



光谱CT、MRI以及血清相关指标 与肿瘤标志物检测在原发性肝癌的诊断价值

唐亮^① 郑晓东^{①*} 郑佳连^②

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[摘要] 目的: 探讨光谱CT、MRI以及血清甲胎蛋白(AFP)及肿瘤标志物糖类抗原19-9(CA19-9)的表达在原发性肝癌诊断中的临床价值。方法: 选取医院收治的80例原发性肝癌(PHC)患者作为观察组, 选择同期就诊的80例肝硬化患者作为对照组。采集两组患者空腹静脉血, 使用Elisa试剂盒检测血清中AFP和CA19-9的表达水平, 使用双层探测器能谱CT对患者行腹部平扫和肝脏双期扫描, 采用超导型磁共振扫描仪和体部相控阵线圈对患者进行检查。绘制受试者工作特征(ROC)曲线, 分析各种检测方法对原发性肝癌的诊断效能。结果: 两组血清AFP的表达均有所升高, 观察组血清AFP及CA19-9表达水平高于对照组, 差异有统计学意义($t=21.881$, $t=28.559$; $P<0.05$)。采用血清AFP和CA19-9为单一标志物对PHC的检出率分别为68.75%和57.50%, 而血清AFP联合CA19-9对PHC的检出率为87.50%。光谱CT和MRI单独检测对PHC的检出率分别为88.75%和90.00%, 而光谱CT和MRI联合血清AFP和CA19-9检测对PHC的检出率分别为93.75%和96.25%。ROC曲线分析结果符合上述统计结果。结论: 光谱CT或MRI联合血清AFP和CA19-9检测对PHC的检出率均高于单一检测方法, 且MRI联合血清AFP和CA19-9检测对PHC的检出率最高。MRI联合血清AFP和CA19-9检测对于PHC的早期诊断以及对原发性肝癌的早期筛查具有一定的应用价值。

[关键词] 光谱CT; 磁共振成像(MRI); 甲胎蛋白(AFP); 糖类抗原19-9(CA19-9); 原发性肝癌(PHC)

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Diagnostic value of spectral CT, MRI, and the detections of serum relative indicators and tumor markers in primary hepatic carcinoma/TANG Liang, ZHENG Xiao-dong, ZHENG Jia-lian//China Medical Equipment, 2021, 18(9):62-66.

[Abstract] **Objective:** To investigate the clinical values of spectral computed tomography (CT), magnetic resonance imaging (MRI), and the expression of serum alpha-fetoprotein (AFP) and carbohydrate antigen19-9 (CA19-9) in the diagnosis of primary hepatic carcinoma (PHC). **Methods:** 80 patients with PHC who admitted to hospital were selected and they were divided into observation group, and 80 patients with liver cirrhosis who admitted to hospital at the same time were divided into control group. After the fasting bloods of two groups were collected, the expression levels of AFP and CA19-9 in the serum were detected by using the Elisa kit. The double-layered detector spectral CT was used to perform abdominal plain scan and dual-phase scan of liver. The superconducting type of magnetic resonance scanner and body phased-array coil were adopted to examine these patients. The receiver operating characteristics (ROC) curve was drawn to analyze the diagnostic efficiency of various detection methods on PHC. **Results:** The expression levels of serum AFP increased in both observation group and control group, and the expression levels of serum AFP and CA19-9 of observation group were significantly higher than those of control group ($t=21.881$, $t=28.559$, $P<0.05$). When the serum AFP and CA19-9 were respectively used as single marker, the relevance ratios of them on PHC were 68.75% and 57.50%. And the relevance ratio that serum AFP combined with CA19-9 was 87.50% for PHC. The relevance ratios of single spectral CT and single MRI were 88.75% and 90.00% on PHC, respectively. And when spectral CT and MRI respectively combined with "serum AFP and CA19-9", the relevance ratios of them were 93.75% and 96.25% on PHC. The results of ROC curve analysis conformed to above statistic results. **Conclusion:** The relevance ratio of spectral CT or MRI respectively combines with "serum AFP and CA19-9" is higher than that of any single one, and the relevance ratio of MRI combines with "serum AFP and CA19-9" is the highest. And the detection that MRI combines with "serum AFP and CA19-9" has a certain of application value on the early diagnosis and early screening of PHC.

