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肾脏肿瘤患者 CT 灌注参数与肾功能生化检测指标的相关性研究 *

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摘要 目的: 探讨肾脏肿瘤患者 CT 灌注参数与肾功能生化检测指标的相关性。**方法:** 选取河北省第六人民医院 2013 年 3 月至 2018 年 1 月期间收治的 35 例肾脏肿瘤患者作为观察组,另选取同期来我院体检的 35 例健康者作为对照组,均对两组受试者实施 CT 灌注成像,获取等效血容量(Equiv BV)、表面渗透性(Ps)、血流量(BF)等 CT 灌注参数,并检测两组受试者血尿素氮(BUN)、血肌酐(Scr)、总胆固醇(TC)、甘油三酯(TG)等肾功能生化指标,对比两组受试者上述指标检测结果,采用 Pearson 相关分析 CT 灌注参数与肾功能生化指标的相关性。**结果:** 与对照组相比,观察组 CT 灌注参数 Equiv BV、Ps、BF 均降低,肾功能生化指标 BUN、Scr、TC、TG 水平均升高,有统计学差异($P<0.05$)。Pearson 相关分析结果显示,CT 灌注参数 Equiv BV、Ps、BF 与肾功能生化指标 TC、BUN 均呈负相关($P<0.05$),与 Scr、TG 无相关性($P>0.05$)。**结论:** 肾脏肿瘤患者的 CT 灌注参数 Equiv BV、Ps、BF 均较低,BUN、Scr、TC、TG 水平均较高,且 CT 灌注参数与 BUN、TC 水平呈负相关性,可作为评估肾脏肿瘤患者肾功能的辅助方法。

关键词: 肾脏肿瘤;CT 灌注参数;肾功能;生化检测指标;相关性

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Study on the Correlation Between CT Perfusion Parameters and Renal Function Biochemical Indexes in Patients with Renal Tumor*

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ABSTRACT Objective: To investigate the correlation between CT perfusion parameters and renal function biochemical indexes in patients with renal tumor. **Methods:** 35 patients with renal tumor from March 2013 to January 2018 were selected as the observation group, another 35 healthy persons who were admitted to The Sixth People's Hospital of Hebei Province during the same period were selected as control group. CT perfusion imaging was performed in two groups, and CT perfusion parameters such as equivalent blood volume (Equiv BV), permeability surface (Ps), blood flow (BF) were obtained. The renal function biochemical indexes such as blood urea nitrogen (BUN), serum creatinine (Scr), total cholesterol (TC) and triglyceride (TG) were detected in two groups, and the results of the above indexes in two groups were compared. The correlation between CT perfusion parameters and renal function biochemical indexes was analyzed by Pearson correlation analysis. **Results:** Compared with the control group, the CT perfusion parameters such as Equiv BV, Ps and BF in the observation group were all decreased, and the levels of renal function biochemical indexes such as BUN, Scr, TC and TG were all increased, the differences were statistically significant ($P<0.05$). Pearson correlation analysis showed that CT perfusion parameters such as Equiv BV, Ps and BF were negatively correlated with renal function biochemical indexes TC and BUN ($P<0.05$), but not correlated with Scr and TG ($P>0.05$). **Conclusion:** CT perfusion parameters such as Equiv BV, Ps and BF of renal tumor patients were lower, and the levels of BUN, Scr, TC and TG were higher. CT perfusion parameters are negatively correlated with the levels of BUN and TG, which can be used as an auxiliary method to evaluate renal function in patients with renal tumor.

