2 = 80\%$) using a random effect model. The results showed no significant difference in the number of lymph node dissections between the 2 groups (MD = 0.21, 95% CI: −0.62 to 1.05, $P = .62$; Figure 2).

Meta-Analysis of Postoperative Outcomes

Seven studies compared the drainage time between MALND and CALND,[12,20,21,24-27] with significant heterogeneity among

Table 1. Summary of Studies Included in Meta-Analysis.

Author	Region	Year	Study period	Size: MALND	Size: CALND	Conversion (%)	Follow-up (month): MALND	Follow-up (month): CALND	Quality scores
Salvat et al	France	1996	1995-1996	20	20	NR	NR	NR	6
Hüscher et al	Italy	2002	1994-1996	10	12	NR	65.8 (48-75)	55.4 (48-69)	7
Wilde et al	Germany	2003	84 days	40	40	NR	84 days	84 days	7
Yamashita et al	Japan	2006	2001-2005	100	34	2	25 (−50)	25 (−50)	7
Antonio et al	Italy	2007	2005-2006	50	50	NR	NR	NR	6
Hussein et al	Egypt	2007	1999-2005	16	25	2	32	32	7
Chen et al	China	2010	2002-2006	53	65	NR	45.9 (36-72)	45.9 (36-72)	7
Ding et al	China	2011	2008	50	50	NR	7.8 (6-11)	7.8 (6-11)	7
Luo et al	China	2012	2003-2005	496	500	27	63 (42-78)	63 (42-78)	8
Lumachi et al	Italy	2013	NR	68	71	NR	NR	NR	7
Zhang et al	China	2013	2008-2010	134	133	NR	30.3 ± 6.5	30.1 ± 7.1	7
Liu et al	China	2017	2015-2016	60	60	NR	90 days	90 days	6

Abbreviations: CALND, conventional axillary lymph node dissection; MALND, mastoscopic axillary lymph node dissection; NR, not reported.

