Trends-in-Medicine

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by Lynne Peterson

SUMMARY

ICD volume is flat and likely to remain that way for at least the next year – or until something (e.g., some new technology) gives the market a kick. ♦ ICD market shares are relatively stable. There is slightly more interest in St. Jude's products, but Boston Scientific/Guidant is not expected to rebound for another 6-12 months because doctors want to be sure the problems and recalls really are over. ♦ Interest is growing in remote monitoring of ICDs, but all the major companies have fairly comparable devices, so this is not driving market share. ♦ T-wave alternans testing as a method of selecting ICD patients remains very controversial. ♦ Robotics was a hot topic, and doctors expect robotic ablation to become standard-of-care in 5-10 years. Adoption is still slow because of the cost, but it is picking up somewhat. ♦ CryoCath's CryoBalloon is attracting interest, and doctors are interested in trying it – when and if there are data establishing its efficacy.

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HEART RHYTHM SOCIETY (HRS)

Denver, CO
May 9-12, 2007

This year's HRS meeting was dominated by atrial fibrillation (AF). A two-day AF summit was sold out, but there were numerous other sessions on AF. In addition, 39 electrophysiologists (EPs) were interviewed about trends in electrophysiology: implantable cardiac defibrillator (ICD) volume, ICD market share, remote monitoring of ICDs, T-wave alternans testing, robotics, cryoablation, and more.

IMPLANTABLE CARDIAC DEFIBRILLATORS (ICDS)

EPs love to debate, but there was general agreement on one point: ICD volume is flat, and no pickup is in sight, though there were some expectations.

ICD Market Shares Among Doctors Interviewed

Company	Current share	Expected share in 1 year
Medtronic	54%	53%
Guidant	18%	21%
St. Jude	20%	21%
Other	8%	5%

Comments on the ICD outlook included:

Flat

- *Virginia:* "ICD volume slowed because of the recall issues and because a lot of EPs cut their marketing because their waiting lists got too long. Companies are starting to push ICDs, and I think we will see an increase with the new HRS guidelines.
- *Arizona #1:* "There is no rebound…It is a very mature market now. Some cardiologists are referring, but some are trying to do ablation themselves."
- *Ohio:* "I do ICDs at three hospitals. Two are down, and one is flat to slightly up, so overall, ICDs are pretty flat."
- *Pennsylvania #1:* "Our ICD volume is down about 10%. Community cardiologists are implanting more, so there are fewer referrals. And there are no great new indications. But the community as a whole is flat."
- *Pennsylvania #2:* "ICDs have started to pick back up because there are a lot of replacements being done. But the patient population has not expanded, so overall it is not growing."

Improving

- *California #1:* "Volume is going up slowly. Local primary care doctors and cardiologists are referring more patients, and awareness is up."
- *California #2:* "There was a huge backlog, and then things slowed down. Now, it is picking up a little again in the past couple of months."
- *California #3:* "Our ICD use is up 35% over last year. Awareness among our primary care doctors is better, and we have regular training sessions on this for them."
- *Washington:* "Volume is increasing steadily, about 10% a year, and I expect that to continue because more patients need ICDs, not because there are more referrals."
- *Arizona #2:* "Our ICD volume is up 10%. We filled the lab and will build another lab."
- *Pennsylvania #3:* "The vendors say volume is up, but I expect quite a plateau over the next year. The device people think we should put ICDs in all people who meet the criteria, but we are to a point where we need new and better tools."

What's needed to spur ICD growth

For volume to accelerate, sources said a catalyst is needed – either some new data, some new technology, or better education of primary care doctors and internists. Comments included:

- *Virginia:* "To grow ICD volume, doctors and patients need to be reminded of the indications, we need clear guidelines, and confidence has to get rebuilt."
- *California #1:* "There is no big, new group of patients (for ICDs). It is not a growth industry. There is no expectation that numbers will continue to go up unless doctors not using ICDs start or more cardiologists refer (more) patients."
- *California #2:* "We need better teaching and guidance directed at internists. They are the stumbling block. Cardiologists are referring (to us), but internists are not sending to the cardiologists."
- *Ohio:* "Internists and other physicians need to be educated to grow ICD use, and new technology is needed. There is also still some reluctance among cardiologists, but more patients themselves are reading the news (about recalls)."
- *New York:* "Patient fear is an issue, so education may help that. More patients are turning down ICDs."
- *North Carolina:* "There needs to be less downward pressure from the government, payors, and hospitals… And there's a general lack of understanding of these devices and their relative cost effectiveness vs. other therapies."

