Surgery for Acquired Heart Disease

Results of nonguided subtotal endocardiectomy associated with left ventricular reconstruction in patients with ischemic ventricular arrhythmias

We analyzed the effects of nonguided endocardiectomy in patients with ischemic ventricular arrhythmias who underwent reconstructive operations for postinfarction left ventricular aneurysm. A total of 106 patients among 287 consecutive patients had spontaneous or inducible ventricular tachycardia (49 spontaneous and 57 inducible). Cryotherapy was done in 67 patients and coronary revascularization was done in 98%. Patients underwent complete hemodynamic study including programmed ventricular stimulation before and early after operation. Thirty-seven patients underwent hemodynamic evaluation after 1 year. The hospital mortality rate was 7.5%. At early and late studies the mean ejection fraction was significantly increased. Ventricular tachycardia was no longer inducible in 92% of patients after operation; only two patients had spontaneous ventricular tachycardia early after operation. At late study 10.8% of patients had inducible ventricular tachycardia and no spontaneous ventricular tachycardia was documented. All surviving patients had clinical follow-up (mean 21.3 months, range 2 to 64 months). There were eight late deaths and no episodes of ventricular tachycardia or syncope that necessitated hospitalization. In conclusion, nonguided, extended endocardiectomy associated with left ventricular reconstruction is safe and effective in curing ischemic spontaneous and inducible ventricular tachycardia. (J THORAC CARDIOVASC SURG 1994;107:1301-8)

V. Dor, MD,a M. Sabatier, MDa (by invitation), F. Montiglio, MDa (by invitation), P. Rossi, MDa (by invitation), Monte Carlo, Monaco; and M. Di Donato, MDb (by invitation), Florence, Italy

During the past decade considerable advancement has been made in the treatment of patients with malignant ventricular arrhythmias. Treatment options include pharmacologic antiarrhythmic therapy, surgical treatment with guided and nonguided endocardial resection of the arrhythmogenic sites,1-4 cryotherapy, and laser ablation.5-10 Blind aneurysmectomy alone, mainly if done with standard linear suture, has been reported to have a higher failure rate in resistant ventricular arrhythmias.11,12

More recently, the introduction of the automatic implantable cardioverter-defibrillator has been an important step forward for patients who have survived sudden death. Furthermore, the sole alternative for the treatment of malignant arrhythmias in patients with severely depressed left ventricular (LV) function whose surgical risk is considered extremely high is heart transplantation.

Nowadays, despite all these clinical and surgical therapeutic interventions, the decision of how to manage ischemic malignant ventricular arrhythmias is still con-
troversial. It has to be mentioned that all these treatments are problematic inasmuch as in the majority of cases they are done in patients with coronary artery disease whose long-term prognosis depends not only on the presence or absence of ventricular arrhythmias, but also mainly on the underlying disease and on LV function.

In our center, a vast experience in reconstructive surgery for postinfarction LV aneurysm associated with complete myocardial revascularization has been developed since 1984, using the technique of endoventricular circular patch repair with septal exclusion.12-17 Our results have definitely demonstrated that this technique allows for achievement of significant improvement in LV function both at early and late hemodynamic evaluation, with a relatively low surgical risk even in patients with extremely severe LV dysfunction.16

In the present paper we report the results of this kind of operation with associated subtotal nonguided endocardectomy in patients with spontaneous or inducible VA who underwent endoventricular circular patch repair for postinfarction LV aneurysm and coronary artery disease.

**Methods**

**Study patients.** A series of 287 consecutive patients were treated by reconstructive operations endoventricular circular patch repair and septal exclusion for postinfarction LV aneurysm between 1987 and 1992. Angina, congestive heart failure (CHF), or ventricular arrhythmia was the single indication for operation in 14%, 8%, and 3% of patients, respectively, whereas 75% of patients had multiple indications. One hundred six patients (97 men and 7 women, mean age 59 ± 8 years) who had spontaneous or inducible ventricular arrhythmias represent the study group. Clinical characteristics of the patients are given in Table I.