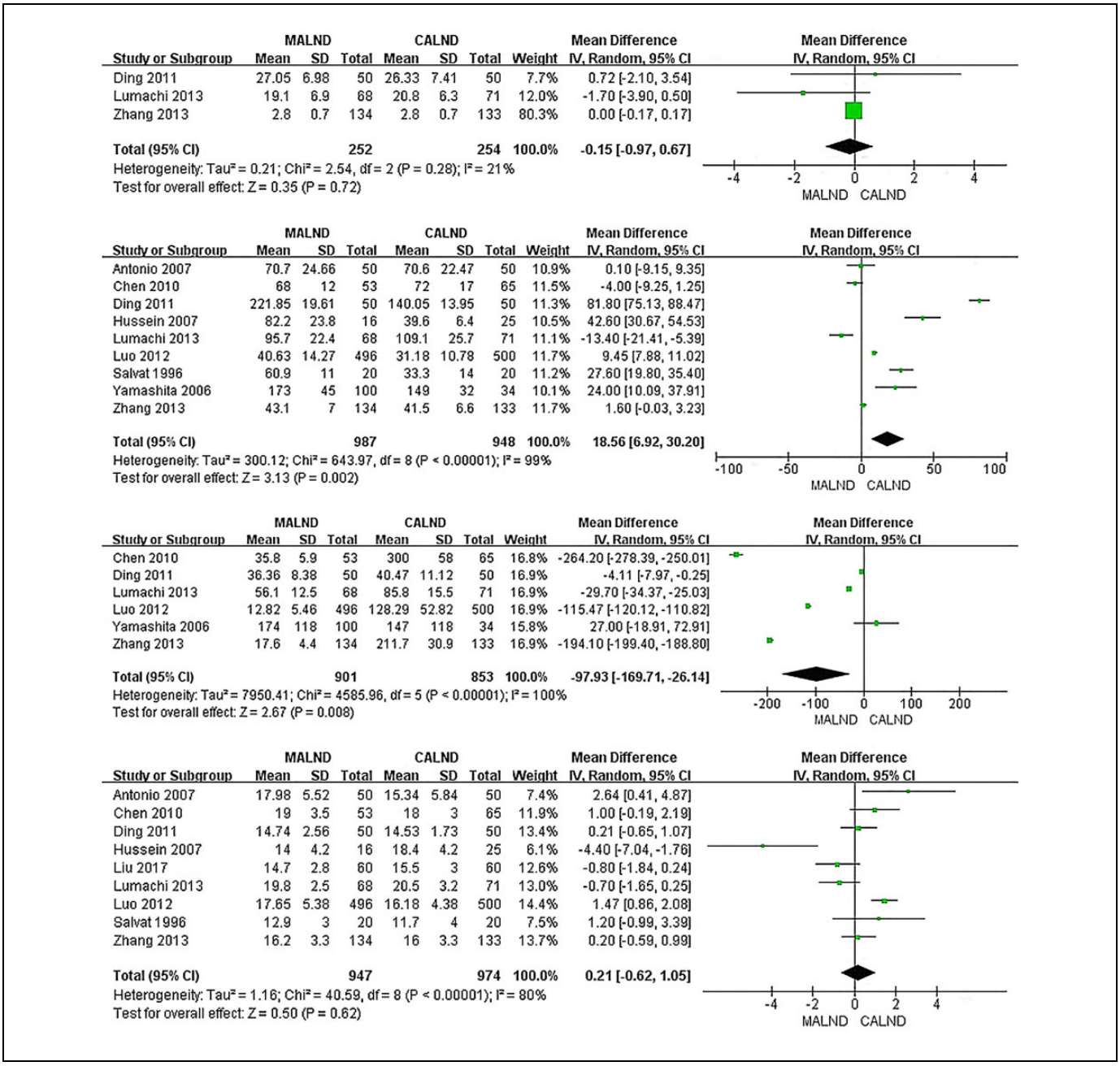

Figure 2. Meta-analysis of tumor size and operative outcomes (surgery duration, intraoperative bleeding, and number of lymph nodes harvested). CALND indicates conventional axillary lymph node dissection; MALND, mastoscopic axillary lymph node dissection.

the studies ($P < .001$, $I^2 = 95\%$). The results showed that the axillary drainage time was significantly less in the MALND group than in the CALND group (MD = −1.13, 95% CI: −1.90 to −0.35, $P < .01$; Figure 3). Six studies compared the armpit drainage flow rate between MALND and CALND,[20,21,24-27] with significant heterogeneity among the studies ($P < .001$, $I^2 = 98\%$); the armpit drainage flow rate was not significantly different between the groups (MD = −21.50, 95% CI: −53.06 to 10.07, $P = .18$; Figure 3). Four studies compared the postoperative hospitalization time between MALND and CALND,[17,22,23,26] with significant heterogeneity among the studies ($P < .001$, $I^2 = 92\%$). The results showed no significant difference in the postoperative hospitalization time between MALND and CALND (MD = −1.25, 95% CI: −2.55 to 0.04, $P = .06$; Figure 3).

Meta-Analysis of Overall Complications

The incidence of postoperative complications was reported in 12 studies,[12,17-27] with significant heterogeneity among the studies ($P < .001$, $I^2 = 82\%$) using a random effect model. The incidence of postoperative complications was significantly less

