·临床研究·

重症监护病房非心脏手术患者术后新发房颤危险因素

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【摘 要】 **目的** 调查重症监护病房(ICU)非心脏手术患者术后新发房颤(POAF)的发生情况,分析其危险因素及对近期预后的影响。**方法** 采用回顾性、病例配对的方法。在2011年1月至2013年12月期间收住ICU的非心脏手术后成年患者2586例中,筛查术后住院期间新发房颤病例。按照1∶2的比例,选择年龄、性别和手术部位相同的病例作为对照组。采用SPSS 21.0统计软件对数据进行分析。多因素logistic回归分析筛选危险因素。比较2组患者的近期结局。**结果** 2.7%(71/2586)出现术后新发房颤。高龄(年龄≥75岁)及胸科手术患者术后新发房颤发生率高。在术后新发房颤患者中,77.5%(55/71)出现在术后3 d以内,仅33.8%(24/71)患者有不适主诉。在配对人群中,脓毒症(*OR*=11.81,95% *CI* 1.72~81.00,*P*=0.012)、低钾血症(*OR*=19.48,95% *CI* 2.31~164.09,*P*=0.006)、术后急性充血性心力衰竭(*OR*=9.91,95% *CI* 1.92~51.22,*P*=0.006)及新发其他类型心律失常(*OR*=20.32,95% *CI* 3.51~117.55,*P*=0.001)是术后新发房颤的独立危险因素。术后新发房颤伴随机械通气时间及ICU停留时间延长及住院死亡率增高。**结论** 非心脏手术入ICU的患者中术后新发房颤发生率为2.7%,多见于高龄(≥75岁)和胸科手术患者。在病例配对人群中,脓毒症、急性充血性心力衰竭、低钾血症和新发非房颤心律失常是术后新发房颤的危险因素。新发房颤伴随预后恶化。

【关键词】 心房颤动;围手术期;高龄;术后并发症
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Risk factors of new-onset postoperative atrial fibrillation in critically ill patients after non-cardiac surgery

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【**Abstract**】 **Objective** To investigate the occurrence of new-onset postoperative atrial fibrillation (POAF) in intensive care unit (ICU) patients after non-cardiac surgery, and to analyze its risk factors and impact on short-time outcomes. **Methods** A retrospective nested case-control study was conducted among the 2586 cases who underwent non-cardiac procedures and then admitted into ICU in the period from January 2011 to December 2013. Those with new-onset POAF during hospitalization were screened out. Control patients who were matched in age, gender and location of surgery were selected at a 1∶2 ratio. SPSS statistics 21.0 was used to perform the statistical analysis. Risk factors were screened with multivariate logistic regression analysis. Early postoperative outcomes were compared between the 2 groups. **Results** Among the subjects, 2.7% (71/2586) developed new-onset POAF. The incidence was quite higher in those very old (≥75 years old) and in those after intra-thoracic surgery. In the patients who developed new-onset POAF, 77.5% (55/71) occurred within 3 d postoperatively, and only 33.8% (24/71) complained of discomfort. Sepsis (*OR*=11.81, 95% *CI* 1.72-81.00, *P*=0.012), hypokalemia (*OR*=19.48, 95% *CI* 2.31-164.09, *P*=0.006), postoperative acute congestive heart failure (*OR*=9.91, 95% *CI* 1.92-51.22, *P*=0.006), and new-onset non-atrial fibrillation arrhythmias (*OR*=20.32, 95% *CI* 3.51-117.55, *P*=0.001) were independent risk factors for new-onset POAF in the matched patients. Higher in-hospital mortality was associated with longer mechanical ventilation and ICU stay in these patients. **Conclusion** The incidence of new-onset POAF is 2.7% in the patients admitted to ICU after non-cardiac surgery. The condition is more common in the very elderly (≥75 years old) and those after intra-thoracic surgery. Sepsis, acute congestive heart failure, hypokalemia and new-onset non-AF arrhythmias are independent risk factors of POAF in the matched patients. New-onset POAF is deteriorated with worse outcomes.

