Surgical Treatment of Atrial Fibrillation with Concomitant Mitral Valve Disease: An Asian Review

Mien-Cheng Chen, MD; Jen-Ping Chang[1], MD; Yung-Lung Chen, MD

Atrial fibrillation (AF) is the most common sustained cardiac arrhythmia in patients with mitral valve disease and is present in up to 50% of patients undergoing mitral valve surgery, contributing to increased risks of systemic embolization, anticoagulant-related hemorrhage and mortality. The Cox maze III procedure, introduced in 1987 by Dr. James Cox, was the first effective operation for AF and is recognized as the gold standard therapy for AF associated with organic heart disease. However, few surgeons have adopted the Cox maze III procedure, as it is a lengthy operation with extensive cutting, suturing and blood loss. Several groups in Asia have successfully developed less invasive approaches using a number of different energy sources to create continuous lines of ablation to replace the surgical incisions. Because high-density real-time intraoperative mapping to define the mechanisms of AF is currently not available to guide AF ablation in most surgical groups, an anatomic approach to ablation based on our understanding of the pathophysiology and empiric results is reasonable. The preoperative left atrial size and duration of AF are primary predictors of sinus conversion after the maze procedure for patients with persistent and permanent AF and mitral valve disease. The maze procedure combined with an atrial volume reduction technique may increase the sinus conversion rate. Future progress will require a better understanding of the mechanisms of AF, and minimally invasive cardiac surgery with endoscopic AF ablation needs to be explored in the Asian region. *(Chang Gung Med J 2008;31:538-45)*

Dr. Mien-Cheng Chen

Key words: atrial fibrillation, maze procedure, mitral valve disease

In the Framingham Heart Study, the lifetime risks for development of atrial fibrillation (AF) were 1 in 4 for men and women 40 years of age and older, underscoring the major public health burden posed by AF and the need for further investigation into predisposing conditions, preventive strategies, and more effective therapies.[1] Atrial fibrillation is the most common sustained cardiac arrhythmia in patients with mitral valve disease and present in up to 50% of patients undergoing mitral valve surgery, contributing to increased risks of systemic embolization, anticoagulant-related hemorrhage and mortality.[2-4] In patients undergoing mitral valve surgery, persistence of postoperative AF is both a marker and a risk fac-

From the Division of Cardiology, Department of Internal Medicine; [1]Division of Cardiovascular Surgery, Chang Gung Memorial Hospital-Kaohsiung Medical Center, Chang Gung University College of Medicine, Kaohsiung, Taiwan.
Received: Dec. 26, 2007; Accepted: Feb. 21, 2008
Correspondence to: Dr. Mien-Cheng Chen, Division of Cardiology, Department of Internal Medicine, Chang Gung Memorial Hospital. 123, Dapi Rd., Niaosong Township, Kaohsiung County 833, Taiwan (R.O.C.) Tel.: 886-7-7317123 ext. 8300;
Fax: 886-7-7322402; E-mail: chenmien@ms76.hinet.net

tor for increased mortality.[5] Antiarrhythmic drugs currently available for treating AF suffer from limited efficacy and the potential for life-threatening ventricular proarrhythmia.[6] For these reasons, a definitive therapeutic strategy for AF should be incorporated into the operative strategy for patients with mitral valve disease and AF undergoing mitral valve surgery.

The first effective operation for AF was introduced in 1987 by Dr. James Cox.[7-9] The Cox maze III procedure involves creating a myriad of incisions on both the right and the left atria (Fig. 1). The operation is based on the belief that AF is produced by multiple macroreentry circuits in the atria.[10] The Cox maze III procedure was highly successful in restoration of sinus rhythm and atrial transport function in patients with lone AF. Later, the Cox maze III procedure was extended to patients with AF associated with organic heart disease and more than 90% of patients with chronic AF associated with mitral valve disease resumed sinus rhythm after the Cox maze III procedure.[11-14] Few surgeons have adopted the Cox maze III procedure, as it is a lengthy operation with extensive cutting, suturing and blood loss. Moreover, the procedure had significant morbidities. In one report, pacemakers were required in 23.3% of patients who underwent Cox maze III operations as concomitant procedures due to bradycardia and 12.8% of patients without the preoperative diagnosis of sick sinus syndrome required postoperative pacemaker implantation.[15] The shortcomings of the Cox maze III procedure led to interest in developing less invasive surgical approaches to AF, either simplification of the lesion set or replacement of the surgical incisions with continuous lines of ablation using a variety of different energy sources.

