
Colorectal Liver Metastases

# Simultaneous laparoscopic approach for colorectal cancer and liver metastasis

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# SURGICAL STRATEGIES

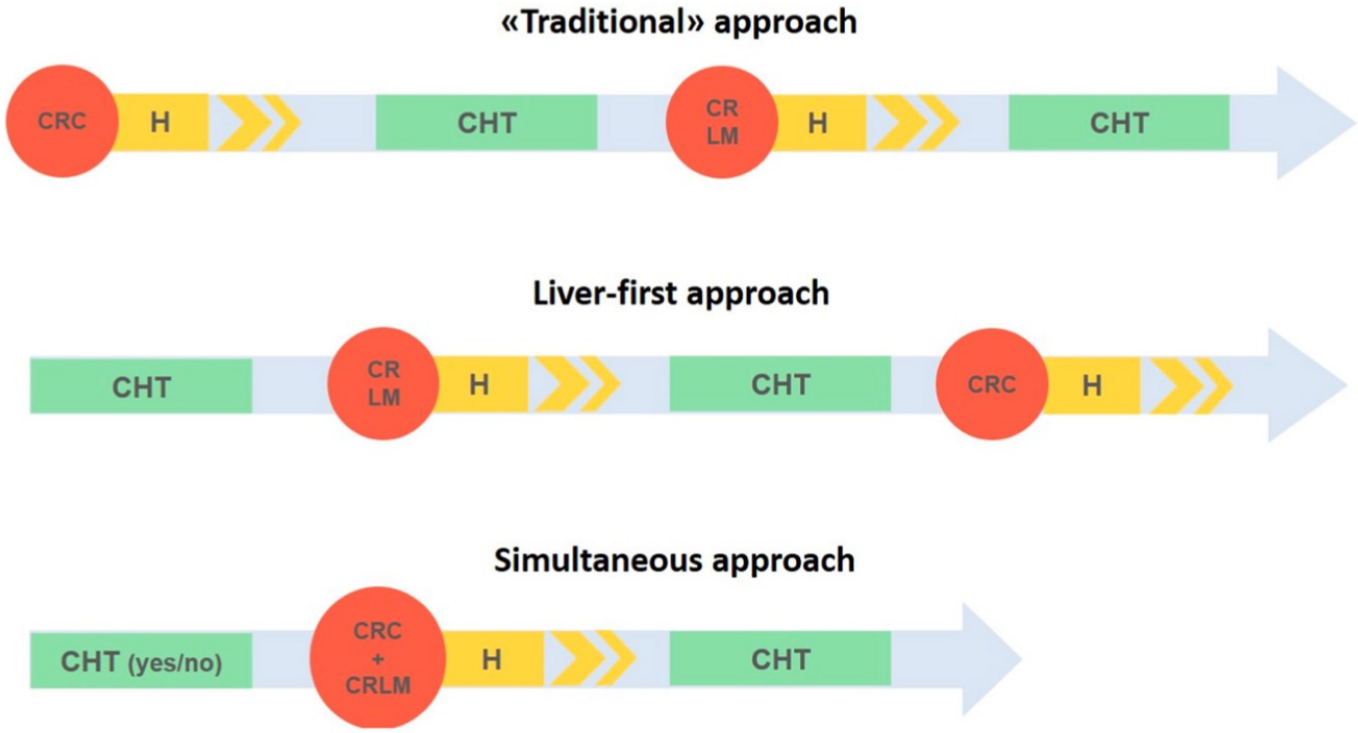



**FIGURE 1 |** Three different strategies in case of synchronous liver metastases and colorectal cancer. CRC, Colorectal cancer; CRLM, colorectal liver metastases; H, hospital stay; CHT, chemotherapy.

Sena G, et al. Frontiers Surg 2021

# SURGICAL STRATEGIES

**Table 1 Controversial issues involving surgical strategies for colorectal cancer with synchronous resectable liver metastases**

| Controversial issue | Advantages | Disadvantages |
|---|---|---|
| Surgical strategies for synchronous CRLM: | | |
| • Traditional "staged" or "classic" approach | Risks of CRR and LR are not cumulated; CHT can be usefully administered before the LR | May determine progression of CRLM, sometimes up to unresectability; manipulation of metastatic CRC may have adverse effects on distant metastases and oncological outcome |
| • "Reverse" or "liver-first" approach | Avoids progression of borderline resectable CRLM; permits appropriate NACHRT for locally advanced rectal cancer, sometimes up to complete response | Comparative results with the traditional approach are still uncertain |
| • Simultaneous colorectal and liver resection | Reduces the number of surgical procedures; may reduce the duration of perioperative CHT; may decrease the cumulative costs of hospitalization | Requires accurate selection of candidates; may increase perioperative morbidity and mortality; oncological outcomes are still uncertain |
| NACHT of resectable CRLM | May reduce the extent of LR; may increase the R0 resection rates; eradicates micrometastases; may select patients with favourable oncological prognosis after LR | May determine progression of CRLM, sometimes up to unresectability; may determine parenchymal damage and increase perioperative morbidity; its overall beneficial impact on oncological outcomes has not been confirmed |

De Raffele E, et al. World J Gastroenterol 2020

# SURGICAL STRATEGIES

**Table 2 Controversial issues involving mini-invasive (laparoscopic and robotic) surgical strategies for colorectal cancer with synchronous resectable liver metastases**

| Controversial issue | Advantages | Disadvantages |
|---|---|---|
| Mini-invasive *vs* open colorectal surgery | Achieves better perioperative results; achieves similar oncological results | In case of rectal resection, may determine a higher risk of suboptimal oncological results at histopathology; in case of rectal resection, its overall impact on oncological outcomes is still uncertain |
| Mini-invasive *vs* open liver surgery | Achieves better perioperative results; achieves at least similar oncological results; rapid technological evolution; rapid growth of surgical experience and skill | Usually preferred for limited disease, in favourable locations and selected patients; may determine more complex and longer procedures; may determine more extended hepatectomies; less frequently used for major LR, including TSH and ALPPS, and for CRLM in postero-superior segments and in the caudate lobe; may determine higher costs |
| Mini-invasive *vs* open simultaneous colorectal and liver resection | Achieves better perioperative results; achieves similar oncological results | Usually preferred for limited liver disease, in favourable locations, and higly selected patients; may determine more complex and longer procedures; may determine higher costs |
| Mini-invasive *vs* open PSLR | Achieves better perioperative results; achieves similar oncological results; rapid technological evolution; rapid growth of surgical experience and skill | The principles of PSLR are time-consuming and rather difficult to apply during mini-invasive procedures; usually preferred for limited disease, in favourable locations and selected patients; may determine more complex and longer procedures; may determine higher costs |
| The impact of PSLR on mini-invasive simultaneous resection | May achieve better perioperative results; may achieve similar oncological results | May determine more complex and longer procedures; may have very limited indications |

De Raffele E, et al. World J Gastroenterol 2020

# STRATEGIES

- ❑ Specialties (same team vs different team)
- ❑ Expertise
- ❑ Location (colon + liver)
- ❑ Complexity
- ❑ Trocar placement
- ❑ BMI
- ❑ Previous abdominal surgery
- ❑ Operative order

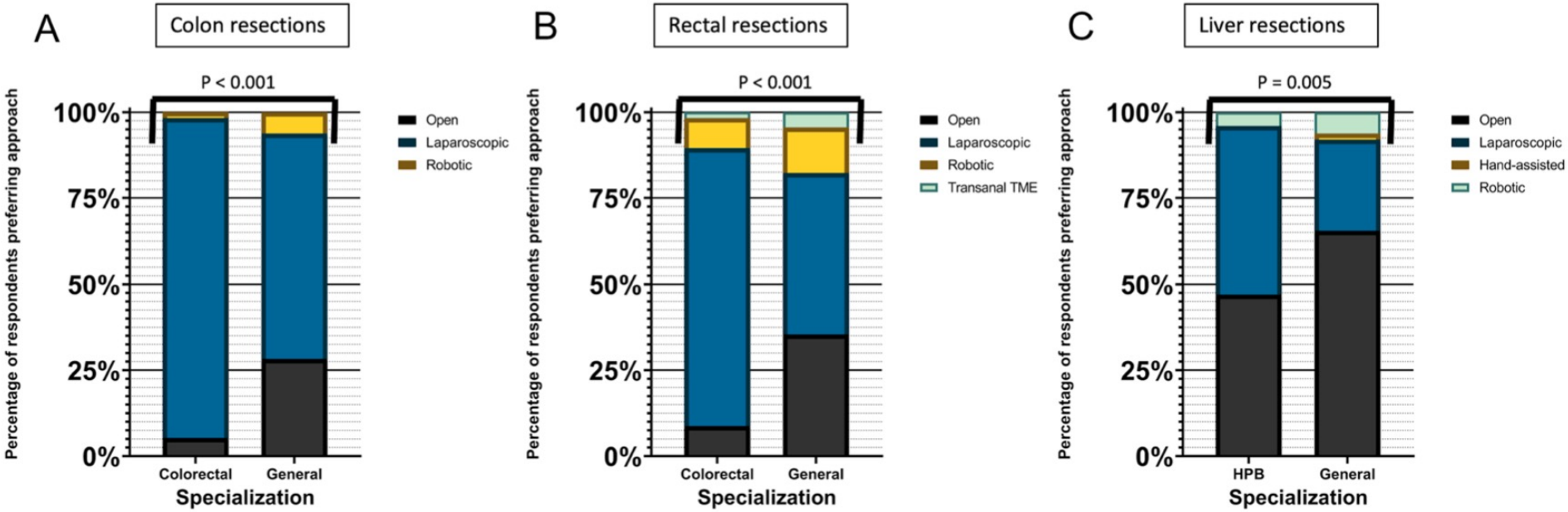
Rocca A, et al. Updates Surg 2021
Adam R, et al. Oncologist 2012;17:1225-39
Adam R, et al. Cancer Treat Ver 2015; 41:729-41

Surgical Endoscopy (2023) 37:4658–4672
https://doi.org/10.1007/s00464-023-09917-8

ORIGINAL ARTICLE

# Global survey on the surgical management of patients affected by colorectal cancer with synchronous liver metastases: impact of surgical specialty and geographic region

Jasper Paul Sijberden[1,2,3] · Antonino Spinelli[4,5] · Alessandro Ferrero[6] · Manish Chand[7] · Steven Wexner[8] · Marc G. Besselink[2,3] · Ibrahim Dagher[9] · Giuseppe Zimmitti[1] · Burak Görgec[1,2,3] · Antonio de Lacy[10] · Mayank Roy[11] · Pieter Tanis[2,12] · Carlo Tonti[1] · Mohammed Abu Hilal[1,13]



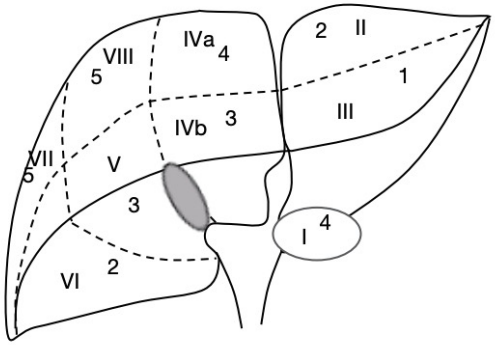

Sijberden JP, et al. Surg Endos (2023) 37:4658–72

# IWATE Criteria

| Difficulty index | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Difficulty level | Low | | | | Intermediate | | | Advanced | | | Expert | | |
| Index surgery | Simple and small partial hepatectomy in segment III | | | | Left lateral sectionectomy | | | Right or left hepatectomy | | | Posterior sectionectomy for segment VII tumor ≥ 3 cm | | |

## Scoring system

### Tumor location (Couinaud segment)




| Segment | Score |
|---|---|
| S1 | 4 |
| S2 | 2 |
| S3 | 1 |
| S4a | 4 |
| S4b | 3 |
| S5 | 3 |
| S6 | 2 |
| S7 | 5 |
| S8 | 5 |

### Tumor size

| | Score |
|---|---|
| <3 cm | 0 |
| ≥3 cm | 1 |

### Proximity to major vessel*

| | Score |
|---|---|
| No | 0 |
| Yes | 1 |

*Main or second branch of Glisson's tree, major hepatic vein, or inferior vena cava

