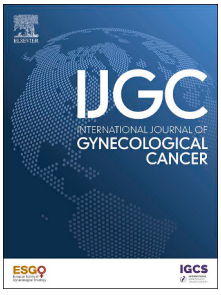
ORIGINAL RESEARCH

Minimally invasive interval debulking surgery in advanced ovarian cancer: a real-life PICture of pAtientS' SelectiOn



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ABSTRACT

Objective: This study aimed to assess the accuracy of pre-operative computed tomography in identifying candidates for minimally invasive interval cytoreductive surgery after neoadjuvant chemotherapy in patients with advanced ovarian cancer.

Methods: This retrospective, single-center study included patients with advanced ovarian cancer who received 3 to 4 cycles of platinum-based neoadjuvant chemotherapy, followed by interval cytoreductive surgery, between July 2021 and May 2024. Pre-operative computed tomography scans were reviewed by expert radiologists to assess the extent and distribution of residual disease. Patients were deemed eligible or ineligible for minimally invasive interval cytoreductive surgery based on radiologic criteria. Computed tomography findings were compared with intra-operative findings to evaluate sensitivity, specificity, predictive values, and diagnostic accuracy. Site-specific concordance was assessed using Cohen's κ.

Results: A total of 87 patients were included. Computed tomography scan demonstrated an overall accuracy of 71.3% (95% confidence interval 61.76 to 80.77) in predicting feasibility of minimally invasive interval cytoreductive surgery, with a sensitivity of 71.4% (95% confidence interval 52.11 to 90.75) and a specificity of 71.2% (95% confidence interval 60.29 to 82.14). False-negative and false-positive rates were 28.6% and 28.8%, respectively. Concordance between computed tomography and surgical findings was moderate (Cohen's k = 0.35). The highest agreement was found for small bowel and mesenteric involvement, whereas diaphragmatic and perihepatic sites showed the lowest concordance.

Conclusions: This study shows that the radiologic selection process for minimally invasive interval cytoreductive surgery is complex. The not negligible false-negative and false-positive rates suggest that a combined approach, including diagnostic laparoscopy or advanced imaging tools, may improve surgical planning and patient selection for minimally invasive surgery at interval cytoreductive surgery.

WHAT IS ALREADY KNOWN ON THIS TOPIC

Selection of candidates for minimally invasive interval cytoreductive surgery after neoadjuvant chemotherapy is challenging, and the accuracy of computed tomography scans in this setting is uncertain.

WHAT THIS STUDY ADDS

Our study shows that computed tomography scan has only moderate accuracy (~71%) in predicting the feasibility of minimally invasive interval cytoreductive surgery, with frequent discrepancies in the assessment of upper abdominal disease.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE, OR POLICY

Integrating advanced imaging, diagnostic laparoscopy, or artificial intelligence–based tools may improve patient selection and optimize surgical planning in advanced ovarian cancer.

Keywords:
Ovarian Cancer; Neoadjuvant Chemotherapy; Interval Cytoreductive Surgery; Minimally Invasive Surgery; Computed Tomography Scan Accuracy; Pre-Operative Assessment

INTRODUCTION

Most ovarian cancer cases are diagnosed at an advanced stage, with widespread tumor involvement within the abdominal cavity. The standard treatment includes cytoreductive surgery and chemotherapy with carboplatin and paclitaxel.[1,2] Randomized trials have demonstrated that neoadjuvant chemotherapy before cytoreductive surgery can reduce surgical morbidity without compromising overall survival.[3-7] Among patients who receive neoadjuvant chemotherapy, a minimally invasive approach at interval cytoreductive surgery[8,9] may further reduce morbidity.

Minimally invasive interval cytoreductive surgery is increasingly common.[8-10] Some retrospective studies have shown that interval minimally invasive cytoreductive surgery is feasible, with good peri-operative outcomes, and is comparable with open surgery in

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terms of progression-free survival in selected women responding to neoadjuvant chemotherapy.[11-16] To date, an international, randomized, multi-center, non-inferiority phase III trial (LANCE trial) is ongoing, with the aim of comparing minimally invasive interval cytoreductive surgery versus laparotomy in terms of disease-free survival.[17]

However, the selection of candidates for minimally invasive interval cytoreductive surgery is not standardized, and it is primarily based on the use of diagnostic laparoscopy.[11,18,19] Recently, Conte and colleagues[18] developed a nomogram to predict the probability of achieving successful minimally invasive interval cytoreductive surgery, including pre-operative and intra-operative factors (CA-125 normalization, availability of a high-volume surgeon, absence of omental cake, and involvement of less than 2 additional peritoneal sites). Nevertheless, diagnostic laparoscopy may increase costs and negatively impact surgical time and organization due to uncertainty of planned surgery. Standard pre-operative imaging methods (computed tomography [CT] scan, positron emission tomography [PET]—CT, or magnetic resonance imaging) may overcome these limitations because they are routinely used to assess location and extension of residual disease and may offer an accurate pre-operative planning. In ovarian cancer, the accuracy of CT scan for peritoneal implant detection ranges between 70% and 90%,[20-23] but studies in the neoadjuvant chemotherapy population are few and limited by the relatively small number and heterogeneity of patients included.[24-27] Although these studies indicate good performance of CT in selecting patients suitable for interval debulking surgery after neoadjuvant chemotherapy, identification of small residual disease remains a significant challenge for radiologists, and it is crucial for selecting candidates for minimally invasive interval cytoreductive surgery.[18]