Modification of the Cox maze procedure in patients with mitral valve disease: lesion set

Electrophysiological findings in human AF have shown that repetitive activations arising from the pulmonary veins are one of the fundamental mechanisms triggering, and perhaps perpetuating AF.[16,17] Indeed, Sueda et al. simply isolated the posterior left atrium including the four pulmonary veins without any incisions on the right atrium in patients with permanent AF associated with mitral valve disease, and found that 74% of the patients were cured of AF in a

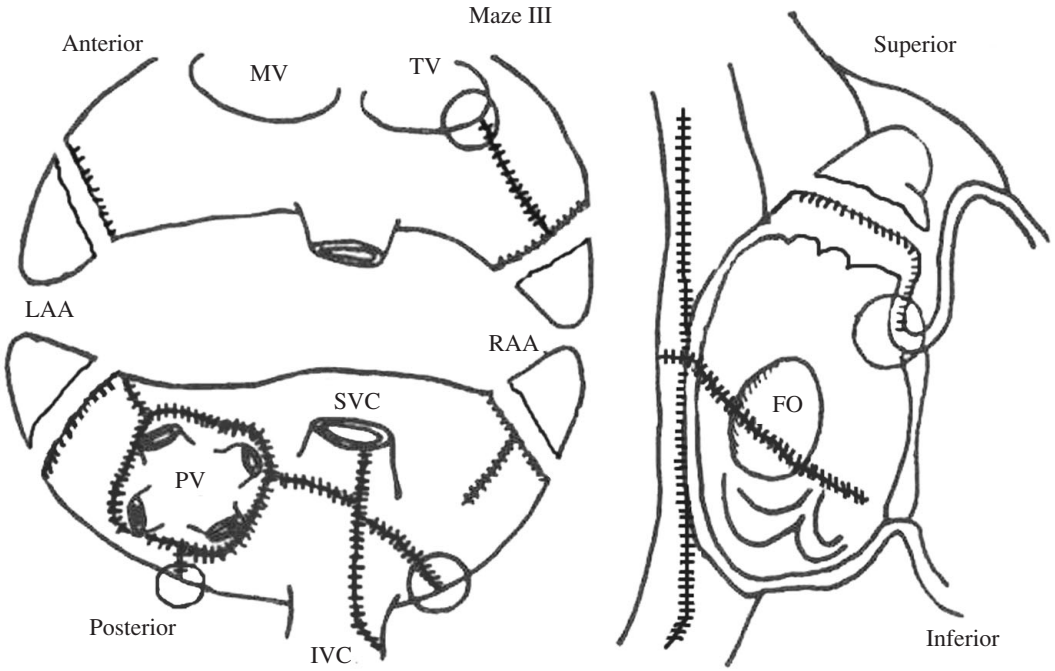

Fig. 1 The Cox maze III procedure. Left, epicardial view of the atria. Right, endocardial view of the atria. Solid line with cross bars, incision and suturing. FO: fossa ovalis; IVC: inferior vena cava; LAA: left atrial appendage; MV: mitral valve; PV: pulmonary vein; RAA: right atrial appendage; SVC: superior vena cava; TV: tricuspid valve.

follow-up period of up to 3 years.[18]

Harada et al. were the first to utilize intraoperative mapping in determining the optimal surgical procedure to cure AF and to apply cryothermy to the left atrial appendage where regular and repetitive electrical discharges originated, and successfully terminated AF.[19] They further examined the usefulness of intraoperative mapping in 12 patients and demonstrated that regular and repetitive activation originated in the left atria while activation in the right atria was extremely complex and chaotic in the majority of the patients with permanent AF and mitral valve disease.[20] From these findings, they concluded that the left atrium acts as an electrical driving chamber for permanent AF. However, sinus rhythm was not restored in more than 20% of patients with permanent AF associated with mitral valve disease following simple left atrial isolation without any incisions on the right atrium[18] Thus, with some patients who have reentrant activations in the right atrium, biatrial incisions in addition to pulmonary vein isolation are necessary and inevitable.[21,22] Nitta et al. used a 256-channel mapping system with custom-made epicardial patch electrodes to examine atrial activation during AF and to determine the optimal procedure intraoperatively.[23] A simple left atrial procedure, consisting of pulmonary vein isolation and left atrial incisions without any right atrial incisions, was performed in patients in whom the right atrial activation was passive, and all were cured of AF. In the remaining patients who had reentrant activations in the right atria, biatrial incisions in addition to pulmonary vein isolation were done and 89% of the patients were cured from AF.

