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冠状动脉桥血管病变的 CT 评价和危险因素分析

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摘 要 目的 探讨 64 层螺旋 CT 在冠状动脉桥血管评价中的应用价值,并分析导致桥血管病变的危险因素。**方法** 2005 年 5 月 ~2008 年 1 月通过 64 层螺旋 CT 共随访到 35 例冠脉搭桥术后患者并记录一般资料。35 位患者共 89 支桥血管,动脉桥 21 支,静脉桥 68 支。根据 CABG 术后是否复发心绞痛分组,对两组间桥血管的通畅率作 χ^2 检验。将患者按照桥血管通畅与否分为两组,首先进行单因素分析,按 $P<0.05$ 标准筛选出的变量纳入 *Logistic* 多因素回归分析,逐步剔除混杂因素得出导致桥血管病变的危险因素。**结果** 近端吻合口、桥血管本身、远端吻合口和远端靶向引流血管的可评价率分别为 98.5%(65/66)、98.9%(88/89)、93.3%(83/89)、92.1%(82/89)。动脉桥血管的可评价率为 85.7%(18/21),静脉桥血管的可评价率为 91.2%(62/68),两两比较差异无统计学意义($P=0.755>0.05$)。桥血管的总体可评价率为 89.9%(80/89)。有心绞痛复发组桥血管的通畅率为 66.7%(16/24),无心绞痛复发组桥血管的通畅率为 88.7%(47/53),组间比较差异有统计学意义。*Logistic* 回归分析结果得出 LDL – C,Glu 相关性明显;其他变量无统计学意义。**结论** 64 层 MSCTA 对冠状动脉桥血管的评价可以很好地满足诊断需要。冠状动脉桥血管病变是 CABG 术后心绞痛复发的重要原因。Glu, LDL – C 是 CABG 术后冠状动脉桥血管病变的独立危险因素。

关键词 多层螺旋计算机体层摄影 冠状动脉搭桥术 多因素危险因子

Evaluation of Coronary Artery Bypass Grafts Lesion with 64 – slice Multi – slice Spiral Computed Tomography and Risk Factor Analysis *Xu Dong, Ren Jie, Zhang Kefeng, Liu Fei, Li Hongli, Lin Yanhui. Heart Center, Xuanwu Hospial, Capital Medical University, Beijing 100053, China*

Abstract Objective To evaluate the application value of 64 – slice multi – slice spiral computed tomography (MSCT) in detecting coronary artery bypass grafts lesion and analyze the risk factors of coronary artery bypass grafts lesion basing on the findings of 64 – slice MSCT. **Methods** 89 grafts of 35 cases were detected by MSCTA, including 21 arterial grafts and 68 venous grafts from May 2005 to January 2008. The patients were divided into two groups according to recurrence of angina or not, and patency of coronary artery bypass grafts was compared using chi – square test. The patients were divided into other two groups according to patency of coronary artery bypass grafts, and univariate analysis was made firstly, then the variates having statistical significance ($P<0.05$) were accepted in to logistic regression analysis. Confounding factors were rejected stepwise, and the risk factors leading to coronary artery bypass grafts lesion were found. **Results** Evaluability of proximal anastomoses, bypass grafts, distal anastomoses, and distal runoff arteries were 98.5% (65/66), 98.9% (88/89), 93.3% (83/89), and 92.1% (82/89), respectively. Evaluability of arterial grafts, venous grafts were 85.7%

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(18/21), 91.2% (62/68), respectively, and they had no statistical significance ($P = 0.755 > 0.05$). Total evaluability of bypass grafts was 89.9% (80/89). The grafts patency rate of patients who recurred angina or not was 66.7% (16/24) or 88.7% (47/53), and there was statistical significance between them ($P = 0.045 < 0.05$). Logistic regression analysis results were the following: for LDL – C, $\beta = 1.491$, $P = 0.043$, $OR = 4.443$; for Glu, $\beta = 1.744$, $P = 0.014$, $OR = 5.720$; other variables had no statistical significance. **Conclusion** 64 – slice MSCTA can satisfy the diagnostic requirement to evaluate the coronary artery bypass grafts. Coronary artery bypass grafts lesion is an important factor of postoperative angina recurrence. Serum glucose, low density lipoprotein – cholesterol are independent risk factors of postoperative coronary artery bypass grafts lesion.