Hemodynamic and electrophysiologic data were gathered for each patient in hemodynamic studies that included catheterization of the right and left sides of the heart and ventricular and coronary artery angiography. Cardiac output was measured by the thermodilution technique; ventricular volumes were calculated with the method of Chapman and associates.18 Global ejection fraction (EF) was calculated as EDV – ESV/EDV × 100 (EDV, end-diastolic volume; ESV, end-systolic volume) and contractile EF (the EF of the nonaneurysmal portion of the LV) was calculated according to the method described by Kapelansky and associates.19 Preoperative programmed ventricular stimulation was done at the right ventricular apex and included pacing at two basic cycle lengths (600 and 500 msec) with up to two extra stimuli. Arrhythmia was considered inducible if monomorphic ventricular tachycardia (VT; VT rate ≤ 260 beats/min) lasting more than 15 seconds was induced. Programmed ventricular stimulation was considered contraindicated if (I) EF was less than 20%, (2) intraventricular thrombi were present, or (3) left main coronary artery disease was detected.

Twenty-three patients who had spontaneous VT did not undergo programmed ventricular stimulation before operation because it was contraindicated (Table II). Shortly after operation programmed ventricular stimulation and LV angiography were repeated in all except 2 survivors; 37 patients underwent hemodynamic study 1 year after operation by programmed ventricular stimulation, complete hemodynamic study, and bypass angiography. Postoperative programmed ventricular stimulation protocol was exactly the same as that before operation and any postoperatively induced sustained monomorphic VT was considered to be significant.

Clinical follow-up was available in all surviving patients. The end points of the follow-up (obtained by telephone interview or by mailing a questionnaire) were mortality, syncope, or arrhythmias necessitating hospitalization.

**Surgical technique.** The technique of endoventricular circular patch with septal exclusion has been described in detail in previous papers;13,17: It involves four steps: (1) coronary revascularization, (2) mobilization and resection of the endocardial scar (Fig. 1), (3) cryotherapy at the border of the lesion, and (4) LV reconstruction by endoventricular autologous or synthetic patch. The procedure is done with the use of total cardiac arrest with crystalloid or blood cold cardioplegia. Coronary revascularization is done first (usually on the left anterior descending artery with internal mammary artery), then the LV is opened on the defined area. Left internal mammary artery bypass is done before endocardiotomy to check and control any eventual bleeding of the excluded septal area after endocardial resection.

In anterior aneurysm the endocardial fibrotic scar is mobilized to the papillary muscle root and deeply on the septum to the sound contractile muscle and then resected. In posterior localization of the aneurysm, if the papillary muscle is involved in the fibrotic scar, the muscle is resected and the valve replaced. Cryotherapy is then applied to the edges of resection. A Dacron fabric patch, or a hemicircular autologous patch modeled in the

**Table I. Clinical characteristics of the study group**

<table>
<thead>
<tr>
<th>Total</th>
<th>(n = 106)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>59 ± 8</td>
</tr>
<tr>
<td>Delay from MI (mo)</td>
<td>48 ± 60</td>
</tr>
<tr>
<td>NYHA class (n)</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>7</td>
</tr>
<tr>
<td>II</td>
<td>30</td>
</tr>
<tr>
<td>III</td>
<td>33</td>
</tr>
<tr>
<td>IV</td>
<td>36</td>
</tr>
</tbody>
</table>

Anterior aneurysm: n = 97; posterior aneurysm: n = 9. MI, Myocardial infarction; NYHA, New York Heart Association.

**Table II. Total cases of ventricular arrhythmias in the study group**

<table>
<thead>
<tr>
<th>Type of ventricular arrhythmia</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inducible VT</td>
<td>57</td>
</tr>
<tr>
<td>Spontaneous and inducible VT</td>
<td>19</td>
</tr>
<tr>
<td>Spontaneous VT (PVS contraindicated)</td>
<td>23</td>
</tr>
<tr>
<td>Spontaneous VT, noninducible at PVS</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>106</td>
</tr>
</tbody>
</table>

PVS, Programmed ventricular stimulation.
septal scar with a septal hinge, is anchored inside the ventricle on contractile tissue, thus reducing the cavity circularly. Excluded external tissues are folded to reinforce suture line. Endocardiectomy was done in all patients; cryotherapy was also done in 67 of them. The indication for the use of cryosurgery is based on the judgment of the surgeon at the time of operation; when all of the surgical scar can be completely resected safely without damaging the mitral valve apparatus, no cryosurgery is used. However, unique to our procedure is that if the septal scar itself can be used as the LV aneurysm patch, it is essential to cryoablate the undetached base of this septal patch to electrically isolate it from the remainder of the heart. The decision to use the septal scar flap as a patch is based on the anatomy of the individual heart and therefore the use of cryosurgery varies from one patient to another. Bypass operation was done in 98% of patients.