Although routine real-time intraoperative mapping is currently not available to guide AF ablation in cardiac surgery patients,[23] an anatomic approach to ablation based on our understanding of the pathophysiology and empiric results is reasonable. We developed an anatomic sequential strategy for AF ablation.[24] In the first phase, a modified left atrial maze operation was carried out with concomitant valvular surgery; the right side maze operation was subsequently carried out as a second phase of the sequential strategy only if AF reappeared following spontaneous restoration of heart beats during the operation. We found that comparing with the left atrial maze procedure, the application of simultaneous sequential strategy successfully restored sinus rhythm in an additional 22.2% of patients with persistent AF, and the overall sinus conversion rate of 88.9% was comparable with that of the standard biatrial maze procedure.[24] In fact, such an anatomic (rather than map-guided) approach is rapidly becoming the foundation for catheter-based ablation of AF.[25-27]

One of the shortcomings of the Cox maze III procedure is that pacemaker implantation is required in 23.3% of patients as a result of bradycardia.[15] In an animal model, Mcloughlin et al. showed that the maze procedure produced significant acute sinus node dysfunction and a trend toward sinus node dysfunction developing in the chronic phase of the maze procedure.[28] Boineau et al. demonstrated that human physiological pacemaker tissue extended across a significantly larger area of atrial tissue than that had been previously recognized.[29] Based on this concept, we introduced another atrial pacemaker complex preserved radiofrequency maze procedure, effectively restoring sinus rhythm and atrial transport function in the majority of patients with permanent AF and mitral valve disease and only 2.8% of patients developed late sinus node dysfunction postoperatively.[30]

Modification of the Cox maze procedure in patients with mitral valve disease: replacement of surgical incisions with ablation using a variety of different energy sources

Another shortcoming of the Cox maze III procedure is that it is a lengthy operation with extensive cutting, suturing and blood loss. This has led to interest in developing less invasive surgical approaches to ablate AF using a variety of different energy sources.

Kosakai et al. modified the Cox maze III procedure with cryoablation for patients with organic heart disease and 86% of patients were free from AF and atrial flutter after the operation.[11] Lee et al. reported similar results.[31]

Intraoperative radiofrequency ablation is a novel surgical principle for the treatment of AF in combination with a standard open heart operation. We introduced intraoperative radiofrequency catheter ablation and cryoablation to modify the maze procedures to obviate the need for extensive atrial incisions in patients undergoing simultaneous valvular surgery and 80% of patients had restored sinus rhythm after surgery in our initial experience.[32] Our results represent the first report in humans that the

maze procedure, using unipolar radiofrequency energy and cryoablation with concomitant valvular surgery, has an acceptable success rate in restoring sinus rhythm and atrial transport function.[33] In our early experience with 77 patients with permanent AF and mitral valve disease undergoing the radiofrequency maze procedure and concomitant mitral valve operations, 65 patients (84.4%) had persistent sinus conversion and 12 patients (15.6%) did not regain sinus rhythm at a mean follow-up of 38 months. In addition, left atrial transport function was observed in 56 patients (86%) and right atrial transport function was observed in all 65 patients (100%) with restoration of sinus rhythm after the radiofrequency maze procedure.[34]

Clinical determinants of sinus conversion by the maze procedure in patients with mitral valve disease