This study aims to assess the accuracy, positive predictive value, and negative predictive value of CT scan to predict successful minimally invasive interval cytoreductive surgery in an ovarian cancer population undergoing interval cytoreductive surgery after 3 or 4 cycles of neoadjuvant chemotherapy.

The secondary objective was to assess the accuracy, positive predictive value, and negative predictive value of CT scan in identifying tumor involvement in pre-specified anatomical regions with respect to intra-operative findings.

METHODS

This is a retrospective, observational, single-center study of patients with advanced ovarian cancer who underwent platinum-based neoadjuvant chemotherapy and subsequent interval cytoreductive surgery from July 2021 to May 2024 at the Gynecologic Oncologic Unit, Fondazione Policlinico Universitario Agostino Gemelli IRCCS. Patients' information was retrieved from the institutional prospectively recorded REDcap database. Our ethics committee (ID 7294) approved the study, and all patients signed informed consent for the processing of personal data.

The inclusion criteria were as follows: International Federation of Gynecology and Obstetrics stage IIIC or IV at diagnosis; high-grade histology (serous, endometrioid, clear cell, transitional carcinomas); invasive epithelial ovarian carcinoma; 3 to 4 cycles of neoadjuvant chemotherapy; subsequent interval cytoreductive surgery; normalization of CA-125 serum levels after neoadjuvant chemotherapy; and a timeframe of <6 weeks from the last cycle of neoadjuvant chemotherapy to interval cytoreductive surgery. Exclusion criteria were: unavailability of pre-operative CT scan images, an interval time of more than 30 days between the CT scan and interval cytoreductive surgery, and additional neoadjuvant chemotherapy cycles after pre-operative CT scan. CT scans performed at our institution followed a standardized acquisition protocol.

A group of expert radiologists in gynecologic oncology reviewed the CT scan of the chest, abdomen, and pelvis of all included patients at the multi-disciplinary institutional tumor board meeting to assess the presence, extent, and location of residual disease. They were aware that CT review was performed to assess patient eligibility for potential enrollment in the LANCE trial and for minimally invasive interval surgery. In case of evidence of tumor not amenable to minimally invasive resection (small bowel tumor involvement, diaphragmatic/Morrison and perihepatic involvement, mesenteric tumor involvement, gastrosplenic and splenic involvement, supracolic omentum/omental cake, and tumor infiltration of the lesser sac), the patient was not considered for minimally invasive surgery approach and underwent interval cytoreductive surgery by laparotomy according to our internal guidelines. The eligibility criteria for minimally invasive surgery followed the same radiologic and surgical parameters adopted in the ongoing LANCE randomized trial.[17] The surgical team remained the same throughout the study period.

We identified 2 populations: patients scheduled for minimally invasive surgery (group A) and patients scheduled for open surgery due to radiologic criteria (group B) (Fig.).

Negative cases were considered if the minimally invasive surgery criteria were met pre-operatively (group A), and positive cases were considered if the criteria for minimally invasive surgery were not found pre-operatively (group B). Pre-operative assessment was then matched with intra-operative findings to identify true and false cases.

Surgical reports of all patients were retrospectively re-evaluated by 2 expert surgeons (AF and CC) according to previously defined criteria for minimally invasive surgery to identify cases in which minimally invasive interval cytoreductive surgery would have been possible (minimally invasive surgery feasible) and those in which minimally invasive surgery would not have been possible (minimally invasive surgery unfeasible), regardless of the final surgical approach.

The reviewers were not blinded to surgical outcomes because this was a retrospective analysis, and inter-rater variability between the 2 surgeons was not formally assessed.

The following radiologic parameter (lesion site) were compared with intra-operative findings (presence or absence of disease): small bowel tumor involvement, diaphragmatic/Morrison and perihepatic involvement, mesenteric tumor involvement, gastrosplenic and splenic involvement, supracolic omentum/omental cake, and tumor infiltration of the lesser sac.

Statistical Analysis

Quantitative variables were described using medians and ranges, whereas qualitative variables were summarized using absolute and percentage frequency tables.

