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Computed Tomography / Tomodensitométrie

Staging Computed Tomography in Patients With Noncurative Laparotomy for Periampullary Cancer: Does Nonstructured Reporting Adequately Communicate Resectability?

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Periampullary cancer (PC) is a term encompassing malignancies that originate near the ampulla of Vater. It includes cancers of the head and neck of the pancreas, distal common bile duct, second part of the duodenum, and the ampulla itself. Differentiating between these entities, even with biopsy, is often not possible. Therefore, PC is managed identically to pancreatic adenocarcinoma, the fourth leading cause of cancer death in the United States despite representing only 3.1% of new cancer diagnoses [1]. Surgical resection by pancreaticoduodenectomy is the only potentially curative measure [2].

Unfortunately, as PC frequently presents at an advanced stage (particularly pancreatic adenocarcinoma), it is often inoperable at the time of diagnosis [3]. The 2016 National Comprehensive Cancer Network (NCCN) Guidelines for Pancreatic Adenocarcinoma define criteria to determine resectability [2]. Nonetheless, a subset of patients undergo noncurative laparotomy (NCL) either because the resection is 1) margin positive (termed an R1 resection) [4,5] or 2) the disease is found to be unresectable due to local invasion or unexpected metastases [6,7]. Although it is not the preferred outcome, NCL can benefit patients via definitive staging in borderline resectable cases, surgical bypass of obstructed bowel or bile ducts, placement of fiducial markers for radiation therapy, and tumour debulking.

One reason NCLs occur is the failure to detect any of the following: vascular invasion [8], lymph node involvement [9], and distant metastases [10] via preoperative computed tomography (CT) [2,11]. The Society of Abdominal Radiology and American Pancreatic Association have published a structured reporting template containing the significant criteria for resectability [12]. This is intended primarily for pancreatic adenocarcinoma, but its components are salient for staging other PCs, as differentiating between them preoperatively is not always possible. There is growing evidence that structured reports more effectively communicate disease extent than do nonstructured reports, and may better inform surgical decision making [13,14]. For example, Brook et al [13] obtained feedback of structured and nonstructured reports for pancreatic cancer from three pancreatic surgeons. All surgeons found that the structured reports contained sufficient information for surgical planning significantly more often than did nonstructured reports. Two of three surgeons found that information pertinent to surgical planning was more easily accessible in structured reports significantly more often than in nonstructured reports.

In our study, using the aforementioned structured reporting template, we retrospectively examined CT scans of patients with PC who had an NCL. To the best of our knowledge, this subgroup has not received focused study in the literature. Our aim was to improve identification of borderline resectable or unresectable PC. This would potentially allow for the application of neoadjuvant treatment or minimally invasive palliative procedures, avoiding the morbidity of NCL. Specifically,

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we analysed preoperative CT in these patients to 1) identify evidence of unresectable disease, 2) correlate imaging with surgical and pathological findings, and 3) compare retrospectively performed structured reviews—blinded to the original CT reports and other findings—to the original nonstructured reports in terms of predicted resectability.

Methods

Patients

A retrospective review of our prospectively maintained, consecutively acquired database was approved by the University of Western Ontario research ethics board (No. R103421), which waived informed consent. All patients scheduled for either a pancreaticoduodenectomy or total pancreatectomy at our institution between 2007-2015 were identified (n = 398) (see Figure 1). Inclusion criteria were that the patient had biopsy proven PC and had an NCL (n = 141). Exclusion criteria included inadequate or inaccessible preoperative CT, >90 days between CT and operation, and structured original report. Preoperative imaging, surgical notes, and pathology reports were collected by a radiology resident.

CT Protocol

Preoperative CT was either performed at our institution or referring hospitals. Therefore, there was variation in the equipment and imaging protocols. We required an arterial phase abdomen and portal venous (PV) phase abdomen or pelvis with axial slice thickness ≤5 mm and 0-mm interval. This was to ensure both the radiologists who originally interpreted the scan and reinterpreting author radiologists had adequate information to comment on criteria relevant for staging. Scans were not excluded based on the brand or dose of intravenous contrast material; presence of gastrointestinal contrast material; kVp; mAs; noise index; pitch; or presence of multiplanar, curved planar, or 3-dimensional reformats.

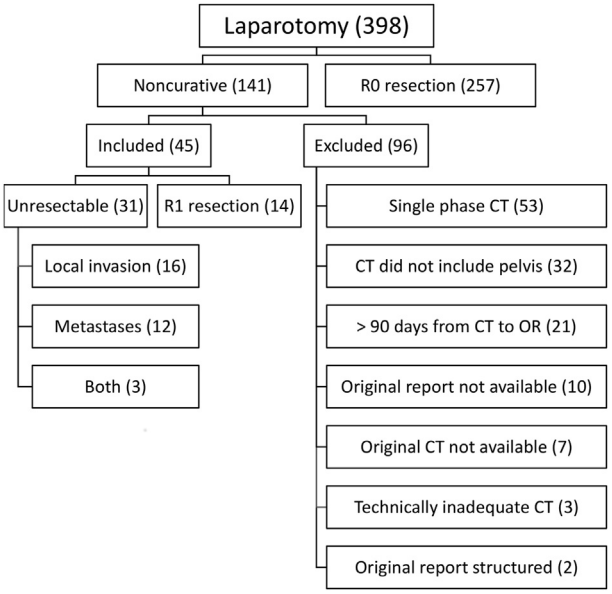

Figure 1. Flowchart of included or excluded patients (number of patients in parentheses). CT = computed tomography.

Structured CT Interpretation and Data Extraction From Original Nonstructured Reports

Preoperative CTs were retrospectively reinterpreted by one of three radiologists with expertise in periampullary malignancies (1 abdominal fellowship trained and 2 interventional fellowship trained, all with >10 years' experience). The radiologists were blinded to the original CT reports, surgical findings, and pathology results. Prior CT images were available for review, but other modalities acquired as part of the cancer workup such as magnetic resonance imaging or endoscopic ultrasound were not accessed.

Reports were structured according to consensus guidelines for pancreatic adenocarcinoma [12]. This template includes 4 sections: morphologic evaluation (primary tumour and biliary or pancreatic ducts), arterial evaluation (celiac axis, common hepatic artery [CHA], superior mesenteric artery [SMA], and variant arterial anatomy), PV evaluation (portal vein, superior mesenteric vein [SMV], thrombus, and collaterals), and extrapancreatic evaluation (metastases, lymphadenopathy, ascites, and organ invasion).

The nonstructured CT reports were converted to structured reports following the same template that the reinterpreting radiologists used [12]. This was done so that the nonstructured reports could be compared directly to the structured review. Omitted criteria were deemed negative. This step was completed by a radiology resident.

Comparison of CT Findings to Surgical Findings

The structured preoperative CT reviews were used to classify each case as resectable, borderline resectable, or unresectable based on the current NCCN guidelines [2] as per the reporting radiologist.

The sensitivity and specificity (including 95% confidence intervals) of preoperative CT for determining local arterial invasion, local PV invasion, and metastatic disease (liver and peritoneal) was calculated using surgical findings as the reference standard. Patients in whom metastatic disease was found and vascular invasion was not assessed intraoperatively were omitted from the vascular involvement calculations.

Comparison of Structured Reviews With Nonstructured Reports

Resectability was determined using the data extracted from the nonstructured reports and compared with resectability according to the structured review. To assess whether report type influenced resectability, the Wilcoxon signed rank test was employed.

To investigate the impact of radiologist expertise, we performed a subgroup analysis of nonstructured reports