【**Key words**】 atrial fibrillation; perioperative period; very old; postoperative complications
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心房颤动(简称房颤)是一种临床常见的心律失常,也是围手术期最常见的心律失常之一。文献报道,术后房颤发生率在非心脏手术患者为8%,在非心脏胸科手术患者为3%~30%,在心脏手术患者可达16%~46%[1]。术后房颤的发生会导致预后恶化,如住院时间延长、医疗花费增加及死亡率上升[2]。随着人口老龄化,房颤的发病率较10年前又有进一步升高,成为导致医疗资源消耗增长的原因之一[3]。国内外关于房颤发病率及危险因素的研究并不鲜见,但对非心脏手术后入重症监护病房(intensive care unit,ICU)患者新发房颤的危险因素研究较为少见。本研究对3年间ICU非心脏手术后新发房颤患者进行筛查并进行病例对照分析,旨在调查其发生率和发作特征并分析其危险因素及对近期预后的影响。

1 对象与方法

1.1 研究设计

本研究采用单中心、回顾性、病例配对的方法。研究方案经北京大学第一医院伦理委员会批准(批准号2016[1110])。由于本研究为回顾性调查,不涉及医疗干预及患者随访,伦理委员会同意免除知情同意。本研究在北京大学第一医院完成。

1.2 研究对象

病例组纳入标准为2011年1月1日至2013年12月31日期间,非心脏手术后入住ICU病房、在术后住院期间出现新发房颤的成年(≥18岁)患者。对照组为在同时期非心脏手术后入住ICU、但术后未发生房颤的成年患者。病例组与对照组按1∶2比例匹配,配对条件应满足:性别相同、手术部位相同、年龄差距在±4岁以内、手术时间最接近者。病例组与对照组使用同样的排除标准:既往有明确心房颤动病史,术前检查发现房颤,或病例资料存在严重缺失。

1.3 数据收集

通过医院电子病案系统收集患者相关资料,包括人口学资料(年龄、性别、体质量指数)、术前合并疾病(高血压、冠心病、风湿性心脏病、老年退行性瓣膜病、心力衰竭、糖尿病、甲状腺疾病、慢性阻塞性肺疾病、哮喘、慢性肾功能衰竭以及除房颤以外的其他心律失常)、术前主要检查结果[包括心电图、超声心动图检查、美国麻醉医师协会(American Society of Anesthesiologists,ASA)分级]、术中情况(麻醉类型、麻醉药物、手术种类、手术时间、输血输液等)、术后主要化验结果[血红蛋白(hemoglobin,Hb)、心肌肌钙蛋白I(cardiac troponin I,cTnI)、脑钠肽(brain natriuretic peptide,BNP)、血钾、血镁]、ICU期间的最差生理参数和并发症发生情况及近期预后。房颤患者记录房颤发作的时间、特点及转归。

1.4 心房颤动的诊断与分类标准

心电监护或心电图记录到持续时间超过1 min的P波消失,代之以振幅、形态、频率绝对不规则的f波,当房室传导正常时R-R间期绝对不规则。每次发作时间不超过7 d(多数<24 h)为阵发房颤。发作时间超过7 d则定义为持续性房颤。药物治疗或电转复治疗不影响其分类。房颤的诊断和治疗由临床主管医师负责。

1.5 统计学处理

采用SPSS 21.0统计软件对数据进行分析。符合正态分布的计量资料以均数±标准差($\bar{x}\pm s$)表示,采用Student t检验比较;不符合正态分布的计量资料以中位数(四分位数间距)来表示,采用Mann-Whitney U检验比较。计数资料以百分率表示,采用χ^2检验或Fisher精确检验比较。将上述比较中$P<0.10$的因素保留,作为自变量进行单因素logistic回归分析,保留$P<0.05$的变量,排除具有共线性的因素后纳入多因素logistic回归(向后法)分析进行危险因素筛选。近期预后中时间的比较使用Kaplan-Meier法作生存分析,率的比较使用Fisher精确检验。$P<0.05$为差异具有统计学意义。