Mitral reconstruction or mitral replacement was done in all patients with posterior aneurysm. The mitral valve is replaced through the ventricular approach when we are obliged to resect the papillary muscle involved in the fibrotic scar, whether or not mitral insufficiency is present; the valve is repaired when preoperative mitral insufficiency and no need to resect the papillary muscle exist.

Statistical analysis. Values are expressed as mean plus or minus the standard deviation. Paired t test, McNemar test, Mann-Whitney test, and the one-way analysis of variance were applied when indicated.

Results

Eight patients (7.5%) died in the perioperative period (six of them died of refractory heart failure; one had massive intraaortic thrombosis 8 hours after operation; one had fatal cerebrovascular ischemia). Of the eight nonsurviving patients five had spontaneous VT and three had inducible nonclinical VT. Postoperative nonfatal complications occurred in 34 patients (32%): low cardiac output occurred in 20, intraaortic balloon counterpulsation had to be used in 18, bleeding complications that necessitated blood transfusion were observed in 8, and renal failure occurred in 8. Two patients underwent heart transplantation (heterotopic heart transplantation) at 6 weeks and 6 months after operation for intractable heart failure, respectively.

Hemodynamic parameters before, shortly after, and 1 year after operation are given in Table III. EF was significantly increased both at early and late studies; mean pulmonary artery pressure was decreased only early after operation. In patients who died in the perioperative period, baseline mean pulmonary artery pressure was significantly higher (31 ± 15 versus 19 ± 9 mm Hg, p < 0.05) and EF lower (23% ± 10% versus 37% ± 13%, p < 0.001) than in survivors. Despite this finding, the hemodynamic results in the subgroup with baseline severe pulmonary hypertension (mean pulmonary pressure ≥ 30 mm Hg) were substantially positive (Table IV). At baseline these patients had a higher end-diastolic volume index (139 ± 51 ml/m² versus 111 ± 45 ml/m², p < 0.007) and a lower EF (29% ± 12% versus 38% ± 13%, p < 0.01) than those with normal pulmonary pressures, but the prevalence of VT inducibility was not significantly different in patients with or without pulmonary hypertension.

Table V reports the results of electrophysiologic study early after operation. VT was no longer inducible after operation in 92% of patients (88/96 patients who underwent postoperative programmed ventricular stimulation protocol). Three of the eight patients with postoperative inducible VT had inducible VT before operation (two of them had inducible-only VT). The other five patients had preoperative spontaneous VT and contraindications to programmed ventricular stimulation. Only two patients had spontaneous VT early after operation; they did not undergo programmed ventricular stimulation because the presence of postoperative spontaneous VT was considered a surgical failure. All patients with postoperative spontaneous or inducible VT were discharged receiving amiodarone or mexiletine.

The favorable results on ventricular arrhythmias were maintained at the 1-year study (Table VI), when ventric-
The Journal of Thoracic and Cardiovascular Surgery
May 1994

Table III. Hemodynamic parameters in the study group after 1 year

<table>
<thead>
<tr>
<th></th>
<th>Preop.</th>
<th>Postop.</th>
<th>One year postop.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDVI (ml/m^2)</td>
<td>120 ± 60</td>
<td>82 ± 23*</td>
<td>93 ± 27*</td>
</tr>
<tr>
<td>EF (%)</td>
<td>32 ± 11</td>
<td>47 ± 11*</td>
<td>45 ± 14*</td>
</tr>
<tr>
<td>EFc (%)</td>
<td>45 ± 11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MPAP (mm Hg)</td>
<td>19 ± 8</td>
<td>17 ± 6*</td>
<td>25 ± 14†</td>
</tr>
<tr>
<td>CI (L/min/m^2)</td>
<td>2.7 ± 0.63</td>
<td>2.6 ± 0.55</td>
<td>2.6 ± 0.56</td>
</tr>
</tbody>
</table>

EDVI, End-diastolic volume index; EF, ejection fraction; EFc, contractile ejection fraction; MPAP, mean pulmonary artery pressure; CI, cardiac index.

