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双极射频消融改良迷宫术治疗房颤的中远期疗效 及其影响因素分析*

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摘要 目的:分析心脏瓣膜置换同期行双极射频消融改良迷宫术治疗房颤的术后中远期疗效及其影响因素。**方法:**选取2007年7月至2010年12月于我院行心脏瓣膜置换同期行双极射频消融改良迷宫术治疗房颤的72例患者,术后随访3至6年,获得患者术后十二导联心电图、24 h 动态心电图和心脏彩超结果,并且记录术后药物应用、相关并发症、心功能恢复情况及生活质量是否改善等情况。根据心电图结果,将患者分为窦性心律组与非窦性心律组,应用统计学方法比较两组患者术前相关因素是否有差异。**结果:**截止至随访终点,有效随访的68例患者中窦性心律维持率为63.2%。单因素分析显示术前房颤病程、术前左室射血分数、是否合并三尖瓣成形或置换是影响手术效果的影响因素,多因素分析显示术前房颤病程、合并三尖瓣成形或置换是影响手术效果的危险因素。**结论:**心脏瓣膜置换同期行双极射频消融改良迷宫术治疗房颤的中晚期疗效好,术后并发症少,能够有效防止血栓栓塞,术前房颤病程长、合并三尖瓣成形或置换的患者术后中远期效果相对较差。

关键词:心房颤动;双极射频消融改良迷宫术;中远期疗效;影响因素

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Analysis of the Mid-long-term Efficacy of Modified Maze Procedure Using Bipolar Radiofrequency Ablation and its Influencing Factors*

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ABSTRACT Objective: To analyze the mid-long-term efficacy and its influencing factors of modified maze procedure using bipolar radiofrequency ablation during concomitant cardiac valve replacement surgery in the treatment of atrial fibrillation. **Methods:** 72 patients who underwent modified maze procedure using bipolar radiofrequency ablation concomitant with cardiac valve replacement surgery in our department from July 2007 to December 2010 were selected. After three to six years' follow-up, their postoperative electrocardiograms with 12-lead or the dynamic electrocardiograms and echocardiography data were collected. We also recorded how they took the medicine after surgery and related complications and the recovery of their cardiac function and life quality and some useful information. Patients were divided into sinus group and non-sinus group according to the results of their ECG or 24-hour Holter. We used statistical methods to analyze the difference of the related factors before operation between the two groups. **Results:** At the end of follow-up, 63.2 % patients maintained sinus rhythm among 68 patients accomplished effective follow-up. In univariate analysis, preoperative AF duration, preoperative left ventricular ejection fraction and whether combined with tricuspid valve replacement or plasty are risk factors affected the results of operation. In multivariate analysis, preoperative AF duration and whether combined with tricuspid valve replacement or plasty are risk factors affected the results of operation. **Conclusion:** Modified maze procedure using bipolar radiofrequency ablation during concomitant cardiac valve replacement surgery had good mid-long-term efficacy in the treatment of atrial fibrillation, which caused only a few postoperative complications and could effectively prevent the thromboembolism. The mid-long-term efficacy of patients with long preoperative AF duration or concomitant with tricuspid valve replacement or plasty were relatively poorer.

Key words: Atrial fibrillation; Modified maze procedure using bipolar radiofrequency ablation; Mid-long-term efficacy; Influencing factor

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前言

心房颤动(atrial fibrillation, AF)简称房颤,是临床最常见的心律失常之一^[1-2],也是心脏瓣膜病最常见的并发症,在国内外人群中具有很高的发病率和死亡率^[3-6]。药物治疗房颤复发率高且有一定的毒副作用^[7],因此需行心脏外科手术且合并房颤的患者大部分应同期治疗房颤。1987年,Cox发明了迷宫手术,开创了外科治疗房颤的新纪元。经过不断改良,迷宫 III 型手术凭借其超过 90 %的成功率一度被公认为是外科治疗房颤的“金标准”^[8-10]。但由于其“切和缝”技术复杂、手术时间长、术后并发症多,难以在临床广泛应用。近年来,采用冷动、微波、激光、超声、射频等作为能源的改良迷宫消融术成为外科治疗房颤的主要手段,其手术成功率与传统迷宫手术相比无显著差异^[11]。其中,双极射频消融改良迷宫术是应用较多、临床效果较为理想的手术之一,其短期临床效果在国内外已有大量研究并获得认可^[12-13],但由于此类手术开展时间较短,五年以上的中远期疗