2 结 果

2.1 患者入组情况

研究期间共有2586例患者行非心脏手术后入住ICU。经过回顾病历记录及原始心电图分析,共有71例(2.7%)确认为术后新发房颤,纳入病例组。

2.2 术后新发房颤的特点

不同性别之间新发房颤的发生率无显著差异[男性2.6%(39/1495),女性2.9%(32/1091),$P=0.618$]。高龄患者(年龄≥75岁)发生率明显高于非高龄患者[≥75岁:3.7%(33/889);<75岁:2.2%(38/1697);$P=0.029$]。45岁以下患者未见术后新发房颤。胸科手术患者的发病率明显高于非胸科手术患者[胸科患者:6.1%(16/262);非胸科患者:2.4%(55/2324);$P<0.001$]。

术后新发房颤首次发作中位时间为术后2(0,3)d,77.5%(55/71)出现在术后3 d以内(含手术当天,图1)。首次发作平均持续(255±113)min,平均心室率(135±23)次/min,39.4%(28/71)伴有血压下降,33.8%(24/71)伴有心悸、胸闷憋气、心前

区疼痛等不适主诉。57.7%(41/71)的患者房颤仅发作1次,38.0%(27/71)表现为阵发房颤,4.2%(3/71)转变为持续房颤。

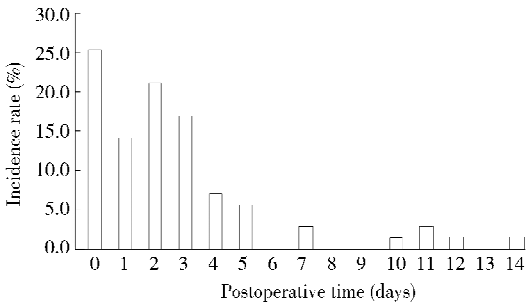


图1 术后新发房颤发病率

Figure 1 Incidence rate of postoperative atrial fibrillation

77.5% (55/71) of new-onset POAF occurred within the first 3 postoperative days. POAF: postoperative atrial fibrillation

2.3 房颤患者及对照患者特征

为房颤患者按1∶2比例配对142例对照患者。2组间性别构成比(男性54.9%)及手术类型构成比(普外46.5%、胸科22.5%、泌尿14.1%、骨科8.5%、神经4.2%、血管2.8%、妇科1.4%)完全相同,年龄相似($P=0.821$)。其他基线和围手术期信息详见表1,2。

2.4 术后新发房颤危险因素分析

多因素logistic回归分析筛选出4项术后新发房颤的独立危险因素,包括术后脓毒症($OR=11.813$, 95%CI 1.72 ~ 81.00, $P=0.012$)、低钾血症($OR=19.48$, 95%CI 2.31 ~ 164.09, $P=0.006$)、急性充血性心力衰竭($OR=9.91$, 95%CI 1.92 ~ 51.22, $P=0.006$),以及新发非房颤心律失常($OR=20.32$, 95%CI 3.51 ~ 117.55, $P=0.001$;表3)。

2.5 术后新发房颤与近期预后

对于带气管插管进入ICU的患者,房颤患者机械通气时间长于对照组患者($P<0.001$)。在全部患者中,房颤患者ICU停留时间长于对照组患者($P<0.001$);房颤患者住院死亡率高于对照组患者($P=0.006$;表4)。

3 讨 论

本研究结果显示,在术后入ICU的非心脏手术患者中,术后新发房颤发生率为2.7%,多见于高龄(≥75岁)和胸科手术患者,其中77.5%出现在术后3 d以内,39.4%合并血压下降,33.8%有不适主诉。57.7%的患者房颤发作1次,38.0%房颤为阵发性,但仅4.2%迁延为持续性房颤。术后脓毒症、低钾血症、急性充血性心力衰竭和新发非房颤心律失常