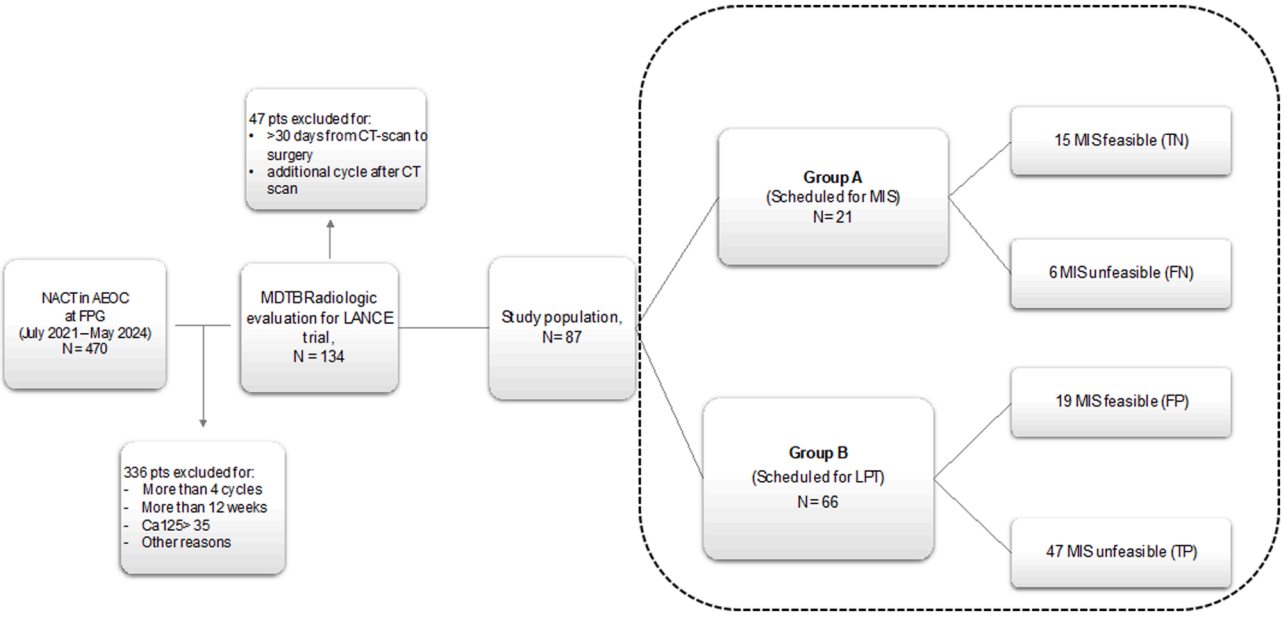

Figure Patients' population flow chart and study design. Study design is in the square with dotted lines.
Abbreviations: AEOC, advanced epithelial ovarian cancer; FN, false negative; FP, false positive; FPG, Fondazione Policlinico Gemelli; LPT, laparotomy; MDTB, multi-disciplinary tumor board; MIS, minimally invasive surgery; NACT, neoadjuvant chemotherapy; TN, true negative; TP, true positive.

To assess the radiologic accuracy, each parameter was correlated with surgical findings. The agreement between CT scan and surgical parameters was evaluated using Cohen's κ. Interpretation of Cohen's index was performed according to Landis and Koch: ≤0.00 indicating no agreement, 0.00 to 0.20 slight, 0.21 to 0.40 fair, 0.41 to 0.60 moderate, 0.61 to 0.80 substantial, and 0.81 to 1.00 almost perfect agreement. Sensitivity, specificity, accuracy, false-positive rate, and false-negative rate of CT scan diagnostic performance after neoadjuvant chemotherapy with respect to surgical outcome were provided with corresponding 95% confidence intervals (CIs). The significance level was set at $p < .05$.

In accordance with the journal's guidelines, we will provide our data for independent analysis by a selected team by the Editorial Team for the purposes of additional data analysis or for the reproducibility of this study in other centers, if such is requested.

RESULTS

From July 2021 to May 2024, 470 patients underwent neoadjuvant chemotherapy and subsequent interval cytoreductive surgery at our institution. A total of 134 women (28.5%) underwent radiologic evaluation to be enrolled in the LANCE trial at the multi-disciplinary tumor board, whereas the remaining 336 patients (71.5%) were not screened due to 1 or more exclusion criteria. Moreover, 47 of 134 patients (35%) were excluded due to an interval time of more than 30 days between the CT scan and surgery and/or underwent a fourth cycle of neoadjuvant chemotherapy after the CT scan (Fig.).

Among the 87 patients included, 21 (24.1%) were assigned to group A (minimally invasive surgery candidates) and 66 (75.9%) to group B (laparotomy candidates). We identified 6 false negatives (28.6%) and 19 false positives (28.8%) based on the comparison between pre-operative CT and intra-operative findings (Fig.)

Pre-operative clinico-pathologic features of the patients are described in Table 1.

In group A, 2 of 12 minimally invasive surgeries (16.7%) were converted to an open approach due to diffusion of disease.