Key words: Renal tumor; CT perfusion parameters; Renal function; Biochemical index; Correlation

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前言

肾脏肿瘤为泌尿系统肿瘤疾病,主要发病群体为中老年人,发病数量约占正常成人肿瘤总发病数量的 5%^[1-3]。肾脏肿瘤

具有起病隐匿、临床症状缺乏等典型性的特点,只有少数患者能够在发病早期确诊,及时接受临床治疗,而大多数患者在就诊时已有恶化倾向,增大了疾病治疗难度^[4-6]。因此寻找能够早期确诊肾脏肿瘤的方法具有十分重要的临床意义。CT 已在肾

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脏肿瘤的临床诊断中得到广泛应用,CT灌注成像是CT扫描仪所具有的一种功能影像成像方法^[7,8]。临床应用发现,该成像方法能够发现肾实质内小于0.5 cm的占位病变,诊断准确性高^[9]。肾功能生化指标检测是我国临床进行肾功能评估的常用方法,其中血尿素氮(blood urea nitrogen,BUN)、血肌酐(serum creatinine,Scr)、总胆固醇(total cholesterol,TC)、甘油三酯(triglyceride,TG)是临床常用指标^[10],鉴于此,本研究对肾脏肿瘤患者CT灌注参数与肾功能生化检测指标的相关性进行分析,旨在为临床早期确诊肾脏肿瘤提供数据性的支持,现报道如下。

1 资料与方法

1.1 一般资料

选取河北省第六人民医院2013年3月至2018年1月期间收治的35例肾脏肿瘤患者作为观察组,纳入标准^[11]:(1)影像学检查可清晰的观察到肿瘤,并经手术病理证实;(2)年龄大于18周岁;(3)不存在认知功能障碍;(4)无第二原发肿瘤;(5)自愿参与本次研究,签署研究知情同意书。排除标准:(1)合并患有心、脑、肝等其他严重器质性疾病者;(2)对碘对比剂过敏者;(3)合并肾动脉狭窄者。观察组男25例,女10例,年龄28-70岁,平均年龄(46.37±5.28)岁。病理类型:肾细胞癌19例,肾盂癌4例,错构瘤10例,嗜酸细胞瘤2例(均大于4 cm)。另选取同期来我院体检的35例健康者作为对照组,男24例,女11例,年龄29-67岁,平均年龄(46.12±5.37)岁。两组的性别、年龄比较差异无统计学意义($P>0.05$),提示可进行组间对比。院内的伦理委员会已批准此次研究。

1.2 研究方法

1.2.1 CT扫描 应用GE-Light Speed VCT64排128层螺旋

CT扫描仪进行扫描,扫描参数:管电压80KV,管电流200 mAs,层厚/层间距5 mm,螺距0.984:1,时间1.0s,先行肾脏CT平扫,选取病变区及其上下层面进行灌注成像。造影剂:江苏恒瑞医药股份有限公司-碘佛醇注射液,用量50-55 mL,流速5.0-5.5 mL/s,高压注射器(拜耳-美德瑞达双筒高压注射器)注射,注射后延迟8-10 s开始扫描。同时扫描8层,扫描时间50 s,共获得图像796幅,将扫描所得图像上传至CT扫描仪配套工作站上,工作站版本为Aw Version4.5,用工作站自带的CT Perfusion4软件打开灌注序列,记录灌注参数,具体包括等效血容量(equivalent blood volume,Equiv BV)、表面渗透性(permeability surface,Ps)、血流量(blood flow,BF)。

1.2.2 肾功能生化指标检测 观察组在接受CT扫描前3d内采集患者5 mL空腹静脉血,对照组则在体检当日采集5 mL空腹静脉血,均以3000 r/min的速度离心5 min,取其血浆,检测两组受试者肾功能生化指标,检测仪器为日本-日立7600全自动生化分析仪,检测试剂为仪器配套试剂(日本-日立),具体检测指标包括BUN、Scr、TC、TG。

1.3 统计学方法

本研究基于统计学软件(版本:SPSS20.0)建立数据统计分析模型,CT灌注参数Equiv BV、Ps、BF等计量资料均以($\bar{x}\pm s$)的形式描述,实施t检验,CT灌注参数与肾功能生化指标的相关性分析采用Pearson相关分析,检验水准设置为 $\alpha=0.05$ 。