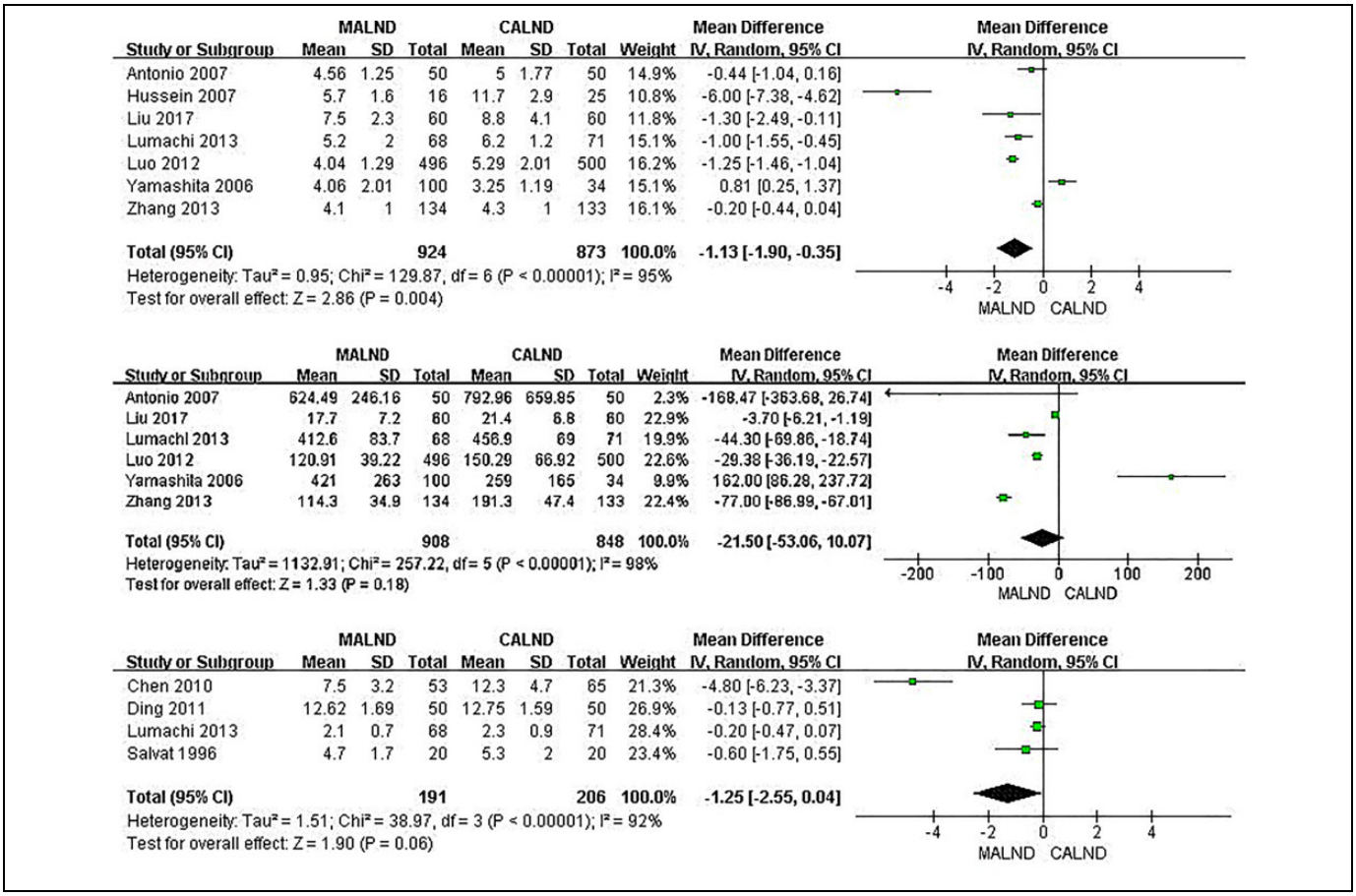

Figure 3. Meta-analysis of postoperative outcomes (drainage duration, drainage flow, and length of hospital stay). CALND indicates conventional axillary lymph node dissection; MALND, mastoscopic axillary lymph node dissection.

in the MALND group than in the CALND group (OR = 0.41, 95% CI: 0.19-0.85, $P < .05$; Figure 4).