Kosakai demonstrated that in patients with mitral valve disease who underwent the surgical maze procedure for AF, the sinus conversion rates decreased as the preoperative left atrial dimensions increased.[35] We had similar observations in patients with permanent AF and mitral valve disease who underwent the saline-irrigated unipolar radiofrequency maze procedure while undergoing concomitant valvular operations (Fig. 2).[34,36] In addition, we showed that the preoperative duration of AF was also a primary predictor of sinus conversion after the radiofrequency maze procedure for patients with persistent AF and mitral valve disease. In our study of 99 consecutive patients with persistent AF and mitral valve disease undergoing radiofrequency maze procedure and concomitant mitral valve operations, we found that the sinus conversion rate was significantly lower in patients with preoperative left atrial diameters > 56.8 mm than in patients with preoperative left atrial diameters < 56.8 mm (OR 7.41, 95% CI 2.29 - 23.98, $p < 0.001$). The incidence of AF at 3 and 5 years was significantly greater in patients with left atrial diameters > 56.8 mm than in those with left atrial diameters < 56.8 mm (16.4% vs 2.9% and 38.7% vs 11.5%, respectively, $p < 0.001$) (Fig. 3).[36]

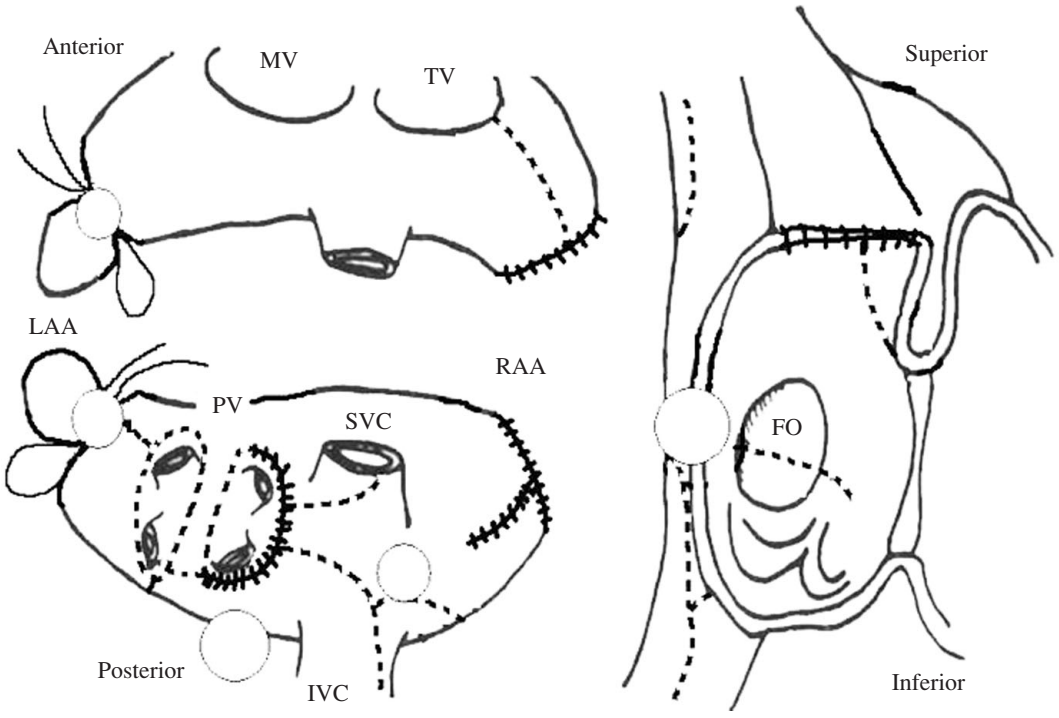

Fig. 2 The radiofrequency maze procedure. Left, epicardial view of the atria. Right, endocardial view of the atria. Circle, cryoablation; solid line with cross bars, incision and suturing; dotted line, radiofrequency ablation. FO: fossa ovalis; IVC: inferior vena cava; LAA: left atrial appendage; MV: mitral valve; PV: pulmonary vein; RAA: right atrial appendage; SVC: superior vena cava; TV: tricuspid valve. Reprinted with permission from Chen et al.[36]