Key words Multi – slice spiral, computed tomography; Coronary artery bypass grafting; Multiple risk factors

国内外关于64层MSCT在冠状动脉搭桥术后随访中的应用的相关文献报道较少,近年来冠状动脉搭桥术后随访研究多侧重于病死率、生活质量、危险因素等,关于桥血管的影像资料较少[1,2]。本研究初步探讨64层MSCT在冠状动脉桥血管评价中的应用价值,并以64层MSCT对冠状动脉桥血管的评价结果作为诊断标准,进一步对可能引起桥血管病变的因素作多因素分析。

材料与方法

1.病例资料:2006年5月~2008年1月MSCTA共随访到35例患者,其中男性25例,女性10例,年龄46~81岁,平均68±8岁,MSCTA检查与CABG术时间间隔3.5~210个月,平均46.5±42.1个月,其中15例有再发心绞痛症状。根据手术记录,35例患者共搭桥89支,其中动脉桥血管21支,包括左内乳动脉19支,右内乳动脉1支,游离桡动脉1支;大隐静脉桥血管68支,其中序贯吻合3支。患者基本临床特征详见表1。

表1　35例CABG术后随访患者基本临床特征(心血管病危险因素)

特征	n
高血压	20
糖尿病	13
高脂血症	16
目前吸烟	6
肥胖(BMI > 25kg/m^2)	17
NYHA心功能分级	
Ⅰ	6
Ⅱ	22
Ⅲ	7
Ⅳ	0
术前冠状动脉支架置入史	1
术前冠状动脉造影	
多支病变	28
弥漫性病变	12

2.MSCTA图像的评价:由两位有丰富循环系统影像资料诊断经验的影像科医师分别进行MSCTA图像的评价,意见不一致时通过协商取得一致结果。桥血管及自身冠状动脉通畅性的评价包括近端吻合口、桥血管本身、远端吻合口、远端靶向引流的血管通畅性评价。血管在横轴位图像和VR图像上未显影者或桥血管近段显影呈残根状为闭塞(图1)。在横轴位和长轴位图像上,以狭窄处两侧血管管径的平均值为参考,将管径的通畅情况分为:无狭窄;轻度狭窄,狭窄程度<50%;中重度狭窄,狭窄程度50%~99%;完全闭塞。无狭窄和轻度狭窄定义为血管通畅,中重度狭窄和完全闭塞定义为血管病变。

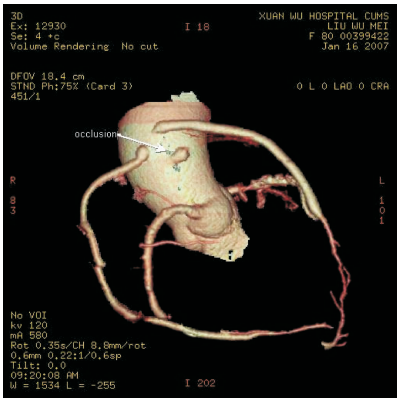

图1　VR显示SVG残根样闭塞(箭头)

3.统计方法:计量资料数据采用$\bar{x} \pm s$表示,桥血管通畅率采用百分数表示,排除有桥血管不可评价的病例,以近端吻合口、桥血管本身和远端吻合口中狭窄最严重处为标准评价桥血管的狭窄程度,根据CABG术后是否复发心绞痛分组,对桥血管的通畅率作χ^2检验,$P < 0.05$,差异有统计学意义。统计分析用SPSS 11.5软件。将患者临床资料和MSCTA评价结果输入SPSS 11.5数据库,按照桥血管通畅与否分为两组,首先进行单因素分析(正态分布的连续计量资料采用t检验,非正态分布的连续计量资料采用秩和检验,计量资料采用χ^2检验,$P < 0.05$有统计学差异),按$P < 0.05$标准筛选出的变量纳入*Logistic*多因素回归分析,逐步剔除混杂因素得出导致桥血管病变的危险因素。

结　　果

1.桥血管及远端靶向引流血管的通畅性:可评价的80支桥血管中56支无狭窄(LIMA 10支,SVG 46支),9支轻度狭窄(LIMA 4支,RA 1支,SVG 4支),6支中重度狭窄(RIMA 1支,SVG 5支),9支完全闭塞(SVG 9支)。桥血管的分布及评价结果见表2。81

支可评价的远端靶向引流血管中 9 支完全闭塞,其余均无狭窄。由于存在不可评价的桥血管,本研究排外 4 例病例,剩余 31 例 77 支桥血管均可评价,根据有无复发心绞痛分为两组,用于评价、比较两组间桥血管的通畅率。有心绞痛复发组桥血管的通畅率为 66.7%(16/24),无心绞痛复发组桥血管的通畅率为 88.7%(47/53),两组间比较差异有统计学意义($P = 0.045 < 0.05$)。

表 2 冠状动脉桥血管的分布及评价结果(n)

桥血管分布	LIMA – LAD	SVG – LAD	SVG – LCX	SVG – RCA	RA – DIA	RIMA – RCA	合计
总数	19	26	20	22	1	1	89
可评价数	16	26	17	19	1	1	80
无狭窄	12	16	14	14	0	0	56
轻度狭窄	4	2	1	1	1	0	9
中重度狭窄	0	4	1	0	0	1	6
闭塞	0	4	1	4	0	0	9