In group B, the diffusion of disease prevented minimally invasive surgery in 47 patients (71.2%); of these, 5 patients (7.6%) were judged not amenable to complete resection. Conversely, we judged minimally invasive surgery feasible in the remaining 19 women (28.8%).

Overall, the accuracy of CT scan in predicting successful minimally invasive surgery was 71.3% (95% CI 61.76 to 80.77), with a false-negative rate (probability of conversion from minimally invasive surgery to laparotomy) of 28.6% (95% CI 9.25 to 47.89) and a false-positive rate (exclusion from feasible minimally invasive surgery) of 28.8% (95% CI 17.86 to 39.71). The sensitivity of this approach resulted in 71.4% (52.11 to 90.75), with a specificity of 71.2% (95% CI 60.29 to 82.14), with a Cohen's k of 0.35 (95% CI 0.16 to 0.55).

There was a good agreement between pre-operative CT scan and intra-operative finding for each anatomical site, with the highest level observed for small bowel and mesentery tumor involvement, gastrosplenic/splenic ligament involvement, and the lesser peritoneal sac (Table 2). The highest positive likelihood ratio was observed for mesenteric tumor involvement (100%), and the highest negative likelihood ratio was obtained for small bowel tumor involvement (100%) (Table 2). Conversely, the lowest agreement was observed for diaphragmatic assessment, where extensive unilateral or bilateral diaphragm was found in 6 of 21 cases (28.6%) judged negative and was not present in 7 of 66 (36.8%) judged positive pre-operatively (Table 3). Other sites erroneously judged negative were the Morrison/perihepatic site (36.8%), the gastrosplenic ligament/spleen (26.3%), and the supramesocolic omentum (26.3%) (Table 3). Specifically, the sites

Table 1 Pre-Operative Clinico-Pathologic Features of the Patients

Variables	Study population *n* (%)	Group A *n* (%)	Group B *n* (%)
All cases	87	21	66
Median age at first diagnosis			
Y (range)	62 (37)	60 (27)	63 (37)
Histology			
High-grade serous	87 (100)	21 (100)	66 (100)
FIGO stage			
III B	3 (3.4)	1 (4.8)	2 (3.0)
III C	45 (51.8)	15 (71.4)	30 (45.5)
IV A	5 (5.7)	1 (4.8)	4 (6.0)
IV B	34 (39.1)	4 (19)	30 (45.5)
***BRCA* 1/2 status**			
Wild-type	57 (65.5)	15 (71.4)	42 (63.6)
BRCA 1mutated	16 (18.4)	1 (4.8)	15 (22.7)
BRCA 2 mutated	14 (16.1)	5 (23.8)	9 (13.7)
Number of NACT cycles			
3	73 (83.9)	17 (81)	56 (84.8)
4	14 (16.1)	4 (19)	10 (15.2)
Kelim score			
Favorable	45 (51.7)	10 (47.6)	35 (53.0)
Unfavorable	42 (48.3)	11 (52.4)	31 (47.0)
Median time between CT scan and ICS			
D (range)	21 (27.0)	22.5 (25)	21 (27.0)
Residual tumor[a]			
0	81 (98.8)	21 (100)	60 (98.3)
<0.5 mm	1 (1.2)	0	1 (1.7)

Abbreviations: CT, computed tomography; FIGO, International Federation of Gynecology and Obstetrics; ICS, interval cytoreductive surgery; NACT, neoadjuvant chemotherapy.

[a] Rates calculated excluding diagnostic surgery at interval cytoreductive surgery ($n = 5$).

with lower levels of agreement between imaging and intra-operative lesions were the unilateral or bilateral diaphragm (Cohen's κ of 0.60; 0.40 to 0.79), the Morrison/perihepatic (Cohen's κ of 0.77; 0.62 to 0.92), and the omentum (Cohen's κ of 0.76; 0.60 to 0.92) (Table 2).

DISCUSSION

Summary of Main Results

In this study, the sensitivity and specificity of pre-operative CT scan in selecting patients with advanced ovarian cancer after neoadjuvant chemotherapy for a minimally invasive surgery approach at interval cytoreductive surgery were approximately 70%. CT scan alone may exclude women who would instead be candidates for minimally invasive surgery cytoreduction in about 30% of the cases. Discrepancies between imaging and intra-operative findings were more frequent in upper abdomen sites, such as the diaphragm and perihepatic area (Cohen's κ of 0.60 and 0.77, respectively), which are crucial for the feasibility of minimally invasive interval cytoreductive surgery.

Results in the Context of Published Literature

Currently, the selection process for minimally invasive interval cytoreductive surgery is not uniformly applied in clinical practice, and few tools are available for predicting candidacy for minimally invasive interval cytoreductive surgery. In retrospective studies[12] and a prospective study[11] evaluating the feasibility of minimally invasive interval cytoreductive surgery, the choice of surgical approach was left to the surgeon's discretion after diagnostic laparoscopy.