### Extent of liver resection

| | Score |
|---|---|
| Partial resection | 0 |
| Left lateral sectionectomy | 2 |
| Segmentectomy | 3 |
| Sectionectomy and more | 4 |

### HALS/Hybrid

| | Score |
|---|---|
| No | 0 |
| Yes | −1 |

### Liver function

| | Score |
|---|---|
| Child Pugh A | 0 |
| Child Pugh B | 1 |

Wakabayashi G, et al. HepatoBiliary Surg Nutr 2016;5:281-9

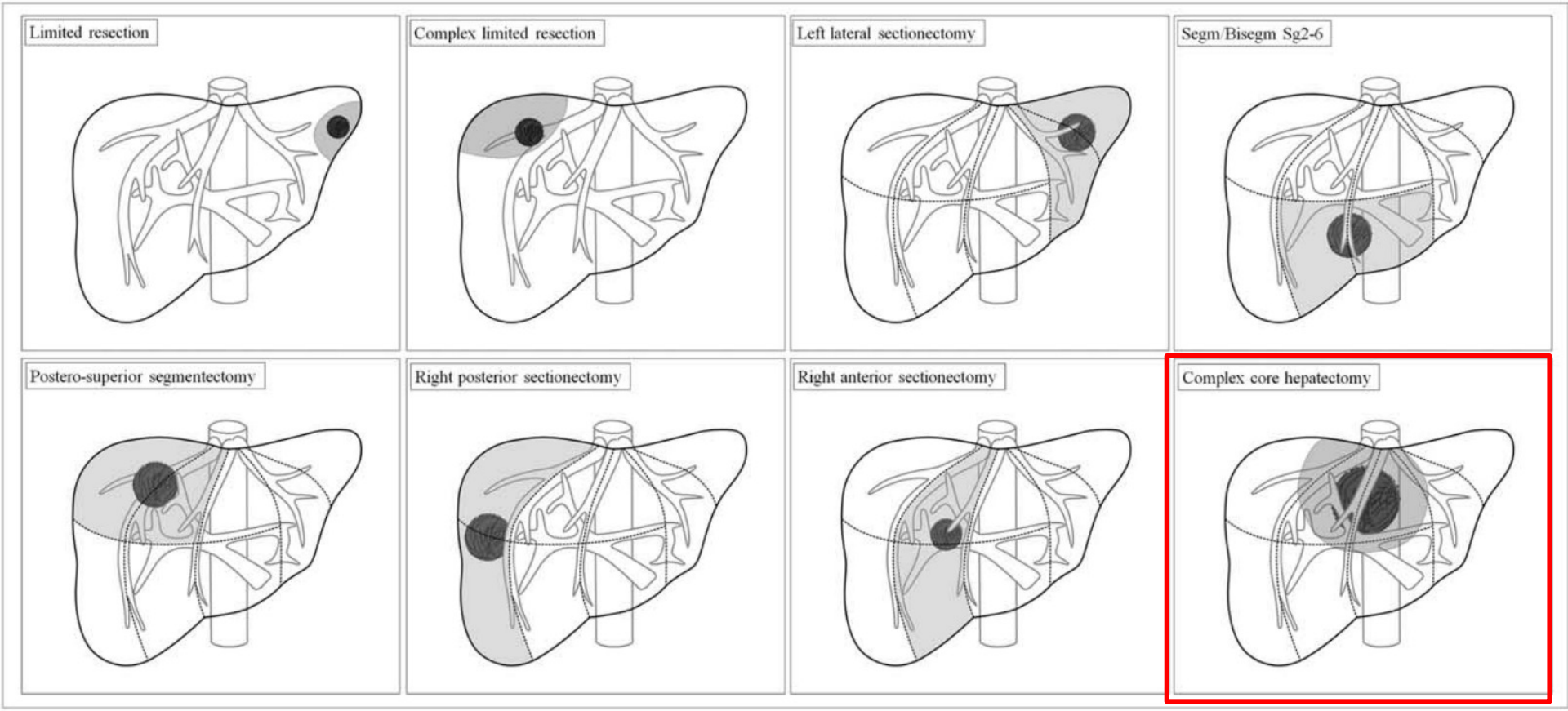
# IWATE CRITERIA

## Synchronous resection

| Intermediate | Advanced | Expert |
|---|---|---|
| 21.0% | 14.0% | 0.5% |

Rocca A, et al. Updates Surg 2021

# MINOR HEPATECTOMY




Vigano L, et al. Ann Surg 2019

# MINOR HEPATECTOMY

**TABLE 3.** Classification of Minor Hepatectomies According to Their Outcomes

| | Risk of | | |
|---|---|---|---|
| | **Severe morbidity** | **Bile leak** | **Liver failure** |
| Left lateral sectionectomy<br>Limited resection | Low | Low | Low |
| Complex limited resection<br>Mono-/bisegmentectomy of antero-lateral segments | Low | Intermediate | Low |
| Right posterior sectionectomy<br>Postero-superior segmentectomy | Intermediate | Intermediate | Low* |
| Complex core hepatectomy | Intermediate | High | Low |
| Right anterior sectionectomy | Intermediate | Intermediate | Intermediate |

Vigano L, et al. Ann Surg 2019

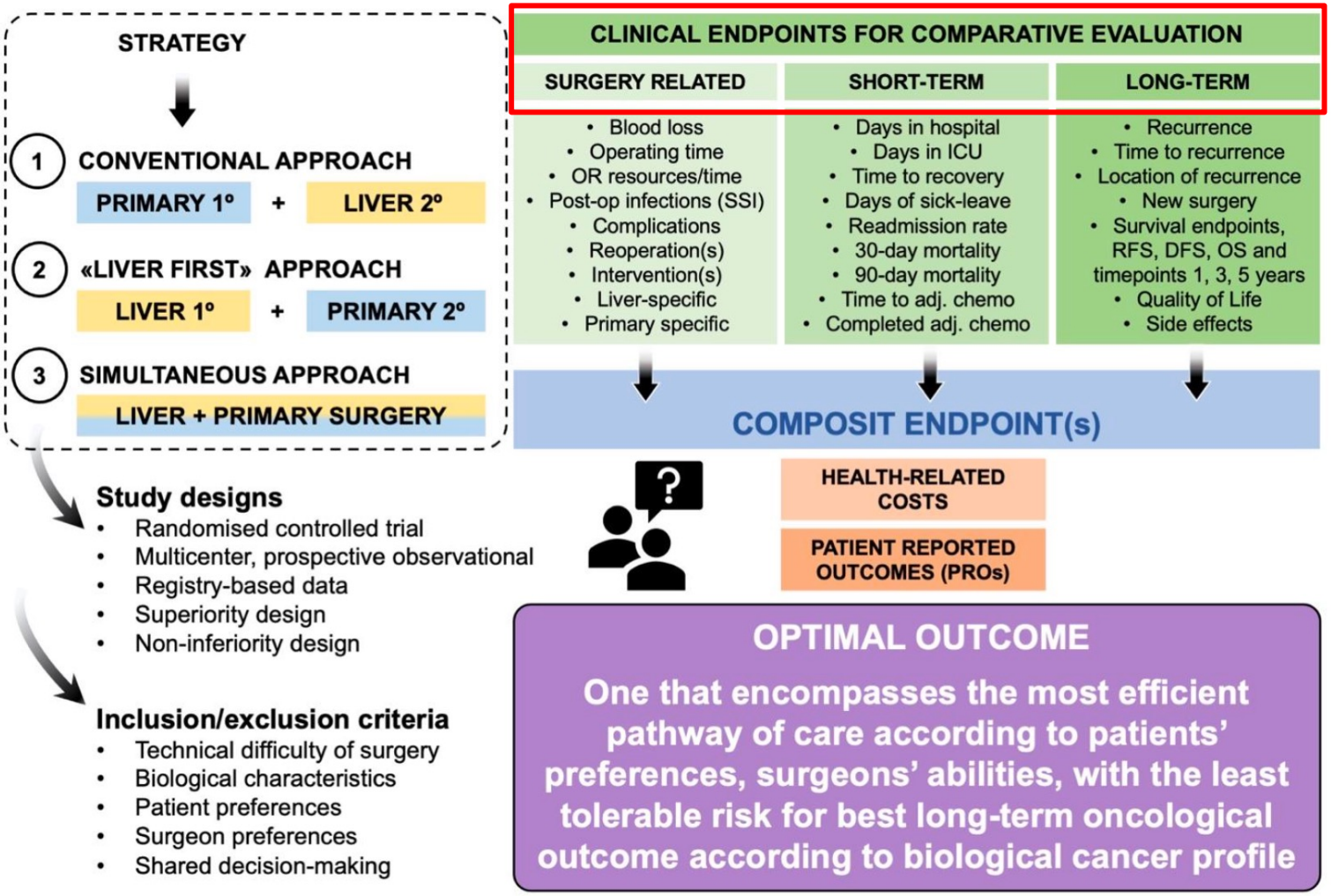



**Figure 1.** Schematic overview of different approaches for patients with colorectal cancer with synchronous liver metastases and clinical endpoints.

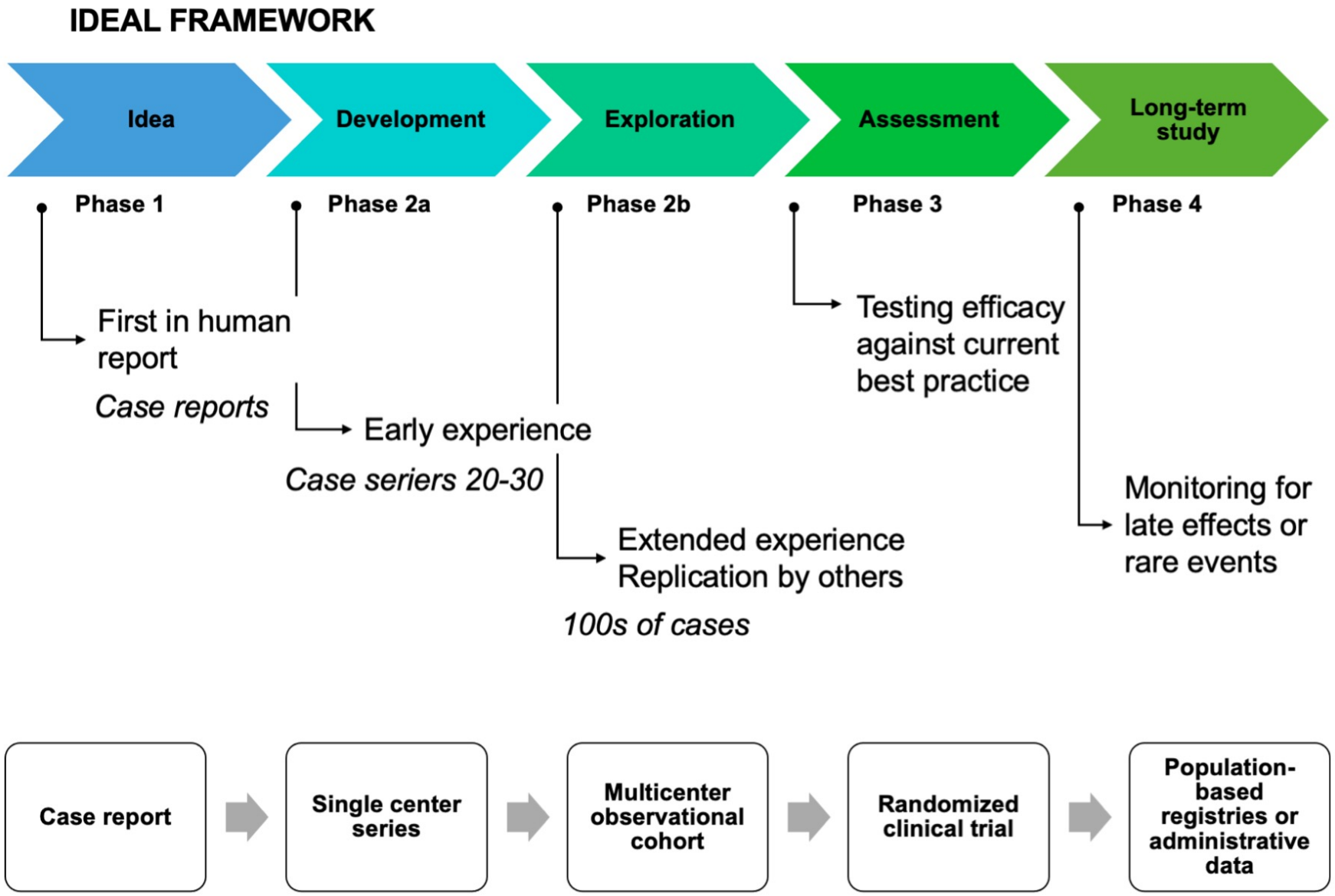



**Figure 2.** The IDEAL framework.

Updates in Surgery
https://doi.org/10.1007/s13304-021-01100-9

ORIGINAL ARTICLE

# The Italian Consensus on minimally invasive simultaneous resections for synchronous liver metastasis and primary colorectal cancer: A Delphi methodology

