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老年骨科手术患者麻醉后认知功能障碍的多因素分析及模型预测初步研究 *

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摘要 目的：探讨分析影响老年骨科手术患者麻醉后的认知功能障碍的因素并建立预测模型。**方法：**将 2016 年 1 月至 2019 年 1 月于我院骨科行手术的 227 例老年患者根据术后认知功能障碍评分分为认知障碍组及无障碍组，比较两组一般资料及手术方式、麻醉方式等手术相关因素，使用多因素 Logistic 回归模型分析影响术后认知功能障碍发生的因素，使用 R 软件建立出现认知功能障碍的列线图预测模型，并验证其效能。**结果：**术后共有 65 例患者出现认知功能障碍，认知障碍组患者的年龄、行全麻的患者比例、术中失血量、手术时间及出现术后并发症患者比例均明显高于无障碍组，而术中血压及应用超前镇痛患者比例均明显低于无障碍组(均 P＜0.05)；而两组患者性别、BMI 及手术部位等指标则无明显差异(均 P＞0.05)；多因素 Logistic 回归分析示高龄、全麻、术中失血量过多、过长手术时间及术后出现并发症均是老年骨科手术患者术后出现认知障碍的独立危险因素(OR=1.077,3.796,3.826,1.712,6.937； 均 P＜0.05)； 而术中高收缩压、舒张压及术前给予超前镇痛是术后出现认知功能障碍的保护因素(OR=0.953,0.913,0.333；均 P＜0.05)；列线图预测认知功能障碍发生的一致性指数(C-index)为 0.904(95%Cl 0.862~0.961)。**结论：**高龄、全麻、无超前镇痛、手术时间过长、术中失血量过多、术中低血压及术后出现并发症是出现术后认知功能障碍的危险因素，基于此构建的列线图可有效对术后认知功能障碍进行预测，具有较好的临床应用价值。

关键词：老年骨科；麻醉后；认知功能障碍；预测模型

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Cognitive Dysfunction in Elderly Patients after Orthopedic Surgery Multi-factor Analysis and Preliminary Study of Model Prediction*

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ABSTRACT Objective: Analyze the factors that affect the cognitive dysfunction after anesthesia in elderly orthopedic surgery patients, and establish a predictive model. **Methods:** According to the postoperative cognitive dysfunction score, 227 elderly patients undergoing surgery in our hospital's orthopedics from January 2016 to January 2019 were divided into cognitive impairment group and barrier-free group. Compare the general information, surgical methods, anesthesia methods and other surgical related factors between the two groups, using the multivariate logistic regression model to analyze the factors that affect postoperative cognitive dysfunction, using the R software to establish a nomogram prediction model for cognitive dysfunction and verify its effectiveness. **Results:** After surgery 65 patients had cognitive dysfunction. The age, the proportion of patients undergoing general anesthesia, the amount of blood loss during surgery, the duration of surgery, and the proportion of patients with postoperative complications of the patients in the cognitive impairment group, were significantly higher than those in the barrier-free group, the intraoperative blood pressure and the proportion of patients with advanced analgesia were significantly lower than those in the barrier-free groups (both P<0.05); while there were no significant differences between the two groups in terms of gender, BMI, surgical site and the other indexes (both P>0.05); multiple factors Logistic regression analysis showed that advanced age, general anesthesia, excessive blood loss during operation, excessive operation time and postoperative complications are independent risk factors for postoperative cognitive impairment in elderly orthopedic surgery patients (OR=1.077, 3.796, 3.826, 1.712, 6.937; both P<0.05); high intraoperative systolic blood pressure, diastolic blood pressure, and preoperative analgesia given before surgery are protective factors for cognitive dysfunction after surgery (OR=0.953, 0.913, 0.333; both P<0.05); the nomogram predicts the consistency index (C-index) of cognitive dysfunction occurrence is 0.904 (95% Cl 0.862~0.961). **Conclusion:** Old age, general anesthesia, no advanced analgesia, long operation time, excessive blood loss during operation, intraoperative hypotension and postoperative complications are risk factors for cognitive dysfunction after operation The map can

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effectively predict postoperative cognitive dysfunction and has good clinical application value.