表1 2组患者基线资料比较

Table 1 Comparison of baseline data between two groups

Item	POAF group ($n=71$)	Control group ($n=142$)	P value
Age(years, $\bar{x}\pm s$)	72.2±10.6	72.6±10.1	0.821
Male[n(%)]	39(54.9)	78(54.9)	
BMI(kg/m^2, $\bar{x}\pm s$)	23.2±4.3	23.0±3.2	0.671
Preoperative comorbidity[n(%)]			
Chronic heart failure	1(1.4)	6(4.2)	0.429
Hypertension	41(57.7)	89(62.7)	0.487
Coronary heart disease	19(26.8)	34(23.9)	0.654
Diabetes mellitus	10(14.1)	25(17.6)	0.513
Chronic obstructive pulmonary disease	3(4.2)	3(2.1)	0.403
Asthma	3(4.2)	5(3.5)	>0.999
Chronic renal failure	5(7.0)	9(6.3)	>0.999
Arrhythmia (non-atrial fibrillation)	4(2.8)	7(9.9)	0.045
Preoperative electrocardiography abnormality	22(31.0)	41(28.9)	0.750
Left atrial enlargement[n(%)]	19(33.9)	24(25.0)	0.111
Left atrial anterior-posterior diameter(cm, $\bar{x}\pm s$)	3.2±0.9	3.2±0.8	0.874
Left atrial supra-inferior diameter(cm, $\bar{x}\pm s$)	4.6±1.5	4.6±1.1	0.975
Left atrial transverse diameter(cm, $\bar{x}\pm s$)	3.6±1.3	3.6±1.0	0.702
Pulmonary arterial systolic pressure(mmHg, $\bar{x}\pm s$)	31.5±11.5	28.6±13.3	0.195
Left ventricular ejection fraction < 50% [n(%)]	6(10.5)	11(10.8)	0.960
Cardiac valves abnormality[n(%)]	55(98.2)	93(96.9)	0.186
Preoperative ASA classification[n(%)]	2(1,3)	2(1,2)	0.983

POAF: postoperative atrial fibrillation; BMI: body mass index; ASA: American Society of Anesthesiologists. 1 mmHg = 0.133 kPa

表2 2组患者围手术期信息

Table 2 Perioperative information of two groups

Item	POAF group ($n=71$)	Control group ($n=142$)	P value
Anesthesia methods[n(%)]			0.717
Local anesthesia	9(12.7)	24(16.9)	
General anesthesia	58(81.7)	111(78.2)	
Combined anesthesia	4(5.6)	7(4.9)	
Intraoperative information			
Duration of surgery[min, $M(Q_1,Q_3)$]	204(131,361)	202(148,333)	0.747
Fluid infusion[ml, $M(Q_1,Q_3)$]	2750(1900,4350)	2300(1600,3925)	0.116
Blood transfusion[n(%)]	25(35.2)	49(34.5)	0.919
Emergency operation[n(%)]	22(31.0)	19(13.4)	0.002
APACHE Ⅱ score at ICU admission* [$M(Q_1,Q_3)$]	10(8,13)	12(9,17)	0.002
Postoperative laboratory test results after ICU admission#			
Hb(g/L, $\bar{x}\pm s$)	99.6±20.0	107.7±18.8	0.005
cTnI[ng/ml, $M(Q_1,Q_3)$]	0.03(0.01,0.13)	0.01(0,0.02)	0.051
BNP[pg/ml, $M(Q_1,Q_3)$]	512(198,1225)	166(90,365)	<0.001
Serum potassium(mmol/L, $\bar{x}\pm s$)	3.9±0.6	4.2±0.5	<0.001
Serum magnesium(mmol/L, $\bar{x}\pm s$)	0.9±0.2	0.9±0.2	0.010
Complications after ICU admission[n(%)]			
Hypoxemia★	11(15.5)	1(0.7)	<0.001
Hypercapnia★★	7(9.9)	5(3.5)	0.110
Sepsis##	27(38.0)	10(7.0)	<0.001
Shock△	16(22.5)	12(8.5)	0.004
Acute heart failure▲	31(18.3)	8(5.6)	<0.001
Arrhythmia (non-atrial fibrillation)☆	29(40.8)	7(4.9)	<0.001
Acute renal failure★★	21(29.6)	3(2.1)	<0.001