**Table 1** Main areas of interest

| Patients' selection | Procedures | Techniques | Implementation |
|---|---|---|---|
| Items | Items | Items | Items |
| 1. High-risk patients | 3. Non-complex ColoRectal Cancer procedures | 10. Outcomes: resection margins, harvested lymph nodes, mean hospital stay and complications | 15. Training |
| 2. Previous abdominal surgery | 4. Complex ColoRectal Cancer procedures | 11. Intra-operative staging techniques for liver resections | 16. Registries and learned societies |
| | 5. Right colon cancer anastomosis | 12. Trocar placement | 17. Surgeons |
| | 6. Minor liver resections/left lateral sectionectomy | 13. Bleeding and conversion | 18. Centres |
| | 7. Major liver resection/posterosuperior segments | 14. Minimally invasive approaches and devices | |
| | 8. Two-stage hepatectomies including ALPPS | | |
| | 9. Emergency and technically complex disease | | |

CANCER DIAGNOSIS & PROGNOSIS
1: 151-156 (2021)
doi: 10.21873/cdp.10020

# Clinical Impact of Operative Order in Laparoscopic Simultaneous Resection for Synchronous Colorectal Liver Metastases

**OPERATIVE ORDER**

Table III. *Operative and postoperative results*.

| Parameter | | Approach | | | |
|---|---|---|---|---|---|
| | | Total (N=27) | Primary first (N=11) | Liver first (N=16) | *p*-Value |
| Operative time, min | Median (range) | 610 (394-939) | 662 (452-924) | 593 (394-939) | 0.23 |
| Time in the operating room, min | Median (range) | 756 (541-1,172) | 841 (581-1,083) | 731 (541-1,172) | 0.28 |
| Blood loss, ml | Median (range) | 405 (5-2,016) | 560 (95-2,016) | 164 (5-820) | 0.0299 |
| Complications, n | Surgical site infection | 1 | 1 | 0 | |
| | Abdominal abscess | 1 | 0 | 1 | |
| | Biloma | 1 | 1 | 0 | |
| | Biliary fistula | 2 | 2 | 0 | |
| | Anastomosis leakage | 0 | 0 | 0 | |
| | Paralytic ileus | 0 | 0 | 0 | |
| | Pneumothorax | 0 | 0 | 0 | |
| | Pleural effusion/ascites | 1 | 0 | 1 | |
| | Pneumonia/urinary tract infection | 0 | 0 | 0 | |
| | None | 21 | 7 | 14 | |
| Clavien–Dindo classification, n (%) | ≥II | 5 (18.5%) | 3 (27.3%) | 2 (12.5%) | 0.33 |
| | ≥III | 4 (14.8%) | 3 (27.3%) | 1 (6.3%) | 0.13 |
| Start of oral intake, days | Median (range) | 4 (2-7) | 4 (3-7) | 4 (2-7) | 0.24 |
| Postoperative hospital stay, days | Median (range) | 14 (10-60) | 15 (10-60) | 14 (10-26) | 0.21 |
| Re-operation within 30 days | Yes | 0 | 0 | 0 | |
| Death within 30 days | Yes | 0 | 0 | 0 | |

Tajiri T, et al. Cancer Diag Prog 2021

# OPERATIVE ORDER

- ❑ LIVER

**Lower blood loss**
**Shorter operative time**

- ❑ Pringle maneuver
- ❑ Restricted volume control
- ❑ Low central venous pressure
- ❑ Body positions

Tajiri T, et al. Cancer Diag Prog 2021

ACTA CIRÚRGICA BRASILEIRA

VOLUME

Review Article

# Decision making process in simultaneous laparoscopic resection of colorectal cancer and liver metastases. Review of literature[1]

**Table 1** - Comparison of surgical outcomes between laparoscopic and open simultaneous resection of colorectal liver metastases

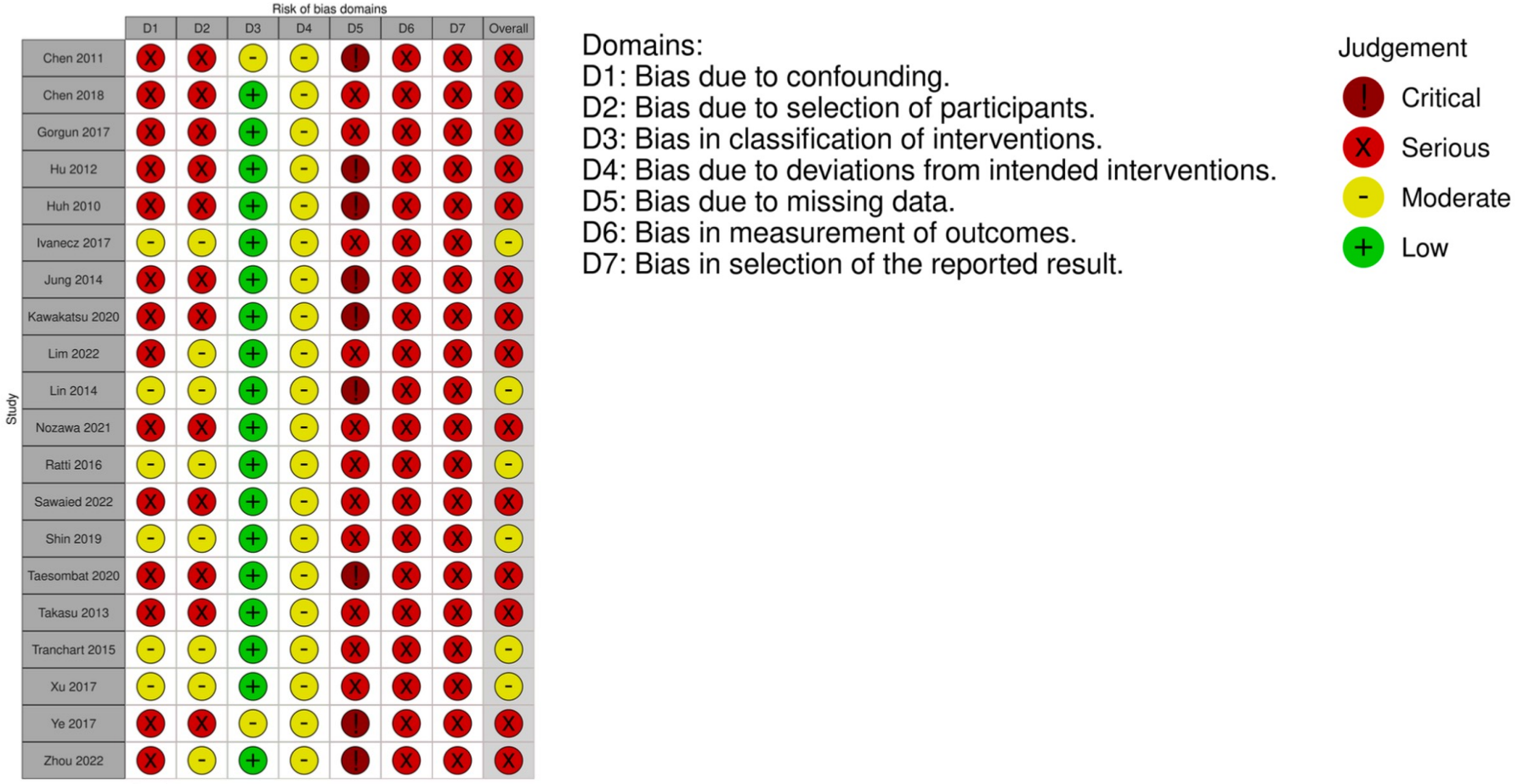
| Author | Year | n | | Age Mean/Median | | Operative time - minutes Mean/Median | | Blood loss – mL Mean/Median | | Morbidity (%) | | Hospital stay – days Mean/Median | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Lap | Open | Lap | Open | Lap | Open | Lap | Open | Lap | Open | Lap | Open |
| Huh[37] | 2010 | 20 | 20 | 63 (36-71) | 62 (44-85) | 358 (215-595) | 278 (140-465) | 350 (120-950) | 500 (100-1200) | 10 (50) | 8 (40) | 10 (7-30) | 10 (7-31) |
| Chen[38] | 2011 | 23 | 18 | . | . | 350 | 342 | 275 | 590 | 34.8% | 50% | 12 | 16 |
| Hu[39] | 2012 | 13 | 13 | 54 ± 10 | 53 ± 11 | 313 ± 44 | 350 ± 46 | 258 ± 111 | 273 ± 95 | 1 (7) | 0 | 8.5 ± 1.9 | 11.2 ± 1.8 |
| Takasu[40] | 2013 | 7 | 7 | 74 ± 12 | 62 ± 5 | 472 ± 90 | 466 ± 107 | 152 ± 128 | 496 ± 191 | 12.5% | 33.3% | 16.2 ± 6.1 | 36.1 ± 24.9 |
| Jung[41] | 2014 | 24 | 24 | 60 (43-75) | 60 (37-0) | 290 (183-551) | 244 (149-375) | 325 (50-900) | 250 (50-850) | 4 (17) | 10 (42) | 8 (5-23) | 10.5 (8-23) |
| Lin[42] | 2014 | 36 | 36 | 57.5 ± 7.3 | 57.4 ± 10.4 | 317.5 ± 47.4 | 251.7+-49.6 | 278.1 ± 173.3 | 382.5 ± 145.6 | 9 (25) | 11 (30.5) | 7.4 ± 1.6 | 9 ± 3.5 |
| Tranchart[43] | 2015 | 89 | 89 | 66.6 ± 10.8 | 65 ± 9.4 | 332 ± 110 | 308 ± 86 | 229 ± 228 | 188 ± 207 | 13 (15) | 13 (15) | 10.3 ± 9.6 | 12.2 ± 9.2 |
| Ratti[44] | 2016 | 25 | 25 | . | . | 420 | 310 | 350 | 600 | 64% | 66% | 7 | 9 |
| Xu[45] | 2017 | 20 | 20 | 58.2 ± 10.6 | 59.6 ± 10.8 | 246.7 ± 78.2 | 248.3 ± 79.9 | 175 (100-275) | 300 (162.5-575)** | 3 (15) | 5 (25) | 9 (8-11) | 12 (10-16) |
| Ivanecz[46] | 2018 | 10 | 10 | 62.2 ± 7.9 | 65.4 ± 8.1 | 261 ± 92.8 | 257 ± 66.8 | 105 (30-180) | 170 (70-230)*** | 5 (50) | 3 (30) | 8 (8-12) | 11.5 (10-33) |

Araujo RL, et al. Acta Cir Bras 2019

International Journal of Colorectal Disease (2023) 38:90
https://doi.org/10.1007/s00384-023-04375-z

RESEARCH

# Laparoscopic versus open resection of primary colorectal cancers and synchronous liver metastasis: a systematic review and meta-analysis



