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Original research article

A Study of normative CT perfusion parameters of pancreas

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Abstract

A knowledge of normal range of the perfusion parameters of pancreas in different age range and sex bears a paramount importance before analyzing the abnormal pancreatic tissue. The aim of this study was to obtain a normative data of the perfusion parameters of pancreatic parenchyma with respect to the age and gender.

Keywords: Normative, CT perfusion, parameters, pancreas

Introduction

A knowledge of normal range of the perfusion parameters of pancreas in different age range and sex bears a paramount importance before analyzing the abnormal pancreatic tissue. CT perfusion imaging of the pancreas is a dynamic technique for discerning information on pancreatic vascularity and disease process [1]. Miles *et al*. [2]initially demonstrated the feasibility of pancreatic perfusion studies using dynamic CT and described the principle advantage of combining functional information and high spatial detail in a single study. The usefulness of perfusion CT for differentiation of ischaemic tissue areas in pancreatitis or malignant lesions from normal pancreatic tissue had been investigated over the last few years [3, 4].Perfusion CT has the potential to be the preferred technique for the assessment of tumor response to antiangiogenic drugs [5, 6].The aim of this study was to obtain a normative data of the perfusion parameters of pancreatic parenchyma with respect to the age and gender.

Material and Methods

This study was done in the Department of Radio-Diagnosis, Father Muller Medical College, Mangalore from June 2013 to May 2014.

This is a prospective study performed in patients having pancreatic tumors at a tertiary care center for a period of 1 year. Before proceeding with the contrast CT, the patients were explained about the study and informed consent was obtained. 33 patients gave an informed consent and 16 patients refused to be part of the study.

Inclusion criteria

- Patients more than 18 years of age.
- Patients who were detected to have pancreatic lesion either on ultrasound or on plain CT study.

Exclusion criteria

- Patients with serum creatinine > 2mg/dl.
- Patient with history of significant allergy to iodinated contrast media.
- Patients without histopathological confirmation of diagnosis.

Procedure

Plain CT scan of the abdomen in the supine position with breath hold for tumor localization (baseline image).A 4-cm region of interest including the tumor (portion of the tumor with enhancing components) and a part of the normal pancreatic parenchyma was localized on the baseline image and selected for the perfusion study.

50ml of Intravenous bolus contrast (iodinated water-soluble non-ionic contrast medium, 300mg/ml) was administered at a rate of 5 ml/sec followed by a saline flush of 35ml at a rate of 5 ml/secvia a peripheral arm vein by using 18 G canula for theperfusion scanthrough a power injector.

A delay of 8 sec was given after the start of contrast injection, followed by a continuous acquisition in the 8i transverse mode (8 sections per gantry rotation). Total of 30 dynamic acquisitions with inter-cycle interval of 2.0Sec.

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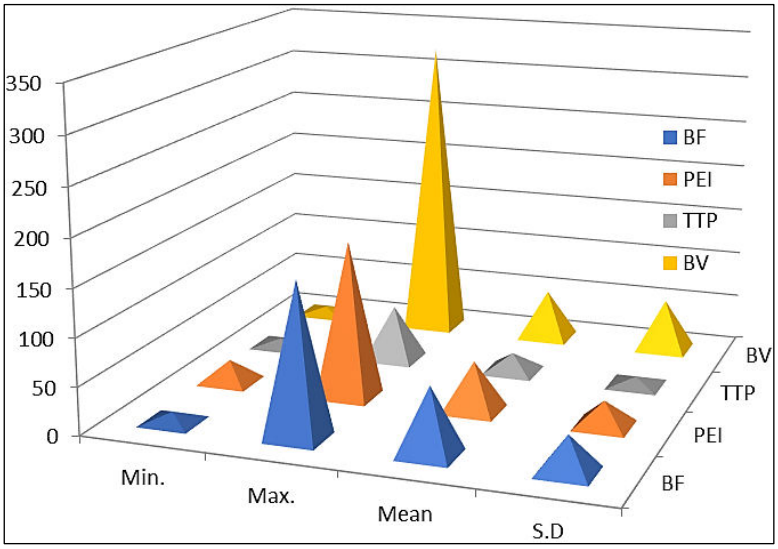
Image analysis and interpretation

240 perfusion images were obtained in each patient and the images were transferred to the CT perfusion analysis software as the first step of analysis. Defining free hand ROI's as the second step of analysis i.e. generation of time-density curves in the aorta, normal pancreas and the pancreatic tumor taking care to exclude areas of necrosis, calcification and blood vessels for quantitative assessment and calculation of perfusion parameters. The resulting perfusion values could be visualised on colour maps.