Meta-Analysis of Recurrence

Eight studies reported tumor recurrence rates,[12,17,18,20,22-25] with no significant heterogeneity between the 2 groups ($P = .74$, $I^2 = 0\%$). The postoperative tumor recurrence rate was not significantly different between the 2 groups (OR = 1.10, 95% CI: 0.68-1.78, $P = .70$; Figure 4).

Publication Bias

To evaluate the publication bias, we utilized a funnel plot analysis to compare the overall complications between MALND and CALND (Figure 5). We obtained a scatter plot of the treatment effects that were estimated from individual studies; we plotted the OR against the standard error of the estimate [SE (logOR)]. The graphical funnel plot showed that none of the studies were outside the 95% CI boundaries, indicating no evidence of publication bias ($P = .862$).

Discussion

The results of the current study showed that the surgery duration was longer in the MALND group than in the CALND group. This was probably because during MALND, the additional process of liposuction is required to dissolve fat; moreover, MALND was prolonged owing to the limitations of cavity mirror surgery as well as considering the proficiency of the performer.

The results of the current study showed that there was less amount of blood loss and a lower incidence of postoperative complications in the MALND group than in the CALND group. Moreover, the axillary drainage time was shorter than that required during CALND. These indicate that MALND results in less trauma, faster postoperative recovery, and fewer complications,[28] probably owing to the following reasons: (1) with the help of endoscopic techniques, MALND can better expose the complex anatomy of the axilla and reduce the damage to the blood vessels, lymphatic vessels, and nerves. (2) Lipid agents are injected before MALND, and the epinephrine in the lipid agents has the effect of constricting blood vessels, thus enhancing physical function and immunity. (3) MALND will not result in changes in the pathological characteristics of lymph nodes if the surgery is performed correctly and if the suction