More recently, Costales and colleagues[19] developed a laparoscopic predictive index value to estimate the likelihood of successfully performing minimally invasive interval cytoreductive surgery. A predictive index value score below 2 identified candidates suitable for optimal minimally invasive interval cytoreductive surgery, with an accuracy of 68.2%.[19]

Conte and colleagues[18] proposed a nomogram capable of predicting successful minimally invasive interval cytoreductive surgery in 84% of cases. This tool also requires diagnostic laparoscopy to evaluate disease extent and distribution but does not incorporate pre-operative imaging variables.

Although some authors have attempted to identify the best method among radiologic, laparoscopic, and laparotomic scoring assessments to predict the outcomes of primary cytoreductive surgery,[28,29] we still lack data on the accuracy of CT scan in the pre-operative selection of patients eligible for minimally invasive interval cytoreductive surgery. Our results align with earlier studies regarding the unsatisfactory accuracy of CT scan in detecting peritoneal disease in advanced ovarian cancer after neoadjuvant chemotherapy.[24,29,30] Previous retrospective studies reported difficulties in distinguishing residual disease from fibrotic or inflammatory changes associated with neoadjuvant chemotherapy, which could affect the peri-operative evaluation of CT and PET-CT scans.[31,32]

These post-treatment changes, including fibrosis and scarring, may significantly reduce CT sensitivity, particularly, for small peritoneal implants or sub-diaphragmatic lesions. This limitation should be considered when interpreting CT findings after neoadjuvant chemotherapy.

Limited to the interval cytoreductive surgery setting, a retrospective study (31 patients) compared CT evaluation and laparoscopic assessment with laparotomic exploration using the Fagotti peritoneal index and the Sugarbaker peritoneal cancer index.[28] The radiologic evaluation was associated with the worst accuracy in predicting residual disease outcome, suggesting that CT scans may miss small lesions or lesions in challenging locations.

In a small retrospective series evaluating the diagnostic performance of CT scan in determining residual disease after neoadjuvant chemotherapy, CT scan showed a low negative predictive value (50.0%) in identifying residual disease after neoadjuvant chemotherapy in patient-based ($n = 58$) and lesion-based analyses ($N = 439$), especially for non-measurable lesions and at the sub-diaphragmatic spaces, bowel serosa, and mesentery (*p*

Table 2 Correlation Between Pre-Operative CT Scan and Intra-Operative Findings in Single Anatomic Sites

Lesion sites	Sensitivity	Specificity	Accuracy	Positive likelihood ratio	Negative likelihood ratio	Cohen's κ	Level of agreement
Small bowel tumor involvement	100 (100-100)	84.0 (69.93-98.37)	95.4 (91-99.8)	93.9 (88.18-99.7)	100 (100-100)	0.88 (0.77-0.99)	**Almost perfect**
Diaphragm	90.8 (83.73-97.81)	68.2 (48.72-87.65)	85.1 (77.57-92.55)	89.4 (81.97-96.82)	71.4 (52.11-90.75)	0.60 (0.40-0.79)	Moderate
Morrison/perihepatic	98.3 (95.09-101.57)	74.1 (57.54-90.60)	90.8 (84.73-96.88)	89.4 (81.97-96.82)	95.2 (86.13-104.35)	0.77 (0.62-0.92)	Substantial
Mesenteric tumor involvement	97.1 (93.04-101.07)	100 (100-100)	97.7 (94.55-100.85)	100 (100-100)	90.5 (77.92-103.03)	0.93 (0.85-1.00)	**Almost perfect**
Gastrosplenic ligament/splenic	98.4 (95.25-101.52)	80.0 (64.32-95.68)	93.1 (87.78-98.43)	92.4 (86.04-98.81)	95.2 (86.13-104.35)	0.82 (0.69-0.92)	**Almost perfect**
Supracolic omentum/omental cake	95.3 (90.13-100.99)	78.3 (61.4-95.12)	90.8 (84.73-96.88)	92.4 (86.04- 98.81)	85.7 (70.75-100.68)	0.76 (0.60-0.92)	Substantial
Lesser peritoneal sac	98.5 (95.54-101.43)	95.2 (86.13-104.35)	97.7 (94.55-100.85)	98.5 (95.54-101.43)	95.2 (86.13-104.35)	0.94 (0.85-1.00)	**Almost perfect**

Abbreviation: CT, computed tomography.
Bold formatting was used to highlight almost perfect agreement results.

