Robotic versus Laparoscopic Cholecystectomy: A Meta-Analysis

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Introduction

Laparoscopic cholecystectomy (LC) remains the gold standard management of benign gallbladder disease. The adoption of the robotic platform that offers high-resolution 3-dimensional images, dexterity, better range of motion, and precise control in comparison to laparoscopic cholecystectomy (LC) into general practice is still lacking. Recent data on the safety and efficacy of Robotic cholecystectomy (RC) in comparison to LC has not yet been analyzed. The aim of this study is to evaluate the effectiveness and safety of RC compared to LC for gallbladder disease from articles published after 2017.

Methods

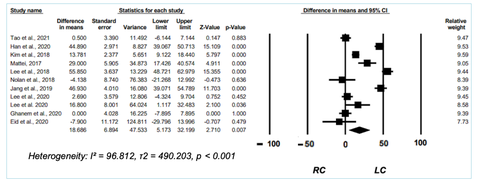
- A systematic review was conducted using EMBASE, PubMed, and Cochrane Library databases (from Dec. 2017 to Sept. 2021) to identify comparative studies investigating the safety and efficacy of RC in comparison to LC.
- Outcomes include: operative times, conversion to open and/or conventional laparoscopy, estimated blood loss (EBL), length of hospital stay (LOS), intraoperative/postoperative complication rates, and bile leaks.
- Statistical analysis was done using random-effects meta-analysis to compare the mean difference (MD) and Odds ratio (OR) of the separate groups (Comprehensive Meta-Analysis Version 3.3.070 software; Biostat Inc., Englewood, NJ).

Table 1. Summary of studies

First author	*Country of origin*	*Year*	*Study period*	*Total (n)*	*LC (n)*	*RC (n)*	*Type of LC & RC*
Aguayo	USA	2020	2008-2017	3,193,697	3,146,454	42,018	NR
Tao	USA	2021	Jan 2006-Feb 2020	783	612	171	NR
Han	South Korea	2020	March 2009-Aug 2015	208	104	104	SIRC & SILC
Kim	South Korea	2018	Jan 2016-July 2017	134	79	55	SIRC, SILC & MILC
Mattei	USA	2017	2013	40	20	20	SIRC & SILC
Lee	South Korea	2018	June 2016-May 2017	121	60	61	SIRC & MILC
Nolan	USA	2018	Oct 2010-Dec 2014	71	50	21	SIRC, SILC, MIRC & MILC
Jang	South Korea	2019	Dec 2013-May 2015	117	78	39	SIRC & SILC
Kulaylat	USA	2020	Jan 2015-Dec 2018	299	220	79	SIRC, MIRC & MILC
Lee	South Korea	2020	March 2018-July 2019	300	103	197	SIRC & SILC
Abel	USA	2021	March 2008-May 2018	584	288	296	SIRC & MILC
J. Lee	South Korea	2020	Nov 2017-Feb 2019	75	25	50	SIRC & SILC
Ghanem	USA	2020	July 2013-June 2016	142	71	71	SIRC & SILC
Eid	USA	2020	June 2016-Oct 2018	90	70	20	NR

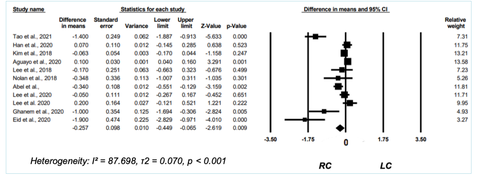
Table 1: SILC= Single-incision laparoscopic cholecystectomy; MILC= Multi-incision laparoscopic cholecystectomy; SIRC= Single-incision robotic cholecystectomy; MIRC= Multi-incision robotic cholecystectomy; NR= Not reported

Figure 1: Operative Time *(min)*



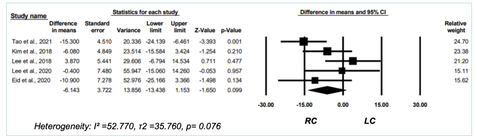
Heterogeneity: I² = 96.812, τ2 = 490.203, p < 0.001

Figure 2: LOS *(days)*



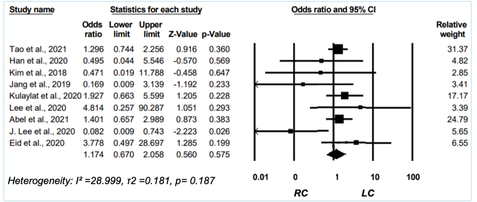
Heterogeneity: I² = 87.698, τ2 = 0.070, p < 0.001

Figure 3: EBL *(ml)*



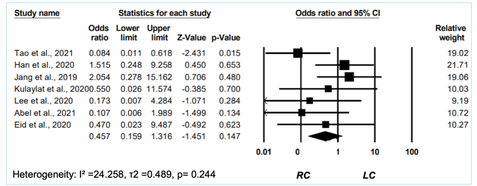
Heterogeneity: I² =52.770, τ2 =35.760, p= 0.076