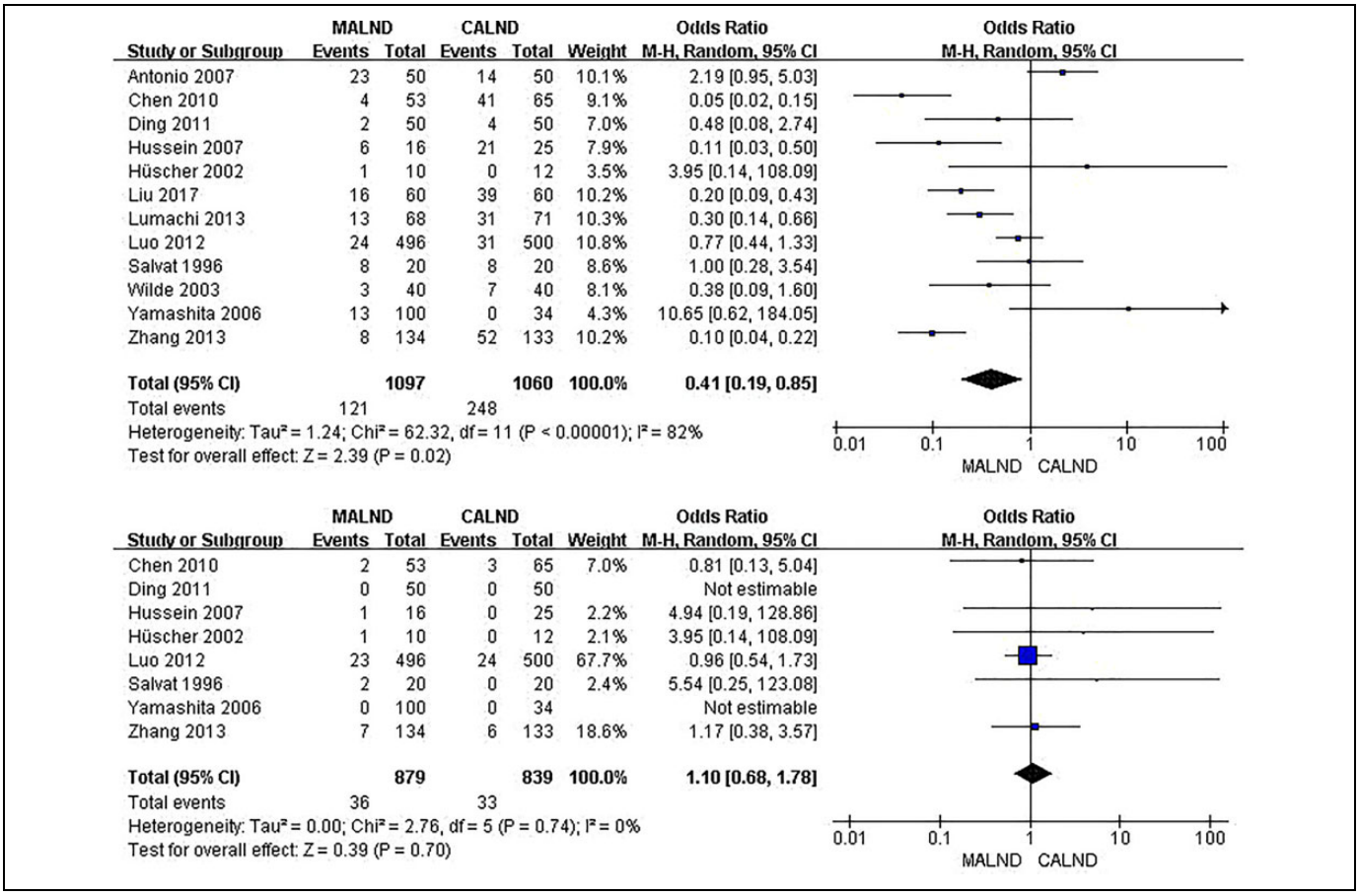

Figure 4. Meta-analysis of overall complications and recurrence. CALND indicates conventional axillary lymph node dissection; MALND, mastoscopic axillary lymph node dissection.

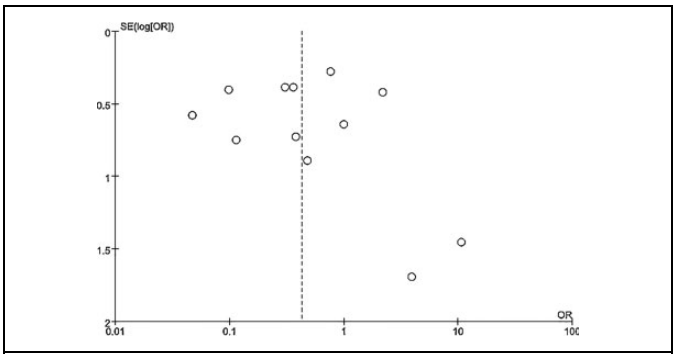

Figure 5. Funnel diagram showing the overall complications. CALND indicates conventional axillary lymph node dissection; MALND, mastoscopic axillary lymph node dissection.

pressure is not too high. (4) Laparoscopic surgery using an ultrasonic knife cutting is time saving and can reduce intraoperative trauma.

Considering the number of lymph nodes dissected, the current meta-analysis showed no significant differences between the MALND and CALND groups. This result might indicate that the clearance of lymph nodes is similar between the groups. After liposuction, the visual field of the cavity is artificially established, and the anatomical structure and lymph nodes of the axilla can be clearly observed from different angles, so that the axillary lymph nodes can be removed more accurately.

Oncological outcomes, such as tumor recurrence, are associated with the skill of surgeons; MALND involves the use of liposuction to remove the fat to form the axillary space. Therefore, if the negative pressure device is overpressured, the integrity of the lymph nodes can be destroyed and tumor metastasis may occur.[9] The results of the current study demonstrated no significant difference between the 2 groups considering the postoperative tumor recurrence rate, but the findings need be interpreted carefully. The surgical technique is demanding, and the number of recurrences was not reported in one-third of the included studies. In addition, data on postoperative follow-up were relatively few. Moreover, the tumor size and molecular subtype of BC were not well comparable among the different studies. Accordingly, unlike surgery-related outcomes, oncological outcomes are hard to evaluate. Therefore, RCTs with longer follow-up are urgently needed for further evaluation of the oncological outcomes.