[Key words] Spectral computed tomography (CT); Magnetic resonance imaging (MRI); Alpha-fetoprotein (AFP); Carbohydrate antigen19-9 (CA19-9); Primary hepatic carcinoma (PHC)

[First-author's address] Medical Imaging Center, Affiliated Hospital of Liaoning University of Traditional Chinese Medicine, Shenyang 110032, China.

原发性肝癌(primary hepatic carcinoma, PHC)是我国最常见的恶性肿瘤之一, 其中以肝细胞癌(hepatocellular carcinoma, HCC)和肝内胆管癌(intrahepatic cholangio carcinoma, ICC)最为常见, 分别占PHC病例总数的70%和15%^[1]。目前, 对于PHC

的治疗手段主要是手术形式的综合治疗, 如部分肝脏切除和肝移植, 但是由于PHC缺乏特异性症状或疾病进程较快导致患者在确诊时多为中晚期, 丧失了最佳的治疗时机, 导致PHC患者的预后不佳^[2-3]。美国肝病研究协会、美国国立综合癌症网络及亚太肝病研究

①辽宁中医药大学附属医院医学影像中心 辽宁 沈阳 110032

②辽宁中医药大学附属医院感染科 辽宁 沈阳 110032

*通信作者: 3244339379@qq.com

作者简介: 唐亮, 男, (1981-), 本科学历, 主治医师, 从事肝癌影像诊断研究工作。



协会指出,目前对PHC的早期检测是提高PHC患者预后最有效的方法^[4]。

随着医学技术的发展,影像学诊断和病理学检测对PHC早期诊断有一定的提高,但准确度有限^[5]。目前在临床中多使用多因素联合检测诊断PHC,为PHC的诊断和治疗提供帮助。本研究旨在探讨光谱CT、MRI以及血清中甲胎蛋白(alpha fetoprotein, AFP)及糖类抗原19-9(carbohydrate antigen 19-9, CA19-9)的表达在PHC诊断中的临床价值。

1 资料与方法

1.1 一般资料

选取2016年12月至2017年12月于辽宁中医药大学附属医院就诊的80例PHC患者作为观察组,选择同期就诊的80例肝硬化患者作为对照组。观察组中男性53例,女性27例;年龄51~74岁,平均年龄(62.9±6.5)岁;病程2~24月;所有患者的细胞学或病理学检测均符合2001年9月第八届全国肝癌学术会议制定的《原发性肝癌的临床诊断与分期标准》^[6]。对照组中男性54例,女性26例;年龄在48~72岁,平均年龄(61.0±5.9)岁;病程2~24月;所有患者的诊断参照2000年中华医学会传染病与寄生虫病学分会、肝病学分会联合颁发的《病毒性肝炎防治方案》^[7]。两组患者的临床资料比较无差异,具有可比性。本研究经医院医学伦理委员会批准,所有参与本研究的患者及其家属均知晓本研究的目的及意义并签署知情同意书。

1.2 纳入与排除标准

(1)纳入标准。①符合原发性肝癌诊断标准;②年龄50~75周岁;③临床资料完整。

(2)排除标准。①伴有心血管、肺、肾等脏器严重疾病或其他原发性恶性肿瘤者;②患者在1个月内接受抗肿瘤药物、华法林或维生素K治疗;③血样本受到污染。

1.3 仪器设备与试剂

使用IQon Spectral型双层探测器能谱CT(荷兰Philips公司),采用Achieva 1.5T超导型磁共振扫描仪(荷兰Philips公司);人AFP酶联检测试剂盒(南京卡米洛生物工程有限公司),人CA19-9酶联检测试剂盒(南京卡米洛生物工程有限公司)。