效鲜有报道。本研究采用回顾性研究的方法,选取 2007 年 7 月至 2010 年 12 月于我院行心脏瓣膜置换同期行双极射频消融改良迷宫术治疗房颤的 72 例患者,分析其术后的中远期随访效以及影响双极射频消融改良迷宫术中远期疗效的危险因素。

1 资料与方法

1.1 临床资料

连续性选取 2007 年 7 月至 2010 年 12 月于我院行心脏瓣膜置换同期行双极射频消融改良迷宫术治疗房颤的 72 例患者,共有效随访 68 例(68/72,94.44 %)。其中男 22 例,女 46 例。心功能(NYHA 分级)II 级 17 例,III 级 46 例,IV 级 5 例。所有病人均具备心瓣膜置换手术指征,其中合并冠心病 1 例,房间隔缺损 1 例,高血压病 8 例,糖尿病 3 例。既往行二尖瓣闭式扩张术 2 例,发生脑卒中事件 2 例,下肢动脉栓塞 1 例。患者临床资料见表 1,手术方式见表 2。

表 1 患者的一般临床资料

Table 1 Patients' clinical data

Data	Range	$\bar{X} \pm S$
Age(years)	34~75	57.0 $\pm$ 8.4
Follow-up time(months)	35~76	50.9 $\pm$ 13.0
AF duration(months)	0.5~240	64.0 $\pm$ 54.7
NYHA Class(I-IV)	2~4	2.8 $\pm$ 0.6
LAD(mm)	39~84	59.2 $\pm$ 9.2
LVEDD(mm)	35~81	50.7 $\pm$ 8.3
RVD(mm)	21~46	29.8 $\pm$ 4.9
SV(L/min)	30~234	75.3 $\pm$ 31.9
LVEF(%)	36~76	60.5 $\pm$ 8.7
CO(L/min)	3.1~19.8	6.5 $\pm$ 3.0
CI(L/min/m ²)	2.0 $\pm$ 10.3	3.8 $\pm$ 1.6
PASP(mmHg)	30 $\pm$ 119	55.6 $\pm$ 16.8
CPB time(min)	61~163	101.9 $\pm$ 24.6
ACC time(min)	34~108	61.0 $\pm$ 20.0

注:NYHA Class:纽约心脏病学会心功能分级,LAD:左房内径,LVEDD:左室舒张末内径,RVD:右室内径,SV:每搏输出量,LVEF:左室射血分数,CO:心输出量,CI:心指数,PASP:肺动脉收缩压,CPB:体外循环,ACC:主动脉阻断。

Note: NYHA Class: New York Heart Association functional classification, LAD: Left atrial diameter, LVEDD: Left ventricular end-diastolic diameter, RVD: Right ventricular diameter, SV: Stroke volume, LVEF: Left ventricular ejection fraction, CO: Cardiac output, CI: Cardiac index, PASP: Pulmonary artery systolic pressure, CPB: Cardiopulmonary bypass, ACC: Aortic cross clamp.

1.2 治疗方法

手术方法:所有病人均采用 Atricure 干式双极消融设备,常规建立体外循环,游离左、右心房后壁心包返折处,游离双侧肺静脉前庭,切断 Marshall 韧带,完成双侧肺静脉前庭消融线。降温,阻断上、下腔静脉和升主动脉,灌注停搏液心脏停跳后,切开右心房及房间隔,显露左心房,切除左心耳,完成左上肺静脉与左心耳之间的消融线。右上、下肺静脉交界处做一小切口,经此切口行双侧肺静脉消融环的连线,同样经此切口行与二尖瓣后瓣环中点之间的连接消融线,缝闭左心耳。完成瓣膜置换,

心脏复跳后,行冠状静脉窦与下腔静脉以及冠状静脉窦与三尖瓣后隔交界之间的消融线,完成三尖瓣成形术。对于术前心脏彩超提示合并左房血栓的患者,为防止血栓脱落,先清除血栓后再行消融。

所有患者术后第 1 天开始常规口服可达龙 200 mg bid,1 周后改为 200 mg qd,嘱患者出院后继续服用 6 个月以维持窦性心律。所有置换机械瓣膜患者终身服用华法林抗凝,置换生物瓣膜患者口服华法林 3 个月,若 3 个月后心律为窦性心律则停止服用,否则继续服用。其他药物治疗同一般心脏瓣膜置换