2 结果

2.1 两组CT灌注参数Equiv BV、Ps、BF比较

观察组CT灌注参数Equiv BV、Ps、BF均低于对照组,有统计学差异($P<0.05$),见表1。

表1 两组CT灌注参数Equiv BV、Ps、BF比较($\bar{x}\pm s$)

Table 1 Comparison of CT perfusion parameters such as Equiv BV, Ps and BF between the two groups($\bar{x}\pm s$)

Groups	n	Equiv BV (mL/100g)	Ps (mL/100·min)	BF (mL/100·min)
Observation group	35	81.02± 3.24	182.16± 10.93	271.46± 26.31
Control group	35	96.11± 3.41	194.36± 11.20	298.14± 26.15
t		18.986	4.612	4.253
P		0.000	0.000	0.000

2.2 两组肾功能生化指标BUN、Scr、TC、TG水平比较

差异($P<0.05$),见表2。

观察组BUN、Scr、TC、TG水平均较对照组升高,有统计学

表2 两组肾功能生化指标BUN、Scr、TC、TG水平比较($\bar{x}\pm s$)

Table 2 Comparison of renal function biochemical indexes such as BUN, Scr, TC, TG between the two groups($\bar{x}\pm s$)

Groups	n	BUN (mmol/L)	Scr (μmol/L)	TC (mmol/L)	TG (mmol/L)
Observation group	35	14.49± 2.03	159.28± 18.30	5.99± 0.35	1.71± 0.33
Control group	35	8.93± 1.35	71.40± 18.22	5.36± 0.29	1.08± 0.20
t		13.411	20.123	3.174	3.590
P		0.000	0.000	0.009	0.003

2.3 观察组患者CT灌注参数与肾功能生化指标的相关性分析

Pearson相关分析结果显示,CT灌注参数Equiv BV、Ps、

BF与肾功能生化指标TC、BUN均呈负相关($P<0.05$),与Scr、TG无相关性($P>0.05$),见表3。

表 3 观察组患者 CT 灌注参数与肾功能生化指标的相关性分析

Table 3 Correlation Analysis of CT perfusion parameters and renal function biochemical indexes in the patients of observation group

Indexes	Equiv BV		Ps		BF	
	r	P	r	P	r	P
BUN	-0.332	0.038	-0.312	0.037	-0.301	0.042
Scr	-0.139	0.084	-0.105	0.104	-0.095	0.128
TC	-0.344	0.036	-0.307	0.041	-0.364	0.031
TG	-0.048	0.226	-0.108	0.101	-0.068	0.194

3 讨论

肾脏肿瘤患者的发病机制较为复杂,涉及神经内分泌激活、炎性反应、血流动力学异常、氧化应激等多个方面,尤其是长期炎性反应可导致肾小球硬化,随着病程的不断延长,对肾功能造成损害^[12-14]。早期,我国临床主要通过检测肾功能生化指标水平对患者肾功能状况进行评估,该评估方法具有操作复杂、耗时长的局限性,因此,近年来我国研究学者一直在探索能够快速、准确诊断肾脏肿瘤患者的方法^[15-17]。由于影像学方法是我国临床诊断肾脏肿瘤的常用方法,故关于影像学诊断所得相关参数与肾功能生化指标的相关性也引起了一部分研究学者的重视^[18-20]。超声是我国临床诊断肾脏肿瘤使用的传统影像学方法,能够发现大于 1 cm 的肾实质病变,但扫描速度受限制,不能进行连续扫描^[21,22]。螺旋 CT 的应用解决了上述问题,使得肾脏肿瘤影像学诊断准确率得到了明显提高。伴随着影像学技术的不断发展,现阶段 CT 灌注成像得到应用,该种成像技术能够观察到肾脏肿瘤内部微血管的状况,与其他影像学诊断方法比较具有明显的应用优势^[23-25]。