Key words: Geriatric orthopedics; After anesthesia; Cognitive dysfunction; Predictive model

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前言

术后认知功能障碍（Postoperative cognitive dysfunction，POCD）是麻醉后中枢神经系统最常见的并发症，以认知功能障碍、人格改变及记忆障碍为主要表现，多见于老年患者[1,2]。POCD 可使患者术后并发症的风险上升，延长患者术后恢复期，增加患者住院时间，使患者死亡率上升[3]。更重要的是，这种短期功能障碍可发展成为阿尔茨海默症等永久性的认知障碍[4-6]，能使患者失去独立生活的能力[7]，给患者身心造成伤害，严重影响患者的生活质量[8]。目前研究表明 POCD 的发病率约为 10%~54%，与高龄、全麻等因素相关[9,10]。但目前临床尚无较为准确、具体的预测标准，故难以对其进行有效预测[11,12]。故本试验基于此，对影响老年患者术后出现 POCD 的指标进行多因素回归分析，并根据影响因素制作列线图，以提供较为直观、个性化的预测方法，便于临床使用，现将研究结果报道如下。

1 资料及方法

1.1 一般资料

将 2016 年 1 月至 2019 年 1 月 227 例于我院行骨科手术的老年患者纳入研究，根据术后是否出现认知功能障碍将其分为认知障碍组及无障碍组。纳入标准：① 年龄≥ 65 岁；② 骨折行手术治疗的患者；③ 病例资料完整者。排除标准：① 不符合纳入标准者；② 术前合并意识障碍、精神疾病者；③ 术后合并神经损伤、血栓形成者。

1.2 认知功能障碍的诊断标准

采用 MoCA 评分[13]对患者术后 1 天及 7 天对的认知功能进行评价，总分 30 分，其中包括视空间 / 执行功能 5 分，命名 3 分，注意 6 分，语言 3 分，抽象 2 分，延迟回忆（记忆）5 分，定向力 6 分，≥ 24 分为正常，＜24 分为认知功能障碍，为校正受教育程度的偏倚，教育年限≤ 12 年加 1 分，在 10 min 内完成评分，若术后 1 天及 7 天的 MoCA 评分均＜24 诊断为认知功能障碍。

1.3 方法

麻醉医师术前评估后给予患者制定相应的麻醉方式，待患者进入手术室后开放静脉通路，常规心电、血压及血氧饱和度监测，术中予以持续低流量吸氧，记录患者的麻醉方式，手术时间，术中失血量及术后是否出现并发症。

1.4 数据处理

采用 SPSS 22.0 进行数据处理，计数资料用例数（构成比）n(%)表示，使用 χ^2 检验进行比较；计量资料用均数±标准差($\bar{x}\pm s$)表示，使用 t 检验，应用 Logistic 回归分析影响 POCD 的因素，使用 R 软件（x64 for Windows，3.6.1）建立预测 POCD 的列线图预测模型，应用一致性指数（C-index）量化模型预测性能，并对其进行 Bootstrap 内部验证，绘制校正曲线。以 P＜0.05 具有统计学差异。

2 结果

2.1 两组患者的一般资料的比较

共有 65 例患者术后出现认知功能障碍，对两组患者的一般资料进行比较，结果表明，认知障碍组患者的年龄明显高于对照组（t=3.261，P=0.001），而两组患者的性别、BMI 等一般资料间无明显差异（均 P＞0.05），见表 1。

2.2 两组患者手术相关因素比较

认知障碍组行全麻患者的比例、术中失血量、手术时间及出现术后并发症患者比例均明显高于无障碍组，超前镇痛患者比例及术中血压均明显低于无障碍组（均 P＜0.05），而两组患

表 1 两组患者一般资料的比较

Table 1 The comparison of general clinical data of patients between two groups

Projects	Cognitive impairment group (n=65)	Barrier-free group(n=162)	t/χ^2	P
Age($\bar{x}\pm s$; year)	75.23±6.48	72.31±5.94	3.261	0.001
Gender (male/female)	41/24	95/67	0.380	0.538
BMI($\bar{x}\pm s$/m^2)	20.98±3.15	21.07±3.29	0.189	0.851
Diseases(n)				
hypertension	27	65	0.039	0.844
CAD	18	41	0.137	0.711
diabetes	15	32	0.312	0.576
COPD	12	25	0.312	0.576
Years of education(n)				
≥2 year	22	51	0.119	0.730
＜2 year	43	111		

者的骨折部位比较则无明显差异(均 P＞0.05),见表 2。

表 2 两组患者手术相关因素比较

Table 2 The comparison of operation correlation factors between two groups

Operation correlation factors	Cognitive impairment group(n=65)	Barrier-free group(n=162)	t/χ^2	P
Fracrure site(n)				
thoracolumber	27	61	0.295	0.587
intertrochanteric	26	67	0.035	0.851
the lower limb	7	12	0.684	0.408
the upper limb	3	22	3.804	0.051
Type of anesthesia(n)				
intrathecal block	52	146	4.266	0.039
general anesthesia	13	16		
Pre-emptive analgesia(n)				
yes/ no	26/39	89/73	4.141	0.042
Intraoperative BP ($\bar{x}\pm s$; mmHg)				
SBP	115.23±12.78	121.78±13.95	3.274	0.001
DBP	62.54±8.72	68.21±9.56	4.140	0.000
Amount of bleeding ($\bar{x}\pm s$; L)	2.35±0.71	2.03±0.65	3.265	0.001
Time($\bar{x}\pm s$; h)	3.91±1.15	3.32±1.09	3.629	0.000
Complication(n)				
yes/ no	14/51	13/149	4.799	0.028

