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Review Article

Role of Advenced MDCT Applications in Evaluation and Preoperative Assessment of Pancreatic Tumors : A Review

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Introduction

Many people are affected by cancers on the world. The early diagnosis of cancer can be lifesaving. The imaging is very important for detection and the staging cancer. İn addition to provides managing and folowing in cancer cases.. Imaging technologies in medicine have shown great improvements over the past three decades and now play a central role in oncology [1].

The accurate determination of resectability in patients with pancreatic cancer is the most important contribution of preoperative staging; the goal being to reduce needless surgery to a minimum. Recent studies reported a predictive value for the ability of multidedector computed tomography (MDCT) to detect resectability of 87% and most of the studies reported better results when predicting unresectability, with predictive values ranging from 96% to 100% [2,3].

National comprehensive canser network (NCCN) new guidelines define now four clinical stages of pancreatic cancer (Resectable, borderline resectable, locally advanced and metastatic), which are now guiding investigators and physicians to determine treatment and to define clinical studies [4].

Due to the particular anatomical relationship between the pancreas and the surrounding vessels, three-dimensional reconstructions are helpful in presenting additional information about this relationship [5].

A-Perfusion Imaging

Angiogenesis is a complex process involving a variety of cells and pro-and antiangiogenic factors. In contrast to normal physiologic angiogenesis, malignant tumor angiogenesis is often a disordered process, typically creating fragile vessels, arteriovenous shunting, with high vessel permeability, unstable blood flow, and heterogeneity of vascular density.

Tumor progression is often associated with neovascularization via angiogenesis. Computed tomography (CT) perfusion imaging, otherwise known as functional CT or cine CT, provides a noninvasive method to evaluate the variables that provide insight into angiogenesis, which with appropriate software can be performed with contrast medium to assess vascular characteristics, such as blood flow (BF), blood volume (BV), mean transit time (MTT), and permeability surface area product (PS) in a variety of organs and tumors [6].

It was verified that CT perfusion imaging allowed for noninvasive, in vivo assessment of pancreatic tissue vascularity and was a useful tool in the early detection of disturbance of the pancreatic microcirculation. CT perfusion provides additional quantitative information on the function of microvasculature of tumor and carries the potential to evolve as a clinically valuable tool in pancreatic disease. Thus, CT perfusion should be investigated as a diagnostic tool in pancreatic adenocarcinoma and mass-forming chronic pancreatitis [7].

Perfusion multidetector-row CT study techniques are continually evolving, but they are typically performed with a cine (continuous scan) technique after intravenous contrast injection of nonionic iodinated contrast. For example, a dual phase approach can be used for pathology in the abdomen and pelvis. With such an approach, a phase I cine mode is performed over a 30 to 40 sec breath hold while the scanner is stationary. In phase II, a delayed scan is obtained consisting of short intermittent helical scans, each obtained during a 7-sec breath hold obtained at 15 sec intervals [8].

The CT perfusion data are then analyzed on an imaging workstation where a region of interest (ROI) can be drawn over a pixel, artery, or vein to obtain time contrast-enhancement curves. The software can then be used to generate and depict parameters, such as BF, BV, or MTT as color-coded images. Prior studies have demonstrated increased microvascular permeability in aggressive tumors with typically a decreased permeability in response to antiangiogenic treatment. This has been shown to correlate with decreased tumor growth [9].

In the field of oncology, perfusion CT has found applications in diagnosis, staging, prognostic evaluation, and monitoring with response to therapies. Ultrasound and magnetic resonance imaging have been exploited for perfusion; however, because of the linear relation of iodine concentration and density changes in CT expressed in Hounsfield units (HU), CT may be regarded as the preferred technique for perfusion imaging in general. Hence blood flow was calculated from time-density curve of the selected region of interest with the following equation: blood flow (mL/min/ mL) = maximal rate of tissue enhancement (HU/mL)/peak aortic enhancement (HU) [10].