1.4 检测方法

所有患者均在空腹12 h后抽取外周血并分离血清,血清置于-20℃条件下保存,按照试剂盒说明书进行双抗体夹心ELISA法,检测血清中AFP和

CA19-9的水平。接受光谱CT检查前,通过肘前静脉以3.0 ml/s的速度注射碘海醇(碘含量:500 mg/kg,剂量:1.4 ml/kg)。使用双层探测器能谱CT进行腹部平扫和肝脏双期扫描,在触发衰减阈值后进行肝动脉期扫描30 s,肝动脉期扫描结束后进行门静脉期扫描。扫描参数为管电压120 kV,管电流20 mA,螺旋间距1.375。扫描完成后使用Philips ISP对所有扫描图像进行标准重建和能谱图像重建,重建厚度为1.25 mm,间隔为1.25 mm,显示视野为360 mm。

对观察组和对照组的患者进行呼吸训练后,采用超导型磁共振扫描仪和体部相控阵线圈进行检查。

1.5 诊断标准

光谱CT检查结果及MRI检查结果的判读均采用双盲法,检测结果由3位资深的放射科医生进行阅片判读。血清AFP≥20.0 μg/L为阳性,血清CA19-9≥40.0 μg/L为阳性^[8]。

绘制受试者工作特征(receiver operating characteristic, ROC)曲线,计算血清AFP、CA19-9、光谱CT、MRI、血清AFP+血清CA19-9、光谱CT+血清AFP+血清CA19-9及MRI+血清AFP+血清CA19-9的ROC曲线下面积(area under curve, AUC)。

1.6 统计学方法

采用SPSS26.0统计学软件对数据进行处理,计量数据符合正态分布以均值±标准差($\bar{x} \pm s$)表示,组间比较采用独立样本 t 检验,以 $P < 0.05$ 为差异具有统计学意义。

2 结果

2.1 两组患者血清AFP及CA19-9水平表达比较

观察组患者血清AFP均值为(301.4±84.6) μg/L, CA19-9均值为(57.4±9.4) μg/L,血清AFP和CA19-9的表达水平平均高于阳性临界值;对照组患者血清中仅有AFP的表达高于阳性临界值。观察组分别是对照组的3.43倍和2.48倍,两组血清AFP及CA19-9的表达比较差异有统计学意义($t=21.881$, $t=28.559$; $P < 0.05$),见表1。

表1 两组血清AFP和CA19-9水平表达比较(μg/L, $\bar{x} \pm s$)

组别	例数	AFP	CA19-9
观察组	80	301.4±84.6	57.4±9.4
对照组	80	87.8±21.6	23.1±5.2
t 值		21.881	28.559
P 值		<0.001	<0.001

注:表中AFP为甲胎蛋白;CA19-9为糖类抗原19-9



表2 不同检测方法诊断检出率比较

检测方法	检出数(例)	检出率(%)	χ^2 值	χ^2 值	P值
血清AFP	55	68.75	16.42*	33.786 [#]	<0.05
血清CA19-9	46	57.50	28.515*	5.714 [#]	<0.05
光谱CT	66	82.5	4.838*	7.964 [#]	<0.05
MRI	67	83.75	4.006*	6.944 [#]	<0.05
血清AFP+血清CA19-9	65	81.25	20.952*	9.014 [#]	<0.05
光谱CT+血清AFP+血清CA19-9	75	93.75	—	—	—
MRI+血清AFP+血清CA19-9	77	96.25	—	—	—