表 2 手术方式

Table 2 Surgical procedures

Procedures	Cases
MVR	20
DVR	13
MVR+TVP(Modified DeVega)	19
MVR+TVP(MC3 ring)	2
MVR+TVR	1
DVR+TVP(Modified DeVega)	11
DVR+TVP(MC3 ring)	1
DVR+TVR	1
Concomitant LAT	13
Concomitant CABG	1
Concomitant ASD repair	1

注:MVR:二尖瓣置换,DVR:双瓣置换(二尖瓣+主动脉瓣),TVP:三尖瓣成形,TVR:三尖瓣置换,LAT:左房血栓清除术,CABG:冠状动脉旁路移植术,ASD:房间隔缺损。

Note:MVR:Mitral valve replacement, DVR: Double valve replacement(mitral valve and aortic valve), TVP: Tricuspid valve plasty, TVR: Tricuspid valve replacement, LAT: Left atrial thrombectomy, CABG: Coronary artery bypass graft, ASD: Atrial septal defect.

手术。

本研究采用查阅原始病案、门诊、信函、电话相结合的随访方式,获得患者术后十二导联心电图、24 h 动态心电图和心脏彩超结果,并且记录术后药物应用、相关并发症、心功能恢复情况及生活质量是否改善等相关信息。根据心电图结果,将患者分为窦性心律组与非窦性心律组,其中心律为房颤、房扑、结性心律以及置入永久心脏起搏器的患者都归为非窦性心律组。应用统计学方法比较两组患者术前相关因素是否有差异。

1.3 统计学分析

所有的统计分析采用 IBM SPSS Statistics 19 软件,计量资料用 $\bar{X} \pm S$ 进行统计描述,检验方法选用 t 检验;定性资料以频数及率表示,检验方法选用卡方 χ^2 检验,有统计学意义的指标行 logistic 多因素回归分析,计算优势比(OR)及 95%置信区间(95%CI),以 $P < 0.05$ 为差异有统计学意义。

2 结果

全组 72 例患者中,1 例因“急性肾衰竭、多器官功能不全”于术后第 22 天院内死亡,1 例患者出院后 3 个月因“心功能不全”于外院死亡,另有失访 2 例,共有效随访 68 例(94.44%)。术中 CPB 时间(101.9 ± 24.6) min,ACC 时间(61.0 ± 20.0) min,射频消融时间(15.2 ± 3.6) min。1 例患者术后 3 个月因“晕厥”置入永久心脏起搏器。1 例行二尖瓣生物瓣膜置换合并左房血栓清除术的患者术后第 4 年复查心脏彩超示左心房内再次血栓形成,该患者目前仍为房颤心律并服用华法林抗凝。截止至随访终点,所有 68 例随访到的患者中,窦性心律 43 例(63.2%),房颤心律 19 例(27.9%),房扑心律 3 例(4.4%),结性心律 2 例(2.9%),起搏心律 1 例(1.5%)。包括术前 3 例既往有栓塞病史的患者在内的所有患者术后无栓塞等意外发生。术后心脏彩超复查结果示左心房直径(47.3 ± 6.6) mm,较术前(59.2 ± 9.2) mm

明显缩小($P < 0.001$)。截止至随访结束时,患者术后心功能(NY-HA 分级)II 级 43 例(术前 17 例),III 级 24 例(术前 46 例),IV 级 1 例(术前 5 例),患者的心功能较术前明显改善。

单因素分析结果显示:术前房颤病程、术前左室射血分数、是否合并三尖瓣成形或置换是影响手术效果的危险因素,见表 3。多因素分析结果显示:术前房颤病程、是否合并三尖瓣成形或置换是影响手术效果的危险因素,见表 4。

3 讨论

房颤是最常见的心律失常之一,其不规则的心律能够引起心脏结构改变以及血流动力学异常,导致患者心悸等不适,增加发生血栓及栓塞的风险,影响患者的日常生活。房颤在人群中的发病率约为 1-2%,老年人中房颤的发生率更高^[3-6]。随着社会人口的老龄化,房颤的发病率也逐渐升高。因此,房颤的治疗已成为近年来临床关注和研究的热点。

迷宫手术是 Cox 于 1987 年率先使用的,随后经过不断改良,Cox 迷宫 III 型手术凭借其超过 90% 的手术成功率一度被公认为外科治疗房颤的“金标准”。但其“切和缝”技术有一定复杂程度,且手术时间长,术后并发症发生几率大,近年来在治疗房颤的领域已很少应用,取而代之的是经过改良的 Cox 迷宫 IV 型手术。Cox 迷宫 IV 型手术即采用冷冻、微波、激光、超声、射频等作为能源的改良迷宫消融术,其手术原理与损伤机制与 Cox 迷宫 III 型手术类似,虽然在损伤透壁的彻底性方面不如“切和缝”技术,但消融能源及设备的应用能够避免“切和缝”技术导致的切口出血,缩短心肌缺血时间,简化手术复杂程度从而缩短手术时间并减少术后并发症。