Figure 4: Intra/Postoperative Complications



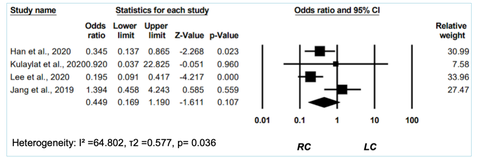
Heterogeneity: I² =28.999, τ2 =0.181, p= 0.187

Figure 5: Conversions



Heterogeneity: I² =24.258, τ2 =0.489, p= 0.244

Figure 6: Bile Leaks



Heterogeneity: I² =64.802, τ2 =0.577, p= 0.036

Results

- 14 studies are included in the meta-analysis.
- 3,196,661 total patients were included.
- 43,202 underwent RC and 3,148,234 underwent LC.
- RC had longer operative time compared to LC (MD= 18.86 min, p=0.007).
- RC had shorter LOS compared to LC (MD= -0.25 days, p=0.009).
- There was no significant difference in EBL (p= 0.09), operative complications (p= 0.57), conversions (p= 0.14), and bile leak (p= 0.10) between LC and RC.

Conclusions

Robotic Cholecystectomy is as safe and efficacious as Laparoscopic Cholecystectomy with shorter length of stay in the hospital.

References

- Eid JJ, Jyot A, Macedo FI, Sabir M, Mittal VK. Robotic cholecystectomy is a safe educational alternative to laparoscopic cholecystectomy during general surgical training: A pilot study. Journal of surgical education. 2020;77(5):1266-1270.
- Ghanem M, Shaheen S, Blebea J, et al. Robotic versus laparoscopic cholecystectomy: Case-control outcome analysis and surgical resident training implications. Curēus (Palo Alto, CA). 2020;12(4):e7641.
- Kim S, Lee J, Kim K, Lee T, Ahn J. Robotic surgery enables safe and comfortable single-incision cholecystectomy: A comparison of robotic and laparoscopic approaches for single-incision surgery. Journal of minimal access surgery. 2020;0(0).
- Abel SA, Dy BM, Al-Lami H, et al. Comparison of short- and long-term postoperative occurrences after robotic single-incision cholecystectomy versus multiport laparoscopic cholecystectomy. Surgical endoscopy. 2021;1.
- Lee SM, Lim JH. Comparison of outcomes of single incision robotic cholecystectomy and single incision laparoscopic cholecystectomy. Annals of hepato-biliary-pancreatic surgery. 2021;25(1):78-83.
- Kulaylat AN, Richards H, Yada K, et al. Comparative analysis of robotic-assisted versus laparoscopic cholecystectomy in pediatric patients. Journal of pediatric surgery. 2020;56(10):1876.
- Jang EJ, Roh YH, Kang CM, Kim DK, Park KJ. Single-port laparoscopic and robotic cholecystectomy in obesity (>25 kg/m 2). Journal of the Society of Laparoendoscopic Surgeons. 2019;23(2):e2019.00005.
- Nolan H, Glenn J. Minimally invasive pediatric cholecystectomy: A comparison of robotic and laparoscopic single and multiport techniques. Journal of laparoendoscopic & advanced surgical techniques. Part A. 2018;28(6):77-773.
- Lee SR, Kim HO, Shin JH. Clinical outcomes of single-incision robotic cholecystectomy versus conventional 3-port laparoscopic cholecystectomy. Canadian journal of surgery. 2019;62(1):52-56.
- Mattei P. Single-site robotic-assisted laparoscopic cholecystectomy in children and adolescents: A report of 20 cases. Surg Endosc. 1234567890;32(5):2402.
- Kim HS, Han Y, Kang JS, et al. Comparison of single-incision robotic cholecystectomy, single-incision laparoscopic cholecystectomy and 3-port laparoscopic cholecystectomy - postoperative pain, cosmetic outcome and surgeon's workload. Journal of minimally invasive surgery. 2018;21(4):168-176.
- Han DH, Choi SH, Kang CM, Lee WJ. Propensity score-matching analysis for single-site robotic cholecystectomy versus single-incision laparoscopic cholecystectomy: A retrospective cohort study. International journal of surgery (London, England). 2020;78:138-142.
- Tao Z, Emuakhagbon V, Pham T, Augustine MM, Guzzetta A, Huerta S. Outcomes of robotic and laparoscopic cholecystectomy for benign gallbladder disease in veteran patients. J Robotic Surg. 123456789;1.
- Aguayo E, Dobaria V, Nakhla M, et al. National trends and outcomes of inpatient robotic-assisted versus laparoscopic cholecystectomy. Surgery. 2020;168(4):625-630.