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Diagnostic Imaging of Pancreatic Carcinoma and Mass-forming

Chronic pancreatitis

CT perfusion imaging allows noninvasive absolute quantification of pancreatic perfusion and may intensify the precision of the differential diagnosis of pancreatic cancer and mass-forming chronic pancreatitis [7].

Mass-forming chronic pancreatitis is rare and is then often indistinguishable from carcinoma. Carcinoma has been found in about 3% of patients with chronic pancreatitis followed for 10 or more years. Abdominal ultrasound, magnetic resonance cholangiopancreatography, positron emision tomography (PET), or endoscopic ultrasonography are usually performed with reasonable sensitivities and specificities in diagnosis of pancreatic carcinoma and chronic pancreatitis. Endoscopic ultrasonography-guided fine-needle aspiration is invasive. Thus, CT perfusion is noninvasive and may provide useful information for early diagnosis of pancreatic cancer and mass-forming chronic pancreatitis [11].

Because there were many patients with chronic inflammatory pancreatic masses who underwent surgery for suspected pancreatic cancer, evaluations should be considered to avoid performing unnecessary surgery for patients with a pancreatic mass. It was observed that blood flow, blood volume, and peak enhancement were lower in patients with pancreatic adenocarcinoma than with mass-forming chronic pancreatitis. The mechanism for such findings could be that pancreatic adenocarcinoma is a hypovascular tumor as demonstrated by contrast CT and because parenchyma of the gland in patients with mass-forming chronic pancreatitis appears less affected than with pancreatic adenocarcinoma [7].

The parenchyma of mass-forming chronic pancreatitis shows necrosis alternating with unaffected regions, or presents only interstitial edema in the early stages. Permeability of massforming chronic pancreatitis was higher than pancreatic adenocarcinoma. The reason for the increase in the permeability of mass-forming chronic pancreatitis may be that fat necrosis particularly involves small veins and venules, leading to swelling and rupture of the wall, increasing fluid extravasations into the extracellular space [12].

It was showed that characteristics on perfusion CT of mass forming chronic pancreatitis were higher blood flow, blood volume, peak enhancement and shorter time to peak, and earlier and higher peak of time-density curves compared with pancreatic adenocarcinoma. We found that perfusion CT accompanied with enhanced CT revealed 77 of 79 lesions and the positive predictive values were 97.5%. The results are promising to provide useful information for physicians [7].

Value of Three-Dimensional Reconstructions in Management of Pancreatic Carcinoma using Multidetector CT

Three-dimensional reconstruction already has a firm place in orthopedics and neurosurgery, where only unmoving and fixed anatomical structures are represented without any great range of variation. The use of this method in visceral surgery is more difficult, since the organs can move and in some cases are shifted and reshaped during respiration and since the rate of anatomical variability is high [13].

Computed tomography (CT) is considered the method of choice for the detection and preoperative staging of pancreatic carcinomas. The high-resolution data sets gained from these also offer the option of three-dimensional image post-processing. In planning an operation, the location of the pancreatic tumor relative to the surroundings, surgically relevant vessels and adjacent organs is of utmost importance to the surgeon. The option of being able to assess the tumor volume in relation to the pancreatic tissue can also represent further valuable information. Due to the particular anatomical relationship between the pancreas and the surrounding vessels, three-dimensional reconstructions are helpful in presenting additional information about this relationship. For the surgeon, it is valuable to be able to see the tumor, both by itself and in the context of its surrounding structures. Thus, the surgeon is provided with as detailed a picture as possible of the field of operation even before the operation takes place [13].

The three-dimensional reconstruction cannot improve on the examination; it can only present the situation in a more plastic form. Thus it is generally not improve the assessment of the resectability of pancreatic carcinomas [5].

Conclusion

In summary, CT perfusion imaging is a feasible quantitative evaluation of hemodynamic of pancreatic adenocarcinoma and massforming chronic pancreatitis and may assist in diagnosis. Greater anatomic coverage can enable perfusion evaluation of multiple organs concurrently. Iit can be said that three-dimensional imaging of pancreatic carcinomas with the surrounding vessels and organs is currently constrained by the great deal of effort involved, but it does primarily provide the surgeon with valuable additional.

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