# TUMOR LOCATION

- Tumor location
  - Rectum
  - Left colon
  - Right colon

**Table 2** Subgroup analysis of operative outcomes based on primary tumour location (rectum vs left colon vs right colon)

| | | Gorgun et al. [18] | | | Ivanecz et al. [21] | | | Kawakatsu et al. [23] | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Location of primary tumour | | | Location of primary tumour | | | Location of primary tumour | | |
| | | Rectum | Left | Right | Rectum | Left | Right | Rectum | Left | Right |
| No of patients | Open | 15 | 5 | 9 | 4 | 3 | 3 | 43 | 37 | 24 |
| | Lap | 8 | 1 | 5 | 5 | 2 | 2 | 24 | 9 | 4 |
| Operative time (minutes ± SD) | Open | 348.8 ± 44.6 | 350.2 ± 44.8 | 321 ± 54.5 | 302.5 ± 30 | 250 ± 30 | 203 ± 27.5 | 639 ± 173.2 | 589.8 ± 138.9 | 447.2 ± 101.5 |
| | Lap | 367 ± 56.7 | N/A | 272.4 ± 47.9 | 320 ± 30 | 155 ± 2.5 | 170 ± 5 | 553.6 ± 160.1 | 423 ± 82.3 | 506 ± 71.1 |
| Blood loss (mL ± SD) | Open | 675.3 ± 166.2 | 500 ± 168.1 | 459.4 ± 243.9 | 307.5 ± 172.9 | 136.6 ± 47.8 | 80 ± 72.5 | 574.3 ± 388.1 | 659.1 ± 490.6 | 764.6 ± 425.7 |
| | Lap | 380 ± 48.2 | N/A | 290 ± 68.3 | 198 ± 129.2 | 20 ± 20 | 15 ± 15 | 252 ± 193.3 | 108.3 ± 124.8 | 326.2 ± 232.7 |
| Length of stay (days ± SD) | Open | 10.8 ± 1.3 | 11.2 ± 3.0 | 8.1 ± 0.7 | 28 ± 18.1 | 11 ± 0.8 | 17 ± 11.3 | 22.1 ± 12.7 | 17.4 ± 6.6 | 18.9 ± 12.3 |
| | Lap | 6.6 ± 1.4 | N/A | 6.2 ± 0.8 | 15.6 ± 13.3 | 7.5 ± 0.5 | 8 | 17.2 ± 8.1 | 10.8 ± 1.9 | 15.5 ± 4 |
| Morbidity | Open | 7 | 2 | 4 | 2 | 0 | 1 | 7 | 0 | 3 |
| | Lap | 1 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 1 |

Morarasu S, et al. Int J Colorect Dis 2023

NUMBER

Pan et al. World Journal of Surgical Oncology (2020) 18:251
https://doi.org/10.1186/s12957-020-02018-z

World Journal of Surgical Oncology

RESEARCH Open Access

# Laparoscopic procedure is associated with lower morbidity for simultaneous resection of colorectal cancer and liver metastases: *an updated meta-analysis*

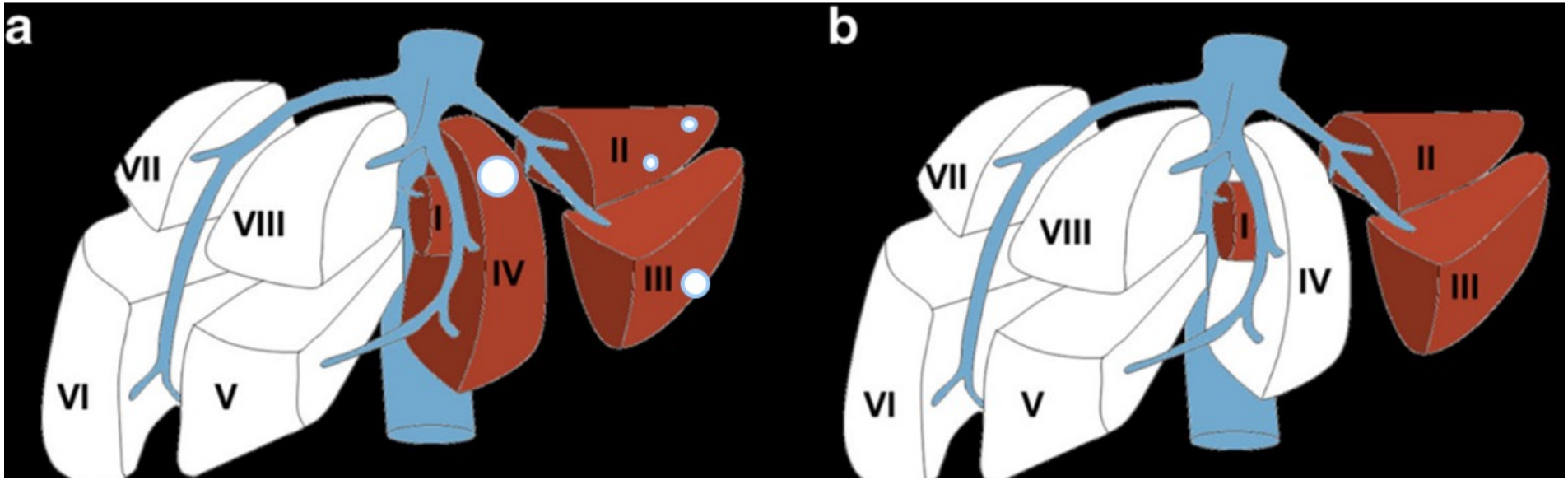
**Table 2** Clinicopathological characteristics of included studies

| Study | Intervention | Location of primary tumor (colon/rectum) | Primary tumor size, mean (SD), cm | No. of CRLM, mean (SD) | CRLM location (unilober/bilobar) | CRLM size | R0 rate (liver/colorectum) | Neoadjuvant therapy | Mortality | Conversions |
|---|---|---|---|---|---|---|---|---|---|---|
| Ma et al. [23] | Lap | 7/5 | NR | 1.6 (0.9) | 7/5 | 3.73 ± 2.91 | 100/100 | 3 (25) | 0 | 0 |
| | Open | 7/5 | NR | 3.1 (1.8) | 5/2 | 3.02 ± 1.62 | 100/100 | 3 (25) | 0 | |
| Ivanecz et al. [20] | Lap | 4/6 | NR | 1.4 (0.9) | 9/1 | 2.0 ± 1.2 | 100/100 | 7 (70) | 0 | 0 |
| | Open | 6/4 | NR | 1.4 (0.9) | 9/1 | 2.9 ± 1.5 | 100/100 | 3 (30) | 0 | |
| Xu et al. [26] | Lap | 15/5 | 3.2 (1.0) | 6[a] | 18/2 | 2.99 ± 1.55 | 100/100 | 6 (30) | 0 | 0 |
| | Open | 15/5 | 3.8 (1.2) | 6 | 17/3 | 3.19 ± 1.53 | 100/100 | 4 (20) | 0 | |
| Chen et al [16]. | Lap | NR/NR | 4.0 (2.0) | 4[a] | NR | 5.5 ± 4.2 | NR/NR | NR | 0 | 1 |
| | Open | NR/NR | 5.0 (3.0) | 3 | NR | 4.7 ± 3.7 | NR/NR | NR | 0 | |
| Gorgun et al. [17] | Lap | 6/8 | 3.7 (0.7) | 1.6 (0.3) | 12/2 | 2.4 ± 0.7 | 86/NR | 6 (43) | 0 | 0 |
| | Open | 14/15 | 3.7 (0.5) | 2.1 ± 0.2 | 19/10 | 2.7 ± 0.2 | 93/NR | 19 (66) | 1 | |
| Ratti et al [24]. | Lap | 13/12 | NR | 2.40 ± 1.27 | 13/12 | 3.65 ± 2.67 | 96/100 | 20 (80) | 0 | 1 |
| | Open | 27/23 | NR | 2.35 ± 1.34 | 27/23 | 3.94 ± 2.47 | 98/98 | 39 (78) | 0 | |
| Tranchart et al. [25] | Lap | 48/41 | NR | 1.4 ± 0.6 | 78/11 | 2.9 ± 1.9 | 83/NR | 11 (12) | 2 | 6 |
| | Open | 51/38 | NR | 1.5 ± 0.7 | 81/8 | 2.8 ± 2.0 | 90/NR | 20 (22) | 0 | |
| Lin et al [22]. | Lap | 3/4 | 5.3 (1.1) | 1.9 ± 0.9 | NR | 3.3 ± 1.8 | 100/NR | 3 (27) | 0 | 0 |
| | Open | 19/17 | 5.7 (1.9) | 2.1 ± 1.0 | NR | 4.2 ± 2.2 | 100/NR | 13 (36) | 0 | |
| Jung et al [21]. | Lap | 18/6 | 5.23 (2.13) | NR | 23/1 | 2.81 ± 1.72 | 100/96 | NR | 0 | 0 |
| | Open | 16/8 | 5.56 (1.93) | NR | 18/6 | 3.23 ± 2.21 | 100/100 | NR | 0 | |
| Hu et al [18]. | Lap | 8/5 | NR | NR | NR | 3.2 ± 1.0 | NR/NR | 0 (0) | 0 | 0 |
| | Open | 8/5 | NR | NR | NR | 3.5 ± 0.9 | NR/NR | 0 (0) | 0 | |
| Huh et al [19]. | Lap | 7/13 | 4 (2–10) | 2 (1–7) | 17/3 | 2 (0.9–5.5) | 100/NR | NR | 0 | 0 |
| | Open | 11/9 | 4.7 (3–7) | 2 (1–8) | 16/4 | 2.4 (1–10) | 100/NR | NR | 0 | |
| Chen et al [15]. | Lap | 0/23 | 2.5 (0.9) | NR | NR | 5.5 ± 1.2 | NR/NR | NR | 0 | 0 |
| | Open | 0/18 | 2.3 (1.0) | NR | NR | 5.6 ± 1.4 | NR/NR | NR | 0 | |

*Lap* Laparoscopic surgery, *NR* Not report
[a]The number of patients with CRLM ≥ 3

Pan L, et al. World J Surg Oncol 2020

# SIMULTANEOUS COMPLEX




- Right hepatectomy
- Extended right hepatectomy

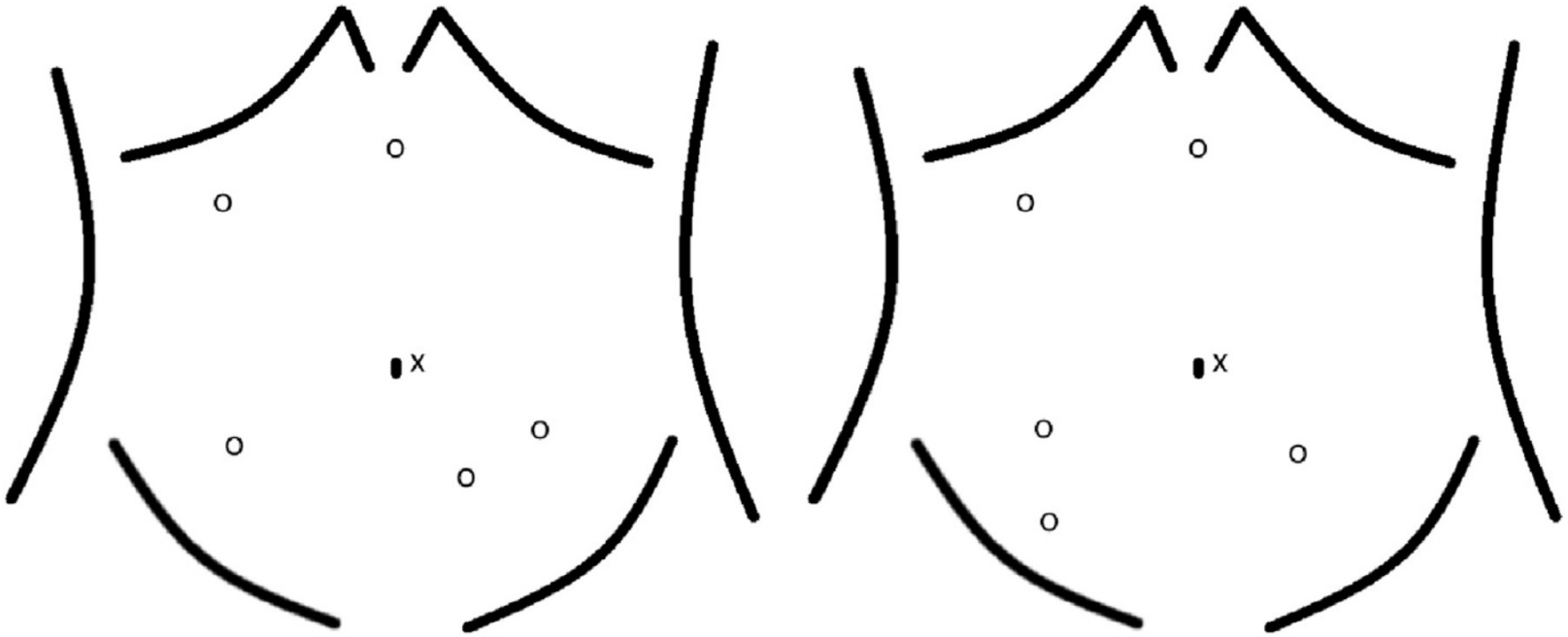
Gotra A, et al. Insights Imaging (2017) 8:377–92