2.3 影响认知功能障碍的多因素 Logistic 回归分析

多因素 Logistic 回归分析示高龄、全麻、术中失血量过多、手术时间过长及出现术后并发症均是老年骨科手术患者术后发生认知障碍的独立危险因素（OR=1.077, 3.796, 3.826, 1.712, 6.937；均 P＜0.05),而术中高收缩压、舒张压及有超前镇痛则是其独立保护因素（OR=0.953, 0.913, 0.333；均 P＜0.05),见表 3。

表 3 认知功能障碍的多因素 Logistic 分析

Table 3 The Logistic regression on multiple factors analysis of POCD

Factors	B	SE	Wald	P	OR	95% CI	
						Lower limit	Upper limit
Ages	0.075	0.031	5.800	0.016	1.077	1.014	1.145
SBP	-0.048	0.015	10.049	0.002	0.953	0.925	0.982
DBP	-0.091	0.023	16.270	0.000	0.913	0.873	0.954
Type of anesthesia	1.334	0.591	5.103	0.024	3.796	1.193	12.080
Pre-emptive analgesia	-1.100	0.480	5.248	0.022	0.333	0.130	0.853
Amount of bleeding	1.342	0.309	18.844	0.000	3.826	2.088	7.014
Time	0.537	0.181	8.770	0.003	1.712	1.199	2.443
Complication	1.937	0.620	9.770	0.002	6.937	2.059	23.371
Constant	-1.112	3.114	0.128	0.721	0.329		

3 讨论

以往研究显示患者术后 7 天 POCD 的发病率为 16%~40%,而术后 3 个月 POCD 发病率为 10%~30%,且年龄不同

发病率不同[14-16]。本试验结果表明老年患者术后 1 周 POCD 的发生率为 28.6%，与上述研究一致。

本研究通过对影响老年患者术后出现 POCD 的因素进行分析，结果显示高龄、全麻、术中失血量过多、过长手术时间及术后并发症均是老年骨科手术患者术后发生认知障碍的危险因素，而术中高收缩压、舒张压及超前镇痛则是其独立保护因素。

随着患者年龄的增加，患者对手术创伤、麻醉应激等因素造成的氧化损伤、神经元水肿及脱髓鞘改变的应激能力下降；而外科手术创伤可使脑肥大细胞脱颗粒，小胶质细胞激活及炎性细胞因子释放，损伤神经元[17,18]；此外，全麻药物的使用能使神经系统改变进一步加剧，神经元节律的中断，诱发神经细胞凋亡，从而增加 POCD 的发生风险[19]。而超前镇痛能缩短手术时间，降低创伤应激，减少炎性介质释放及麻醉、镇静药物的摄入量，从而降低 POCD 风险[20-23]。

此外，超前镇痛能降低外周及中枢神经的敏感程度，控制刺激信号的程度及幅度，维持围手术期的生理指标平衡[24,25]；若术中低血压及失血过多则能使脑灌注不足，损伤海马神经及基底节神经，而上述神经损伤则与认知功能障碍密切相关[26,27]。相关研究表明急性低血压患者的 POCD 发生率可达 38.63%~44.16%[28-30]。

且应用 R 软件，根据多因素 Logistic 回归分析结果建立预测 POCD 发生风险的列线图模型显示随着年龄、术中失血量及手术时间增加，列线图模型评分随之增加；而术中收缩压及舒张压降低，列线图模型评分亦随之增加；而合并术后并发症、无超前镇痛、全麻及出现并发症患者的评分高于无上述指标的患者，相应的其发生 POCD 的风险增加，列线图预测 POCD 发生风险的 C-index 为 0.904（95%Cl 0.862~0.961），区分度良好。采用 Bootstrap 自抽样方式，对样本重复自抽样 1000 次对模型进行内部验证，获得校正曲线，结果表明列线图预测 POCD 发生风险与实际 POCD 发生风险平均绝对误差为 0.019，一致性良好，具有较好的临床应用价值。

综上所述，高龄、全麻、术中失血量过多、过长手术时间及术后并发症等因素是导致 POCD 发生的主要影响因素，且基于此建立的列线图可有效预测老年骨科患者术后 POCD 的发生情况，并具有较好的应用价值。但同时本研究仍存在以下不足：POCD 的具体发生机制及与各种危险因素间的相互作用仍不明确；亦有相关研究得出的危险因素结果与本研究不尽相同；且单中心研究具有一定的局限性等。

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