* p < 0.001 versus preoperative study.
† p < 0.001 versus postoperative study.

Table IV. Hemodynamic parameters in patients with severe pulmonary hypertension (mean pulmonary artery pressure 30 mm Hg or greater; n = 18)

<table>
<thead>
<tr>
<th></th>
<th>Preop.</th>
<th>Postop.</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPAP (mm Hg)</td>
<td>37 ± 6</td>
<td>24 ± 8</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>EF (%)</td>
<td>29 ± 12</td>
<td>41 ± 7</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>EDVI (ml/m^2)</td>
<td>139 ± 51</td>
<td>83 ± 23</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

MPAP, Mean pulmonary artery pressure; EF, ejection fraction; EDVI, end-diastolic volume index.

Indications for operation. It has to be first pointed out that, in our series, patients underwent reconstructive operation for LV aneurysm and symptoms that, in the majority of cases, were angina and/or CHF (as evidenced by the high proportion of patients in New York Heart Association functional classes III and IV). Indication for intractable arrhythmias alone was low in our series and the incidence of spontaneous clinical VT was 18% when the overall number of patients (49/287) who underwent operation is considered. Thus comparison with other series, whose major indication for operation was intractable VT, appears difficult. In fact, most previous investigators reporting on the effects of a given surgical procedure for VT have confined their study group to those patients who had spontaneous documented VT.

Because VT is a pathologic rhythm (that is, it cannot be induced in normal hearts as can ventricular fibrillation) we have treated inducible, nonclinical VT as a pathologic rhythm, and because LV aneurysms are frequently accompanied by this pathologic rhythm, we have actively searched for it in hopes of improving the long-term outlook for these patients by reducing the risk of late postoperative sudden death. In our study we chose a stimulation protocol with only two extrastimuli to avoid the risk of inducing clinical irrelevant arrhythmias; nevertheless, preoperative inducible-only VT was more prevalent in our patients than that reported by others; in fact, 57 patients (38%) out of 150 who underwent preoperative programmed ventricular stimulation had inducible-only VT. This high frequency of nonclinical arrhythmias may have influenced the results. However, owing to the prognostic importance of VT inducibility after myo-
cardiac infarction\textsuperscript{24-26} and to the poor prognostic value of persistent, postoperative VT inducibility in patients with clinical arrhythmias\textsuperscript{27-31} we believe that patients with inducible-only VT and LV aneurysm should undergo endocardial excision inasmuch as we have demonstrated that even latent VT can be abolished in these patients and such a result is superior to leaving the patients vulnerable to postoperative VT, a problem that is known to be a harbinger of sudden death.

As far as ventricular arrhythmias in posterior aneurysm is concerned, our results show that there are no differences in postoperative VT inducibility related to the site of the aneurysm. In fact, of the 10 patients with posterior aneurysm (among the 287 patients of the total group), 9 (90\%) had preoperative spontaneous or inducible VT but only 1 patient had inducible-only VT and none had spontaneous VT after operation.

In the present series we found that patients who died in the perioperative period had a significantly lower EF, thus confirming previous data.\textsuperscript{28,30,31-33} On the contrary, we could not confirm any association between a poor systolic function of the nonaneurysmal LV portion and increased mortality: contractile EF, in fact was only marginally lower in nonsurvivors than in survivors (38\% ± 8\% versus 45\% ± 11\%, not significant). However, the small number of deaths may have accounted for the lack of significance. Patients who died perioperatively had a much higher mean pulmonary pressure: as far as we know, this finding has not been reported in the major published series.\textsuperscript{20,28,30} Perhaps because a complete hemodynamic study, including hemodynamics of the right side of the heart, is not routinely done. According to our data, we might therefore suggest that pulmonary hypertension and associated low EF can be regarded as relative contraindications for operation. On the contrary, results have been good also in patients with an extremely severe LV dysfunction a low EF per se (EF ≤ 20\%) should not be considered a contraindication for LV reconstruction with endocardial circular patch repair and associated endocardectomy (Table VII).