In addition, the sinus conversion rate was significantly lower in patients with an AF duration > 66 months than in patients with AF duration < 66 months (OR 9.45, 95% CI 2.74 to 32.60, $p < 0.001$). The incidence of AF at 3 and 5 years was significantly greater in patients with AF duration > 66 months than in those with AF duration < 66 months (22.6% vs 0% and 37.9% vs 12.5%, respectively, $p < 0.0001$) (Fig. 4).[36] Furthermore, we showed that the postoperative left and right atrial dimensions of patients who had sinus conversion by the radiofrequency maze procedure were significantly smaller than those of patients who did not regain sinus rhythm.[37] Based on our report, Marui et al. developed a novel atrial volume reduction technique combined with the Cox maze III procedure or left atrial maze procedure in patients with large left atrial diameters (≥ 60 mm) and they found that the sinus conversion rate in patients with the volume reduction technique was significantly better that in patients without this technique.[38]

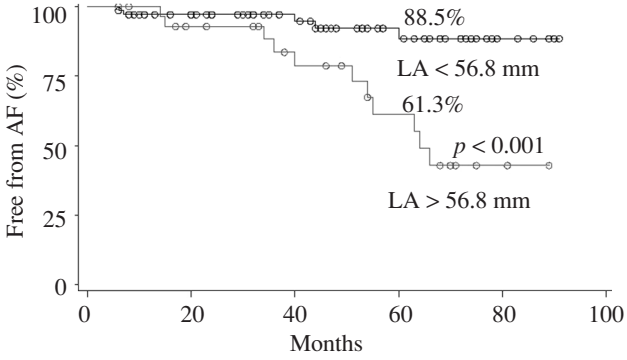

Fig. 3 Kaplan-Meier estimates of the mean rates of freedom from atrial fibrillation (AF) among patients with persistent AF who underwent the radiofrequency maze procedure, according to the preoperative left atrial (LA) diameter. Note that the incidence of AF was significantly greater in patients with preoperative LA diameters > 56.8 mm than in patients with preoperative left atrial diameters < 56.8 mm. Reprinted with permission from Chen et al.[36]

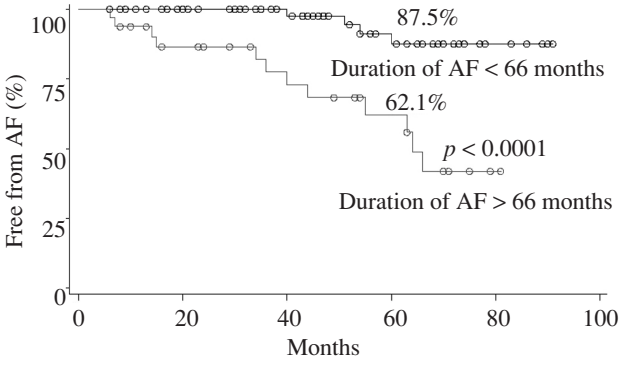

Fig. 4 Kaplan-Meier estimates of the mean rates of freedom from atrial fibrillation (AF) in patients with persistent AF who underwent the radiofrequency maze procedure, according to the preoperative duration of AF. Note that incidence of AF was significantly greater in patients with durations of AF > 66 months than in patients with duration of AF < 66 months. Reprinted with permission from Chen et al.[36]

Future directions

Minimally invasive cardiac surgery with endoscopic AF ablation is possible in selected patients[39] but this technique needs to be explored in the Asian region.

Conclusions

Atrial fibrillation is the most frequent sustained cardiac arrhythmia in patients with mitral valve disease. If left untreated, AF increases morbidity and jeopardizes survival. The shortcomings of the cut-and-sew Cox maze III procedure have led to replacement of the operations with alternative energy sources to rapidly create lines of conduction block with fewer morbidities. Continued progress in understanding the mechanisms of AF and minimally invasive AF ablation will facilitate tailored ablation approaches and improve the surgical outcomes as well as the quality of life for individual patients with atrial fibrillation and concomitant mitral valve disease.

REFERENCES

1. Lloyd-Jones DM, Wang TJ, Leip EP, Larson MG, Levy D, Vasan RS, D'Agostino RB, Massaro JM, Beiser A, Wolf PA, Benjamin EJ. Lifetime risk for development of atrial fibrillation: The Framingham Heart Study. Circulation 2004;110:1042-6.
2. Chesebro JH, Fuster V, Halperin JL. Atrial fibrillation-risk marker for stroke. N Engl J Med 1990;323:1556-8.
3. Benjamin EJ, Wolf PA, D'Agostino RB, Silbershatz H, Kannel WB, Levy D. Impact of atrial fibrillation on the risk of death: the Framingham heart study. Circulation 1998;98:946-52.
4. Grigioni F, Avierinos JF, Ling LH, Scott CG, Bailey KR, Tajik AJ, Frye RL, Enriquez-Sarano M. Atrial fibrillation complicating the course of degenerative mitral regurgita-