With the advent of sentinel lymph node biopsy (SNB), patients with BC without sentinel lymph node metastasis, ALND has been replaced by SNB as the standard treatment. Besides, ALND following a positive SN biopsy is being

progressively abandoned while patients meet the criteria of AMAROS trial.[29-32] The results of the ACOSOG Z0011 phase 3 randomized clinical trial were then reported in 2017 with a median follow-up of 10 years.[33] Researchers found that 10-year overall survival (OS) for patients with T1 or T2 invasive primary BC treated with SNB alone was significantly noninferior to OS for those treated with ALND. Meanwhile, SNB without ALND offers excellent regional control for patients with T1 or T2 invasive primary BC treated with breast-conserving therapy and adjuvant systemic therapy.[34] These findings do not support routine use of ALND in abovementioned patient population.

The comparative analysis of MALND and CALND showed that MALND was effective and had wide application prospects for the treatment of BC owing to its unique technical advantages and therapeutic effect. As a minimally invasive surgery technique, it might be feasible to replace CALND with MALND for most cases. However, the overall low quality of the 12 studies included in the current meta-analysis influenced the strength of the evidence in this study. Because most of the studies included did not use the double-blind method, the expression methods for each observation index were different, and some of the indicators of individual studies were transformed, thereby affecting the stability of the results to a certain extent. Therefore, although the findings of this study are relevant, the results should be interpreted with caution.

Conclusions

The current evidence-based analysis revealed that MALND was safer and more feasible than CALND for patients with BC, owing to the lower incidence of intraoperative bleeding, shorter drainage duration, and lower incidence of complications. Nevertheless, well-designed RCTs are needed in future to verify the use of MALND for BC.

Authors' Note

H.X., Z.C., and L.X. contributed equally to this work.

Acknowledgments

The authors apologize to all researchers whose relevant contributions were not cited owing to space limitations. The authors would like to thank Editage (www.editage.com) for English language editing.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: The work was supported by the National Natural Science Foundation of China (No. 81972453, No. 81972597, No. 81602471 and No. 81672729), Zhejiang Provincial Natural Science Foundation of China under Grants (No. LY19H160055, LY19H160059, LY18H160005, LY18H160030, and LY20H160026). The work was sponsored by Zheng Shu Medical Elite Scholarship Fund.