Market share shifts

EPs do not expect any significant market share shifts over the next year. There is a little more interest in St. Jude's products, but EPs are not convinced Guidant's recalls and problems are over yet, so most plan to wait at least another 6-12 months before increasing their use of Guidant ICDs. Many also said that Guidant has fallen behind and needs some new technology. Comments included:

- *North Carolina:* "I don't use any Guidant because there is an attorney who advertises in our market: 'If you have a Guidant ICD, come by our office.' I had the TV on one day while I was consenting a patient for an ICD, and that commercial came on. You can imagine how that consenting session went."
- *California #1:* "I cut back my Guidant use because of the recalls, so I'll avoid Guidant until the dust settles. I think the situation is getting better, but I also think Guidant had quality assurance problems, so I'm not sure it is over…In a year I would consider looking at Guidant again."
- *Virginia:* "In one year, Guidant could increase its share if it gets more new features."
- *California #2:* "I was doing some Guidant and cut back because of the recalls and because I think Medtronic ICDs are easier to implant; they have thinner and shorter leads, and the guide sheaths are better. Medtronic service is also very good and fast."
- *California #3:* "Guidant has had to wait for new things because of the heavy FDA scrutiny. That has hurt them, but they will come back when they get new things, but it is probably a year before Guidant comes back."
- *Tennessee:* "Our Guidant use has gone up because we were 100% Medtronic, and we didn't want all our eggs in one basket any longer."
- *New York:* "We had shied away from Guidant because we were concerned patients would hear about the recalls. As we do more Guidant, we are doing fewer Medtronic devices."
- *Ohio:* "I was doing more Guidant ICDs before the recalls. Guidant is rebounding, but I'm not sure yet if I will increase much. It may take a few months. Most people were starting to regain confidence, and then there was the recent field alert on battery failures, which shook confidence again."
- *Washington:* "Our Guidant use is going down. We have a lot of strong Guidant implanters who didn't pull back until recently. We had several 100% Guidant implanters who switched. They no longer want one brand. The recalls gave them a reality check…Boston Scientific has had a lot of layoffs recently, and we've had several local people who've left recently…Guidant will come back but probably not for a year."

- *Ohio:* "It takes time to be sure patients are safe, but the quality of the lead was more an issue than the recalls."
- *Arizona:* "Boston Scientific wants to be in the market, so it may be competitive when contracting time comes, but Boston Scientific tends to be more expensive."
- *Hawaii:* "It will take time and new products for Guidant to come back. Patients are concerned and ask which company I'm using. They are happy to hear I use Medtronic."
- *Pennsylvania:* "Guidant needs new technology; they've been kind of static. And they need time to elapse to build confidence that the new products don't have problems. The only thing that cures that (lack of confidence) is time. It will take two years without a recall (to restore confidence)."
- *Utah:* "We hadn't used Guidant for a long, long time, and then we decided after the Medtronic recall to give it a try. When the Guidant recalls happened, we stopped using Guidant. It will take time and better devices to get us to come back. The lack of full disclosure by Guidant really hurt them."

Sudden Cardiac Arrest Coalition

One program that has the ***potential*** to give ICD volume a kick is the new Sudden Cardiac Arrest Coalition, which was unveiled at HRS, but it is unlikely to have any immediate or near-term impact. An industry source said, "We've picked the cherries (the easy ICD patients). There are still plenty of patients out there, but most of them are asymptomatic now. We hope the Sudden Cardiac Arrest Coalition can help reignite growth in the ICD market by putting more urgency around it."

Sudden cardiac arrest (SCA) is a major cause of death, taking >250,000 lives each year in the U.S. – more than breast cancer, lung cancer, stroke, or AIDS. In SCA, the heart stops abruptly, without warning, and stops pumping blood to organs of the body. In essence, the heart's electrical system malfunctions. SCA is not the same thing as a myocardial infarction (MI, or heart attack), it usually occurs without any warning arrhythmias, and 95% of all SCA victims die.

SCA is not a random event, and certain known genetic factors can put a person at higher risk, though the screening tools are not yet available to identify these patients. Dr. Dwight Reynolds, the 2006-2007 president of HRS and a cardiologist at the University of Oklahoma Health Sciences Center, said an ICD is 98% effective in protecting those at risk, but at least 50% of patients who are at a known high risk of SCA do not have an ICD.