POAF: postoperative atrial fibrillation; APACHE Ⅱ: acute physiology and chronic health evaluation Ⅱ; Hb: hemoglobin; cTnI: cardiac troponin I; BNP: brain natriuretic peptide; ICU: intensive care unit. * The worst score within 24 hours after ICU admission. #The last one before POAF in POAF group. The worst one after ICU admission in control group. ★Hypoxemia, $PaO_2<60$ mmHg in arterial blood gas analysis. ★★Hypercapnia, $PaCO_2>50$ mmHg in arterial blood gas analysis. ##Sepsis refers to the systemic inflammatory response caused by a known or probable infection. △Shock refers to the life-threatening acute circulatory failure, leading to cell oxygenation disorder, associated with elevated blood lactic acid (>2 mmol/L). It is based on a clinical doctor's diagnosis. ▲Acute heart failure refers to the rapid onset or aggravation of the symptoms/signs of heart failure shortly after surgery, and BNP>100 pg/ml. ☆Arrhythmia (non-atrial fibrillation) refers to the patient having no previous history of arrhythmia, and postoperative electrocardiogram or ECG monitoring revealing cardiac arrhythmias except atrial fibrillation. ★★Acute renal failure refers to the blood creatinine increasing to more than 26.5 nmol/L within 48 hours after surgery, or the blood creatinine increasing more than 1.5 times the baseline value within 7 days after, or the urine output <0.5 ml/(kg·h) within 6 hours. 1 mmHg=0.133 kPa

表3 术后新发房颤的独立危险因素的logistic回归分析

Table 3 Logistic regression analysis of POAF independent risk factors

Risk facor	Univariate analysis	Multivariate analysis	
	P value	OR(95% CI)	P value
Preoperative arrhythmia (non-atrial fibrillation)	0.039	–	0.336
Emergency operation	0.002	–	0.943
APACHE Ⅱ score≥15	0.010		0.538
Postoperative sepsis	<0.001	11.81(1.72–81.00)	0.012
Postoperative Hb<100 g/L	0.070	–	–
Postoperative cTnI>0.04 ng/ml	<0.001	–	0.514
Postoperative BNP>100 pg/mL	0.001	–	0.065
Postoperative hypokalemia*	0.003	19.48(2.31–164.09)	0.006
Postoperative hypomagnesemia#	0.228	–	–
Postoperative hypoxemia	0.003	–	0.057
Postoperative acute heart failure	<0.001	9.91(1.92–51.22)	0.006
Postoperative new-onset arrhythmia (non-atrial fibrillation)	<0.001	20.32(3.51–117.55)	0.001
Postoperative renal failure	<0.001	–	0.622

POAF: postoperative atrial fibrillation; APACHE Ⅱ: acute physiology and chronic health evaluation Ⅱ; Hb: hemoglobin; cTnI: cardiac troponin I; BNP: brain natriuretic peptide. * Hypokalemia, serum potassium<3.5 mmol/L; #Hypomagnesemia, serum magnesium<0.8 mmol/L

表4 术后新发房颤与近期预后

Table 4 POAF and short-term prognosis

Item	POAF group (n=71)	Control group (n=142)	P value
Mechanical ventilation time* [h, $M(Q_1, Q_3)$]	24.0(0-58.9)	7.0(4.7-9.3)	<0.001
ICU stay time[d, $M(Q_1, Q_3)$]	7.7(6.1-9.3)	2.2(1.8-2.7)	<0.001
New-onset brain stroke within 30 days[n(%)]	1(1.4)	0(0.0)	-
Mortality during hospitalization[n(%)]	6(8.5)	1(0.7)	0.006

POAF: postoperative atrial fibrillation; ICU: intensive care unit. *Patients with tracheal intubation in ICU

是术后新发房颤的独立危险因素。术后新发房颤患者机械通气时间和ICU停留时间更长、住院死亡率更高。

随患者人群和手术种类的不同,不同研究报道的术后房颤发生率有很大差异[1]。在非心脏非胸科手术患者中,术后新发房颤发生率从0.4%到26%不等[4]。Bhave等[5]的研究观察了370 447例接受非心脏大手术的成年(≥18岁)患者,术后房颤的发生率为3%,但术后新发房颤的发生率约为1%。本研究的目的是观察术后新发房颤,因此排除了术前已有房颤的患者。本研究术后新发房颤的发生率为2.7%,仍在以往文献报道的发生率范围。

