

DeBakey I 型主动脉夹层术后急性肾损伤的危险因素分析

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【摘要】 目的:分析急性 DeBakey I 型主动脉夹层术后急性肾损伤的危险因素并探讨肾脏保护措施。 方法:回顾性分析 2000 年 7 月至 2018 年 5 月 365 例接受手术的急性 DeBakey I 型主动脉夹层患者,根据患者术后是否发生急性肾损伤分为急性肾损伤组和无急性肾损伤组,对两组术前、术中、术后相关临床特征进行比较,多因素条件 logistic 回归方法分析术后急性肾损伤的独立危险因素。 结果:55 例患者术后出现急性肾损伤,急性肾损伤组年龄明显大于无急性肾损伤组,术前合并马凡综合征、术前肾功能异常、术前心包积液、术前冠状动脉粥样硬化的比例均明显高于无急性肾损伤组,术中心肺转流时间、主动脉阻断时间、输注红细胞量、输注血小板量、术后 24 h 胸腔积液量均明显高于无急性肾损伤组,术前左室射血分数(LVEF)和术后血小板-淋巴细胞比值(PLR)则均明显低于无急性肾损伤组(P 均 <0.05)。多因素 logistics 回归分析显示术后发生肾损伤的独立危险因素为年龄 >55.5 岁($OR=4.292, 95\%CI:2.069\sim8.900, P<0.001$)、术前肾功能异常($OR=3.601, 95\%CI:1.632\sim7.945, P=0.002$)、心包积液($OR=2.230, 95\%CI:1.113\sim4.469, P=0.024$)、术后 24 h 胸腔积液引流量 >745 mL($OR=3.023, 95\%CI:1.484\sim6.158, P=0.002$)及术后 PLR 降低($OR=1.004, 95\%CI:1.001\sim1.006, P=0.018$)。结论:高龄、术前合并肾功能异常、心包积液、术后 24 h 胸腔积液量和术后 PLR 降低是急性 DeBakey I 型主动脉夹层患者术后发生急性肾损伤的独立危险因素。

【关键词】 胸主动脉夹层;急性肾损伤;危险因素

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【Abstract】 Objective: To analyze the risk factors of acute kidney injury (AKI) after surgery in patients with acute DeBakey I aortic dissection and to explore the renal protection measures. **Methods:** The records of 365 patients with acute DeBakey I aortic dissection who underwent operation from July 2000 to May 2018 were reviewed retrospectively. According to the occurrence of AKI after operation, they were divided into AKI group and non-AKI group. The clinical characteristics before, during and after operation were compared between the two groups. The multivariable conditional logistic regression models were used to identify risk factors of AKI after operation. **Results:** Fifty-five patients suffered from AKI after operation. The patients in AKI group were older than non-AKI group. And the proportion of patients with Marfan syndrome, preoperative renal disorder, pericardial effusion, and tear of the coronary sinus were higher than non-AKI group. In AKI group, the cardiopulmonary bypass time, aortic occlusion time, intraoperative red blood cell transfusion, intraoperative platelet transfusion

and postoperative 24-hour pleural fluid volume increased significantly; the left ventricular ejection fraction and postoperative platelet-lymphocyte ratio (PLR) were lower (all $P < 0.05$). Multivariate logistic regression analysis showed that age above 55.5 (OR = 4.292, 95% CI 2.069-8.900, $P < 0.001$), preoperative renal insufficiency (OR = 3.601, 95% CI 1.632-7.945, $P = 0.002$), pericardial effusion (OR = 2.230, 95% CI 1.113-4.469, $P = 0.024$), postoperative 24-hour pleural effusion fluid volume above 745 mL (OR = 3.023, 95% CI 1.484-6.158, $P = 0.002$), and postoperative PLR (OR = 1.004, 95% CI 1.001-1.006, $P = 0.018$) were risk factors for AKI after operation. **Conclusions:** Age, preoperative renal insufficiency, pericardial effusion, postoperative 24-hour pleural effusion and postoperative PLR are risk factors of AKI after operation in patients with acute DeBakey I aortic dissection.