本次研究对 CT 灌注参数与肾功能生化检测指标的相关性进行分析,选择的参数包括 Equiv BV、Ps、BF,选择的肾功能生化指标为 BUN、Scr、TC、TG。经检测发现观察组 CT 灌注参数均较对照组降低,肾功能生化指标水平均较对照组升高。Pearson 相关分析结果显示观察组患者 CT 灌注参数与 BUN、TC 呈负相关性,与 Scr、TG 无明显相关性。Equiv BV、Ps、BF 主要用于评价肾脏血流动力学,患者出现肾脏肿瘤后,肾脏的血流动力学发生明显改变,故上述参数具有较高的敏感性。肾脏肿瘤的发生可导致机体代谢功能发生异常,多种生化指标异常表达,其中以 BUN、Scr、TC、TG 变化最明显,特异性最高,故常被我国临床用于评价患者肾功能^[26]。张旭辉^[27]等人对“脂肪型肾错构瘤患者的 CT 灌注参数与肾功能生化检测指标的相关性”这一课题进行研究时,选择脂肪型肾错构瘤患者和健康人作为研究对象,对比两组 Equiv BV、Ps、BF 发现,观察组患者均较对照组健康人低,肾功能生化指标表达异常更明显,本研究结果与张旭辉等人的研究结果具有高度相似性。分析得到上述研究结果的原因可能为肾脏肿瘤的发生会导致患者肾脏血流灌注发生异常,对肾功能造成损伤,故上述 CT 灌注参数降低,而肾功能生化指标也会随着肾功能损伤的加重发生明显的波动^[28,29]。通过进行相关性分析能够明确患者 CT 灌注参数和肾功能指标的变化特征及两者之间是否存在相关作用,有利于临床医师进一步明确患者疾病发展的作用机制^[30]。

综上所述,肾脏肿瘤患者的 CT 灌注参数与肾功能生化检测指标的表达式有一定程度的相关性,可作为评估肾脏肿瘤患者肾功能的辅助方法。但由于本次研究所选样本量较少,操作过程有待进一步规范,因此本次研究结果的准确性仍需后续更多实践研究进行验证。

参考文献(References)

- [1] 汪帮琦,赵永斌,张长征,等.3D 腹腔镜在肾脏肿瘤保留肾单位手术中的应用优势[J].中国内镜杂志,2015,21(11): 1126-1129
Wang Bang-qí, Zhao Yong-bin, Zhang Chang-zheng, et al. Clinical advantage of 3D laparoscopic nephron sparing surgery in renal neoplasm[J]. China Journal of Endoscopy, 2015, 21(11): 1126-1129
- [2] Vaillancourt B, Oligney L, Déry J, et al. Ossifying Renal Tumor of Infancy: Report of a Case With Positive WT1 Immunohistochemistry and High Mitotic Index and Review of the Literature [J]. Pediatr Dev Pathol, 2017, 20(6): 511-516
- [3] Xiao ZD, Han L, Lee H, et al. Energy stress-induced lncRNA FILNC1 represses c-Myc-mediated energy metabolism and inhibits renal tumor development[J]. Nat Commun, 2017, 8(1): 783
- [4] Banyai D, Vastag F, Yusenko M, et al. Embryonal Origin of MTSCC of Kidney May Explain its Morphological Heterogeneity: Diagnostic Impact of Genetic Analysis [J]. Anticancer Res, 2017, 37 (3): 1185-1189
- [5] 李怡莹,孟政,连玲芳,等.肾脏原发性肿瘤 CT 成像进展[J].现代生物医学进展,2016,16(16): 3196-3200
Li Yi-xuan, Meng Huan, Lian Ling-fang, et al. Progress of Primary Renal Tumor CT Imaging[J]. Progress in Modern Biomedicine, 2016, 16(16): 3196-3200
- [6] Agochukwu N, Huber S, Spektor M, et al. Differentiating Renal Neoplasms From Simple Cysts on Contrast-Enhanced CT on the Basis of Attenuation and Homogeneity [J]. AJR Am J Roentgenol, 2017, 208(4): 801-804
- [7] Popovic P, Leban A, Kregar K, et al. Computed Tomographic Perfusion Imaging for the Prediction of Response and Survival to Transarterial Chemoembolization of Hepatocellular Carcinoma [J]. Radiol Oncol, 2017, 52(1): 14-22
- [8] Zhang D, Xu A. Application of dual-source CT perfusion imaging and MRI for the diagnosis of primary liver cancer[J]. Oncol Lett, 2017, 14 (5): 5753-5758
- [9] Chung HW, Ko SM, Hwang HK, et al. Diagnostic Performance of Coronary CT Angiography, Stress Dual-Energy CT Perfusion, and Stress Perfusion Single-Photon Emission Computed Tomography for Coronary Artery Disease: Comparison with Combined Invasive