tion: determinants and long-term outcome. J Am Coll Cardiol 2002;40:84-92.
5. Bando K, Kasegawa H, Okada Y, Kobayashi J, Kada A, Shimokawa T, Nasu M, Nakatani S, Niwaya K, Tagusari O, Nakajima H, Hirata M, Yagihara T, Kitamura S. Impact of preoperative and postoperative atrial fibrillation on outcome after mitral valvuloplasty for nonischemic mitral regurgitation. J Thorac Cardiovasc Surg 2005;129:1032-40.
6. Waldo AL, Prystowsky EN. Drug treatment of atrial fibrillation in the managed care era. Am J Cardiol 1998;81:23C-29C.
7. Cox JL, Canavan TE, Schuessler RB, Cain ME, Lindsay BD, Stone C, Smith PK, Corr PB, Boineau JP. The surgical treatment of atrial fibrillation. II. Intraoperative electrophysiologic mapping and description of the electrophysiologic basis of atrial flutter and atrial fibrillation. J Thorac Cardiovasc Surg 1991;101:406-26.
8. Cox JL, Schuessler RB, D'Agostino HJ Jr, Stone CM, Chang BC, Cain ME, Corr PB, Boineau JP. The surgical treatment of atrial fibrillation. III. Development of a definitive surgical procedure. J Thorac Cardiovasc Surg 1991;101:569-83.
9. Cox JL. The surgical treatment of atrial fibrillation. IV. Surgical technique. J Thorac Cardiovasc Surg 1991;101:584-92.
10. Moe GK, Abildskov JA. Atrial fibrillation as a self-sustaining arrhythmia independent of focal discharge. Am Heart J 1959;58:59-70.
11. Kosakai Y, Kawaguchi AT, Isobe F, Sasako Y, Nakano K, Eishi K, Kito Y, Kawashima Y. Modified Maze procedure for patients with atrial fibrillation undergoing simultaneous open heart surgery. Circulation 1995;92(suppl II):359-64.
12. Sandoval N, Velasco VM, Orjuela H, Caicedo V, Santos H, Rosas F, Carrea JR, Melgarejo I, Morillo CA. Concomitant mitral valve or atrial septal defect surgery and the modified Cox-maze procedure. Am J Cardiol 1996;77:591-6.
13. Kawaguchi AT, Kosakai Y, Sasako Y, Eishi K, Nakano K, Kawashima Y. Risks and benefits of combined maze procedure for atrial fibrillation associated with organic heart disease. J Am Coll Cardiol 1996;28:985-90.
14. Isobe F, Kawashima Y. The outcome and indications of the Cox maze III procedure for chronic atrial fibrillation with mitral valve disease. J Thorac Cardiovasc Surg 1998;116:220-7.
15. Prasad SM, Maniar HS, Camillo CJ, Schuessler RB, Boineau JP, Sundt TM 3rd, Cox JL, Damiano RJ Jr. The Cox maze III procedure for atrial fibrillation: long-term efficacy in patients undergoing lone versus concomitant procedures. J Thorac Cardiovasc Surg 2003;126:1822-8.
16. Haissaguerre M, Jais P, Shah DC, Takahashi A, Hocini M, Quiniou G, Garrigue S, Le Mouroux A, Le Metayer P, Clementy J. Spontaneous initiation of atrial fibrillation by ectopic beats originating in the pulmonary veins. N Engl J Med 1998;339:659-66.
17. Chen SA, Hsieh MH, Tai CT, Prakash VS, Yu MC, Hsu TL, Ding YA, Chang MS. Initiation of atrial fibrillation by ectopic beats originating from the pulmonary veins: electrophysiologic characteristics, pharmacologic responses, and effects of radiofrequency ablation. Circulation 1999;100:1879-86.
18. Sueda T, Nagata H, Shikata H, Orihashi K, Morita S, Sueshiro M, Okada K, Matsuura Y. Simple left atrial procedure for chronic atrial fibrillation associated with mitral valve disease. Ann Thorac Surg 1996;62:1796-800.
19. Harada A, Sugimoto T, Asano T, Yamada K. Intraoperative map-guided operation for chronic atrial fibrillation. Ann Thorac Surg 1998;66:1401-3.
20. Harada A, Konishi T, Fukata M, Higuchi K, Sugimoto T, Sasaki K. Intraoperative map guided operation for atrial fibrillation due to mitral valve disease. Ann Thorac Surg 2000;69:446-50.
21. Nitta T, Ishii Y, Miyagi Y, Ohmori H, Sakamoto S, Tanaka S. Concurrent multiple left atrial focal activations with fibrillatory conduction and right atrial focal or reentrant activation as the mechanism in atrial fibrillation. J Thorac Cardiovasc Surg 2004;127:770-8.
22. Chen SA, Tai CT, Yu WC, Chen JY, Tsai CF, Hsieh MH, Chen CC, Prakash VS, Ding YA, Chang MS. Right atrial focal atrial fibrillation: electrophysiologic characteristics and radiofrequency catheter ablation. J Cardiovasc Electrophysiol 1999;10:328-35.
23. Nitta T, Ohmori H, Sakamoto S, Miyagi Y, Kanno S, Shimizu K. Map-guided surgery for atrial fibrillation. J Thorac Cardiovasc Surg 2005;129:291-9.
24. Chang JP, Chen MC, Kao CL, Yang CH, Yu TH, Chen CJ. Role of the simultaneous sequential strategy for failed acute sinus restoration after modified left maze procedure for persistent atrial fibrillation with concomitant mitral surgery. World J Surg 2006;30:1802-8.
25. Pappone C, Oreto G, Rosanio S, Vicedomini G, Tocchi M, Gugliotta F, Salvati A, Dicandia C, Calabro MP, Mazzone P, Ficarra E, Di Gioia C, Gulletta S, Nardi S, Santinelli V, Benussi S, Alfieri O. Atrial electroanatomic remodeling after circumferential radiofrequency pulmonary vein ablation: efficacy of an anatomic approach in a large cohort of patients with atrial fibrillation. Circulation 2001;104:2539-44.
26. Oral H, Pappone C, Chugh A, Good E, Bogun F, Pelosi Jr F, Bates ER, Lehmann MH, Vicedomini G, Augello G, Agricola E, Sala S, Santinelli V, Morady F. Circumferential pulmonary vein ablation for chronic atrial fibrillation. N Engl J Med 2006;354:934-41.
27. Fuster V, Ryden LE, Cannom DS, Crijns HJ, Curtis AB, Ellenbogen KA, Halperin JL, Le Heuzey JY, Kay GN, Lowe JE, Olsson SB, Prystowsky EN, Tamargo JL, Wann S, Smith Jr SC, Jacobs AK, Adams CD, Anderson JL, Antman EM, Hunt SA, Nishimura R, Ornato JP, Page RL, Riegel B, Priori SG, Blanc JJ, Budaj A, Camm AJ, Dean V, Deckers JW, Despres C, Dickstein K, Lekakis J,