# SIMULTANEOUS COMPLEX

Right hepatectomy + Low anterior resection

Rocca A, et al. Updates Surg 2021

# TROCAR PLACEMENT

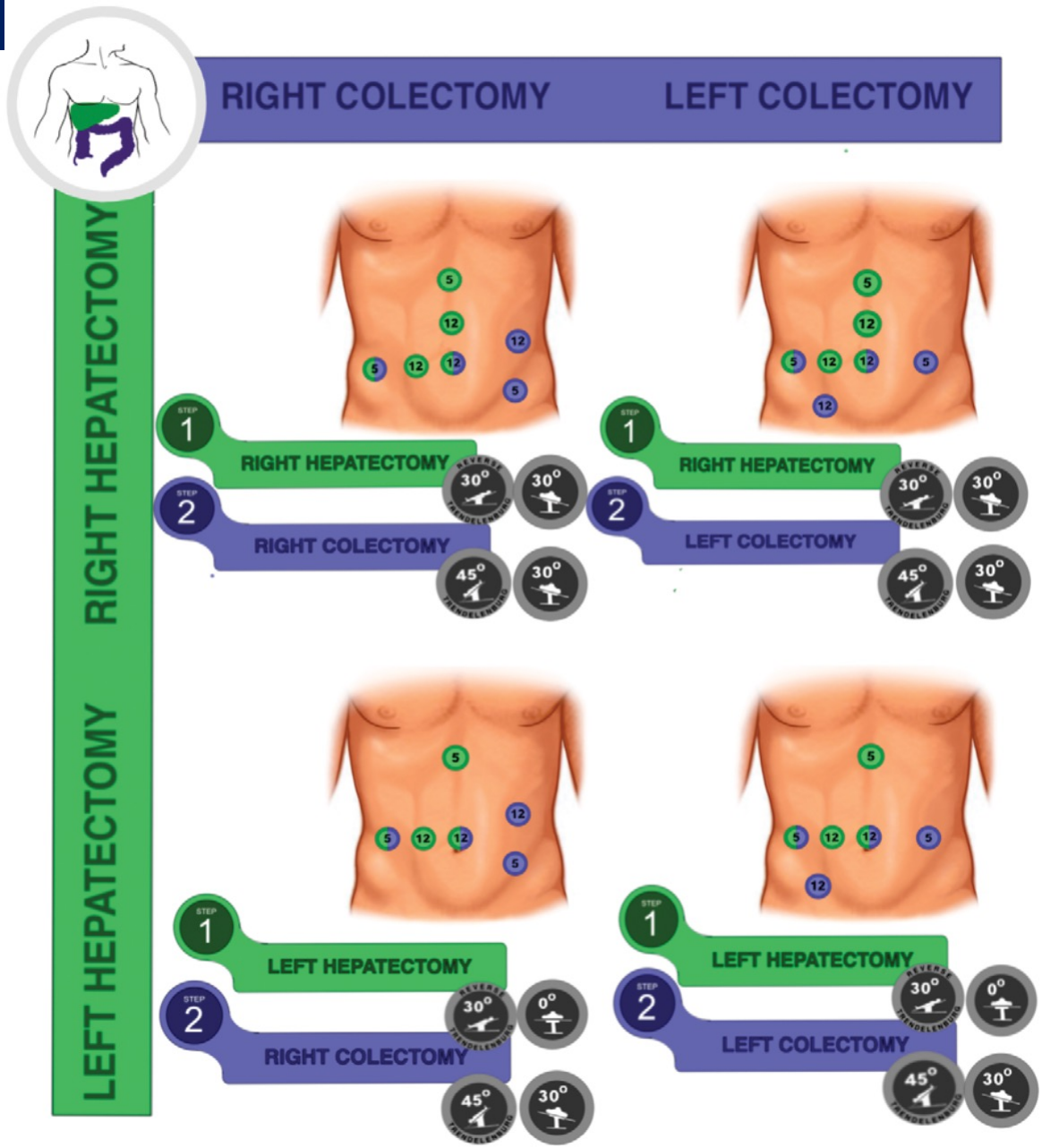


Right side colectomy

Left side colectomy

Chen YW, et al. Asian J Surg 2019

# TROCAR PLACEMENT




Araujo RL, et al. Acta Cir Bras 2019

# TROCAR PLACEMENT

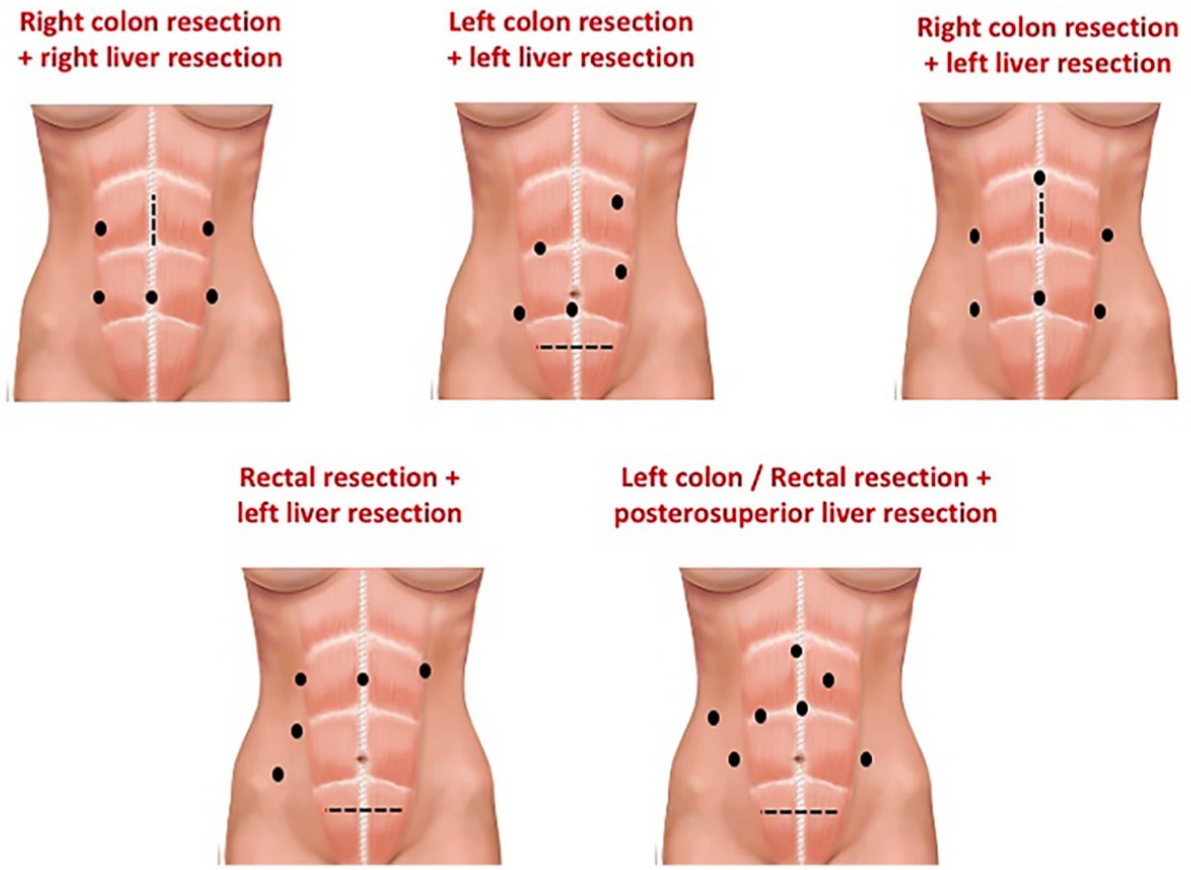
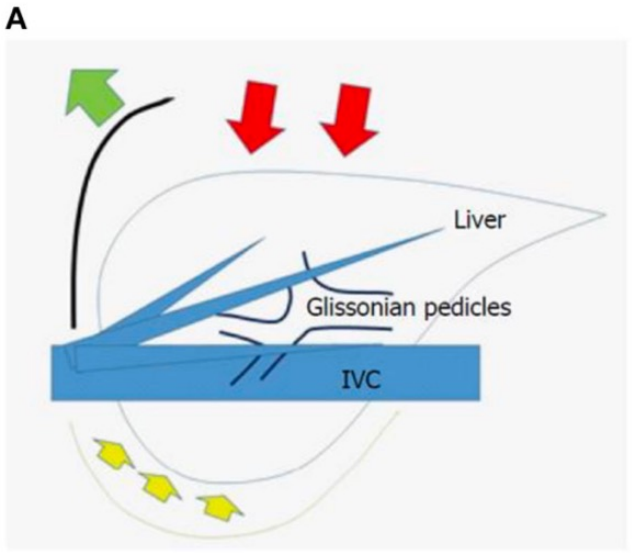


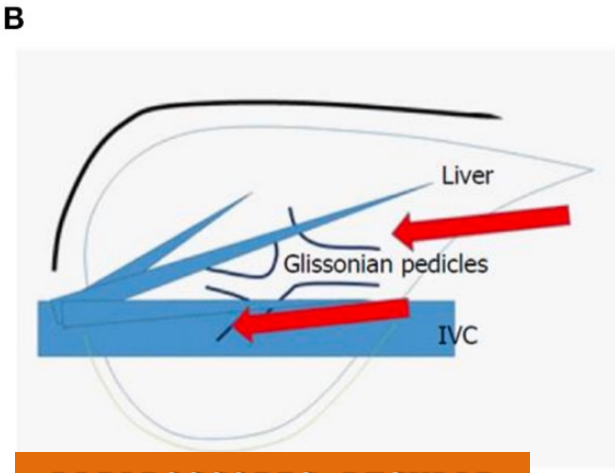

**FIGURE 2 |** Example of trocar placement to perform a combined resection. From Rocca et al. (31).

Sena G, et al. Frontiers Surg 2021

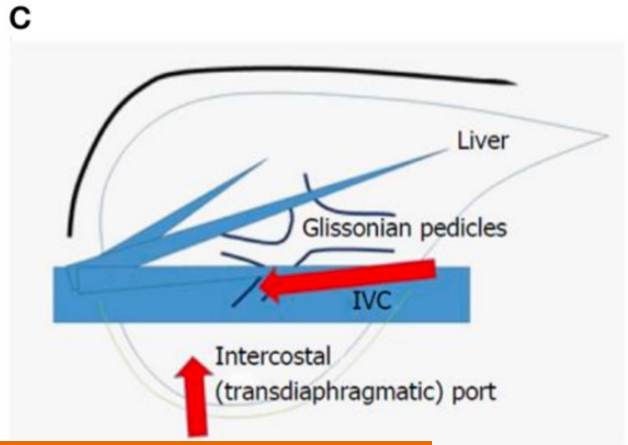
# APPROACH



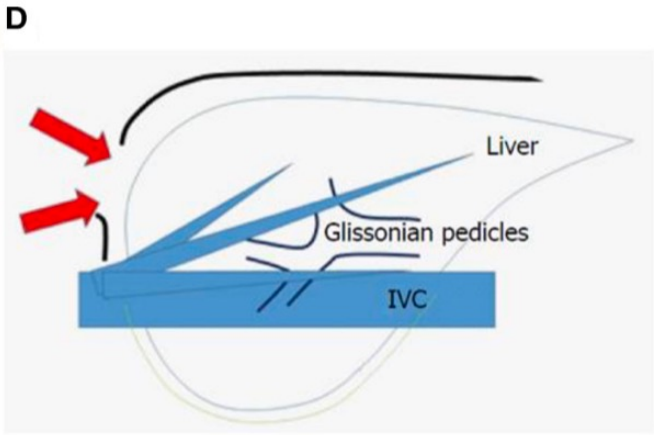

OPEN




LAPAROSCOPIC REGULAR




LAPAROSCOPIC LATERAL




THORASCOPIC

Sena G, et al. Frontiers Surg 2021

Surgical Endoscopy (2019) 33:1124–1130
https://doi.org/10.1007/s00464-018-6371-1

BLOOD LOSS

# Laparoscopic combined resection of liver metastases and colorectal cancer: a multicenter, case-matched study using propensity scores