- Coronary Angiography and Stress Perfusion Cardiac MRI [J]. Korean J Radiol, 2017, 18(3): 476-486
- [10] Kawada T. Inter-relationship among renal arteriosclerosis, vascular function indexes, estimated renal function indexes and biochemical markers in patients with chronic kidney disease [J]. Nephrology (Carlton), 2016, 21(7): 633
- [11] 邱敏, 向军吉, 马潞林, 等. 实时超声监测后腹腔镜下肾部分切除术治疗完全内生型肾肿瘤的疗效分析[J]. 中华泌尿外科杂志, 2016, (10): 730-734
- Qiu Min, Xiang Jun-ji, Ma Lu-lin, et al. Analysis of the efficacy of laparoscopic partial nephrectomy in the treatment of complete endophytic renal tumors by real-time ultrasound monitoring [J]. Chinese Journal of Urology, 2016, (10): 730-734
- [12] 罗靖, 王东文, 汤元杰, 等. 肾脏肿瘤 CT 三维重建体积与病理体积的差异研究[J]. 现代泌尿外科杂志, 2015, 20(7): 457-459
- Luo Jing, Wang Dong-wen, Tang Yuan-jie, et al. Comparison of CT three-dimensional reconstruction and pathological volumes of renal tumors[J]. Journal of Modern Urology, 2015, 20(7): 457-459
- [13] Ueda K, Suekane S, Nishihara K, et al. Early primary renal tumor response predicts clinical outcome in patients with primary unresectable renal cell carcinoma with synchronous distant metastasis receiving molecularly targeted therapies [J]. Mol Clin Oncol, 2017, 7(2): 205-210
- [14] Cardili L, Wrublevsky Pereira G, Viana CR. A rare case of TFE-related pigmented renal tumor with overlapping features between melanotic Xp11 translocation renal cancer and Xp11 renal cell carcinoma with melanotic features [J]. Pathol Int, 2017, 67(4): 208-213
- [15] Zhu L, Wu G, Huang J, et al. Comparing renal function preservation after laparoscopic radio frequency ablation assisted tumor enucleation and laparoscopic partial nephrectomy for clinical T1a renal tumor: using a 3D parenchyma measurement system [J]. J Cancer Res Clin Oncol, 2017, 143(5): 905-912
- [16] Dong W, Gupta GN, Blackwell RH, et al. Functional Comparison of Renal Tumor Enucleation Versus Standard Partial Nephrectomy[J]. Eur Urol Focus, 2017, 3(4-5): 437-443
- [17] Porpiglia F, Autorino R, Fiori C, et al. The impact of T1 renal tumor characteristics on baseline renal function in patients undergoing partial nephrectomy: A renal scan based objective assessment[J]. Eur J Surg Oncol, 2017, 43(8): 1598-1602
- [18] 张颖, 李建初. 肾脏占位性病变更超声造影的现状与发展趋势[J]. 中华医学超声杂志(电子版), 2015, 12(7): 503-506
- Zhang Ying, Li Jian-chu. Current status and development trend of ultrasonography in renal space occupying lesions [J]. Chinese Journal of Medical Ultrasound (Electronic Edition), 2015, 12(7): 503-506
- [19] Mazaheri Y, Akin O, Hricak H. Dynamic contrast-enhanced magnetic resonance imaging of prostate cancer: A review of current methods and applications[J]. World J Radiol, 2017, 9(12): 416-425