LIMA:左乳内动脉;LAD:左前降支,包括对角支(DIA);LCX:左旋支,包括钝缘支(OM);RCA:右冠状动脉,包括后降支(PDA)、左心室后支(PL);RIMA:右乳内动脉;RA:桡动脉

2. CABG 术后患者桥血管病变的临床多因素分析:31 例患者中存在桥血管病变者 13 人,占总数的 41.9%。80 支桥血管中有病变者 15 支,占桥血管总数的 18.8%,其中 RIMA 桥 1 支,SVG14 支。按照 MSCTA 结果将患者分为桥血管病变组和桥血管通畅组,首先进行单因素分析,结果见表 3 。按照 $P < 0.05$ 标准,手术年龄、糖尿病史、弥漫性病变、复诊时心功能Ⅲ~Ⅳ级、Glu、TC、LDL – C、HDL – C 有统计学意义,可能与 CABG 术后桥血管病变有关。将上述单因素分析有统计学意义的变量进行 *Logistic* 回归分析,按 $P < 0.05$ 标准逐步剔除混杂因素,得出导致桥血管病变的危险因素,结果见表 4。依据 *Logistic* 回归分析结果得出 LDL – C、Glu 是导致桥血管病变的危险因素($\beta > 0$, $OR_j > 1$, $P < 0.05$),建立回归方程:logit $P = -15.462 + 1.491$LDL – C $+ 1.744$Glu,此回归方程模型适配度的 χ^2 检验,$P = 0.023 < 0.05$,有统计学意义,说明该模型的适配度很好。OR(Glu) > OR(LDL – C),说明血糖对桥血管病变的作用大于低密度脂蛋白胆固醇。

讨 论

CABG 术后患者桥血管的通畅情况与患者的预后有着非常密切的关系。冠脉造影可以准确评价桥血管的管腔通畅情况,但它为有创性操作,患者的依从性差。国外报道 CABG 术后造影的复查率可达 22.6%,但国内复查率比较低,大多数为心绞痛频繁发作或发生急性心肌梗死后才住院造影[3]。无创性桥血管评价方法一直是人们关注的热点,主要方法有电子束 CT、MSCT、MRI。其中 MSCT 不仅可以清晰显示桥血管本身,还能准确评价桥血管的近远端吻合口,较其他方法有明显优势。本研究应用 64 层螺旋 CT 进行桥血管的评价,约 10s 即可完成图像采集,且桥血管各部分评价率均较高。本研究中有 2 例患者 ICA 未能进行桥血管造影,进而行 MSCTA 检查显示桥血管成像质量良好有轻中度狭窄。MSCTA 图像不仅可以反映桥血管的管腔通畅情况,而且可以显示管壁增厚情况,可以通过图像后处理 VR、MPR 技术多角度立体直观地观察桥血管的走行、狭窄部位、狭窄程度以及与心脏和周围器官组织的毗邻关系,用于指导 ICA 桥血管造影和再次 CABG 手术。MSCTA 对桥血管的评价受到诸多因素的影响,使其应用受到了限制。心脏运动幅度大、血管直径小、血管钙化程度高可降低 MSCTA 对桥血管的评估价值,尤其是桥血管远端部分;心律不齐尤其是心房颤动可以明显影响 MSCTA 的影像质量。尽管如此,本研究显示 64 层螺旋 CT 对桥血管的评价仍具有很高的可评价率,各种因素对 MSCTA 图像质量的影响多数在可接受的范围。文献报道,以 ICA 作为“金标准”用 64 层螺旋 CT 对桥血管进行评价,Gregor Pache 等[4] 显示所有闭塞的桥血管都被准确检查出,评价桥血管狭窄 >50% 的敏感性、特异性、阳性预测值、阴性预测值分别为 97.8%、89.3%、90%、97.7%。因此,64 层螺旋 CT 对桥血管评价的准确性较高,本研究将其对桥血管的评价结果作为诊断标准,进一步对引起桥血管病变的因素做多因素分析。冠状动脉搭桥术后随时间的变化桥血管和自身冠状动脉仍然有再发狭窄或原有狭窄加重的可能性。充分认识引起桥血管病变的危险因素,并加强对这些因素进行预防控制和针对性治疗,具有重要的临床意义。

表 3　桥血管病变的单因素分析结果[n(%)]