ORCID iD

Hanchu Xiong https://orcid.org/0000-0001-6075-6895

References

1. Ferlay J, Colombet M, Soerjomataram I, et al. Estimating the global cancer incidence and mortality in 2018: GLOBOCAN sources and methods. *Int J Cancer*. 2019;144(8):1941-1953. doi:10.1002/ijc.31937
2. Spillane AJ, Brennan ME. Minimal access breast surgery: a single breast incision for breast conservation surgery and sentinel lymph node biopsy. *Eur J Surg Oncol*. 2009;35(4):380-386. doi:10.1016/j.ejso.2008.07.009
3. Seki T, Hayashida T, Takahashi M, Jinno H, Kitagawa Y. A randomized controlled study comparing a vessel sealing system with the conventional technique in axillary lymph node dissection for primary breast cancer. *Springerplus*. 2016;5(1):1004. doi:10.1186/s40064-016-2710-7
4. Chengyu L, Jian Z, Xiaoxin J, Hua L, Qi Y, Chen G. Experience of a large series of mastoscopic axillary lymph node dissection. *J Surg Oncol*. 2008;98(2):89-93. doi:10.1002/jso.21080
5. Glechner A, Wockel A, Gartlehner G, et al. Sentinel lymph node dissection only versus complete axillary lymph node dissection in early invasive breast cancer: a systematic review and meta-analysis. *Eur J Cancer*. 2013;49(4):812-825. doi:10.1016/j.ejca.2012.09.010
6. Sun Y, Kim SW, Heo CY, et al. Comparison of quality of life based on surgical technique in patients with breast cancer. *Jpn J Clin Oncol*. 2014;44(1):22-27. doi:10.1093/jjco/hyt176
7. Hussien M, Spence RA. Axillary lymph node clearance: overcoming the technical difficulties. *Breast*. 2004;13(2):133-138. doi:10.1016/j.breast.2003.10.004
8. Luini A, Gatti G, Ballardini B, et al. Development of axillary surgery in breast cancer. *Ann Oncol*. 2005;16(2):259-262. doi:10.1093/annonc/mdi060
9. Brun JL, Rousseau E, Belleannee G, de Mascarel A, Brun G. Axillary lymphadenectomy prepared by fat and lymph node suction in breast cancer. *Eur J Surg Oncol*. 1998;24(1):17-20.
10. Kuhn T, Santjohanser C, Koretz K, Bohm W, Kreienberg R. Axilloscopy and endoscopic sentinel node detection in breast cancer patients. *Surg Endosc*. 2000;14(6):573-577.
11. Langer I, Kocher T, Guller U, et al. Long-term outcomes of breast cancer patients after endoscopic axillary lymph node dissection: a prospective analysis of 52 patients. *Breast Cancer Res Treat*. 2005;90(1):85-91. doi:10.1007/s10549-004-3268-6
12. Hussein O, El-Nahhas W, El-Saed A, Denewer A. Video-assisted axillary surgery for cancer: non-randomized comparison with conventional techniques. *Breast*. 2007;16(5):513-519. doi:10.1016/j.breast.2007.03.005
13. Panic N, Leoncini E, de Belvis G, Ricciardi W, Boccia S. Evaluation of the endorsement of the preferred reporting items for systematic reviews and meta-analysis (PRISMA) statement on the