Dr. Reynolds announced that more than 25 leading heart advocacy groups had collaborated in the formation of the SCA Coalition to advance increased research, awareness, and educational efforts about SCA. However, three major medical groups are not a part of the coalition, at least not yet. Noticeably absent are the American College of Cardiology (ACC), the American Heart Association (AHA), and the American Association of Family Physicians (AAFP). Dr. Reynolds said, "They are still looking at whether they are going to participate…We have some optimism that they will."

One of the initial priorities of the SCA Coalition will be to seek federal funding for programs to raise public awareness of SCA, for research, and for access to ICDs. The Coalition plans to encourage introduction and passage of a bill in Congress that, if passed, would give the U.S. Department of Health and Human Services (HHS) funding to develop and implement a comprehensive education and research program for SCA. He said this will include appropriations for medical screening and tracking studies, as well as public awareness and education campaigns. The bill will also include a resolution to create a National Sudden Cardiac Arrest Week.

HRS officials declined to say how much money they would be seeking with this legislation. Diane Canova, executive director of the Sudden Cardiac Arrest Association, a patient advocacy group, said, "We are still looking at that. NIH (National Institutes of Health) and CDC (Centers for Disease Control and Prevention) already have strong programs in heart-related areas, and we are looking on ways to use existing funds…but a national awareness campaign will take significant resources."

The Coalition released the results of a national survey on SCA, claiming it showed "the American public strongly supports increased federal funding to stop SCA." The survey questions included:

- *How concerned are you that you or a family member is at risk of having a SCA in the next 5 years?* 73.6% were concerned, and 24.5% were not concerned.
- *It is important to raise awareness about SCA.* 93.5% agreed, 3.9% disagreed.
- *Do you favor increasing federal funding for SCA education, research, and treatment?* 77.1% were in favor, 12.4% opposed it, 10.5% were unsure or had no answer.

T-Wave Alternans (TWA)

T-wave alternans testing, which detects small, abnormal, beat-to-beat variations in the heartbeat during an electrocardiogram (ECG), has been proposed as a risk stratification tool to help identify candidates (or non-candidates) for ICDs. Two TWA tests are currently available: one by Cambridge Heart and another by GE Medical. The key difference between these two tests is how they compute the TWA. Cambridge Heart uses spectral analysis, in which data are converted to a frequency domain. GE's test uses a modified moving average (MMA) algorithm.

A Cambridge Heart official pointed out that its test has more data. And EPs were more aware of the Cambridge Heart test.

The GE TWA test is a separate feature that can be added to the GE stress test or Holter monitor and can run in the background. GE claims that its test "can present results in a more intuitive way." A GE official said that hospitals are the purchasers because the test is considered capital equipment, and he pointed out that IT (information technology) people are becoming a bigger factor because the data from the tests feed into electronic medical records (EMRs), etc., which could give GE a marketing edge.

In 2006, the Centers for Medicare and Medicaid Services (CMS) approved reimbursement for spectral tests (i.e., Cambridge Heart's test), but turned down GE's test, saying there wasn't sufficient evidence yet on MMA testing, but leaving the door open for a re-review when more data were available. A GE official said they are re-applying for CMS coverage.

A Finnish study ("Tampere") presented at HRS found GE's TWA test predicts mortality in a general population undergoing a clinical exercise test, with 65 µV the most useful cut-off point. The researchers used a bicycle stress test, which is common in Europe but not in the U.S. The researchers examined 1,037 consecutive patients at one center as part of the ongoing Finnish Cardiovascular Study (FINCAVAS). They reported that the MMA test successfully stratified patients for sudden cardiac death (SCD), cardiovascular mortality, and all-cause mortality. These were patients who would normally have been considered low-risk. In fact, the average LVEF was 65% in these patients, but a "positive" test corresponded to ≥7-fold risk of SCD and a 3-fold increase in all-cause mortality over <4 years.

Finnish Experience with GE's MMA TWA Test

Measurement	Results with MMA
Patients with LV functional data	529
LVEF <50%	12.7%
All-cause mortality	5.7%
Cardiovascular death	3.3%
SCD	1.9%

Mortality Prediction with GE's MMA TWA Test

Measurement	TWA ≥65 µV	TWA <65 µV	p-value
Death	15%	5%	<.001
All-cause mortality	Relative risk 3.3	---	0.001
SCD	Relative risk 7.4	---	<.001
CV death	Relative risk 6.0	---	<.001

Few electrophysiologists said they are currently using TWA – either Cambridge Heart's or GE's test – to help select (or eliminate) patients for ICDs. Comments included:

