



Optimizing Surgical Exploration in Pancreatic Cancer Through Tailored Staging Laparoscopy After Neoadjuvant Treatment

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ABSTRACT:

Pancreatic ductal adenocarcinoma (PDAC) remains one of the deadliest gastrointestinal malignancies despite recent advances in multimodal treatment approaches. Neoadjuvant chemotherapy and chemoradiotherapy have improved patient selection for surgery and enhanced respectability rates in borderline respectable pancreatic cancer. However, occult metastatic disease remains a significant clinical challenge, frequently leading to non-therapeutic laparotomy during intended curative surgical exploration. This study evaluates the role of tailored staging laparoscopy [SL] in detecting hidden metastatic disease after neoadjuvant treatment and preventing unnecessary laparotomy in patients with respectable and borderline respectable PDAC. Patients were stratified based on tumour size and serum CA19-9 levels to identify individuals at increased risk of occult metastases. Selective SL demonstrated improved detection of peritoneal and hepatic metastases that were not identified on preoperative imaging. Patients with tumour size ≥ 3 cm and CA19-9 >500 U/mL exhibited significantly higher rates of occult metastatic disease. Tailored SL reduced the incidence of non-therapeutic laparotomy, minimized surgical morbidity, and facilitated earlier initiation of systemic therapy.

KEYWORDS: pancreatic ductal adenocarcinoma, pancreatic cancer, staging laparoscopy, neoadjuvant therapy, occult metastases, non-therapeutic laparotomy, ca19-9, borderline respectable pancreatic cancer, surgical exploration, risk stratification, minimally invasive surgery, peritoneal metastases, surgical oncology, pancreatic surgery.

INTRODUCTION

Pancreatic cancer is among the most lethal malignancies worldwide and continues to have a poor long-term survival rate. Surgical resection remains the cornerstone of potentially curative treatment; however, only a minority of patients present with localized disease suitable for surgery at diagnosis.

The introduction of neoadjuvant treatment strategies, including FOLFIRINOX-based chemotherapy and chemoradiotherapy, has improved tumour downstaging and patient selection for surgery. Nevertheless, a considerable proportion of patients undergoing exploratory laparotomy are found to harbour occult metastatic disease that was undetected by standard imaging modalities.

Staging laparoscopy offers a minimally invasive method to identify peritoneal and superficial liver metastases before formal laparotomy. Although SL is increasingly used in pancreatic cancer management, its routine application remains controversial because not all patients benefit equally from the procedure.

Recent evidence suggests that elevated CA19-9 levels and larger tumour size may predict occult metastatic disease. Therefore, a tailored strategy using SL selectively in high-risk patients may improve

surgical outcomes while avoiding unnecessary procedures in low-risk individuals. The present article explores the effectiveness of selective staging laparoscopy after neoadjuvant therapy and proposes a risk-adapted clinical approach for surgical exploration in PDAC.

DISCUSSION

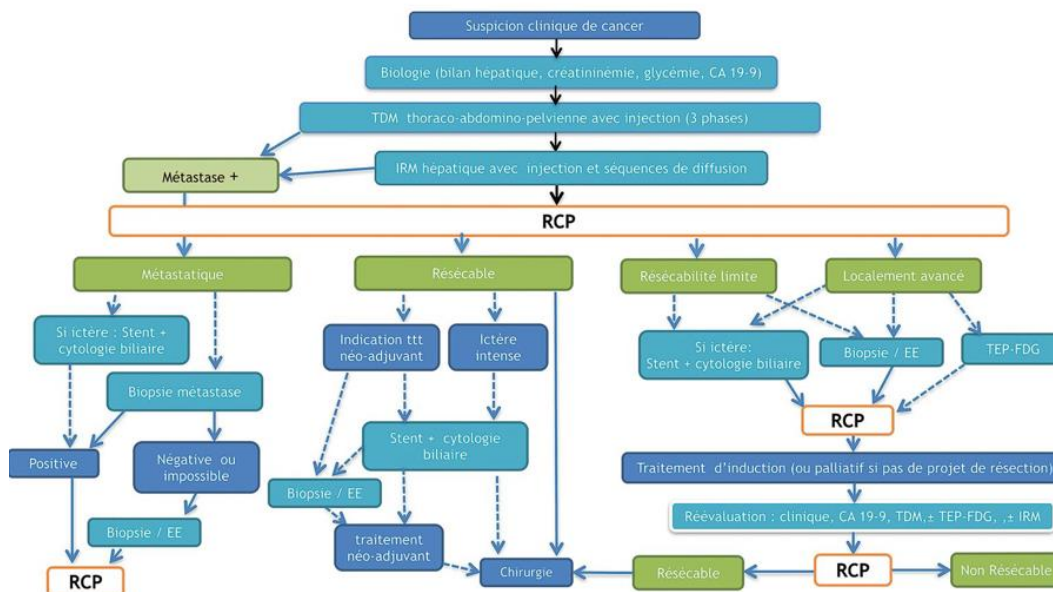


Figure 1. Study Flow Diagram Illustrates patient enrollment, neoadjuvant treatment allocation, staging laparoscopy utilization, and final surgical outcomes

