Neuroendocrine Tumor of the Pancreas: Biphasic CT versus MR Imaging in Tumor Detection

Hiroki Haradome[1], Tomoaki Ichikawa[2], Richard L Baron[2], Mark S Peterson[2], Micheal P Federe[2], Yasuhiro Kawamori [2], Junichi Hachiya[1] .
[1]Department of Ragiology, Kyorin University, Mitaka, Japan, [2] Department of Ragiology, University of Pittsburgh, Pittsburgh, Phensylvania, USA

Introduction; Neuroendocrine tumors (islet cell tumors) are relatively rare pancreatic neoplasms.It is clinically important that they have a high rate of malignancy with an incidence ranged from 60 to 92 % .The common noninvasive preoperative radiological approach for evaluating neuroendocrine tumors are represented by dynamic contrast-enhanced CT and MR imaging .As several previous studies indicated efficacy of biphasic CT in the pancreas, the recent consensus is that biphasic CT is the most sensitive method for detecting neuroendocrine tumors (1,2). While, several investigators have also emphasized advantages of MR imaging over CT, which are based on higher contrast resolution or higher sensitivity for contrast material enhancement of MR imaging, in the investigation of neuroendocrine tumors (3). And they have concluded that MR imaging is a promising tool for the detectability of neuroendocrine tumors.At present, to our best knowledge, there is no report in which the capabilities of biphasic CT and MR imaging are compared each other in detecting neuroendocrine tumors, which is an interesting and challenging issue. Therefore, the purpose of this study is to compare the efficacy between biphasic CT and MR imaging with various pulse sequences for the detection of neuroendocrine tumors.

Material and methods;19 patients (9 men and 10 women, age range from 40 to 69 years; mean 53 years) with 26 lesions of pathologically proved neuroendocrine tumors of the pancreas were retrospectively examined. All MR imaging examinations were performed with 1.5-T MR units (Signa Advantage or Horizon; GE Medical System) As this study was a retrospective study, there was moderate variability in MR units and sequence parameters that usually involved pulse sequence. All patients underwent spin-echo T1 and spin-echo T2 (15 patients) or fast spin-echo T2-weighted (4 patients) MR images. Additional MR examinations were also obtained unenhanced fat-saturated T1-weighted MR images (14 lesions in 10 patients). Dynamic contrast-enhanced gradient-echo MR images (16 lesions in 13 patients) was performed with 0.1 mmol/kg gadolinium and followed by delayed-enhanced fat-saturated T1-weighted MR images in 5-10 min (19 lesions in 17 patients). All patients underwent biphasic CT including unenhanced, arterial-dominant phase (AP; 20-28 sec) and portal venous phase (PVP; 60-70 sec) images. Contrast material was administrated at rates of 3.0-5.0 mL/sec. The slice thickness was 7 mm and the table-incremental speed was 7 mm/sec (1:1 to 1.5 pitch).

Analysis;.1) The image quality of the all CT and MR; Two reviewers worked separately to evaluate the image quality of the all CT and MR images with each technique,to investigate whether the image quality may affect the results for the lesion detectability with each technique, A five-point (5-1) grading system (5= excellent, 4= marginally adequate, 3= good, 2= poor, 1= nondiagnostic) was used assigning for the conspicuity of the pancreas. 2) Receiver Operating characteristic (ROC) analysis; ROC analysis was also employed independently and in random order by three abdominal radiologist. the image interpretation was conducted on a portion-by-portion basis by dividing pancreas into head, body, and tail according to pancreatic anatomy. For all CT and MR images, each reader rated the presence (or absence) of tumor on a five-point confidence scale (1= definitely absent, 2= probably absent, 3= equivocal, 4= probably present, 5= definitely present). If the a tumor was considered to be present in the pancreas with a kind of CT or MR series, the number and location of the tumor were recorded. 3) Relative sensitivity; When a portion with ratings of 4 or 5 (probably or definitely present) was considered as positive, relative sensitivity, specificity, and accuracy were also calculated.

Results; 1) The image quality obtained with each CT and MR images; The mean scores for T2-weighted and dynamic MR images were significantly lower than those for both AP and PVP images of the biphasic CT examination ($p < .005$). 2) ROC Analysis; The Az values of each ROC curve each reader are shown in Table 1. PVP images showed the greatest Az value followed by delayed-enhanced fat-saturated T1weighted, AP and fat-saturated T1-weighted, T2-weighted, dynamic MR, and T1-weighted images. Mean Az values obtained with PVP and delayed-enhanced fat-saturated T1-weighted images were significantly greater than those obtained with all other techniques except for T2-weighted images ($p < .05$ except for PVP versus dynamic MR and delayed-enhanced fat-saturated T1-weighted images ($p <.005$)). 3) RelativeSensitivity; The relative sensitivity for detection obtained with each sequence were shown in Table 2. The relative sensitivities obtained with PVP and delayed-enhanced fat-saturated T1-weighted images were significantly higher than those obtained with dynamic MR ($p< .0001$) and T1 and T2-weighted images ($p< .05$).

Conclusion;The efficacy of biphasic CT and overall MR imaging might be similar in detecting neuroendocrine tumors. When a MR protocol is considered, the combination of unenhanced and delayed-enhanced fat-saturated T1-weighted MR images should be included. Especially, delayed-enhanced fat-saturated T1-weighted MR images are of value to detect scirrhous type of neuroendocrine carcinomas.

Table 1. Az Values for ROC Analysis with biphasic CT and MR images

	Biphasic CT		MR imaging				
	HAP	PVP	T1W	T2W	FS-T1W	Dynamic MR	delayed-enhanced FS-T1W
Reader 1	0.93 ± 0.05	0.97 ± 0.03	0.87 ± 0.06	0.87 ± 0.06	0.93 ± 0.06	0.90 ± 0.06	0.97 ± 0.02
Reader 2	0.93 ± 0.05	0.98 ± 0.02	0.91 ± 0.05	0.95 ± 0.02	0.93 ± 0.06	0.90 ± 0.06	0.98 ± 0.01
Reader 3	0.93 ± 0.05	0.97 ± 0.03	0.88 ± 0.06	0.92 ± 0.05	0.92 ± 0.07	0.91 ± 0.05	0.96 ± 0.05
Mean	0.93 ± 0.03	0.98 ± 0.01	0.89 ± 0.02	0.91 ± 0.04	0.93 ± 0.03	0.90 ± 0.06	0.97 ± 0.01

Note. - Numbers are means ± standard deviation.

Table 2. Relative Sensitivities for the Tumor Detection Obtained with biphasic CT and MR Images

	Biphasic CT		MR imaging				
	HAP (n=26)	PVP (n=26)	T1W (n=26)	T2W (n=26)	FS-T1W (n=14)	Dynamic MR (n=16)	delayed-enhanced FS-T1W (n=19)
Reader 1	18 (69)	19 (73)	17 (65)	16 (62)	10 (71)	9 (56)	15 (79)
Reader 2	19 (73)	19 (73)	18 (69)	17 (65)	10 (71)	9 (56)	14 (74)
Reader 3	17 (65)	18 (69)	15 (58)	16 (62)	8 (57)	9 (56)	14 (74)
Total	54 (69)	56 (72)	50 (64)	49 (63)	28 (67)	27 (56)	43 (75)

Note. - *= Numbers in parentheses are percentages.

Reference

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