注:表中AFP为甲胎蛋白;CA19-9为糖类抗原;*为与光谱CT+血清AFP+血清CA19-9组相比;#为与MRI+血清AFP+血清CA19-9组相比

2.2 各检测方法检出率比较

以血清AFP $\geq 20.0 \mu\text{g/L}$ 为临界值诊断PHC的准确度为68.75%,血清CA19-9 $\geq 40.0 \mu\text{g/L}$ 为临界值诊断PHC的准确度57.50%,两项指标联合检测诊断PHC的准确率为81.25%,光谱CT诊断PHC的检出率为82.5%,MRI诊断PHC的检出率为83.75%,光谱CT联合两项指标诊断PHC的检出率为93.75%,MRI联合两项指标诊断PHC的检出率为96.25%。相较于单独血清AFP检测,光谱CT联合两项指标诊断PHC的检出率明显增加($\chi^2=16.42$, $P<0.05$);相较于单独血清CA19-9检测,光谱CT联合两项指标诊断PHC的检出率明显增加($\chi^2=28.515$, $P<0.05$);相较于单独光谱CT检测,光谱CT联合两项指标诊断PHC的检出率明显增加($\chi^2=4.838$, $P<0.05$);相较于单独MRI检测,光谱CT联合两项指标诊断PHC的检出率明显增加($\chi^2=4.006$, $P<0.05$);相较于血清AFP+血清CA19-9两项联合指标检测,光谱CT联合两项指标诊断PHC的检出率明显增加($\chi^2=20.952$, $P<0.05$);相较于单独血清AFP检测, MRI联合两项指标诊断PHC的检出率明显增加($\chi^2=33.786$, $P<0.05$);相较于单独血清CA19-9检测, MRI联合两项指标诊断PHC的检出率明显增加($\chi^2=5.714$, $P<0.05$);相较于单独光谱CT检测MRI联合两项指标诊断PHC的检出率明显增加($\chi^2=7.964$, $P<0.05$);相较于单独MRI检测, MRI联合两项指标诊断PHC的检出率明显增加($\chi^2=6.944$, $P<0.05$);相较于血清AFP+血清CA19-9两项联合指标检测, MRI联合两项指标诊断PHC的检出率明显增加($\chi^2=9.014$, $P<0.05$);且MRI联合两项指标诊断PHC的检出率最高。见表2。

2.3 各检测方法诊断结果ROC曲线分析

以灵敏度为纵坐标, (1-特异性)作为横坐标绘制ROC曲线(图1)。计算血清AFP、CA19-9、光谱CT、MRI、血清AFP+血清CA19-9、光谱CT+血清AFP+血清CA19-9及MRI+血清AFP+血

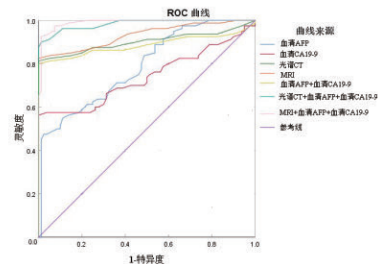


图1 各方法诊断结果ROC曲线分析
清CA19-9的AUC分别为0.788、0.740、0.902、0.932、0.886、0.984和0.990。ROC曲线分析结果显示, MRI联合两项指标诊断PHC的准确度最高, 见表3。

表3 不同检测方法ROC分析结果

检测项目	AUC	SE	P值	95%CI
血清AFP	0.788	0.035	0.000	0.719~0.857
血清CA19-9	0.740	0.041	0.000	0.660~0.821
光谱CT	0.902	0.028	0.000	0.800~0.957
MRI	0.932	0.021	0.000	0.892~0.973
血清AFP+血清CA19-9	0.886	0.031	0.000	0.825~0.947
光谱CT+血清AFP+血清CA19-9	0.984	0.008	0.000	0.969~0.999
MRI+血清AFP+血清CA19-9	0.990	0.006	0.000	0.979~1.000

注:表中AFP为甲胎蛋白;CA19-9为糖类抗原;AUC为受试者工作特征曲线下面积;SE为标准误差;95%CI为95%置信区间

3 讨论

PHC的发生发展是一个多中心多病因的过程,是全球癌症致死的第二原因。PHC主要包括肝细胞癌和胆总管癌,在过去的数十年中HCC和胆总管癌的发病率逐步上升^[9-10]。尽管国内外均制定了PHC的诊断指南,但是这些癌症在早期通常无明显的症状,导致早期的PHC诊断效率并不高^[6,11]。因此,改进PHC的筛查方式,提升患者的治愈率及生活质量至关重要。