Table 3 Diagnostic Performance of CT Scan After NACT in Single Anatomic Sites

Anatomic sites of disease[a]		Group A *n* (%)	Group B *n* (%)
All patients	**87**	**21**	**66**
False negative (converted to LPT/MIS unfeasible)	**6**	**6 (28.5)**	**-**
False positive (MIS feasible at ICS)	**19**	**-**	**19 (28.8)**
Small bowel tumor involvement	4 (4.6%)	0	4 (21.0)
Diaphragm	14 (16.1%)	6 (28.6)	7 (36.8)
Morrison/perihepatic	8 (9.2)	1 (4.8)	7 (36.8)
Mesenteric tumor involvement	2 (2.3%)	2 (9.5)	0
Gastrosplenic ligament/splenic	6 (6.9%)	1 (4.8)	5 (26.3)
Supracolic omentum/omental cake	8 (9.2%)	3 (14.3)	5 (26.3)
Lesser peritoneal sac	2 (2.3%)	1 (4.8)	1 (5.3)
Others[b]	2 (2.3%)	0	2 (10.5)

Abbreviations: ICS, interval cytoreductive surgery; LPT, laparotomy; MIS, minimally invasive surgery.
Bold formatting was used to emphasize key values, including the total number of patients and the counts of false-negative and false-positive cases.
[a] Each patient could have more than 1 site involved.
[b] Bulky lymph nodes.

<.001).[24] The CT scan accuracy rates were 87.93% and 66.51% in the patient-based and lesion-based analyses, respectively.[24] In this study, a false negative on CT scan was associated with lesion size, and the accuracy of peritoneal carcinomatosis detection on CT was site-dependent.[24]

These results could be explained by the small size of the lesions, the fibrotic tissue shrinkage related to chemotherapy, and the low number of lesions in certain locations, such as the perihepatic area and the diaphragm, which are important sites to consider in the surgical planning, especially for the minimally invasive surgery approach.

Strengths and Weaknesses

To the best of our knowledge, this is the first study to assess CT scan accuracy in selecting patients for minimally invasive interval cytoreductive surgery after neoadjuvant chemotherapy.

The patient cohort was selected based on radiologic criteria consistent with those of the ongoing LANCE randomized trial, ensuring a homogeneous sample regarding eligibility and disease characteristics. Radiologists with expertise in gynecologic oncology reviewed all CT scans in the multi-disciplinary tumor board. This ensured high consistency and accuracy in pre-operative radiologic evaluation throughout the whole study period. All patients underwent interval cytoreductive surgery after radiologic evaluation, and we had confirmatory examination with diagnostic laparoscopy/laparotomy and pathologic findings regarding the presence or absence of disease. The surgical team was composed of experts in minimally invasive surgery and surgical treatment of ovarian cancer, ensuring that conversion and/or unfeasibility evaluation were not related to the lack of technical skills. However, this study has several limitations that must be considered. First, its retrospective design and single-center nature restrict the

generalizability of the findings to broader patient populations or other health care settings. In particular, our cohort reflects a highly selected patient population managed at a tertiary referral center, which may differ from general advanced ovarian cancer populations in terms of disease complexity, radiologic expertise, and surgical experience. Second, no standardized radiologic report format was used during the multi-disciplinary tumor board evaluation. In addition, the sample size is relatively small, limiting statistical power and precision of some of estimates, especially when evaluating less common imaging patterns.

Lastly, because this was a retrospective study, the surgeons who re-evaluated the surgical reports were not blinded to clinical outcomes, which may have introduced a subjective bias. Moreover, the inter-rater variability between the 2 reviewers was not formally assessed and should be considered a limitation

Implications for Practice and Future Research

A combination of advanced imaging and diagnostic laparoscopy, as previously suggested,[18,28] may improve patient selection for successful minimally invasive interval cytoreductive surgery and help address limitations of each technique. To confirm this potential approach to the selection process for minimally invasive interval cytoreductive surgery, diagnostic laparoscopy was included as an amendment to the LANCE trial algorithm before randomization in women with positive CA-125.[17]

The integration of artificial intelligence into clinical practice holds great promise for improving pre-operative imaging accuracy in advanced ovarian cancer by enhancing detection of small or difficult-to-visualize lesions, such as those in the diaphragm or mesentery, thereby reducing false negatives and refining patient selection for minimally invasive interval debulking surgery. In addition, radiomics can recognize different tissue textures related to minimal residual disease from fibrotic or inflammatory changes after neoadjuvant chemotherapy.

Future multi-center, prospective studies should aim to validate multi-modal diagnostic algorithms combining CT, diagnostic laparoscopy, and biomarkers or radiomic-based models to improve patient selection for minimally invasive interval cytoreductive surgery

CONCLUSIONS

In conclusion, our study indicates that the radiologic selection process for minimally invasive interval cytoreductive surgery is complex, particularly for lesions located in anatomically challenging areas in the upper abdomen. The non-negligible false-negative and false-positive rates suggest the importance of incorporating a thorough and systematic laparoscopic evaluation before abandoning any attempt of minimally invasive surgery at interval cytoreductive surgery.

A combined pre-operative approach incorporating advanced imaging, radiomics, and artificial intelligence–based models should be explored to improve patient selection and surgical planning, in addition to diagnostic laparoscopy, where appropriate.

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Declaration of Competing Interests None declared.