【Key words】 Thoracic aortic dissection; Acute kidney injury; Risk factors

急性主动脉夹层是一种危及生命的严重心血管疾病,分为 DeBakey I、II、III 型,开放性外科手术是胸主动脉夹层的主要手术方法^[1]。急性肾损伤是心脏外科手术后常见的并发症,占手术患者的 5%~30%^[2],可增加患者术后致死性心血管疾病的发生率和死亡率^[3-4]。明确急性主动脉夹层术后肾损伤的危险因素有助于针对性观测患者临床指标,为预防和减少术后急性肾损伤的发生提供干预依据,有助于改善患者预后,减少早期和远期死亡率。

1 对象与方法

1.1 病例资料

回顾性分析海军军医大学附属长海医院胸心外科 2000 年 7 月至 2018 年 5 月手术治疗的 365 例急性 DeBakey I 型主动脉夹层患者,其中男性 272 例,女性 93 例,年龄 19~78 岁,平均 (49.46 ± 12.81) 岁,年龄 ≥ 55.5 岁 124 例 (34%), 年龄 ≤ 55.5 岁 241 例 (66%)。患者术前合并马凡综合征 34 例 (9.3%), 糖尿病 15 例 (4.1%), 高血压 224 例 (61.3%), 冠状动脉粥样硬化性心脏病 (冠心病) 11 例 (3.0%), 术前肾功能异常 66 例 (18.1%); 有吸烟史 104 例 (28.4%)。手术中心肺转流时间 (CBPT) 150.91 (21~195) min, 主动脉阻断时间 (ACCT) 90.91 (37~184) min。术后二次开胸止血 21 例 (5.8%)。

1.2 分组和相关定义

根据术后急性肾损伤发生情况将患者分为急性肾损伤组和无急性肾损伤组。参照 RIFLE 分类标准^[5],术后血肌酐水平在 7 d 内较术前上升 ≥ 2 倍或者肾小球滤过率下降 50% 以上即可诊断为术后急性肾损伤。术前肾功能异常是指术前检查中血肌酐或尿素氮水平高于正常值。住院死亡定义为术后住院期间死亡或经随访确定在转院后 30 d 内死亡。

1.3 统计学分析

采用 SPSS 20.0 软件对数据进行统计学分析。呈正态分布的计量资料使用均数 ± 标准差表示,非

正态分布的计量资料使用中位数和四分位间距表示,分别采用 t 检验或 Mann-Whitney 检验。计数资料以例数和百分比表示,采用卡方检验或 Fisher 精确检验。绘制年龄的受试者工作特征曲线 (ROC 曲线),选取单因素分析中 $P < 0.05$ 的变量对术后肾损伤的危险因素进行多因素条件 logistic 回归分析。 $P < 0.05$ 为差异有统计学意义。

2 结果

2.1 患者一般临床特征

在 365 例 DeBakey I 型急性主动脉夹层患者中,发生急性肾损伤者 55 例 (急性肾损伤组),未发生急性肾损伤者 310 例 (无急性肾损伤组),其中 1 例患者术后发生肾损伤,22 d 后肾功能恢复。两组性别、身高、体质量、体质量指数 (BMI)、吸烟史、动脉氧分压 < 95% 的比例,合并症 (高血压、糖尿病、冠心病),血小板-淋巴细胞比值 (PLR)、中性粒细胞-淋巴细胞比值 (NLR)、红细胞分布宽度 (RDW) 的差异均无统计学意义。ROC 曲线中约登指数 = 灵敏度 + 特异度 - 1,最大的约登指数所对应的临界值对于诊断试验具有较高的灵敏度及特异度。通过分析年龄诊断术后急性肾损伤的 ROC 曲线,约登指数最大时的临界值为 55.5 岁,可以作为最佳的诊断界值,见图 1。急性肾损伤组年龄 > 55.5 岁 ($P < 0.001$)、术前肾功能异常 ($P = 0.002$)、术前心包积液 ($P = 0.005$)、术前冠状窦撕裂 ($P = 0.004$)、合并马凡综合征 ($P = 0.038$) 的比例均明显高于无急性肾损伤组,术前左室射血分数 (LVEF) ($P = 0.037$) 明显低于无急性肾损伤组,见表 1。