传统的迷宫手术以及采用其它方法进行的外科消融手术的中远期疗效已有报道,Toshihiro Funatsu 等^[16]报道了 268 例行二尖瓣手术同期行冷冻消融治疗房颤病人的随访结果,平均

表 3 影响双极射频消融改良迷宫术治疗房颤的中远期疗效的单因素分析

Table 3 Univariate analysis of influencing factors of the mid-long-term efficacy of modified maze procedure using bipolar radiofrequency ablation in the treatment of atrial fibrillation

Factors	Sinus Group(43Cases)	Not Sinus Group(25Cases)	P
Gender(Male/Female)	14/29	8/17	0.962
Age(Years)	56.4± 8.5	58.1± 8.3	0.441
AF duration(months)	51.9± 58.3	84.7± 41.4	0.016
NYHA Class(I-IV)	2.8± 0.5	2.8± 0.6	0.851
LAD(mm)	58.2± 8.8	61.0± 9.7	0.229
LVEDD(mm)	50.7± 7.3	50.8± 10.0	0.976
RVD(mm)	29.4± 4.9	30.4± 5.0	0.414
SV(L/min)	76.4± 27.4	73.4± 39.1	0.718
LVEF(%)	62.5± 7.8	57.1± 9.1	0.011*
CO(L/min)	6.7± 3.2	6.1± 2.7	0.397
CI(L/min/m ²)	3.9± 1.6	3.5± 1.5	0.363
PASP(mmHg)	55.2± 17.5	56.4± 16.0	0.788
CPB time(min)	100.2± 24.3	104.9± 25.2	0.455
ACC time(min)	60.4± 19.8	62.0± 20.8	0.762
Concomitant LAT (Y/N)	6/37	7/18	0.271
Concomitant TVR or TVP(Y/N)	17/26	18/7	0.010*
Artificial Valve(Mechanical/Biological)	24/19	13/12	0.761

注:* 有统计学意义。

Note: *Statistically significant.

表 4 影响双极射频消融改良迷宫术治疗房颤的中远期疗效的多因素分析

Table 4 Multivariate analysis of influencing factors of the mid-long-term efficacy of modified maze procedure using bipolar radiofrequency ablation in the treatment of atrial fibrillation

Factors	P	OR	95%CI
AF duration(months)	0.047	1.010	1.000~1.021
Concomitant TVR or TVP(Y/N)	0.046	0.314	0.101~0.980
LVEF(%)	0.057	0.937	0.875~1.002

随访时间 3.8 年,其 3 年和 5 年的成功率分别为 84.1 % 和 80.2 %。Gammie 等^[17]报道了 119 例行冷冻消融迷宫术的患者平均随访 3.2 年的房颤转复率为 60 %。Hyung Gon Je 等^[18]报道了 560 例行迷宫手术(包括传统的 Maze III、冷冻消融、微波消融等不同方式)治疗房颤的患者,3 年、5 年、7 年、9 年的成功率分别为 86.5 %、82.2 %、75.4 %、69.8 %。双极射频消融改良迷宫术是目前应用最多也是效果较好的 Cox 迷宫 IV 型手术,其短期疗效国内外已有大量报道,手术成功率多在 70-80 %^[14-15]。然而报道双极射频消融改良迷宫术的文献随访时间一般不超过 36 个月,本组病例随访时间最长 76 个月,最短 35 个月,平均 51 个月,能够反映双极射频消融改良迷宫术的中远期疗效。

本组病例窦性心律维持率为 63.2 %,略低于国内外的同类手术报道,考虑有以下几方面的原因:(1)与其它报道单纯双极射频消融改良迷宫术短期疗效的文献相比,本组病例随访时间长,随着随访时间的延长,房颤的复发率更高;(2)有的文献将术

后除房颤心律外的其它心律(包括安装永久心脏起搏器)都定义为手术成功,本文严格将术后一直维持窦性心律定义为手术成功,因此手术成功率略低;(3)本组患者术前并未制定严格的筛选标准,患者平均术前房颤病史超过 5 年,平均术前左房内径 59.2 mm,病人总体房颤病史长、术前左心房直径大,两项高危因素结合是手术成功率低的重要原因;(4)随访期间发现部分患者出院后未继续口服可达龙,可能成为导致房颤复发的因素之一。

