Prospective study comparing two iodine concentrations for multidetector computed tomography of the pancreas

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Abstract

Purpose. The authors sought to determine the influence of two different iodine concentrations of nonionic contrast media (cm) on contrast enhancement in pancreatic computed tomography angiography (CTA).

Materials and methods. Sixty patients with clinically suspected or known pancreatic disease underwent pancreatic CTA. The patients were randomly assigned to group A (n=30) and group B (n=30). The contrast agent was injected with iodine concentrations of 400mgI/ml (Iomeron 400) in group A and 300mgI/ml (Iopamidol 300) in group B with the same total iodine dose (36 g). Arterial and portal venous phase contrast enhancement of the vessels, organs and pancreatic masses was measured, and blinded qualitative image assessment was performed by two expert radiologists.

Results. In the arterial and portal venous phase, the highly concentrated cm led to significantly greater enhancement in the abdominal main vessels, pancreas and pancreatic carcinoma than did the low concentrated cm. No statistically significant attenuation differences were measured between pancreatic carcinomas and the pancreatic parenchyma in the arterial and portal venous phase between group A and B. The overall trend for both readers was to assign higher scores to group A than group B.

Conclusions. The higher iodine concentration leads to greater contrast enhancement of abdominal vessels and organs in pancreatic CTA. Detection and demarcation of pancreatic carcinomas was facilitated in pancreas and at the interface with the adjacent organs and structures.

Riassunto

Obiettivo. Valutare l’influenza di due mezzi di contrasto a differenti concentrazioni sull’enhancement in angiografia TC del pancreas (CTA).

Materiali e metodi. Sessanta pazienti con patologia pancreatica nota o clinicamente sospetta sono stati sottoposti a CTA. I pazienti sono stati assegnati casualmente ad un gruppo A (n=30) e ad un gruppo B (n=30). Il mezzo di contrasto è stato iniettato con una concentrazione iodica di 400 mgI/ml (Iomeron 400) nel gruppo A, e di 300 mgI/ml (Iopamidol 300) nel gruppo B, con la stessa dose totale di iodio (36 g). Sono state misurate le fasi contrastografiche arteriosa e portale di vasi, organi, e masse pancreatiche, e le immagini complessive valutate “alla cieca” da due radiologi esperti.

Risultati. Nella fase arteriosa e portale il mdc ad alta concentrazione ha portato ad un enhancement significativamente maggiore dei principali vasi addомinali, del pancreas e dei carcinomi del pancreas, rispetto al mdc a più bassa concentrazione. Non sono state osservate differenze significative di attenuazione nelle fasi arteriosa e portale, tra carcinomi del pancreas e parenchima tra il gruppo A e il gruppo B.

Conclusioni. Una concentrazione di iodio più elevata porta ad un maggiore enhancement dei vasi addомinali e degli organi nella CTA pancreas. L’individuazione e la definizione del carcinoma
Hypovascular pancreatic carcinoma was not found to be improved by the higher iodine concentration.

**Keywords** Pancreas · Pancreatic neoplasm · Contrast media · X-ray computed tomography

**Introduction**

Multidetector computed tomography (MDCT) allows acquisition of multiple slices within subsecond rotation times, which makes multiphasic imaging possible. Recently, multiphasic pancreatic contrast-material-enhanced helical CT has been suggested as an accurate technique for detecting and staging pancreatic ductal adenocarcinoma [1]. Contrast enhancement of the pancreatic parenchyma after intravenous injection is determined by many interacting factors, e.g. total iodine dose, iodine concentration, injection rate and scanning delay; the use of a saline flush after contrast material administration; and patient characteristics such as age, sex, weight, height, cardiovascular status and renal function. Recently, there have been several attempts to optimise the use of contrast material for pancreatic imaging mainly with regard to total iodine dose, injection rate and scanning delay [2–7]. Reports about the influence of iodine concentration on contrast enhancement of the pancreas are relatively few [6]. This study focused on the influence of iodine concentration on contrast enhancement in pancreatic CT angiography (CTA) in patients with known or suspected pancreatic tumours and patients after pancreatic surgery.

**Materials and methods**

**Patients**

From March to July 2007, 60 consecutive patients referred to our department for pancreatic CTA because of known or suspected pancreatic tumours or for postoperative follow-up after pancreatic surgery were enrolled in this prospective randomised parallel-group study after having given their written informed consent. Excluded were patients with hypersensitivity to iodinated contrast agents, hyperthyroidism, malignant thyroid tumours, renal or heart failure or insulin-dependent diabetes mellitus; pregnant patients or nursing women, patients <18 years of age and patients who had participated in another study within the past 30 days. The patient population consisted of 28 women and 32 men 18–82 years old (median 60 years). Patients were randomly assigned to group A or group B. Each group consisted of 30 patients. The study was approved by the institutional review board, and informed consent was obtained from all patients before CT examinations.

**CT protocol**

CT examination was performed after oral administration of water (800 ml). The nonionic contrast agents Iomeron and Iopamidol (Bracco Altana Pharma GmbH, Konstanz, Germany) were applied, with an iodine concentration of 400 mgI/ml (Iomeron 400) and a volume of 90 ml in group A and an iodine concentration of 300 mgI/ml (Iopamidol 300) and a volume of 120 ml in group B. The amount of injected iodine was approximately 36 g in both groups. The nonionic contrast agents were heated to 37°C and injected with a flow rate of 3 ml/s with an automatic injector through a 20-gauge plastic cannula placed in a cubital vein in both groups. MDCT (LightSpeed 16, GE) of the pancreas was performed in all patients prior to contrast medium administration as well as in the arterial and portal venous phases following contrast administration. CTA image acquisition used a bolus-tracking program (SmartPrep, GE Healthcare), which monitored contrast enhancement of the aorta after injection of contrast media before initiation of the diagnostic scans. The region of interest (ROI) cursor for bolus tracking was placed in the aorta at the level of the diaphragmatic dome. Real-time low-dose (120 kVp, 50 mA) serial monitoring scanning was initiated 10–12 s after the start of the contrast injection, and the scanning threshold values were set at 80 HU. When CT values of the aorta were >80 HU, the arterial phase acquisition was triggered, and 30 s after the end of arterial phase acquisition, the portal phase acquisition was triggered. In addition, a 20-ml saline flush was administered at the end of the dynamic contrast material injection. Acquisition parameters of the unenhanced, arterial and portal venous phase scans were as follows: tube potential 120 kV; tube current 240 mAs; beam pitch 1:1.375; beam collimation 4–2.5 mm; gantry rotation time 0.8 s; section thickness and interval 5.0 mm; reconstruction thickness 2.5 mm; reconstruction interval 1.25 mm; table feed 27.5 mm/rotation.

**Quantitative analysis**

For the following quantitative and qualitative evaluation of the pancreatic masses, we included pancreatic carcinomas only, and excluded the other pancreatic lesions, as their number was small and distinctively different between the