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APPENDIX. CONFERENCE DISCUSSION

Dr S. Salzberg *(Zurich, Switzerland)*: You summarize how biatrial pacing can actually lead to a shorter hospital stay and better short-term outcomes after the maze procedure. I would like to start with a brief comment.

A maze procedure isn't a maze procedure, we know that. Therefore, I think it would be good if, in your manuscript, you might change the title, or even the definition, and really say what it is: it is a left atrial ablation procedure, if I understand correctly, only left-sided ablations, and therefore it is not a true Cox maze as we learned it.

My question is in regard to your pacing protocol. We know that failure of sinus rhythm at the end of an ablation procedure is a factor for a bad outcome. Were all patients paced? I understood you randomized 80 patients to biatrial pacing and 80 patients to right-sided pacing. Were all patients able to be paced?

Dr Wang: First, I will answer your question regarding the maze procedure. I don't know, maybe we'll redesign my descriptor. We didn't do the right or left maze procedure alone. For these 240 patients, it was a full maze, which is left maze plus right maze. This is a full maze. The only reason we do the left maze, for example, is for paroxysmal atrial fibrillation or in patients aged 70 and above and a long history of atrial fibrillation with coronary bypass surgery. We don't know if we are going to restore sinus rhythm, so we just do a left maze.

To answer your question regarding the pacing, from my experience, after completion of the maze procedure, the majority of patients, probably 80%, are in junctional rhythm in the OR; we like junctional rhythm. If the patient is in junctional rhythm, we are very happy. We know we're going to get back to sinus rhythm. But a very small number, maybe 15%, are in sinus rhythm. So yes, you are right, maybe 10–12% of the patients, no matter what you do, are still in atrial fibrillation. We knew preoperatively the types of patients who do very poorly with the maze procedure: for example, number 1, the patients with a long history of chronic atrial fibrillation; number 2, the huge giant atrium; number 3, aortic valve combined with coronary bypass surgery. These patients do not do very well. The truly rheumatic mitral valve patients are younger and usually do very well with the maze procedure. So yes, to answer your question, probably in 12%, maybe a little more, we are not able to capture atrial pacing, we are not able to pace them.

Dr Salzberg: Did you also look at catecholamine use, inotropic support during ICU support, how did that reflect the pacing strategies?

Dr Wang: Yes, you are right. Basically, right now, we are going to start a clinical trial in the Scripps Memorial Hospital using a drug called Precedex by IV infusion postoperatively after the maze procedure. We are also routinely checking the BNP level and if the level is above 800, we start Natrecor IV plus Precedex IV to reduce catecholamines.

In general, postoperative inotropic usage after valve surgery is relatively low compared with coronary surgery. Probably 45–50% of our patients having concomitant valve surgery and maze did not require any inotropes. I don't know if I answered your question or not.

Dr Salzberg: And one last question. In the manuscript I read that all patients were treated with amiodarone and Viagra. Could you please comment on that.

Dr Wang: We have a postoperative protocol for maze patients. Preoperatively amiodarone is not mandatory. In the operating room a bolus of 250 mg amiodarone is administered, then 1 mg IV for six hours, followed by 0.5 mg/kg IV for 18 h or until extubated. After extubation the patient can start PO with 200 mg twice daily for three months, something like that. A lot of you guys may ask, okay, amiodarone probably slows down the patient's heart rate, but because we have the biatrial pacing, we don't worry about that. That's number one. Number two is Viagra. The reason is that the majority of patients with mitral valve disease present with pulmonary hypertension. We thought that 25 or 50 mg of Viagra, to reduce the pulmonary hypertension, would have benefits for long-term atrial fibrillation.

Dr M. Castella *(Barcelona, Spain)*: When you pace two different chambers with only one pacemaker, you have the negative pole and the positive pole. The negative pole is the one that makes the impulse and the positive is the one that receives the impulse. Were you always placing the negative on the left atrium, that would be the difference between pacing the right atrium, or did you not make any difference between the positive and the negative?