从发作特点来看,本研究中术后新发房颤患者多数无症状(66.2%)。这可能由于ICU中的术后患者持续接受心电监护,因而检出了更多的无症状房颤患者。Brachmann等[6]对原因不明脑卒中患者的观察也发现,采用持续心电图监护,3年房颤检出率为30%,其中81%的首次房颤发作无症状;而采用常规临床检查,3年房颤检出率为3%,其中仅40%首次发作无症状。其他研究也报道了类似结果[3,7]。本研究中半数以上的术后新发房颤仅发作1次,且大多能自行转复为窦性心律,因此常常被内科医师视作自限性的良性的心律失常[8]。ICU术后新发房颤的发病率在高龄患者增加,这与该疾病总体人群年龄特征一致[3],但本研究未发现性别差异。手术类型对发生率有影响,胸科手术较其他非心脏手术有更高的术后新发房颤的发生率,这在既往研究[2,9]和本研究中均得到证实,可能与胸科手术或留置胸管的局部刺激相关。

既往研究归纳的术后新发房颤共同危险因素包括:年龄增加、男性和胸科手术[2,9,10]。因此本研究进行病例配对时将年龄、性别和手术类型作为配比因素,以平衡这些混杂因素、进一步探寻其他危险因素的影响。此外,有研究报告某些慢性合并疾病,如心力衰竭史、心律失常史,也是术后新发房颤的危险因素[2]。但这些疾病因素配比难度过大,本研究仍将其作为潜在危险因素研究。

脓毒症与新发房颤的关系最近逐渐受到重视。Walkey等[11]的研究发现,脓毒症患者中31%伴发房颤,其中7.2%为新发房颤;而在需要入住ICU治疗的脓毒症患者中新发房颤发生率增加至10.7%。Sanne等[12]也报道,新发房颤发生率在脓毒症患者中为8%,在严重脓毒症患者中为10%,而在脓毒症休克患者中则增加至23%。这可能由于脓毒症导致全身炎症反应,炎症因子参与房颤的发生和维持[13]。在Bruins等[17]的研究中,心脏术后6 h时IL-6升高达峰值,术后2 d时C-反应蛋白(C-reactive protein,CRP)达峰值,术后2 d或3 d补体-CRP复合物达峰值。这些炎症介质的峰值时间与本研究中术后房颤高发时间段一致。

心力衰竭可触发并维持房颤,房颤可诱发并加重心力衰竭,二者常常互为因果、形成恶性循环,且心力衰竭患者伴发房颤时预后更差[20]。有研究显示,心功能从1级下降到4级,房颤的发生率将从4%上升至40%[21]。本研究也得出类似的结论,即术后急性心力衰竭的发生伴随术后新发房颤的风险增加至近10倍。心力衰竭诱发房颤的机制可能包括心房扩张引起电活动紊乱、神经内分泌改变及纤维化等[22]。

术后低钾血症可通过引起心肌细胞电活动改变诱发房颤。鉴于其易于纠正,在多种危险因素中应首先予以识别和治疗,以预防和治疗术后新发房颤。本研究还发现,在新发房颤前往往存在其他形式的心律失常,以窦性心动过速、室上性心动过速、房性早搏等多见,出现这些心律失常伴随新发房颤风险增高。提示这些心律失常可能与房颤有共同的发病机制和危险因素。

ICU患者出现房颤会导致ICU停留时间延长、死亡率增加、医疗费用增加等多种不良后果[2,3]。本研究也发现,ICU患者术后新发房颤者机械通气时间和ICU停留时间更长,近期死亡率也更高。有作者认为,死亡率增加可能与心功能下降有关[23]。虽然本研究结果并不能证明术后新发房颤与近期预后恶化之间的因果关系,但提示应对术后新发房颤

给予足够重视,应将其视作全身疾病严重程度的一个指标。本研究由于观察的病例数不足,对术后新发脑卒中发生率暂时无法评估。POISE 研究曾证实[24],术后新发房颤是非心脏术后 30 d 内脑卒中的独立预测因素。