McGregor K, Metra M, Morais J, Osterspey A, Zamorano JL, ACC/AHA/ESC. Guidelines for the management of patients with atrial fibrillation. Circulation 2006;114: e257-354.
28. Mcloughlin DE, Blitz A, Simmons J, Brodman R, Frame R, Bator S, Adams J, Schwartz DS, Furman S, Fisher JD. Electrophysiological effect of the maze procedure on canine sinoatrial nodal function. Pacing Clin Electrophysiol 1992;15:2084-91.
29. Boineau JP, Canavan TE, Schuessler RB, Cain ME, Corr PB, Cox JL. Demonstration of a widely distributed pacemaker complex in the human heart. Circulation 1988;77:1221-37.
30. Chen MC, Chang JP, Chen CJ, Yang CH, Hung WC, Fu M, Yeh KH. Atrial pacemaker complex preserved radiofrequency maze procedure reducing the incidence of sick sinus syndrome in patients with atrial fibrillation. Chest 2005;128:2571-5.
31. Lee JW, Choo SJ, Kim KI, Song JK, Kang DH, Song JM, Song H, Lee SK, Song MG. Atrial fibrillation surgery simplified with cryoablation to improve left atrial function. Ann Thorac Surg 2001;72:1479-83.
32. Chen MC, Guo BF, Chang JP, Yeh KH, Fu M. Radiofrequency and cryoablation of atrial fibrillation in patients undergoing valvular operations. Ann Thorac Surg 1998;65:1666-72.
33. Khargi K, Hutten BA, Lemke B, Deneke T. Surgical treatment of atrial fibrillation: a systematic review. Eur J Cardiothorac Surg 2005;27:258-65.
34. Chen MC, Chang JP, Chang HW. Preoperative atrial size predicts the success of radiofrequency maze procedure for permanent atrial fibrillation in patients undergoing concomitant valvular surgery. Chest 2004;125:2129-34.
35. Kosakai Y. Treatment of atrial fibrillation using the maze procedure: the Japanese experience. Semin Thorac Cardiovasc Surg 2000;12:44-52.
36. Chen MC, Chang JP, Chang HW, Chen CJ, Yang CH, Chen YH, Fu M. Clinical determinants of sinus conversion by radiofrequency maze procedure for persistent atrial fibrillation in patients undergoing concomitant mitral valvular surgery. Am J Cardiol 2005;96:1553-7.
37. Chen MC, Chang JP, Guo GBF, Chang HW. Atrial size reduction as a predictor of the success of radiofrequency maze procedure for chronic atrial fibrillation in patients undergoing concomitant valvular surgery. J Cardiovasc Electrophysiol 2001;12:867-74.
38. Marui A, Nishina T, Tambara K, Saji Y, Shimamoto T, Nishioka M, Ikeda T, Komeda M. A novel atrial reduction technique to enhance the Cox maze procedure: initial results. J Thorac Cardiovasc Surg 2006;132:1047-53.
39. Saltman AE. Minimally invasive surgery for atrial fibrillation. Semin Thorac Cardiovasc Surg 2007;19:33-8.