REFERENCES

1. Siegel RL, Miller KD, Fuchs HE, Jemal A. Cancer statistics, 2022. *CA Cancer J Clin*. 2022;72(1):7–33. https://doi.org/10.3322/caac.21708.
2. Colombo N, Sessa C, Du Bois A, et al. ESMO-ESGO consensus conference recommendations on ovarian cancer: Pathology and molecular biology, early and advanced stages, borderline tumours and recurrent disease. *Ann Oncol*. 2019;30(5):672–705. https://doi.org/10.1093/annonc/mdz062.
3. Fagotti A, Ferrandina G, Vizzielli G, et al. Phase III randomised clinical trial comparing primary surgery versus neoadjuvant chemotherapy in advanced epithelial ovarian cancer with high tumour load (SCORPION trial): final analysis of peri-operative outcome. *Eur J Cancer*. 2016;59:22–33. https://doi.org/10.1016/j.ejca.2016.01.017.
4. Vergote I, Tropé CG, Amant F, et al. Neoadjuvant chemotherapy or primary surgery in stage IIIC or IV ovarian cancer. *N Engl J Med*. 2010;363(10):943–953. https://doi.org/10.1056/NEJMoa0908806.
5. Kehoe S, Hook J, Nankivell M, et al. Primary chemotherapy versus primary surgery for newly diagnosed advanced ovarian cancer (CHORUS): an open-label, randomised, controlled, non-inferiority trial. *Lancet*. 2015;386(9990):249–257. https://doi.org/10.1016/S0140-6736(14)62223-6.
6. Onda T, Satoh T, Saito T, et al. Comparison of treatment invasiveness between upfront debulking surgery versus interval debulking surgery following neoadjuvant chemotherapy for stage III/IV ovarian, tubal, and peritoneal cancers in a phase III randomised trial: Japan Clinical Oncology Group Study JCOG0602. *Eur J Cancer*. 2016;64:22–31. https://doi.org/10.1016/j.ejca.2016.05.017.
7. Mahner S, Heitz F, Salehi S, et al. TRUST: trial of radical upfront surgical therapy in advanced ovarian cancer (ENGOT ov33/AGO-OVAR OP7). *J Clin Oncol*. 2025;43(suppl 17):LBA5500. https://doi.org/10.1200/JCO.2025.43.17_suppl.LBA5500. LBA5500.
8. Jorgensen K, Melamed A, Wu CF, et al. Minimally invasive interval debulking surgery for advanced ovarian cancer after neoadjuvant chemotherapy. *Gynecol Oncol*. 2023;172:130–137. https://doi.org/10.1016/j.ygyno.2023.01.017.
9. Melamed A, Eisenhauer EL. Minimally invasive interval cytoreductive surgery for advanced ovarian cancer. *J Surg Oncol*. 2024;129(1):126–127. https://doi.org/10.1002/jso.27553.
10. Rauh-Hain JA, Melamed A, Pareja R, et al. Laparoscopic cytoreduction after neoadjuvant chemotherapy in high-grade epithelial ovarian cancer: a LANCE randomized clinical trial. *JAMA Netw Open*. 2024;7(11):e2446325. https://doi.org/10.1001/jamanetworkopen.2024.46325.
11. Gueli Alletti S, Bottoni C, Fanfani F, et al. Minimally invasive interval debulking surgery in ovarian neoplasm (MISSION trial-NCT02324595): a feasibility study. *Am J Obstet Gynecol*. 2016;214(4):503.e1–503.e6. https://doi.org/10.1016/j.ajog.2015.10.922.
12. Fagotti A, Gueli Alletti S, Corrado G, et al. The INTERNATIONAL Mission study: minimally invasive surgery in ovarian neoplasms after neoadjuvant chemotherapy. *Int J Gynecol Cancer*. 2019;29(1):5–9. https://doi.org/10.1136/ijgc-2018-000012.
13. Wright AA, Bohlke K, Armstrong DK, et al. Neoadjuvant chemotherapy for newly diagnosed, advanced ovarian cancer: Society of Gynecologic Oncology and American Society of Clinical Oncology Clinical Practice Guideline. *Gynecol Oncol*. 2016;143(1):3–15. https://doi.org/10.1016/j.ygyno.2016.05.022.
14. Patel A, Iyer P, Matsuzaki S, Matsuo K, Sood AK, Fleming ND. Emerging trends in neoadjuvant chemotherapy for ovarian cancer. *Cancers (Basel)*. 2021;13(4):626. https://doi.org/10.3390/cancers13040626.
15. Corrado G, Mancini E, Cutillo G, et al. Laparoscopic debulking surgery in the management of advanced ovarian cancer after neoadjuvant chemotherapy. *Int J Gynecol Cancer*. 2015;25(7):1253–1257. https://doi.org/10.1097/IGC.0000000000000491.
16. Favero G, Macerox N, Pfiffer T, et al. Oncologic concerns regarding laparoscopic cytoreductive surgery in patients with advanced ovarian cancer submitted to neoadjuvant chemotherapy. *Oncology*. 2015;89(3):159–166. https://doi.org/10.1159/000381462.