2.2 术后一般情况及单因素分析

365 例患者术后死亡 56 例 (15.3%),其中急性肾损伤组 42 例 (75%),无急性肾损伤组 14 例 (25%),两组术后死亡率的差异有统计学意义 ($P < 0.001$)。与无急性肾损伤组相比,急性肾损伤组术后并发脑卒中和感染的比例明显升高,ICU 监护时

间和住院时间明显延长,心肺转流时间(CBPT)、主动脉阻断时间(ACCT)、术中输注红细胞量、术中输注血小板量和术后 24 h 胸腔积液引流量均明显增加,而术后 PLR 明显降低(P 均 <0.05)。见表 2。根据 ROC 曲线,术后 24 h 胸腔积液引流量诊断术后急性肾损伤的最佳诊断界值为 745 mL。

2.3 多因素条件 logistic 回归分析

多因素条件 logistics 回归分析发现,急性主动脉夹层术后发生肾损伤的独立危险因素为年龄 >55.5 岁($OR = 4.292, 95\%CI: 2.069 \sim 8.900, P < 0.001$)、术前肾功能异常($OR = 3.601, 95\%CI: 1.632 \sim 7.945, P = 0.002$)、心包积液($OR = 2.230, 95\%CI: 1.113 \sim 4.469, P = 0.024$)、术后 24 h 胸腔积液引流量 >745 mL($OR = 3.023, 95\%CI: 1.484 \sim 6.158, P = 0.002$)及术后 PLR 降低($OR = 1.004, 95\%CI: 1.001 \sim 1.006, P = 0.018$)。见表 3。