本研究存在一些不足。作为回顾性配对病例对照研究,资料收集依赖电子病历资料,可能会有漏诊。ICU 术后患者主诉主要依赖医护询问和记录,可能导致偏倚。配对设计方法平衡掉了一些既往研究中比较明确的危险因素,如年龄、性别及胸科手术情况。此外,本研究也缺乏长期预后的观察。已有研究指出,冠脉旁路手术后新发房颤增加远期死亡率[25],可以进一步随访本研究纳入的患者,观察其远期生存情况。

【参考文献】

[1] Mayson SE, Greenspon AJ, Adams S, *et al*. The changing face of postoperative atrial fibrillation prevention: a review of current medical therapy[J]. Cardiol Rev, 2007, 15(5): 231 - 241. DOI: 10.1097/CRD.0b013e31813e62bb.

[2] Vaporciyan AA, Correa AM, Rice DC, *et al*. Risk factors associated with atrial fibrillation after noncardiac thoracic surgery: analysis of 2588 patients[J]. J Thorac Cardiovasc Surg, 2004, 127(3): 779 - 786. DOI: 10.1016/j.jtcvs.2003.07.011.

[3] Zoni-Berisso M, Lercari F, Carazza T, *et al*. Epidemiology of atrial fibrillation: European perspective[J]. Clin Epidemiol, 2014, 6: 213 - 220. DOI: 10.2147/CLEP.S47385.

[4] Joshi KK, Tiru M, Chin T, *et al*. Postoperative atrial fibrillation in patients undergoing non-cardiac non-thoracic surgery: a practical approach for the hospitalist[J]. Hosp Pract, 2015, 43(4): 235 - 244. DOI: 10.1080/21548331.2015.1096181.

[5] Bhave PD, Goldman LE, Vittinghoff E, *et al*. Incidence, predictors, and outcomes associated with postoperative atrial fibrillation after major noncardiac surgery[J]. Am Heart J, 2012, 164(6): 918 - 924. DOI: 10.1016/j.ahj.2012.09.004.

[6] Brachmann J, Morillo CA, Sanna T, *et al*. Uncovering atrial fibrillation beyond short-term monitoring in cryptogenic stroke patients: three-year results from the cryptogenic stroke and underlying atrial fibrillation trial[J]. Circ Arrhythm Electrophysiol, 2016, 9(1): e003333. DOI: 10.1161/CIRCEP.115.003333.

[7] Chiang CE, Naditch-Brûlé L, Murin J, *et al*. Distribution and risk profile of paroxysmal, persistent, and permanent atrial fibrillation in routine clinical practice: insight from the real-life global survey evaluating patients with atrial fibrillation international registry[J]. Circ Arrhythm Electrophysiol, 2012, 5(4): 632 - 639. DOI: 10.1161/CIRCEP.112.970749.

[8] Walsh SR, Tang T, Gaunt ME, *et al*. New arrhythmias after non-cardiothoracic surgery[J]. BMJ, 2006, 333(7571): 715. DOI: 10.1136/bmj.333.7571.715.

[9] Passman RS, Gingold DS, Amar D, *et al*. Prediction rule for atrial fibrillation after major noncardiac thoracic surgery[J]. Ann Thorac Surg, 2005, 79(5): 1698 - 1703. DOI: 10.1016/j.athoracsur.2004.10.058.

[10] Onaitis M, D'Amico T, Zhao Y, *et al*. Risk factors for atrial fibrillation after lung cancer surgery: analysis of the Society of Thoracic Surgeons general thoracic surgery database[J]. Ann Thorac Surg, 2010, 90(2): 368 - 374. DOI: 10.1016/j.athoracsur.2010.03.100.

[11] Walkey AJ, Greiner MA, Heckbert SR, *et al*. Atrial fibrillation among Medicare beneficiaries hospitalized with sepsis: incidence and risk factors[J]. Am Heart J, 2013, 65(6): 949 - 955. DOI: 10.1016/j.ahj.2013.03.020.

[12] Sanne K, Peter MC, Olaf LC, *et al*. Incidence, risk factors and outcomes of new-onset atrial fibrillation in patients with sepsis: a systematic review[J]. Crit Care, 2014, 18(6): 688. DOI: 10.1186/s13054-014-0688-5.