17. Nitecki R, Rauh-Hain JA, Melamed A, et al. Laparoscopic cytoreduction after neoadjuvant ChEmotherapy (LANCE). *Int J Gynecol Cancer*. 2020;30(9):1450—1454. https://doi.org/10.1136/ijgc-2020-001584.
18. Conte C, Rosati A, Marchetti C, et al. Nomogram to predict feasibility of minimally invasive interval debulking surgery in advanced ovarian cancer. *Int J Gynecol Cancer*. 2022;32(4):532—539. https://doi.org/10.1136/ijgc-2021-002908.
19. Costales AB, Crane EK, Chambers L, et al. Laparoscopic predictability of minimally invasive interval debulking in advanced ovarian cancer: the MIID-SOC trial. *Gynecol Oncol*. 2024;185:143—147. https://doi.org/10.1016/j.ygyno.2024.02.019.
20. Forstner R, Sala E, Kinkel K, Spencer JA, European Society of Urogenital Radiology. ESUR guidelines: ovarian cancer staging and follow-up. *Eur Radiol*. 2010;20(12):2773—2780. https://doi.org/10.1007/s00330-010-1886-4.
21. Javitt MC. ACR appropriateness criteria on staging and follow-up of ovarian cancer. *J Am Coll Radiol*. 2007;4(9):586—589. https://doi.org/10.1016/j.jacr.2007.05.019.
22. Pannu HK, Horton KM, Fishman EK. Thin section dual-phase multidetector-row computed tomography detection of peritoneal metastases in gynecologic cancers. *J Comput Assist Tomogr*. 2003;27(3):333—340. https://doi.org/10.1097/00004728-200305000-00006.
23. Diop AD, Fontarensky M, Montoriol PF, Da Ines D. CT imaging of peritoneal carcinomatosis and its mimics. *Diagn Interv Imaging*. 2014;95(9):861—872. https://doi.org/10.1016/j.diii.2014.02.009.
24. An H, Chiu KWH, Tse KY, Ngan HYS, Khong PL, Lee EYP. The value of contrast-enhanced CT in the detection of residual disease after neo-adjuvant chemotherapy in ovarian cancer. *Acad Radiol*. 2020;27(7):951—957. https://doi.org/10.1016/j.acra.2019.09.019.
25. Bregar A, Mojtahed A, Kilcoyne A, et al. CT prediction of surgical outcome in patients with advanced epithelial ovarian carcinoma undergoing neoadjuvant chemotherapy. *Gynecol Oncol*. 2019;152(3):568—573. https://doi.org/10.1016/j.ygyno.2018.12.012.
26. Mou D, Xie S, Li P. The evaluation value of CT in the efficacy of neoadjuvant chemotherapy in ovarian cancer patients. *Contrast Media Mol Imaging*. 2022;2022:7195888. https://doi.org/10.1155/2022/7195888.
27. Son J-H, Chang K, Kong TW, Paek J, Chang SJ, Ryu HS. A study of clinicopathologic factors as indicators for early prediction of suboptimal debulking surgery after neoadjuvant chemotherapy in advanced ovarian cancer. *J Obstet Gynaecol Res*. 2018;44(7):1294—1301. https://doi.org/10.1111/jog.13653.
28. Di Donna MC, Cucinella G, Zaccaria G, et al. Concordance of radiological, laparoscopic and laparotomic scoring to predict complete cytoreduction in women with advanced ovarian cancer. *Cancers (Basel)*. 2023;15(2):500. https://doi.org/10.3390/cancers15020500.
29. Cortés García BY, Sollozo-Dupont I, Torres Gómez EA, et al. Computed tomography-based prediction of interval cytoreduction in advanced ovarian cancer. *Int J Gynecol Cancer*. 2025;35(1):100011. https://doi.org/10.1016/j.ijgc.2024.100011.
30. Li JY, Wang R. Prediction of the survival of patients with advanced-stage ovarian cancer patients undergoing interval cytoreduction with the use of computed tomography reevaluation after neoadjuvant chemotherapy. *J Obstet Gynaecol Res*. 2023;49(11):2700—2710. https://doi.org/10.1111/jog.15760.
31. Narayanan P, Sahdev A. The role of 18F-FDG PET CT in common gynaecological malignancies. *Br J Radiol*. 2017;90(1079):20170283. https://doi.org/10.1259/bjr.20170283.
32. Ko SM, Jung DC, Oh YT, Kim SH, Kang S. Discrepancy between preoperative imaging and surgical findings in patients with advanced ovarian cancer: a study of initial false-negative lesions. *J Comput Assist Tomogr*. 2013;37(4):568—571. https://doi.org/10.1097/RCT.0b013e31828b683b.