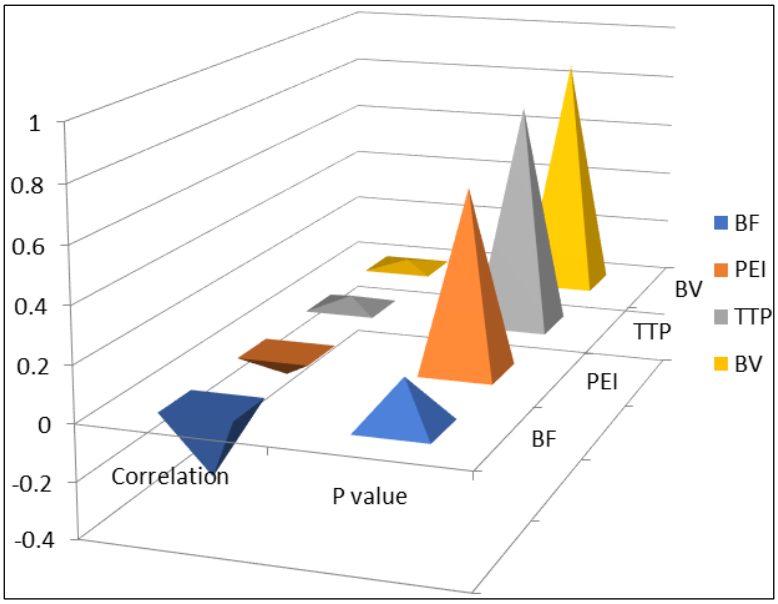
Perfusion Parametersrecorded wereBF (Perfusion-ml/100gm/min), BV (ml/100gm), PEI (HU) and TTP (s)

Images were interpreted by a radiologist with 8 years of experience in perfusion imaging. Descriptive statistics of the perfusion values of normal pancreatic parenchyma was tabulated and relationship of these normative values with age and sex of the subjects were calculated applying Pearson's correlation coefficient.

Observation and Results



Graph 1: Descriptive statistics of the perfusion values from the normal pancreas



Graph 2: Relationship of perfusion characteristics of the normal pancreas with the age of the subjects

Relationship of perfusion characteristics of the normal pancreas with the gender

No statistically significant differences were observed in perfusion of normal pancreatic parenchyma between men and women on applying the Pearson's correlation coefficient.

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Discussion

In a study by Miles *et al*.[2], values for perfusion in eight normal pancreases fell within a narrow range of 1.25 and 1.66 ml min^{-1} ml^{-1} (mean: 1.52 ml min^{-1} ml^{-1}). Tsushima Y *et al*. [7] in their study, reported perfusion values of normal pancreatic parenchyma in 23 patients which ranged from 0.554 to 1.698 ml min^{-1} ml^{-1} (mean $\pm$ SD, 0.963 $\pm$ 0.064). Sonja Kandel*et al*. [8] observed perfusion values ranging from 0.75 $\pm$ 0.55 min^{-1} in the head, 0.94 $\pm$ 0.59 min^{-1} in the body and 0.92 $\pm$ 0.57 min^{-1} in the tail of the pancreas in 30 patients. They also observed a lower perfusion in the head than in the body and tail of the pancreas, although this was not statistically significant.

Jin Xu *et al*.[9] did not record any significant difference between the distribution of BF, BV and PS values in different regions of the pancreas, namely the head, neck, body and tail ($P > 0.05$) in 36 subjects. The BF, BV and PS of normal pancreas were recorded as 135.24 $\pm$ 48.36 ml min^{-1} $100g^{-1}$, 200.55 $\pm$ 54.96 ml $100g^{-1}$and 49.75 $\pm$ 24.27 ml min^{-1} $100g^{-1}$, respectively. They concluded that the normal pancreas appears homogeneous on perfusion CT. Xue H D *et al*.[10] measured perfusion parameters of normal pancreatic parenchyma in 19 subjects as follows: BF, 104. 9 $\pm$ 28.9 ml min^{-1} $100g^{-1}$, BV, 166.4 $\pm$ 41.8 ml $100g^{-1}$, TTP, 133.3 $\pm$ 24.4 seconds, Permeability, 81.3 $\pm$ 24.4and PEI, 121.3 $\pm$ 31.1 HU.

Conclusion

Though not statistically significant, a tendency of BF and PEI to reduce with age, BV and TTP to increase with age was observed and these parameters showed no difference with respect to the sex of the subjects.

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