**Guided versus nonguided endocardectomy.** The efficacy of map-guided endocardectomy has been extensively proved.\textsuperscript{1,2,34-36} However, as has been discussed by Cox,\textsuperscript{20} intraoperative map-guided endocardectomy is particularly useful to guide localized procedures\textsuperscript{2,34} but its benefit can be counterbalanced by “the wider excision of potentially arrhythmogenic tissue, that is accomplished by generalized procedures. . . .” Our technique consists of removing the visible endocardial scar and fibrosis and of applying cryoablation at the border of the lesion. Thus it is an extended, generalized, blind procedure done with total cardiac arrest and blood cold cardioplegia in the majority of cases. Nevertheless, Cox\textsuperscript{20} has pointed out that surgical therapy for VT done in the normothermic beating heart gives better results. At present, however, no one technique in itself has proved its absolute superiority. In our series, the prevalence of postoperative VT inducibility was low in comparison with that of almost all the reported series.\textsuperscript{27,29,30} In particular, it was lower even in respect to the series that can be matched for number of patients and the type of operation.\textsuperscript{37-39} Our results were similar to those reported by the Duke-Barnes experience.\textsuperscript{20} This unusually low prevalence of postoperative VT inducibility cannot be ascribed to the type of operation, because our technique was different from that used by Cox. Most likely, it can be probably ascribed, apart from the extended endocardial resection, to the improved shape and geometry of the LV cavity achieved with endoventricular circular patch repair and to the complete myocardial revascularization that was done in the great majority of our patients. Nevertheless, there were eight patients in whom VT was still inducible after operation and this can be considered as surgical failure. Three of these patients had inducible VT before operation (two of them had inducible-only VT); the other five patients had spontaneous VT and contraindication to programmed ventricular stimulation, thus it is possible that they would have had inducible VT also before operation. Of these eight patients only one died of progressive heart failure 5 years after operation.

VT inducibility was still low after 1 year (4/37 patients had inducible VT at the 1-year programmed ventricular stimulation), and in patients followed up on clinical ground, no episodes of spontaneous VT were documented. As far as late survival is concerned, our results seem also encouraging, inasmuch as only three sudden deaths occurred among eight late deaths. Two patients who died suddenly had preoperative spontaneous VT and one had inducible-only VT. All three had no inducible VT at early follow-up examination. Thus 92\% of patients with preoperative ventricular arrhythmias (excluding perioperative deaths) were alive at mean follow-up of 21.3 months.

### Table VII. Hemodynamic and electrophysiologic data in patients with extremely poor LV function (EF 20\% or less)

<table>
<thead>
<tr>
<th></th>
<th>Preop. (n = 15)</th>
<th>Postop. (n = 13)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EF (%)</td>
<td>15.8 ± 3.4</td>
<td>36.6 ± 8.1</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>PAP (mm Hg)</td>
<td>27.3 ± 9.4</td>
<td>22.9 ± 7.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Spontaneous VT (n)</td>
<td>11</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Inducible VT (n)</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

EF, Ejection fraction; PAP, pulmonary artery pressure.
In our opinion, these are considerable results, even though data at longer follow-up are needed.

The role of the automatic implantable cardioverter-defibrillator. The use of the automatic implantable cardioverter-defibrillator has gained increasing acceptance in the most recent period and, in the future, its use will further increase with technical improvement of the device. Our experience in this particular field is scant: in the present series, no patient received an automatic implantable cardioverter-defibrillator during or after operation and, in the two patients who had the device implanted before operation, it was removed when postoperative examination showed VT was not inducible. Some authors have recommended routine placement of cardioverter-defibrillator patches at the time of operation. Cox suggests implanting such patches during operation if a guided procedure in the normothermic beating heart still results in inducible VT or if patients with extremely high risk for operation do not respond to amiodarone therapy. It has to be mentioned, however, that at present implantation of an automatic implantable cardioverter-defibrillator has several problems. First, it does not seem to unequivocally improve survival, because rates of sudden death and 5-year mortality rates of 1.5% to 2% per year and of 8% to 10%, respectively, have been reported, second, it is a palliative form of therapy that can sometimes be even dangerous because of inadequate or inappropriate discharges of the device.