自变量	病变组(n=13)	通畅组(n=18)	P
手术年龄(岁)	67.85±6.36	61.67±9.88	0.043
>70 岁	6(46.2)	4(22.2)	0.247
性别(男)	9(69.2)	13(72.2)	1.000
术后时间(月)	52.35±55.10	46.50±34.19	0.718
高血压史	8(61.5)	10(55.6)	1.000
糖尿病史	8(61.5)	3(16.7)	0.021
高脂血症史	9(69.2)	8(44.4)	0.275
吸烟史	5(38.5)	9(50.0)	0.717
目前吸烟	4(30.8)	2(11.1)	0.208
肥胖(BMI>25kg/m^2)	5(38.5)	12(66.7)	0.157
家族史	5(38.5)	9(50.0)	0.717
身高(cm)	165.77±7.20	167.44±5.27	0.460
体重(kg)	67.77±8.65	71.61±8.76	0.236
BMI(kg/m^2)	24.63±2.39	25.51±2.59	0.343
心肌梗死病史	6(46.2)	10(55.6)	0.722
急诊 CABG	2(15.4)	2(11.1)	1.000
多支病变	11(84.6)	13(72.2)	0.667
弥漫性病变	10(76.9)	2(11.1)	0.000
桥血管数(≥3)	9(69.2)	7(38.9)	0.149
复诊时心功能Ⅲ~Ⅳ级(NYHA)	0(0)	6(46.2)	0.002
复诊时 EF	55.23±9.81	58.82±10.05	0.330
药物服用情况			
ACEI	3(23.1)	1(5.6)	0.284
钙通道阻滞剂	4(30.8)	7(38.9)	0.718
他汀类降血脂药物	3(23.1)	5(27.8)	1.000
口服降糖药物	7(53.8)	3(16.7)	0.052
胰岛素	3(23.1)	2(11.1)	0.625
平均动脉压(mmHg)	95.3±4.13	94.6±5.05	0.685
实验室检查			
Glu	6.89±1.16	5.23±0.58	0.000
TC	5.63±0.82	4.59±0.75	0.001
LDL-C	3.82±0.94	2.80±0.59	0.001
HDL-C	1.14±0.44	1.78±0.57	0.002
TG	1.18±0.65	1.50±0.58	0.161

BMI:体重指数;EF%:射血分数;ACEI:血管紧张素抑制剂;Glu:血糖;TC:总胆固醇;LDL-C:低密度脂蛋白胆固醇;HDL-C:高密度脂蛋白胆固醇;TG:三酰甘油

表 4　*Logistic* 回归分析导致桥血管病变的危险因素结果

	β_j	S.E.	Wald	P	OR_j	OR_j 95% CI
LDL-C	1.491	0.738	4.083	0.043	4.443	1.046~18.877
Glu	1.744	0.710	6.083	0.014	5.720	1.422~23.009
β_0	-15.462 5.169	8.946	0.003	0.000		

LDL-C:低密度脂蛋白胆固醇;Glu:血糖;β_0:常数项;β_j:回归系数;S.E.:标准误;Wald:回归模型的假设检验;OR_j:优势比;OR_j 95% CI:OR_j 95%可信区间

本研究中术后患者均常规服用阿司匹林 100mg/d,个体化服用控制血糖、血脂、血压等药物治疗,未常规服用他汀类降血脂药物,将各种因素进行单因素分析,发现手术年龄、糖尿病史、弥漫性病变、复诊时心功能Ⅲ~Ⅳ级、Glu、TC、LDL-C、HDL-C 可能与 CABG 术后桥血管病变有关。并进一步进行 *Logistic* 回归,得到 LDL-C、Glu 是导致桥血管病变的危险因素的结论,且血糖对桥血管病变的作用大于低密度脂

蛋白胆固醇,这与文献报道结果相近。因此,CABG 术后患者加强血脂监控和调脂治疗并注意血糖控制对提高桥血管的远期通畅率具有重要意义。CABG 术后服用抗血小板药物可以有效抑制血管内膜的增生而提高桥血管的通畅率,阿司匹林已成为术后常规用药,终生服用。有研究认为,术后早期(6h)服用小剂量(100mg)阿司匹林不仅能较好地改善 CABG 术后移植物的通畅率,还能降低 CABG 的病死率,减少 CABG 术后相关并发症的发生[5]。对怀疑有阿司匹林抵抗者,术后早期小剂量(75mg/d)的氯吡格雷能起到较好的作用[6]。虽然作为一种诊断价值很高的无创性检查手段,MSCTA 相对 ICA 具有诸多优点,但由于需要注射造影剂,且费用仍较高,CABG 术后患者尤其是无症状患者对此检查的接受程度仍相对有限。此外,MSCTA 检查本身应用也有局限性。本研究为单中心回顾性分析,可供采用的样本量较小,且术中未常规测量桥血管血流流速、流量、靶血管管径,因此本研究未能分析桥血管病变与上述变量的关系。关于导致桥血管病变危险因素的进一步研究还有待临床继续扩大样本量,并应努力加强 CABG 术后患者的宣教和随访干预,强化患者健康意识和随访意识。

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