**Table 3** Perioperative outcomes after matching based on propensity scores

| | LLCR ($n=61$) | LCR ($n=61$) | $p$ |
|---|---|---|---|
| Operative time, min, median (IQR) | 206 (166–308) | 197 (148–231) | 0.057 |
| Blood loss, ml, median (IQR) | 200 (100–700) | 75 (5–200) | 0.011 |
| Conversion | 3 (5) | 5 (8) | 0.687 |
| Peroperative incidents, Oslo classification | | | 0.237 |
| None | 52 (85) | 56 (92) | |
| Grade 1 | 6 (10) | 4 (7) | |
| Grade 2 | 3 (5) | 1 (2) | |
| Grade 3 | 0 | 0 | |
| Stoma | | | 0.317 |
| None | 51 (84) | 46 (75) | |
| Double loop ileostomy | 4 (7) | 7 (12) | |
| End ileostomy | 2 (3) | 0 | |
| End colostomy | 4 (7) | 8 (13) | |
| Severe complications | 9 (15) | 13 (21) | 0.481 |
| Anastomotic leakage | 5 (8) | 4 (7) | 1.0 |
| Postoperative stay, days, median (IQR) | 6 (5–9) | 7 (4–13) | 0.164 |
| Resection margins, $R_0$ | 57 (93) | 61 (100) | 0.125 |
| Readmission | 7 (12) | 8 (13) | 1.0 |
| 30-day mortality | 0 | 1 (2) | 1.0 |

All values in parenthesis are percentages unless mentioned otherwise. Percentages may not add up to 100 due to rounding. *IQR* inter-quartile range

van der Poel MJ, et al. Surg Endosc 2019;33:1124–30

BLOOD LOSS

Pan et al. World Journal of Surgical Oncology (2020) 18:251
https://doi.org/10.1186/s12957-020-02018-z

World Journal of Surgical Oncology

RESEARCH Open Access

# Laparoscopic procedure is associated with lower morbidity for simultaneous resection of colorectal cancer and liver metastases: *an updated meta-analysis*

**Table 3** Secondary outcomes in this meta-analysis

| Outcome of interest | No. of studies | WMD/OR | 95% CIs | *P* value | $I^2$ (%) |
|---|---|---|---|---|---|
| Operative time | 12 | 36.57 | 7.80 to 65.35 | 0.013 | 82.4 |
| Blood loss | 12 | − 113.31 | − 189.03 to − 37.59 | 0.003 | 91.4 |
| Hospital stay | 7 | − 2.70 | − 3.99 to − 1.40 | < 0.001 | 53.6 |
| Postoperative stay | 4 | − 3.20 | − 5.06 to − 1.34 | 0.001 | 55.2 |
| 1-year DFS | 4 | 1.05 | 0.59 to 1.86 | 0.86 | 0 |
| 3-year DFS | 4 | 0.66 | 0.41 to 1.08 | 0.097 | 7.5 |
| 1-year OS | 5 | 0.56 | 0.23 to 1.33 | 0.187 | 0 |
| 3-year OS | 6 | 0.94 | 0.53 to 1.65 | 0.822 | 0 |
| 5-year OS | 3 | 0.69 | 0.29 to 1.68 | 0.417 | 0 |

*DFS* Disease-free survival, *OS* Overall survival

Pan L, et al. World J Surg Oncol 2020

# EXTENT OF THE LIVER RESECTION

**Table 2** Peri-operative characteristics of the patients in two groups.

| | Laparoscopic (n = 16) | Open (n = 22) | *p* - value |
|---|---|---|---|
| Colorectal Operation method | | | 0.74 |
| Right hemicolectomy | 4 | 8 | |
| Left hemicolectomy | 0 | 1 | |
| AR | 6 | 3 | |
| LAR | 6 | 9 | |
| Subtotal colectomy | 0 | 1 | |
| Liver operation method | | | 0.78 |
| Wedge | 5 | 7 | |
| One segmental | 6 | 9 | |
| Two segment | 2 | 3 | |
| (>=3 segment) | 3 | 3 | |
| OP time (minutes) | 320 ± 124 | 227 ± 55 | **0.04** |
| Blood loss (ml) | 369 ± 400 | 325 ± 260 | 0.27 |
| Number of Pringle maneuver | 5 | 7 | |
| Conversion (%) | 1 (6.3) | | |
| Post-operative complication | | | 0.06 |
| Wound infection | 1 | 2 | |
| Paralytic ileus | 1 | 3 | |
| Pleuropulmonary | 1 | 1 | |
| Intraabdominal abscess | 1 | 2 | |
| Clavien-Dindo classification | | | |
| Grade 1 | 1 | 2 | |
| Grade 2 | 2 | 3 | |
| Grade 3 | 1 | 3 | |
| Hospital days | 11.6 ± 5.2 | 12.7 ± 6.4 | 0.67 |

Chen YW, et al. Asian J Surg 2019

# EXTENT OF THE LIVER RESECTION

83.3% 91.7%

**Table 2**

Peri-operative outcomes of patients who had laparoscopic or open surgery.

| Characteristics | Laparoscopic group (n = 12) | Open group (n = 24) | *p* value |
|---|---|---|---|
| Type of colorectal resection | | | 0.06 |
| Right hemicolectomy | 3 (25.0) | 3 (12.5) | |
| Left hemicolectomy | 4 (33.3) | 5 (20.9) | |
| Anterior/low anterior resection | 4 (33.3) | 12 (50.0) | |
| Total abdominal colectomy | 1 (8.4) | 2 (8.3) | |
| Posterior exenteration | 0 | 2 (8.3) | |
| Type of liver resection | | | 0.52 |
| Wedge resection | 10 (83.3) | 22 (91.7) | |
| Lateral sectionectomy | 2 (16.7) | 2 (8.3) | |
| Operative time (minutes) | 494.6 ± 129.4 | 313.8 ± 80.9 | <0.001 |
| Blood loss (ml) | 291.7 ± 181.9 | 497.9 ± 329.2 | 0.04 |
| Blood transfusion | 2 (16.7) | 5 (20.8) | 0.14 |
| Postoperative complication | 4 (33.3) | 10 (41.7) | 0.64 |
| Grading of complication | | | |
| Grade I | 1 | 1 | |
| Grade II | 2 | 1 | |
| Grade IIIa | 1 | 7 | |
| Grade IIIb | 0 | 1 | |
| Hospital stay (days) | 8.2 ± 4.6 | 16.8 ± 13.0 | 0.007 |
| Time to first postoperative chemotherapy (days) | 49.8 ± 17.1 | 53.4 ± 23.3 | 0.67 |

Data are shown as number (%) or mean ± standard deviations.

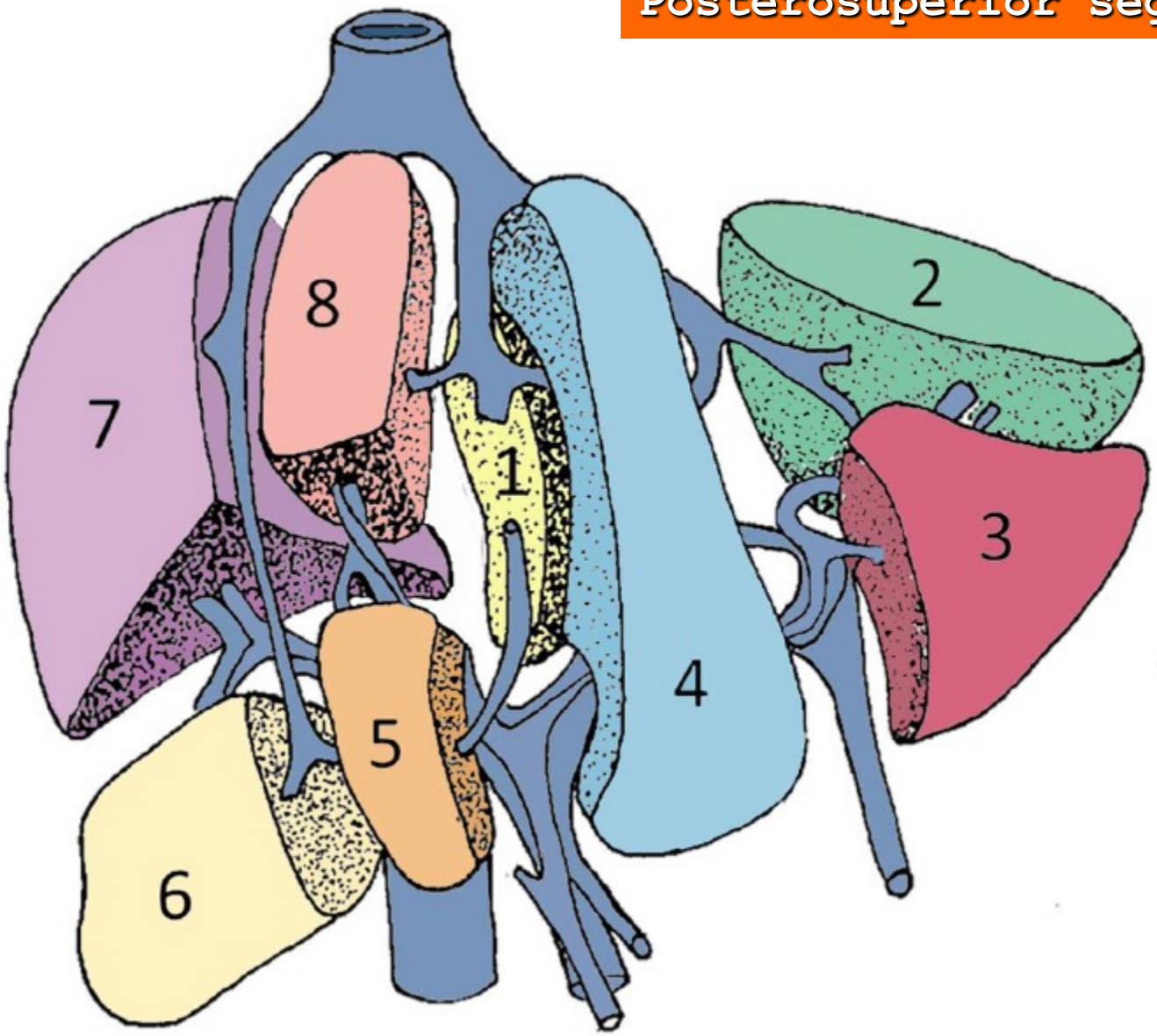
Taesombat W et al. Ann Med Surg 2020;58:120–123