[13] 王玉红, 董志军, 张晔. 炎症在心房纤颤中的作用研究进展[J]. 中国全科医学, 2013, 16(2B): 1312 - 1314. DOI: 10.3969/j.issn.1007-9572.2013.11.039.
Wang YH, Dong ZJ, Zhang Y. Research progress of inflammation role in atrial fibrillation[J]. Chin Gen Pract, 2013, 16(2B): 1312 - 1314. DOI: 10.3969/j.issn.1007-9572.2013.11.039.

[14] Boos CJ, Anderson RA, Lip GY. Is atrial fibrillation an inflammatory disorder?[J]. Eur Heart J, 2006, 27(2): 136 - 149. DOI: 10.1093/eurheartj/ehi645.

[15] Issac TT, Dokainish H, Lakkis NM. Role of inflammation in initiation and perpetuation of atrial fibrillation: a systematic review of the published data[J]. J Am Coll Cardiol, 2007, 50(21): 2021 - 2028. DOI: 10.1016/j.jacc.2007.06.054.

[16] Abdelhadi RH, Gurm HS, van Wagoner DR, *et al*. Relation of an exaggerated rise in white blood cells after coronary bypass or cardiac valve surgery to development of atrial fibrillation postoperatively[J]. Am J Cardiol, 2004, 93(9): 1176 - 1178. DOI: 10.1016/j.amjcard.2004.01.053.

[17] Bruins P, teVelthuis H, Yazdanbakhsh AP, *et al*. Activation of the complement system during and after cardiopulmonary bypass surgery: postsurgery activation involves C-reactive protein and is associated with postoperative arrhythmia[J]. Circulation, 1997, 96(10): 3542 - 3548.

[18] Fontes ML, Amar D, Kulak A, *et al*. Increased preoperative white blood cell count predicts postoperative atrial fibrillation after coronary artery bypass surgery[J]. J Cardiothorac Vasc Anesth, 2009, 23(4): 484 - 487. DOI: 10.1053/j.jvca.2009.01.030.

[19] Amar D, Goenka A, Zhang H, *et al*. Leukocytosis and increased risk of atrial fibrillation after general thoracic surgery[J]. Ann Thorac Surg, 2006, 82(3): 1057 - 1061. DOI: 10.1016/j.athoracsur.2006.03.103.

[20] Thihalolipavan S, Morin DP. Atrial fibrillation and congestive heart failure[J]. Heart Fail Clin, 2014, 10(2): 305 - 318. DOI: 10.1016/j.pcad.2015.07.004.

[21] Maisel WH, Stevenson LW. Atrial fibrillation in heart failure: epidemiology, pathophysiology, and rationale for therapy[J]. Am J Cardiol, 2003, 91(6): 2 - 8. DOI: 0.1016/S0002-9149(02)03373-8.

[22] Costantini M, Ranieri AT, Fachechi C, *et al*. Atrial fibrillation and heart failure: a complex relationship[J]. G Ita Cardiol, 2006, 7(1): 40 - 49.

[23] Rivero-Ayerza M, Scholte Op Reimer W, Lenzen M, *et al*. New-onset atrial fibrillation is an independent predictor of in-hospital mortality in hospitalized heart failure patients: results of the Euro-Heart Failure Survey[J]. Eur Heart J, 2008, 29(13): 1618 - 1624. DOI: 10.1016/j.jacc.2007.08.066.

[24] Devereaux PJ, Yang H, Yusuf S, *et al*. Effects of extended-release metoprolol succinate in patients undergoing non-cardiac surgery (POISE trial): a randomized controlled trial[J]. Lancet, 2008, 371(9627): 1839 - 1847. DOI: 10.1016/S0140-6736(08)60601-7.

[25] El-Chami MF, Kilgo P, Thourani V, *et al*. New-onset atrial fibrillation predicts long-term mortality after coronary artery bypass-graft[J]. J Am Coll Cardiol, 2010, 55(13): 1370 - 1376. DOI: 10.1016/j.jacc.2009.10.058.

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