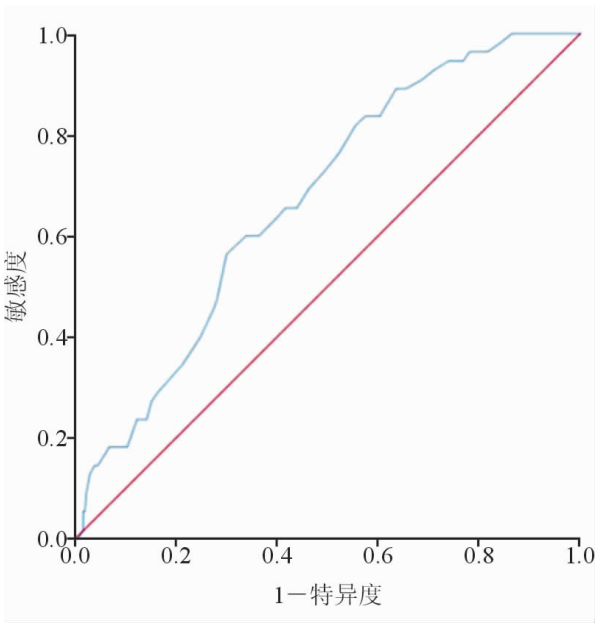


图 1 年龄诊断术后急性肾损伤的 ROC 曲线

表 1 两组术前变量的单因素分析

变量	急性肾损伤组($n = 55$)	无急性肾损伤组($n = 310$)	P 值
年龄/岁	55.98 \pm 10.52	48.30 \pm 12.84	<0.001
年龄 >55.5 岁/例(%)	31(56.4)	93(30.0)	<0.001
男性/例(%)	40(72.7)	232(74.8)	0.741
体质量/kg	70.60 \pm 13.07	76.65 \pm 43.05	0.303
身高/cm	166.73 \pm 7.86	169.85 \pm 11.36	0.051
体质量指数/kg \cdot m ⁻²	25.32 \pm 3.76	27.64 \pm 24.20	0.480
马凡综合征/例(%)	1(1.8)	33(10.6)	0.038
吸烟史/例(%)	18(32.7)	86(27.7)	0.450
糖尿病/例(%)	3(5.5)	12(3.9)	0.586
高血压/例(%)	40(72.7)	184(59.4)	0.061
冠心病/例(%)	2(3.6)	9(2.9)	0.769
肾功能异常/例(%)	18(32.7)	48(15.5)	0.002
动脉氧分压 $<95\%$ /例(%)	1(1.8)	8(2.6)	0.737
左室射血分数/%	57.66 \pm 7.63	59.88 \pm 7.16	0.037
心包积液/例(%)	24(43.6)	78(25.2)	0.005
冠状动脉窦撕裂/例(%)	16(29.1)	42(43.5)	0.004
胸腔积液/例(%)	4(7.3)	15(4.8)	0.454
术前血小板-淋巴细胞比值/%	206.64 \pm 136.91	202.11 \pm 112.92	0.791
术前中性粒细胞-淋巴细胞比值/%	15.92 \pm 12.41	12.24 \pm 8.27	0.065
术前红细胞分布宽度/fL	13.17 \pm 1.04	13.11 \pm 1.28	0.716

表 2 两组术中与术后变量的单因素分析

变量	急性肾损伤组 (n = 55)	无急性肾损伤组 (n = 310)	P 值
心肺转流时间/min	162.47 ± 42.30	148.85 ± 37.24	0.015
主动脉阻断时间/min	97.85 ± 28.39	89.68 ± 25.87	0.034
选择性脑灌注时间/min	28.84 ± 21.37	25.67 ± 11.52	0.109
停循环温度>25℃/例(%)	53(96.4)	296(95.5)	0.769
顺行灌注/例(%)	55(100.0)	306(98.7)	0.397
输注红细胞量/mL	1 000.00 ± 880.24	666.06 ± 631.22	0.003
输注血浆量/mL	592.73 ± 443.83	457.87 ± 628.04	0.134
输注血小板量/ mL	12.00 ± 4.87	10.76 ± 4.10	0.044
输注冷沉淀量/ mL	11.00 ± 4.04	10.08 ± 4.10	0.124
术后血小板-淋巴细胞比值/%	151.27 ± 119.05	248.59 ± 213.69	<0.001
术后中性粒细胞-淋巴细胞比值/%	19.43 ± 11.47	22.70 ± 12.65	0.075
术后红细胞分布宽度/fL	13.98 ± 1.21	13.95 ± 4.73	0.950
术后 24 h 胸腔积液/mL	816.36 ± 557.53	514.15 ± 325.64	<0.001
术后 24 h 胸腔积液>745 mL/例(%)	24(43.6)	55(17.7)	<0.001
二次开胸止血/例(%)	5(9.1)	16(5.2)	0.249
术后脑卒中/例(%)	6(10.9)	8(2.6)	0.003
术后感染/例(%)	24(43.6)	23(7.4)	<0.001
死亡/例(%)	42(76.4)	14(4.5)	<0.001
住院时间/d	23.65 ± 27.78	21.29 ± 11.04	0.02
ICU 监护时间/d	18.04 ± 22.62	8.28 ± 7.70	0.018

表 3 术后发生肾损伤的危险因素的多因素 logistic 回归分析

危险因素	B 值	SE	Wald	df	P 值	OR	95%CI
年龄>55.5 岁	1.457	0.372	15.322	1	<0.001	4.292	2.069~8.900
术前肾功能异常	1.281	0.404	10.073	1	0.002	3.601	1.632~7.945
术前心包积液	0.802	0.355	5.113	1	0.024	2.230	1.113~4.469
术后 24 h 胸腔积液>745 mL	1.106	0.363	9.283	1	0.002	3.023	1.484~6.158
术后血小板-淋巴细胞比率	0.004	0.001	5.575	1	0.018	1.004	1.001~1.006