# EXTENT OF THE LIVER RESECTION

| | Before propensity score matching | | | | After propensity score matching | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Lap (n = 51) | Hybrid (n = 154) | Open (n = 442) | p value | Lap (n = 42) | Hybrid (n = 81) | p value | Lap (n = 48) | Open (n = 136) | p value |
| **Colorectal tumor** | | | | | | | | | | |
| Colorectal resection, n (%) | | | | < 0.001 | | | 0.589 | | | 0.851 |
| Right-sided colectomy (RHC) | 10 (19.6) | 6 (3.9) | 93 (21.0) | | 5 (11.9) | 6 (7.4) | | 9 (18.8) | 29 (21.3) | |
| Left-sided colectomy (LHC/AR) | 16 (31.4) | 55 (35.7) | 149 (33.7) | | 13 (31.0) | 32 (39.5) | | 15 (31.3) | 45 (33.1) | |
| Rectal resection (LAR/ ULAR/ISR/Hartmann) | 22 (43.1) | 87 (56.5) | 168 (38.0) | | 21 (50.0) | 41 (50.6) | | 21 (43.8) | 53 (39.0) | |
| APR | 2 (3.9) | 5 (3.2) | 11 (2.5) | | 2 (4.8) | 1 (1.2) | | 2 (4.2) | 3 (2.2) | |
| STC/TC/TPC | 1 (2.0) | 1 (0.6) | 21 (4.8) | | 1 (2.4) | 1 (1.2) | | 1 (2.1) | 6 (4.4) | |
| Stoma, n (%) | 12 (23.5) | 53 (34.4) | 94 (21.3) | 0.005 | 11 (26.2) | 24 (29.6) | 0.689 | 12 (25.0) | 32 (23.5) | 0.837 |
| **Liver metastases** | | | | | | | | | | |
| Extent of liver resection, n (%) | | | | 0.008 | | | 0.800 | | | 0.841 |
| Minor | 43 (84.3) | 96 (62.3) | 277 (62.7) | | 34 (81.0) | 64 (79.0) | | 40 (83.3) | 115 (84.6) | |
| Major | 8 (15.7) | 58 (37.7) | 165 (37.3) | | 8 (19.0) | 17 (21.0) | | 8 (16.7) | 21 (15.4) | |
| **Liver resection, n (%)** | | | | < 0.001 | | | 0.302 | | | 0.391 |
| Tumorectomy | 31 (60.8) | 41 (26.6) | 168 (38.0) | | 23 (54.8) | 37 (45.7) | | 28 (58.3) | 84 (61.8) | |
| Segmentectomy | 7 (13.7) | 17 (11.0) | 43 (9.7) | | 6 (14.3) | 10 (12.3) | | 7 (14.6) | 11 (8.1) | |
| Sectionectomy | 5 (9.8) | 42 (27.3) | 73 (16.5) | | 5 (11.9) | 20 (24.7) | | 5 (10.4) | 22 (16.2) | |
| Hemihepatectomy | 8 (15.7) | 45 (29.2) | 127 (28.7) | | 8 (19.0) | 11 (13.6) | | 8 (16.7) | 16 (11.8) | |
| Trisectionectomy | 0 (0) | 9 (5.8) | 31 (7.0) | | 0 (0) | 3 (3.7) | | 0 (0) | 3 (2.2) | |
| Conversion, n (%) | 4 (7.7) | N.A | N.A | N.A | 4 (9.5) | N.A | N.A | 4 (8.3) | N.A | N.A |

Lim HK, et al. Scientific reports 2022

# Posterosuperior segments




Lim HK, et al. Scientific reports 2022

# EXTENT OF THE LIVER RESECTION

## Posterosuperior segments

## MAJOR LIVER RESECTIONS

- Simultaneous colorectal and liver resection in the posterosuperior segments can be feasible with a MI technique.
- However, the **evidence** to support that this approach may produce similar or better results of the combined open is **insufficient**.
- Therefore, they have to be considered an option in experienced hands and for selected patients.

Rocca A, et al. Updates Surg 2021

# EXTENT OF THE LIVER RESECTION

- Simultaneous colorectal and major liver resection may be feasible with a MI technique. However, the evidence to support that this approach may produce similar or better results of the combined open is insufficient. Therefore, it **is not recommended an expansion of the indications** compared to what is currently defined for the open approach.

Rocca A, et al. Updates Surg 2021

# EXTENT OF THE LIVER RESECTION

## Posterosuperior segments

- Major or posterosuperior liver resection combined with colorectal surgery is **demanding**.
- Retrospective comparative studies show that the procedure **is feasible**.
- However, the data are based on a **limited number of treated patients**.
- Existing oncosurgical consensus judge the evidence still **controversial to recommend** simultaneous major liver and colorectal resections.


Rocca A, et al. Updates Surg 2021
Adam R, et al. Oncologist 2012;17:1225-39
Adam R, et al. Cancer Treat Ver 2015; 41:729-41

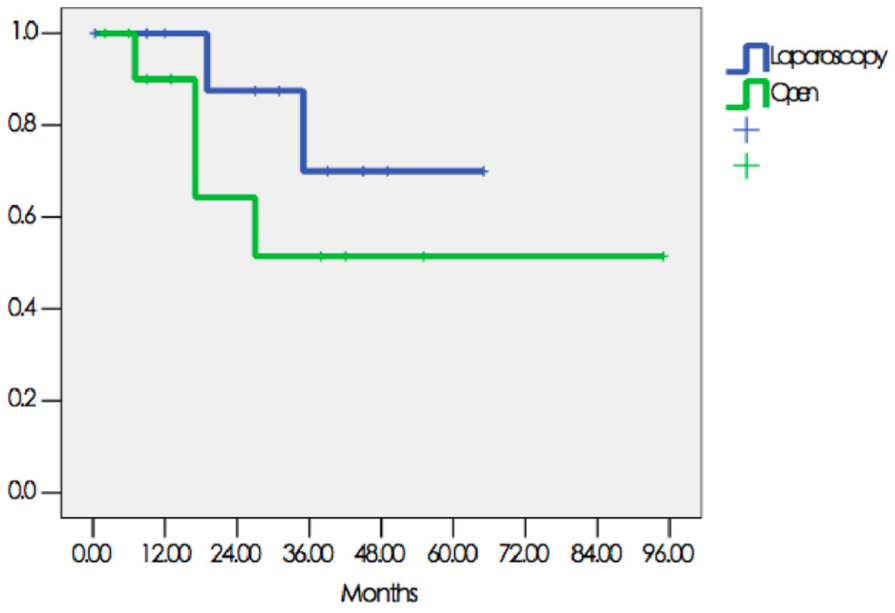
# SURVIVAL

**Table 3** Outcome and survival.

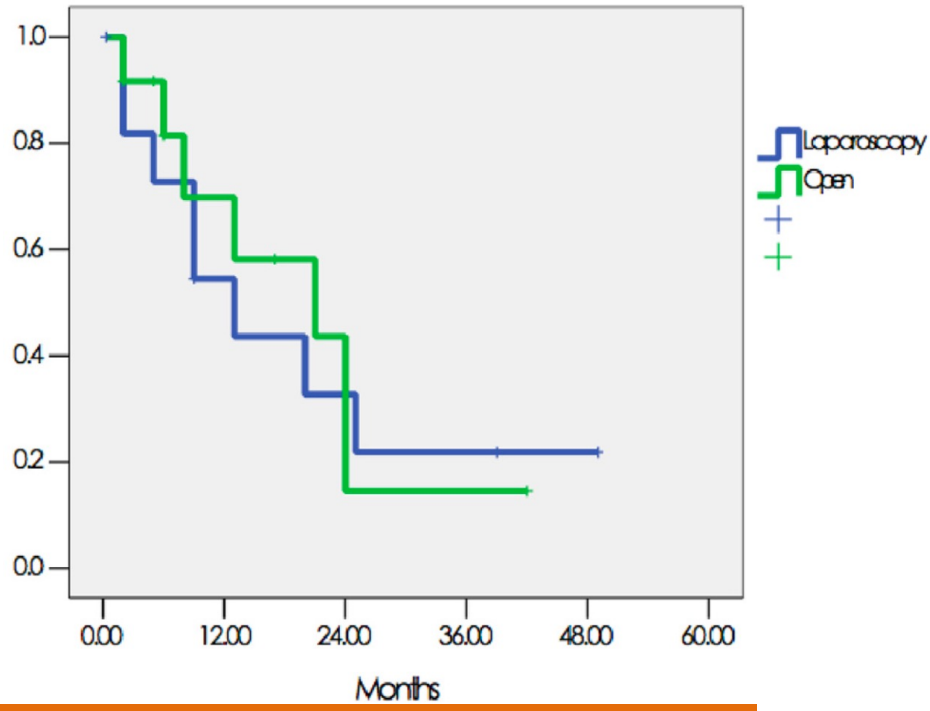
| | Laparoscopic (n = 15) | Open (n = 15) | *p* - value |
|---|---|---|---|
| Median follow (months) | 19 | 13 | 0.91 |
| Disease free | | | 0.99 |
| Mean (month) | 13 | 10 | |
| 1 year | 0.56 | 0.70 | |
| 3 year | 0.35 | 0.15 | |
| Overall survival | | | 0.14 |
| Mean (month) | 26 | 22 | |
| 1 year | 1.00 | 0.84 | |
| 3 year | 0.73 | 0.48 | |
| Adjuvant chemotherapy | 12 | 13 | |
| Recurrence | 8 | 8 | 1.00 |
| Death | 2 | 5 | 0.09 |
| Site of initial recurrence | | | 0.85 |
| Liver | 6 | 6 | |
| Lung | 1 | 1 | |
| Peritonium | 0 | 1 | |
| Adrenal gland | 1 | 0 | |

Chen YW, et al. Asian J Surg 2019

# SURVIVAL




Overall survival (p=0.26)




Disease free survival (p=0.26)

Chen YW, et al. Asian J Surg 2019

# LYMPHADENECTOMY

**Table 1** Patient characteristics.

| | Laparoscopic (n = 16) | Open (n = 22) | *p* - value |
|---|---|---|---|
| Age (year) | 66.0 ± 10.4 | 64.8 ± 13.0 | 0.46 |
| Gender Male/female | 10/6 | 9/13 | 0.20 |
| ASA score, mean (range) | 1.9 (1–3) | 2.0 (1–3) | 0.49 |
| CEA | 929 ± 1936 | 247 ± 728 | **0.01** |
| BMI | 23.8 ± 3.7 | 23.3 ± 4.1 | 0.44 |
| Primary tumor Size (cm) | 4.0 ± 2.0 | 5.0 ± 3.0 | 0.05 |
| Venous invasion | 10 | 15 | 0.72 |
| Perineural invasion | 4 | 11 | 0.13 |
| Primary tumor | | | |
| TNM stage | | | 0.84 |
| T1 | 1 | 1 | |
| T2 | 1 | 1 | |
| T3 | 11 | 16 | |
| T4 | 4 | 4 | |
| N0 | 4 | 7 | |
| N1-2 | 12 | 15 | |
| Lymph node harvesting | 24.5 ± 9.2 | 32.0 ± 19.5 | 0.42 |
| Liver tumor | | | |
| Number of tumor | | | 0.23 |
| 1 | 8 | 17 | |
| 2 | 4 | 2 | |
| >=3 | 4 | 3 | |
| Liver tumor pathology | | | |
| Metastatic adenocarcinoma | 15 | 17 | |
| Hepatocellular carcinoma | 1 | 2 | |
| Neuroendocrine tumor | 0 | 1 | |
| Benign tumor | 0 | 2 | |
| Largest tumor size (cm) | 5.5 ± 4.2 | 4.7 ± 3.7 | 0.99 |
| Tumor location only at S2,3,6 | 4 | 7 | 0.37 |

Chen YW, et al. Asian J Surg 2019;42:217-23

# INFECTIOUS COMPLICATIONS

Hindawi
Evidence-Based Complementary and Alternative Medicine
Volume 2022, Article ID 5268554, 7 pages
https://doi.org/10.1155/2022/5268554

*Research Article*

**Synchronous Colorectal Liver Metastases considering Infectious Complications: Simultaneous or Delayed Surgery?**

Table 4: Occurred postoperative complications.

| | Clavien-dindo grade* | Simultaneous group $n = 88$ | Delayed group $n = 25$ | $P$ value |
|---|---|---|---|---|
| Bleeding | II/IIIa/IIIb/IVa/IVb | 8<br>7/0/0/1/0 | 1<br>1/0/0/0/0 | 0.278 |
| Bowl obstruction | II/IIIa/IIIb/IVa/IVb | 4<br>4/0/0/0/0 | 0<br>0/0/0/0/0 | 0.407 |
| Liver-related infection | | 15 | 0 | 0.027 |
| Bile leakage | II/IIIa/IIIb/IVa/IVb | 0/1/0/0/0 | 0/0/0/0/0 | |
| Abscess around liver | II/IIIa/IIIb/IVa/IVb | 2/9/1/1/1 | 0/0/0/0/0 | |
| Bowl-related infection | | 4 | 2 | 0.497 |
| Anastomotic leakage | II/IIIa/IIIb/IVa/IVb | 0/0/3/0/0 | 0/0/1/1/0 | |
| Abscess around intestine | II/IIIa/IIIb/IVa/IVb | 0/1/0/0/0 | 0/0/0/0/0 | |
| Wound infection | II/IIIa/IIIb/IVa/IVb | 7<br>6/1/0/0/0 | 1<br>0/1/0/0/0 | 0.333 |
| Others** | II/IIIa/IIIb/IVa/IVb | 8<br>6/1/0/1/0 | 2<br>1/0/0/0/1 | 0.865 |
| Total | | 32 | 5 | 0.124 |

*Postoperative usage of analgesics and antiemetic is a routine treatment in our department. We cannot distinguish Grade 1 complications, so complications are defined as more than Grade 2. **Other complications contain urinary tract infection, pulmonary infection, and catheter-related infection.