AFP是一种胎儿特异性糖蛋白抗原,是最常用的血清生物学标准物,被认为是临床中筛选和早期诊断PHC的有效标志物之一^[12]。Famei等^[13]研究显示,



AFP诊断PHC的特异性和敏感度的跨度较大,使得AFP诊断PHC的准确性不尽人意。此外,在一些非恶性慢性肝病患者中也可以观察到血清AFP的表达高,如部分慢性肝炎患者和部分肝硬化患者^[12,14]。在本研究中,观察组和对照组患者血清中AFP的表达均高于 $20.0\text{ }\mu\text{g/L}$,以血清AFP $\geq 20.0\text{ }\mu\text{g/L}$ 为临界值诊断PHC的检出率为68.75%。CA19-9是唾液酸化乳-N岩戊糖Ⅱ存在的低聚糖,若消化系统中存在肿瘤,其含量会明显上升,是一种粘蛋白型糖类蛋白肿瘤标记物,广泛存在于血液循环的肿瘤相关抗原中^[15]。本研究发现,观察组患者血清中CA19-9的表达高于 $40.0\text{ }\mu\text{g/L}$,血清CA19-9 $\geq 40.0\text{ }\mu\text{g/L}$ 为临界值诊断PHC的准确度检出率为57.50%。研究还发现,联合检测血清AFP与CA19-9的表达可将PHC的检出率提高至87.50%,能有效的减少漏诊和误诊的发生。

光谱CT是近年来以光谱探测器为成像基础的新型CT技术,以“双层”立体探测器为核心技术,探测器分层接收高能和低能X射线,能够实现同源、同时、同向以及同步的精准能谱扫描。光谱CT检测不仅可以减少CT的检查次数,还可以减少其他不必要的影像学检查,在实现诊断效率提升的同时也可以减轻患者的经济负担^[16-17]。本研究结果显示,单独的光谱CT检查,对PHC的检出率为88.75%,相较于单独检查血清AFP和CA19-9有更高的检出率,且光谱CT联合血清AFP和CA19-9检测对PHC的检出率为93.75%,显著提高了3项单独检测的诊断准确度。因为MRI能清晰地显示患者的肝部解剖图像和信息,所以PHC的诊断过程中MRI通常作为传统CT的补充检查手段^[5]。在本研究中,MRI对PHC的检出率为90.00%,高于单独检测血清AFP、血清CA19-9及光谱CT对PHC的检出率,且检出率还高于血清AFP和血清CA19-9的联合检测。MRI联合血清AFP和CA19-9检测对PHC的检出率为96.25%,高于其余方法对PHC的检出率。

对上述检测方法得出的结果进行ROC曲线分析,其结果显示,7种检测方法对应的AUC分别为0.788、0.740、0.902、0.932、0.886、0.984和0.990,符合实际诊断的准确度。从ROC曲线图中还可以看出,光谱CT或MRI联合血清AFP和CA19-9对PHC诊断的灵敏度和特异度相较于其余检测方法均有显著提升,且MRI联合血清AFP和CA19-9对PHC诊断的灵敏度和特异度最高。

4 结论

光谱CT或MRI联合血清AFP和CA19-9对PHC诊断均有较高的灵敏度和特异性,但MRI联合血清AFP和CA19-9效果更好。故MRI联合血清AFP和CA19-9检测对PHC的早期诊断具有较高的价值,为改进PHC的诊断方法提供一定的理论依据。

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MRI体素内不相干运动成像对妊高征患者 产后子痫病理学反应的预测价值*