3 讨论

随着主动脉夹层手术方法、插管策略、脑灌注和温度管理等方面的改进,急性主动脉夹层患者的生存率有所提高^[6-8]。主动脉无钳夹技术、深低温停循环技术(DHCA)以及心肺转流术后的顺行灌注进一步改善了主动脉夹层患者的长期预后^[9]。尽管如此,主动脉夹层术后死亡率依然较高,影响 I 型主动脉夹层手术患者预后的一个主要并发症是术后急性肾损伤^[10]。目前认为心脏手术后发生急性肾损伤的主要危险因素包括高龄、高血压、术前肾功能异常、LVEF≤55%、术前血红蛋白<100 g/L、白蛋白<40 g/L、心肺转流时间≥180 min、手术时间>7 h 以及大量输入红细胞等^[8,11-14]。

随着年龄的增长,肾单位的减少、肾小球毛细血管压的增加等病理改变使急性主动脉夹层患者肾功能下降,耐受力降低^[15]。主动脉夹层手术过程

中低温、停循环、主动脉阻断等手术创伤可对肾功能造成损伤。已有研究表明年龄>70 岁是急性主动脉夹层术后发生急性肾损伤的重要危险因素^[13]。本研究发现,年龄>55.5 岁是 I 型主动脉夹层术后发生肾损伤的独立危险因素,这可能与统计病例中患者高血压、冠心病等基础疾病的年轻化有关。

术前肾功能异常与心脏术后急性肾损伤的发生密切相关^[14]。本研究也证实了术前肾功能异常是术后急性肾损伤的独立危险因素。急性主动脉夹层患者术前肾功能异常的发生主要是由于炎性反应、主动脉撕裂和心包积液引起肾脏灌注不全,而术中的体外循环导致肾脏灌注方式的改变和进一步的缺血再灌注损伤^[16]。因此,术前肌酐、尿素氮水平的检测对预测急性肾损伤的发生具有一定的价值。

术前心包积液是主动脉夹层患者死亡的重要

危险因素^[17]。心包积液会引起心输出量和血压的下降,进而降低肾灌注量。有研究显示,单纯心包积液引起的急性肾损伤较为罕见^[18],但本研究提示术前合并心包积液是 I 型急性主动脉夹层患者术后肾损伤的独立危险因素,但心包积液量与急性主动脉夹层术后急性肾损伤的关系有待进一步研究。

胸腔积液在心脏手术后较为常见,原因包括各种临床因素如心力衰竭、心律失常和抗凝剂的使用,而且术前合并胸腔积液的患者术后并发症的发生率增加^[19]。本研究提示术后 24 h 胸腔积液量的增加是 I 型急性主动脉夹层患者术后发生急性肾损伤的独立危险因素,对于提示术后急性肾损伤的发生具有重要意义。

非内皮化的假腔和管腔湍流在术前激活了急性主动脉夹层患者的凝血系统^[20],而术中体外循环和低温环境会加剧血小板的消耗和功能障碍^[21]。研究表明,PLR 与急性主动脉夹层的诊断有显著相关性。本研究提示术后 PLR 是急性主动脉夹层患者术后发生急性肾损伤的独立危险因素,原因可能是炎性细胞,如巨噬细胞、自然杀伤细胞、淋巴细胞和中性粒细胞浸润并破坏肾脏组织^[22]。PLR 可提示全身的炎症反应,并可预示心血管疾病的不良预后^[23]。

本研究为回顾性研究,有一定局限性:选取的病例数量有限,时间跨度较大,术者和术式有差异。通过相关统计学分析,本研究得出 DeBakey I 型主动脉夹层术后出现急性肾损伤的患者并发脑卒中、感染和死亡的比例,ICU 治疗时间和住院时间显著增加。急性主动脉夹层术后发生急性肾损伤的危险因素很多,除了年龄、心肺转流时间等因素外,术前冠状窦撕裂、合并心包积液、术后 24 h 胸液量以及术后 PLR 的降低均是术后发生急性肾损伤的相关危险因素,这对于围手术期预估 DeBakey I 型主动脉夹层术后急性肾损伤的发生具有重要意义,同时为尽早通过肾脏替代治疗或者其他相关措施干预术后急性肾损伤的发生提供了临床依据。

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