In conclusion, extended, nonguided endocardectomy with or without cryotherapy, associated with endoventricular circular patch repair and complete myocardial revascularization in patients with postinfarction LV aneurysm, depressed systolic function, and ischemic VT is safe and effective in curing spontaneous and inducible VT. The effects of this procedure on VT, as well as on the improvement in LV geometry and function, are still evident after 1 year. By preventing arrhythmias, reversing ischemia, and restoring LV geometry and shape toward normal, our aggressive approach appears to be an optimal treatment for patients whose ventricular arrhythmia is only one aspect of a complex clinical problem.

REFERENCES
18. Chapman CB, Baker O, Reynolds J, Bonte FJ. Use of

Discussion

Dr. Lynda L. Mickleborough (Toronto, Ontario, Canada). Dr. Dor, you have made it clear that remodeling the LV and resection of the aneurysm in these patients does something to improve the prevalence of arrhythmias during follow-up. I agree entirely with this conclusion.

I have three questions. I wonder whether this series is truly comparable with results obtained in most map-directed series for VT control. The two criteria for entry of patients into these series would be the spontaneous occurrence of symptomatic arrhythmias in addition to inducibility of arrhythmias at the time of preoperative electrophysiologic testing. It was not clear to me how many of the patients in your series met both these inclusion criteria.

Do you think there could be any possible negative effect of extensive endocardial excision as used in your approach? In particular, how many of your patients required postoperative pacing because of inadequate ventricular rate?

Finally, how do you decide which of your patients gets cryoablation in addition to excision of the endocardial scar?

Dr. William W. Angell (Tampa, Fla.). We seem to have switched over almost completely to defibrillator implantation for patients with VT syndromes, particularly in that group of
patients in whom revascularization is not an essential compo-
nent of the surgical procedure. I wonder if Dr. Dor could tell us
what his present indication is for the use of a defibrillator and
whether his group is still using endocardectomy as the primary
modality for the treatment of VT.

Dr. G. Hossein Almassi (Milwaukee, Wis.). I was intrigued
by the fact that these investigators are using the autogenous scar
tissue as a patch for ventricular reconstruction. Would you not
be concerned about the fate of this patch in the long term in
terms of its expansion and the creation of the same problem that
was there to begin with, namely, an aneurysm underneath the
closure line?

Dr. Dor. Dr. Mickleborough, I mentioned in our last table
that, among these 106 patients, we had 49 with spontaneous
sustained VT and 57 with inducible sustained VT. In terms of
prognosis, however, the final evolution of this second category
was almost the same as the first with 35% risk of sudden death.
This method is therefore a good way to cure spontaneous and
inducible VT.

As far as pacing is concerned, we had no need for permanent
pacing in this series. Sometimes we have to use temporary pac-
ing, mainly according to the type of cardioplegia used.

Concerning cryoablation, because we started using it in 1989,
there was no use of cryoablation in the series from 1987 to 1989.
We used cryoablation to try to achieve 100% success, but its use
did not change the statistics, which is the reason we say that we
are not sure whether cryoablation gives more benefit than
endocardectomy, ventricular reconstruction, and total revas-
cularization of the infarcted area.

Dr. Angell, we have never used a defibrillator in addition to
operation and, in the two patients fitted with the device before
radical operation, we removed the defibrillator once we were
sure that at the 1-year follow-up they no longer had VT. May-
be we are wrong, but we think it is a nice way to eliminate this
very heavy material in a patient who hopes to lead a normal life
without any trouble.

To answer our colleagues from Milwaukee, we talked last
year about the autogenous patch. It is true that we started this
technique in 1988 and, in all our patients followed up after 1
month and 1 year, we have not seen any disturbances or any
evolution with this type of fibrous material. However, the future
might show us at the 5-year follow-up examination that we are
wrong and we will then go back to the artificial tissue patch. But,
again, for pure septal scar, it is elegant and fast to use this
autogenous tissue to rebuild the normal ventricle and for the
moment we will continue to do so.