目前文献报道的影响迷宫手术治疗房颤的危险因素有:术前房颤病程长、术前左心房直径大、年龄大、永久性房颤、f 波平坦、术后早期复发等^[14,19-21]。本研究发现术前房颤病程长、合并三尖瓣成形或置换是影响手术效果的危险因素。术前房颤病程与术前左心房直径是报道的最多的影响房颤复发的危险因素,房颤病程与左心房大小有关,两者相互作用。房颤的发生能使心房电生理及组织结构改变,最终导致左心房扩大,左心房的扩

大参与并维持房颤复发,因此房颤病程越长,左心房越大,由房颤引起的心肌结构及功能的改变就越严重,术后复发房颤的可能就越大。本组病例窦性组与非窦性组术前房颤病程分别为(51.9 ± 58.3)月和(84.7 ± 41.4)月,单因素及多因素分析均显示差异有统计学意义,与以往结果一致。术前左心房内径分别为(58.2 ± 8.8)mm和(61.0 ± 9.7)mm,有差异但无统计学意义,考虑与样本量较小有关。

房颤时心房肌电生理以及机械活动紊乱,不能主动、有规律的收缩和舒张,血液充盈及排空异常,局部血流淤滞,导致心房扩大,左心房压力增高,肺静脉瘀血,肺小动脉痉挛,引起肺动脉高压,肺动脉高压又是造成右心室扩张、三尖瓣环扩大进而产生相对性三尖瓣返流的主要原因。可见,房颤能导致三尖瓣瓣环扩大继发三尖瓣关闭不全。Jun Sung Kim 等^[20]发现术前中度以上三尖瓣返流是迷宫 IV 型手术后房颤复发的危险因素。本研究发现合并三尖瓣成形或置换术的患者术后窦性心律维持率为 48.57%,三尖瓣未处理的患者术后窦性心律维持率为 78.79%,单因素及多因素分析均显示差异有统计学意义,说明合并三尖瓣手术的患者术后中远期疗效差,而三尖瓣需处理的患者大部分为三尖瓣瓣环扩大、中度以上三尖瓣反流的病人。

房颤时心房肌无法有效收缩,心房和心室搏动不协调,不规则的心律导致心室舒张及收缩功能降低;而增快的心室率引起心脏舒张期缩短,进一步减少左心室血液充盈进而降低左心室射血分数。本组病例窦性组与房颤组术前左室射血分数分别为(62.5 ± 7.8)%和(57.1 ± 9.1)%,单因素分析显示差异有统计学意义,多因素分析显示差异无统计学意义,以往的文献也未曾报道术前左室射血分数可以作为双极射频消融改良迷宫术治疗房颤手术效果的预测因素之一,考虑本研究样本量较小,存在偶然因素,且目前并无理论支持,因此暂不能说明术前左室射血分数是影响手术效果的影响因素。

本组病例中虽然有 1 例术后第 22 天死亡及 1 例出院后 3 个月死亡,但是两例死亡均与本身的心脏瓣膜病以及瓣膜置换手术有关,与双极射频消融手术无关。虽然本组病例术后窦性心律维持率为 63.2%,与传统的迷宫手术 90%的手术成功率有一定差距,但随访过程中无远期死亡,包括既往发生脑卒中事件 2 例以及下肢动脉栓塞 1 例患者在内,所有患者随访期间未出现脑卒中或血栓栓塞,考虑与切除左心耳有效防止血栓形成^[21]及口服华法林抗凝密切相关。以上结果说明双极射频消融改良迷宫术安全、有效,术后并发症少,能够有效防止血栓形成,其中远期疗效较为理想。

本研究的局限性及不足之处在于:(1)研究为临床回顾性研究,缺乏前瞻性设计及随机性分组,无法达到盲法。(2)术后由于经济与地域条件的限制,无法获得术后患者连续的心电图资料,病例分组是根据最后一次的心电图及心脏超声心动检查结果。(3)本研究中部分患者没有 24 h 动态心电图资料,因此阵发性房颤的患者可能漏诊。(4)本研究有失访患者,随访率未达到 100%。(5)本组病例样本量小,研究结果存在一定偶然性。因此,今后需要建立更完善的随访制度,选择更加科学的研究方法,更大样本量的随机对照研究以及更长的随访时间来确定改良迷宫手术治疗房颤的远期效果。

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