

Semi-quantitative analysis of normal pancreas and pancreatic carcinoma with dynamic contrast-enhanced MR imaging on a 3.0T system

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Introduction:

Recent advances in imaging techniques have enabled us to precisely detect pancreatic carcinoma. However, it was difficult to quantify pancreatic cancer with MRI in human^[1]. Our study target to semi-quantify the perfusion parameters of normal pancreas and pancreatic carcinoma with three-dimension (3D) high spatial and time resolution dynamic contrast enhanced (DCE) MRI on a 3.0T MR system, and to assess the value of 3D DCE-MRI in the diagnosis of pancreatic carcinoma.

Methods:

31 patients who need abdomen contrast enhancement scan but with normal pancreas and 34 pancreatic carcinoma patients (pathology verified), underwent DCE-MRI on a 3.0T MR system (GE Healthcare, HDxt) with 8-channel body coil. After bolus injected 20 ml GD-DTPA (injection rate: 3.5ml/s) for 15 seconds, breath-hold 3D LAVA was scanned with following parameters: 40 slices with thickness: 3.6 mm, matrix: 288x180, scan time: 6.3s per phase and breath-hold for 3 phases each. Patients were trained to take a long breath for two times immediately after previous breath hold and hold their breath again. The data were processed on a workstation (GE AW4.2) and time axial was revised. The perfusion parameters of the head, body and tail of normal pancreas, together with lesion and non-lesion area of pancreatic carcinoma were measured and statistically analyzed, including signal enhancement ratio at 30 seconds after injection (SER₃₀), signal enhancement ratio at 90 seconds after injection(SER₉₀), positive enhancement integral (PEI), time to peak (TTP) and maximum slope of increase (MSI).

Results:

Paired T test was used and result was listed as Table 1. There was no significant perfusion difference among head, body or tail of normal pancreas ($P>0.05$). The difference of SER₃₀, PEI, TTP and MSI between lesion and non-lesion region of carcinous pancreas was significant ($P<0.05$). The TTP and SER₉₀ between normal pancreas and the non-lesion region of carcinous pancreas was significantly different ($P<0.05$). PEI and MSI were not compared because there were not independent among different exams.

	Parameters	SER ₃₀ (%)	SER ₉₀ (%)	PEI	TTP(s)	MSI
Normal Pancrease	Head	86.59±34.11	77.11±32.56	288.07±71.71	50.30±12.75	307.86±95.92
	Body	88.72±36.93	89.71±41.24	319.78±117.64	54.41±11.40	331.93±105.06
	Tail	85.36±43.05	88.85±42.89	300.37±99.83	55.93±14.69	284.83±111.90
	Head vs. Body (P)	0.81	0.19	0.21	0.19	0.35
	Body vs. Tail (P)	0.74	0.94	0.49	0.65	0.09
	Tail vs Head(P)	0.9	0.23	0.58	0.11	0.39
Pancretic Carcinoma	Lesion area	56.62±48.03	142.66±59.30	272.42±137.85	85.44±11.37	247.20±81.34
	Non-lesion area	98.36±65.28	148.59±73.50	373.78±154.61	65.69±11.34	350.61±142.53
	P	0	0.72	0.01	0	0
Carcinoma non-lesion area vs. normal area (P)		0.43	0		0.01	

Table 1: 3D DCE semi-quantification value for pancreas area.

Discussion:

The DCE-MRI semi-quantitative method used in our study can reflect the hemodynamic features of the pancreas. Normal pancreas has no regional perfusion difference. A possible explanation is that although the regional arterial supply is different, artery form a rich and uniform distributed vascular network. Accordingly, the perfusion difference between the lesion and non-lesion region of carcinous pancreas has nothing to do with the aterial supply but because of the neoplasms itself. Our data from DCE-MRI provide reliable information for the diagnosis of pancreatic cancer, and for the assessment of the invasion of pancreatic carcinoma. The difference in TTP and SER₉₀ between the normal pancreas and non-lesion region of carcinous pancreas suggest the existence of potential pathological changes. Furthermore, it might prompt surgical excisional range before operation.

Reference:

1. Bali MA, Metens T, Denolin V,et al.Pancreatic perfusion:noninvasive quantitative assessment with dynamic contrast-enhanced MR imaging without and with secretin stimulation in healthy volunteers-initial results. Radiology,2008,247(1):115-121.