Dr Wang: That's a very good question, because right now a lot of people are confused with this pacing. Last year I presented a paper on the same subject at the AATS, published in JTCVS, and it confused people. For example, you put one unipolar pacing wire in the Bachmann's bundle area, which is on the dome of the left atrium, located between the ascending aorta and the SVC area, and put another unipolar wire on the right atrium connected to a bipolar pacemaker. That is not called biatrial pacing, just a single atrial pacing. You have to attach one bipolar pacing wire on the dome of the left atrium which has one negative and one positive pole. Another unipolar pacing wire is placed in the right *crista terminalis* area. You insert one negative pole of the left pacing wire and the right unipolar pacing pole together into one of the pacemaker sockets, and you plug the positive pole of the left pacing wire to the other socket of the pacemaker. This format of pacing is biatrial pacing.

Another option you can do is to plug the unipolar right atrial wire and the unipolar left atrial pacing wire together into one socket, place another unipolar pacing wire on the skin and connect to another pacemaker socket. That also is biatrial pacing.

Dr Castella: The two in the negative at least?

Dr Wang: Yes. Because the two is positive and one is negative, you start biatrial pacing.

Dr Castella: So it's truly biatrial pacing.

Dr Wang: Yes.

Dr Castella: And about results, did these patients have a shorter length of stay?

Dr Wang: Yes. This is a very good question. Regarding hospital stay, if there is no recurrent atrial fibrillation after the maze procedure the patients go home usually on postoperative day 5. I don't know what happens in Barcelona, but in the United States, if patients develop postoperative recurrent atrial fibrillation, we do not advocate early conversion; we first try pharmacologic control and even discharge patients home on day 4 if they are stable. If atrial fibrillation persists, we will bring the patient back for cardioversion in the fourth postoperative week.

eComment. Is atrial pacing after maze procedure the key to a successful outcome?

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doi:10.1093/icvts/ivt104

We read with great interest the article by Wang *et al.* on the "effectiveness of biatrial pacing in reducing early postoperative atrial fibrillation after the maze procedure" [1]. The problem of postoperative atrial fibrillation (AF) after cardiac operations remains a major one, complicating up to 40% of patients [2,3]. Furthermore, our unpublished data show that AF after maze procedure can involve as many as 50% of the patients in the immediate postoperative period. Our personal experience has shown that it can take a few weeks or even months after the maze procedure to establish a sinus rhythm. It is our strong belief that every effort has to be made in order to avoid postoperative AF in order to maintain haemodynamic stability and embolic events.

Our routine protocol after a maze procedure is to pace the right atrium for 48h postoperatively, while starting aggressive beta-blocker therapy the morning after the operation regardless of the patient's vasopressor requirements. However, this

study is a great example that bi-atrial pacing may be even more beneficial. We would like to see more similar studies that could finally lead to a change in current practice in order to reduce the number of patients with postoperative AF after a maze procedure.

Conflict of interest: none declared.

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eComment. How to maintain sinus rhythm in patients with atrial fibrillation after atrium ablation?

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doi:10.1093/icvts/ivt133

I read with great interest the article by Wang *et al.* on the effectiveness of biatrial pacing in reducing early postoperative atrial fibrillation after the maze procedure [1]. I congratulate Wang and coworkers on their well-designed analysis and the interesting results in their publication. The most important factors to re-establish postoperative sinus rhythm in patients with long-term atrial fibrillation (AF) before cardiac surgery are dilatation of the left atrium, time of onset of AF and effectiveness and completeness of the procedure to remove the re-entry circuits in the atrium. I did not publish data on recurrence of AF after left atrium (radio)ablation in the postoperative period. My experience led me to use a loading dose of 300 mg of amiodarone intraoperative intravenous and then 900 mg intravenous 24 hours postoperatively. This was followed by 200 mg daily at discharge for 6 months. I used single or biatrial pacing according to the patient condition at completion of the surgery. This allowed me to mostly re-establish a long-term sinus rhythm postoperatively.

All the factors mentioned above and the postoperative medical treatment play a role in letting the atrium restore its sinus rhythm.

Conflict of interest: none declared.

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