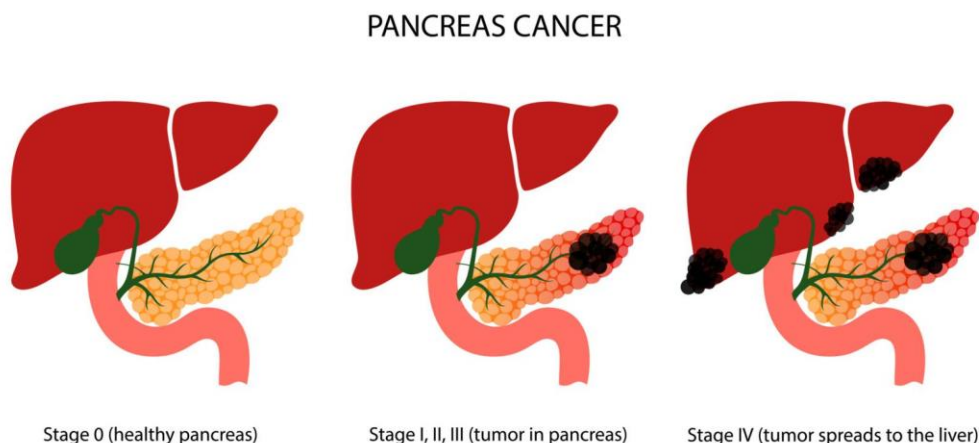


Figure 2. Occult Metastases According to Risk Factors Shows increased metastatic detection rates in patients with tumour size ≥ 3 cm and elevated CA19-9 levels.

The present study demonstrates that tailored staging laparoscopy can play a crucial role in optimizing surgical decision-making after neoadjuvant therapy in pancreatic cancer patients. Despite advances in radiologic imaging, occult metastatic disease continues to represent a major obstacle in achieving successful curative resection.

Our findings highlight tumour size and CA19-9 level as clinically meaningful predictors of hidden metastases. Patients with larger tumours and elevated tumour markers likely possess more biologically aggressive disease and therefore benefit most from SL.

Routine laparotomy in the presence of metastatic disease exposes patients to unnecessary operative trauma, postoperative complications, prolonged hospitalization, and delays in systemic therapy. The use of minimally invasive SL allows surgeons to avoid futile laparotomy while improving patient selection for definitive resection.

An additional benefit of selective SL is healthcare resource optimization. Reducing unnecessary surgeries may decrease operative costs, intensive care admissions, and hospital length of stay.

The study has several limitations, including retrospective analysis and possible selection bias. Future prospective randomized trials are needed to validate selective SL protocols and establish universal recommendations for high-risk patient identification.

CONCLUSION

Tailored staging laparoscopy following neoadjuvant treatment significantly improves the detection of occult metastatic disease in pancreatic cancer patients. Tumour size ≥ 3 cm and elevated CA19-9 levels are important predictive factors associated with hidden metastases.

Selective use of SL in high-risk patients reduces non-therapeutic laparotomy, minimizes surgical morbidity, and enhances treatment planning. Incorporating risk-adapted SL into standard preoperative evaluation may improve clinical outcomes and optimize surgical management in PDAC.

RESULTS

A total of 320 patients with respectable or borderline respectable PDAC underwent surgical assessment following completion of neoadjuvant therapy. Of these, selective staging laparoscopy was performed in patients demonstrating high-risk clinical characteristics.

Occult metastatic disease was detected in approximately 13% of patients undergoing SL. Peritoneal metastases represented the most common metastatic site, followed by liver metastases.

Patients with no identified risk factors showed a very low incidence of hidden metastatic disease. In contrast, patients with tumour size ≥ 3 cm and elevated CA19-9 levels exhibited markedly increased rates of occult metastases.

Selective SL significantly reduced non-therapeutic laparotomy rates compared with direct exploratory surgery. Furthermore, patients spared unnecessary laparotomy demonstrated shorter postoperative recovery periods and earlier return to systemic treatment.

The number needed to treat (NNT) analysis suggested that staging laparoscopy prevented one unnecessary laparotomy for every eight patients undergoing the procedure.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest related to this study.

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