僧帽瓣疾病併心房纖維顫動的外科治療方式：亞洲的綜合評論

陳勉成 張仁平[1] 陳永隆

心房纖維顫動是僧帽瓣疾病病人最常見持續性的心律不整，而且可在百分之五十進行僧帽瓣手術的病人身上見到心房纖維顫動的存在，心房纖維顫動會增加全身性血栓的形成、抗凝血劑相關的出血及死亡。西元 1987 年由 James Cox 醫師所發明的 Cox maze III 手術是第一個針對心房纖維顫動有效的治療手術，而且被公認爲器質性心臟病合併心房纖維顫動的標準治療方式。然而，極少數的外科心臟醫師採用 Cox maze III 手術方式，因爲它需要較長的手術時間用於切割及縫合，及其造成較多的血液流失。幾個亞洲的研究團隊已經成功的發展出，利用不同的能量來源來產生連續的病灶，用以取代傳統的手術切割方式。由於，目前大多數的手術團隊並無法擁有高密度即時的電生理學定位儀器，來確定心房纖維顫動的機制而引導迷路手術。所以，根據我們所瞭解的病生理學知識及經驗性的累積，使用解剖學上固定路線來燒灼的處理方式是合理的。術前左心房的大小及心房纖維顫動已存在的時間，是主要預測持續性或永久性心房纖維顫動及僧帽瓣疾病病人，接受迷路手術後是否能回復成正常竇性心臟節律的決定因子。迷路手術合併心房容積減少手術可能會增加回復成正常竇性心臟節律的機率。未來的發展包括需要更瞭解心房纖維顫動的機制，另外使用內視鏡作爲治療心房纖維顫動的微創迷路手術方式，也是未來需要進一步在亞洲區域進行發展的方向。(長庚醫誌 2008;31:538-45)

關鍵詞：心房纖維顫動，迷路手術，僧帽瓣疾病

長庚紀念醫院 高雄院區 心臟內科，[1]心臟外科；長庚大學 醫學院
受文日期：民國96年12月26日；接受刊載：民國97年2月21日
通訊作者：陳勉成醫師，長庚紀念醫院 心臟內科。高雄縣833鳥松鄉大埤路123號。Tel.: (07)7317123轉8300; Fax: (07)7322402; E-mail: chenmien@ms76.hinet.net