- [20] Kim HA, Kim KA, Choi JJ, et al. Comparison of biannual ultrasonography and annual non-contrast liver magnetic resonance imaging as surveillance tools for hepatocellular carcinoma in patients with liver cirrhosis (MAGNUS-HCC): a study protocol [J]. BMC Cancer, 2017, 17(1): 877
- [21] 王艳, 王辉, 查小霞, 等. 超声造影与增强 CT 鉴别诊断肾实质性恶性肿瘤的临床价值比较 [J]. 现代生物医学进展, 2013, 13(24): 4667-4670
- Wang Yan, Wang Hui, Zha Xiao-xia, et al. Comparison of the clinical value of contrast-enhanced ultrasound and enhanced CT in the differential diagnosis of renal parenchymal malignancies[J]. Progress in Modern Biomedicine, 2013, 13(24): 4667-4670
- [22] Ohno Y, Fujisawa Y, Sugihara N, et al. Dynamic Contrast-Enhanced Perfusion Area-Detector CT: Preliminary Comparison of Diagnostic Performance for N Stage Assessment With FDG PET/CT in Non-Small Cell Lung Cancer [J]. AJR Am J Roentgenol, 2017, 209(5): W253-W262
- [23] Takahashi Y, Sasahara A, Yamazaki K, et al. Disturbance of CT perfusion within 24 h after onset is associated with WFNS grade but not development of DCI in patients with aneurysmal SAH [J]. Acta Neurochir (Wien), 2017, 159(12): 2319-2324
- [24] Ukmar M, Degraffi F, Pozzi Mucelli RA, et al. Perfusion CT in acute stroke: effectiveness of automatically-generated colour maps [J]. Br J Radiol, 2017, 90(1072): 20150472
- [25] Lim JW, Lee H, Her K, et al. Myocardial CT perfusion imaging for pre- and postoperative evaluation of myocardial ischemia in a patient with myocardial bridging: A case report [J]. Medicine (Baltimore), 2017, 96(42): e8277
- [26] Kawada T. Inter-relationship among renal arteriosclerosis, vascular function indexes, estimated renal function indexes and biochemical markers in patients with chronic kidney disease [J]. Nephrology (Carlton), 2016, 21(7): 633
- [27] 张旭辉, 陈晓荣, 张珊珊, 等. 乏脂肪型肾错构瘤患者的 CT 灌注参数与肾功能生化检测指标的相关性[J]. 现代肿瘤医学, 2016, 24(22): 3585-3588
- Zhang Xu-hui, Chen Xiao-rong, Zhang Shan-shan, et al. The correlation between renal function biochemical index and CT perfusion parameters in the lack of fat-type renal angiomyolipoma patients[J]. Journal of Modern Oncology, 2016, 24(22): 3585-3588
- [28] Ferrari M, Huellner M, Pauli C, et al. Assessment of prostate cancer with integrated CT-perfusion using a sector-wise approach [J]. Turk J Urol, 2017, 43(2): 152-157
- [29] Ghani AA, Nayan SAM, Kandasamy R, et al. Assessment of Pre- and Post-Operative Cerebral Perfusion in Anterior Circulation Intracranial Aneurysm Clipping Patients at Hospital Sungai Buloh Using CT Perfusion Scan and Correlations to Fisher, Navarro and WFNS Scores [J]. Malays J Med Sci, 2017, 24(1): 47-58
- [30] 刘东婷, 刘家祎, 温兆赢, 等. 320 排螺旋 CT 对主动脉夹层肾血流灌注的研究[J]. 影像诊断与介入放射学, 2017, (2): 91-96
- Liu Dong-ting, Liu Jia-yi, Wen Zhao-ying, et al. 320-row CT perfusion imaging of kidneys in aortic dissection [J]. Diagnostic Imaging & Interventional Radiology, 2017, (2): 91-96