quality of published systematic review and meta-analyses. *PLoS One*. 2013;8(12):e83138. doi:10.1371/journal.pone.0083138
14. Zeng X, Zhang Y, Kwong JS, et al. The methodological quality assessment tools for preclinical and clinical studies, systematic review and meta-analysis, and clinical practice guideline: a systematic review. *J Evid Based Med*. 2015;8(1):2-10. doi:10.1111/jebm.12141
15. Grobmyer SR, Pieracci FM, Allen PJ, Brennan MF, Jaques DP. Defining morbidity after pancreaticoduodenectomy: use of a prospective complication grading system. *J Am Coll Surg*. 2007;204(3):356-364. doi:10.1016/j.jamcollsurg.2006.11.017
16. Higgins JP, Thompson SG. Quantifying heterogeneity in a meta-analysis. *Stat Med*. 2002;21(11):1539-1558. doi:10.1002/sim.1186
17. Salvat J, Knopf JF, Ayoubi JM, et al. Endoscopic exploration and lymph node sampling of the axilla. Preliminary findings of a randomized pilot study comparing clinical and anatomopathologic results of endoscopic axillary lymph node sampling with traditional surgical treatment. *Eur J Obstet Gynecol Reprod Biol*. 1996;70(2):165-173.
18. Hüscher CG, Barreca M, Paola MD, Ricchiuti C, Lirici MM. Quadrantectomy and video-assisted axillary dissection for stage I breast cancer. *Minim Invasive Ther Allied Technol*. 2002;11(1):23-28. doi:10.1080/136457002317255054
19. de Wilde RL, Schmidt EH, Hesseling M, Mildner R, Frank V, Tenger M. Comparison of classic and endoscopic lymphadenectomy for staging breast cancer. *J Am Assoc Gynecol Laparosc*. 2003;10(1):75-79.
20. Yamashita K, Shimizu K. Endoscopic video-assisted breast surgery: procedures and short-term results. *J Nippon Med Sch*. 2006;73(4):193-202.
21. Antonio M, Pietra T, Domenico L, et al. Does LigaSure reduce fluid drainage in axillary dissection? A randomized prospective clinical trial. *Ecancermedicalscience*. 2007;1:61. doi:10.3332/eCMS.2007.61
22. Kaiyun C, Guoan X. The application of mastecoscope to dissect axillary lymph node in breast-conserving surgery. *Chin J Endocr Surg*. 2010;4(1):25-27.
23. Boni D, Xiaorong L, Daojin C, Junhui W, Liyuan Q. Clinical application of mastoscopic axillary lymph node dissection [in Chinese]. *Zhonghua Pu Tong Wai Ke Za Zhi*. 2011;20(5):474-477.
24. Luo C, Guo W, Yang J, et al. Comparison of mastoscopic and conventional axillary lymph node dissection in breast cancer: long-term results from a randomized, multicenter trial. *Mayo Clin Proc*. 2012;87(12):1153-1161. doi:10.1016/j.mayocp.2012.07.022
25. Jian Zhang CL. Randomized controlled trial comparing mastoscopic with traditional axillary lymph node dissection for early breast cancer. *Zhonghua Shi Yong Wai Ke Za Zhi*. 2013;33(2):143-145.
26. Lumachi F, Basso SM, Santeufemia DA, Bonamini M, Chiara GB. Ultrasonic dissection system technology in breast cancer: a case-control study in a large cohort of patients requiring axillary dissection. *Breast Cancer Res Treat*. 2013;142(2):399-404. doi:10.1007/s10549-013-2746-0
27. Guijin LJH. Postoperative recovery and complications of axillary lymph node dissection: conventional vs mastoscopic. *Chin J Breast Dis*. 2017;11(4):218-222.
28. Aponte-Rueda ME, Saade Cardenas RA, Saade Aure MJ. Endoscopic axillary dissection: a systematic review of the literature. *Breast*. 2009;18(3):150-158. doi:10.1016/j.breast.2009.05.001
29. Hussien M, Spence RAJ. Axillary lymph node clearance: overcoming the technical difficulties. *Breast (Edinburgh, Scotland)*. 2004;13(2):133-138. doi:10.1016/j.breast.2003.10.004
30. Luini A, Gatti G, Ballardini B, et al. Development of axillary surgery in breast cancer. *Ann Oncology*. 2005;16:259-262. doi:10.1093/annonc/mdi060
31. Boughey JC, McCall LM, Ballman KV, et al. Tumor biology correlates with rates of breast-conserving surgery and pathologic complete response after neoadjuvant chemotherapy for breast cancer: findings from the ACOSOG Z1071 (Alliance) Prospective Multicenter Clinical Trial. *Ann Surg*. 2014;260(4):608-616. doi:10.1097/SLA.0000000000000924
32. Donker M, van Tienhoven G, Straver ME, et al. Radiotherapy or surgery of the axilla after a positive sentinel node in breast cancer (EORTC 10981-22023 AMAROS): a randomised, multicentre, open-label, phase 3 non-inferiority trial. *Lancet Oncol*. 2014;15(12):1303-1310. doi:10.1016/S1470-2045(14)70460-7
33. Giuliano AE, Ballman KV, McCall L, et al. Effect of axillary dissection vs no axillary dissection on 10-year overall survival among women with invasive breast cancer and sentinel node metastasis: The ACOSOG Z0011 (Alliance) Randomized Clinical Trial. *JAMA*. 2017;318(10):918-926. doi:10.1001/jama.2017.11470
34. Giuliano AE, Ballman K, McCall L, et al. Locoregional recurrence after sentinel lymph node dissection with or without axillary dissection in patients with sentinel lymph node metastases: long-term follow-up from the American College of Surgeons Oncology Group (Alliance) ACOSOG Z0011 Randomized Trial. *Ann Surg*. 2016;264(3):413-420. doi:10.1097/sla.0000000000001863