Huang L, et al. Ann Transl Med J 2022

# OPERATION-RELATED FACTORS

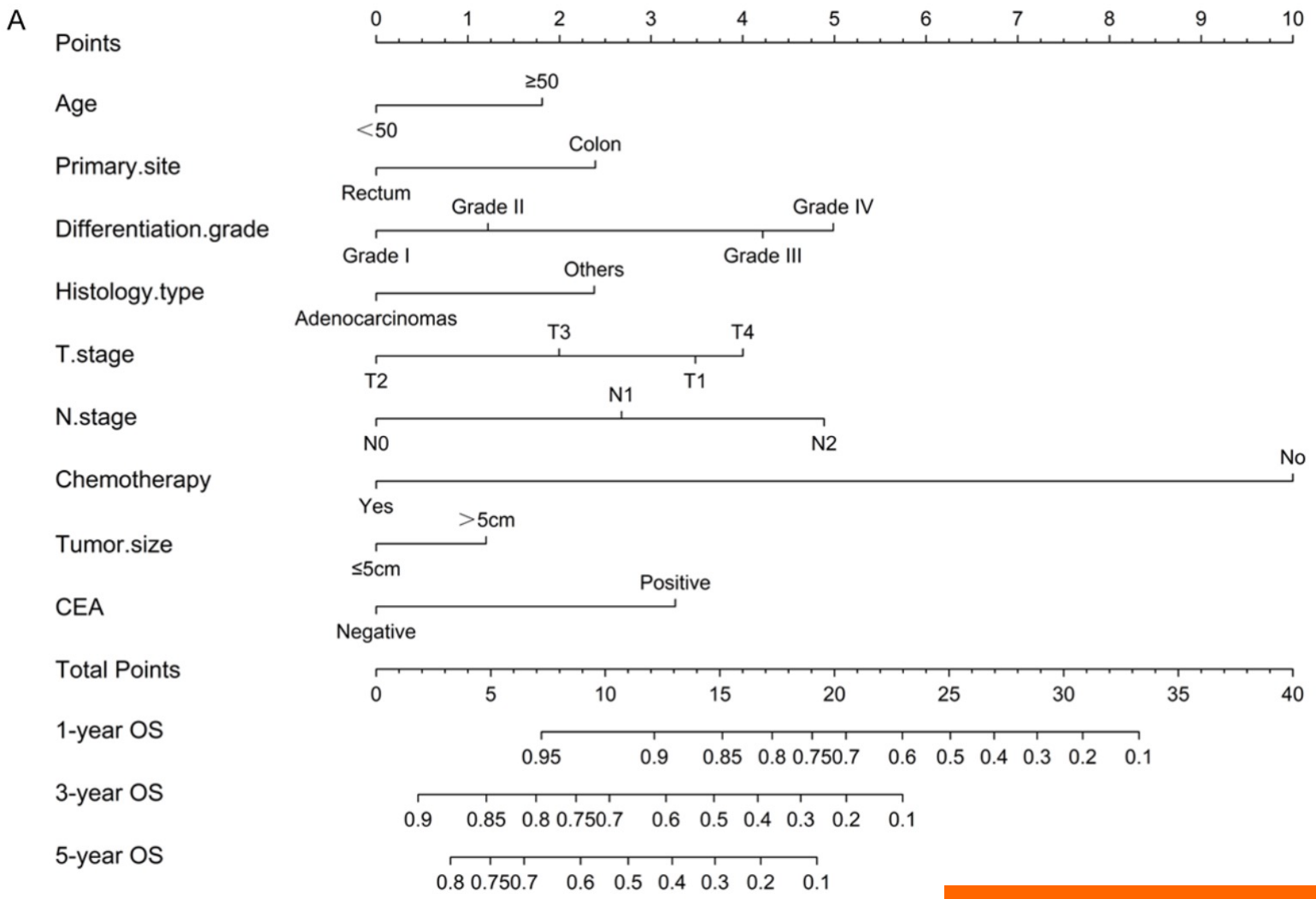
**TABLE 2** | Operation-related factors.

| Characteristic | Before propensity score matching | | | | | After propensity score matching | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Laparoscopy (*n* = 60) | Hybrid (*n* = 70) | *p* | Open (*n* = 151) | *p* | Laparoscopy (*n* = 47) | Hybrid (*n* = 47) | *p* | Laparoscopy (*n* = 34) | Open (*n* = 34) | *p* |
| **Operation time, min** | 229.25 ± 8.27 | 228.01 ± 8.80 | 0.920 | 200.48 ± 4.68 | **0.002** | 232.53 ± 10.01 | 218.94 ± 44.16 | 0.375 | 229.09 ± 10.94 | 192.24 ± 9.49 | **0.013** |
| **Intraoperative blood loss, ml** | 150.00 (100.00–300.00) | 200.00 (100.00–400.00) | **0.036** | 200.00 (150.00–400.00) | **<0.001** | 150.00 (100.00–300.00) | 200.00 (100.00–400.00) | 0.290 | 100.00 (50.00–300.00) | 200.00 (150.00–400.00) | **0.021** |
| **Intraoperative transfusion, %** | | | 0.139 | | **0.038** | | | 0.180 | | | 1.000 |
| **Yes** | 7 (11.67) | 15 (21.43) | | 37 (24.50) | | 6 (12.77) | 11 (23.40) | | 5 (14.71) | 5 (14.71) | |
| **No** | 53 (88.33) | 55 (78.57) | | 114 (75.50) | | 41 (87.23) | 36 (76.60) | | 29 (85.29) | 29 (85.29) | |
| **Initial defecation time, days** | 3.00 (2.00–5.00) | 4.00 (3.00–5.00) | 0.412 | 4.00 (3.00–6.00) | **<0.001** | 3.00 (2.00–5.00) | 4.00 (3.00–5.00) | 0.348 | 4.00 (2.00–6.00) | 4.00 (3.00–5.00) | 0.709 |
| **Postoperative hospital stay, days** | 8.00 (7.00–11.00) | 9.00 (7.75–12.00) | 0.092 | 9.00 (8.00–12.00) | **0.005** | 8.00 (7.00–11.00) | 10.00 (8.00–12.00) | 0.095 | 8.00 (7.00–11.00) | 9.00 (8.00–12.25) | 0.052 |
| **Postoperative complications, %** | | | 0.468 | | 0.415 | | | 0.285 | | | 0.434 |
| **Absent** | 45 (75.00) | 48 (68.57) | | 94 (64.24) | | 36 (76.60) | 32 (68.09) | | 28 (82.35) | 25 (73.53) | |
| **Grade I** | 8 (13.33) | 8 (11.43) | | 27 (17.88) | | 6 (12.77) | 4 (8.51) | | 1 (2.94) | 3 (8.82) | |
| **Grade II** | 4 (6.67) | 8 (11.43) | | 11 (7.28) | | 3 (6.38) | 7 (14.89) | | 3 (8.82) | 1 (2.94) | |
| **Grade III** | 2 (3.33) | 6 (8.57) | | 15 (9.93) | | 1 (2.13) | 4 (8.51) | | 2 (5.88) | 3 (8.82) | |
| **Grade IV** | 1 (1.67) | 0 (0.00) | | 4 (2.65) | | 1 (2.13) | 0 (0.00) | | 0 (0.00) | 2 (5.88) | |

*$p < 0.05$ was considered statistically significant and shown in bold.*

Zhou J, et al. Frontiers Oncol 2022

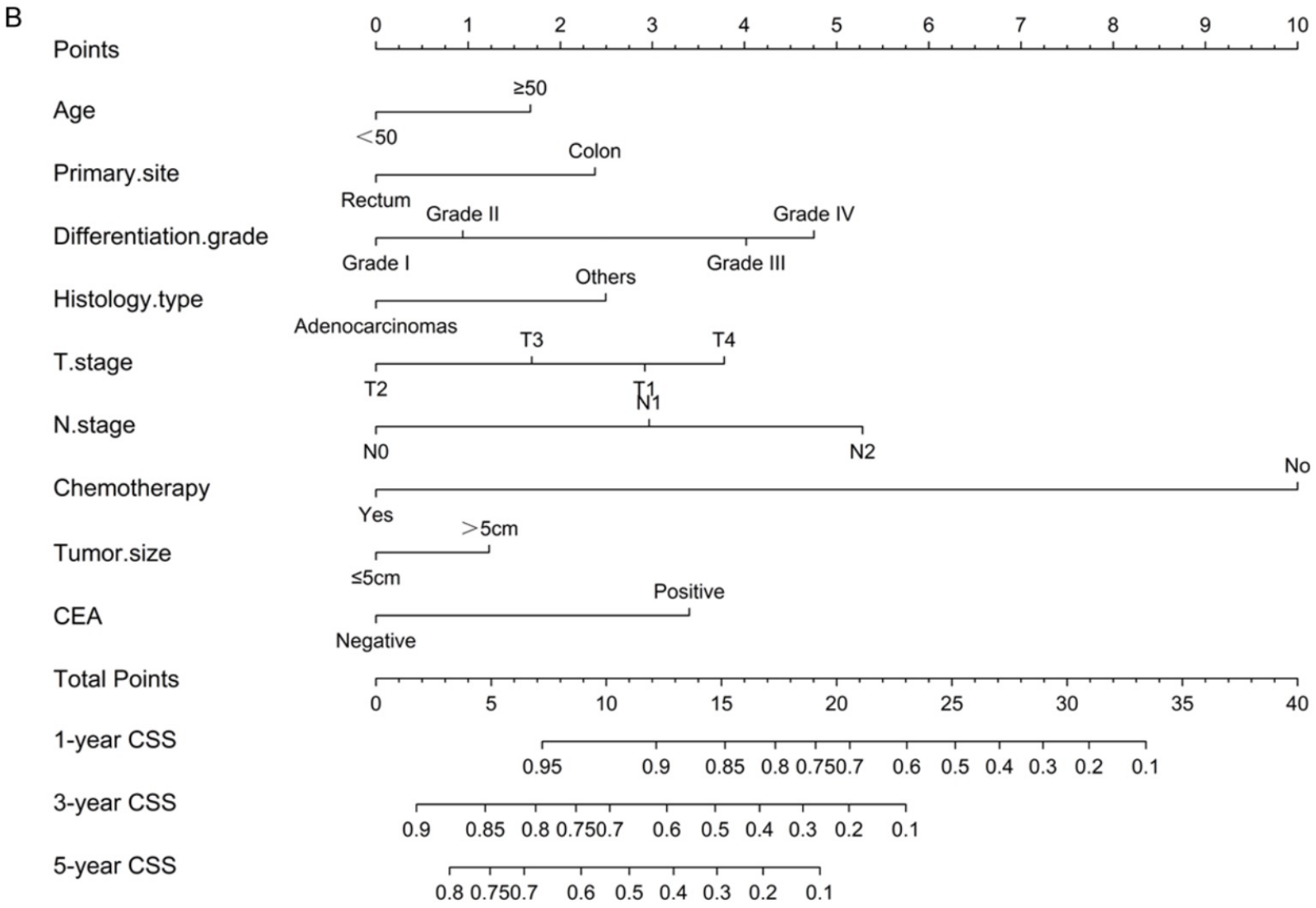
# SURVIVAL NOMOGRAMS




**overall survival**

Guo X, et al. Am J Cancer Res 2021;11:2654-69

# SURVIVAL NOMOGRAMS




Guo X, et al. Am J Cancer Res 2021;11:2654-69

cancer-specific survival

# CONCLUSION

- There appears to be consensus on an expanding role for MIS and simultaneous resections.
- LLCR is feasible and does not increase postoperative morbidity compared to LCR alone, in selected patients with synchronous colorectal liver metastases requiring a minor liver resection, operated in experienced centers

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Thanks!

Gracias!

Obrigado!

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