王海尧^① 张林奎^{①*} 刘刚^① 刘飞^① 李小花^①

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[摘要] 目的: 探讨磁共振成像(MRI)体素内不相干运动(IVIM)成像对妊娠高血压综合征(即妊高征)患者产后子痫病理学反应的预测价值。方法: 选取医院收治的72例妊娠高血压产妇, 按照其是否出现产后子痫分为子痫组(35例)和妊高组(37例), 所有产妇均于产前、产后分别行MRI和IVIM成像检查, 用双指数模型拟合不同b值下平均信号曲线, 计算表观弥散系数(ADC)、弥散系数(D)、灌注系数(D*)及灌注分数(f), 评估IVIM成像对妊高征患者产后子痫病理学反应的预测效能。结果: 产后子痫组ADC和f值高于妊高组, 差异有统计学意义($t=4.205$, $t=2.611$; $P<0.05$), D值高于妊高组, 差异有统计学意义($Z=5.953$, $P<0.05$); 而D*值差异无统计学意义($P>0.05$); 子痫组产前、产后ADC变化值和变化率均大于妊高组, 差异有统计学意义($t=16.322$, $t=5.095$; $P<0.05$), f和D*变化值、变化率两组差异无统计学意义, D变化值和变化率均大于妊高组, 差异有统计学意义($Z=3.041$, $Z=2.938$; $P<0.05$)。ADC变化值、ADC变化率、D变化值、D变化率预测产后子痫灵敏度分别为67.8%、67.8%、73.4%和81.0%, 特异度分别为94.5%、88.9%、77.8%和72.3%。结论: 妊高征孕妇伴产后子痫患者的产前、产后IVIM成像ADC、D变化值和变化率可作为子痫病理学反应的预测指标, 其中D值的变化值和变化率预测效能更优。

[关键词] 磁共振成像(MRI); 体素内不相干运动(IVIM); 弥散加权成像(DWI); 妊娠高血压; 子痫

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Predictive value of MRI IVIM imaging on pathological response of postpartum eclampsia of PIH patient/
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[Abstract] **Objective:** To explore the predictive value of magnetic resonance imaging (MRI) intra voxel incoherent motion (IVIM) imaging on the pathological response of postpartum eclampsia in patients with pregnancy-induced hypertension (PIH). **Methods:** 72 cases with PIH who admitted to hospital were selected and they were divided into eclampsia group (35 cases) and PIH group (37 cases) according to whether occurred postpartum eclampsia. All of parturient underwent MRI and IVIM imaging examination before and after delivery. Double exponential model was used to fit average signal curve under different b values so as to calculate apparent diffusion coefficient (ADC), diffusion coefficient (D), perfusion coefficient (D*) and perfusion fraction (f), and to assess the predictive performance of IVIM imaging for the pathological response of postpartum eclampsia in patients with PIH. **Results:** The ADC and f value of postpartum eclampsia group were significantly higher than those of PIH group, and the difference was statistically significant ($t=4.205$, $t=2.611$, $P<0.05$). And the D value of former was significantly higher than that of PIH group, and the difference was statistically significant ($Z=5.953$, $P<0.05$). While the difference of D* value between two groups was not statistically significant ($P>0.05$). The prenatal and postnatal change values and change rates of ADC in eclampsia group were significantly higher than those in PIH group ($t=16.322$, $t=5.095$, $P<0.05$), respectively. The differences of change values and changes rate of f and D* between two groups were not statistically significant ($P>0.05$), while both change value and change rate of D value of former were significantly larger than those of PIH group ($Z=3.041$, $Z=2.938$, $P<0.05$). The sensitivities of ADC change value, ADC change rate, D change value and D change rate were 67.8%, 67.8%, 73.4% and 81.0% in predicting postpartum eclampsia, respectively. And the specificities of them were 94.5%, 88.9%, 77.8% and 72.3%, respectively. **Conclusion:** The change value and change rate of ADC and D of prenatal and postpartum IVIM imaging of PIH pregnant women with postpartum eclampsia can be used as predictors of pathological response of eclampsia. Among them, the change value and change rate of D value have better predictive performance.

[Key words] Magnetic resonance imaging (MRI); Intra voxel incoherent motion (IVIM); Diffusion-weighted imaging (DWI); Pregnancy-induced hypertension (PIH); Eclampsia

[First-author's address] Department of Radiological Intervention, Qinghai Red Cross Hospital, Xining 810000, China.

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①青海红十字医院放射影像介入科 青海 西宁 810000

*通信作者: Leonjack_20@sina.com

作者简介: 王海尧, 男, (1981-), 本科学历, 主治医师, 从事CT及MRI临床诊断研究工作。

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