- *Pennsylvania #1:* "We have TWA capability, but we don't do it on all patients. Alone it is not a good predictor."
- *Colorado:* "Unless the guidelines change, I won't use TWA…There are not enough data to support it yet. We need big enough trials to change the guidelines. But it is interesting and may play a role, especially as a negative predictor. CMS reimbursement (for Cambridge Heart) gives it credibility, but without guidelines, I still can't justify it."
- *Washington:* "I'm not doing TWA, but it will happen, and it could increase ICD volume."
- *Arizona:* "We do a lot of TWA, but mostly for studies. It is not a standard part of what we do."
- *Canada:* "We've thought a lot about TWA. We need ways to pick the primary prevention population better, and TWA might turn out to be that. It is not quite there yet, but I think the negative predictive value is pretty good. I want a test that also has positive predictive value."
- *Pennsylvania #2:* "I'm not a huge fan of TWA. It is popular now, and I think it will catch on for a while, but I'm not buying in yet."
- *Pennsylvania #3:* "We use Cambridge Heart's TWA now. I believe there is a role, a place for it. It's a tool that helps. We have one system, and we use it, not exclusively but selectively."
- *Pennsylvania #4:* "It has value in cases where we are not certain. It is another data point. All the data so far is on Cambridge Heart. Does the GE test have the same predictive value? And Medicare only covers Cambridge Heart's test right now."

CARDIAC RESYNCHRONIZATION THERAPY (CRT)

U.S. EPs said they rarely use CRT-Ps (CRTs with pacing only) any longer, putting CRT-Ds (CRTs with a defibrillator) in 95%-100% of patients. European doctors said CRT-Ps are still an average of 25% of their implants, with wide variations from country to country, but CRT-Ds are increasingly replacing CRT-Ps there, too. Comments included:

- *California #1:* "I hardly ever put CRT-Ps in any more. Most CRT patients have bad EF (ejection fraction) and need a CRT-D. CRT-P is not going anywhere. There is controversy over whether CRT is ever indicated without CRT-D."
- *California #2:* "I don't put in many CRT-Ps, just in patients who don't want shocks or a defibrillator."
- *California #3:* "About 10% of my CRTs are CRT-P. I do CRT-P for AF ablations, patients with declining EF because of chronic RV (right ventricular) pacing, and people with an indication for biventricular pacing who don't want to be shocked."
- *Tennessee:* "Patients rarely get a CRT-P. Usually that's someone who just doesn't want a defibrillator or an older, symptomatic heart failure patient without a long life expectancy."

ATRIAL FIBRILLATION (AF)

AF is the most common heart rhythm disorder, affecting more than three million Americans, but electrophysiologists (EPs) estimated that only about a quarter of these people receive appropriate care. From 15,000-40,000 Americans get an AF ablation each year. Most often, that treatment is radiofrequency (RF) ablation. Most EPs said they are doing RF ablations, and most of those who aren't already doing them plan to start or another EP in their practice handles those procedures.

Some EPs complained that they lose money doing AF ablations – not because they aren't reimbursed (they are), but because they could be using the time to do other, better reimbursed procedures. A Maryland doctor said, "AF ablations cost more than we are reimbursed. The fee is the same for five hours as for a different 2-hour procedure. So, AF ablation is not profitable, too hard to do, too risky, and requires too much work taking care of the patients. As a result, AF ablation tends to be done at large academic centers."

Regulatory status

There are different therapy modalities approved for atrial flutter, but no devices currently have approval to treat AF, and doctors were complaining about that at HRS. However, FDA officials said the only hold-up is that the companies have to do the trials to get approval. An expert said, "The FDA feels pressured to get an approved catheter system, but they want data."

Guidelines

The first guidelines on catheter and surgical ablation for AF were released at HRS. This was a consensus statement hammered about by a task force of international heart rhythm specialists representing HRS, the American College of Cardiology (ACC), the American Heart Association (AHA), the European Heart Rhythm Association (EHRA), the European Cardiac Arrhythmia Society (ECAS), and the Society of Thoracic Surgeons (STS).

According to the guidelines, AF ablation should be considered in patients whose symptoms are severe enough to interfere with their quality of life and have failed or been intolerant to treatment with at least one antiarrhythmic medication. The guidelines provide standardized definitions and patient selection criteria. They include:

Standardized definitions:

- Paroxysmal AF = recurrent AF (>2 episodes) that terminates spontaneously within seven days.
- Persistent AF = AF that is sustained beyond seven days, or lasting less than seven days but necessitating pharmacologic or electrical cardioversion.
- Long-standing persistent AF = continuous AF of >1 year duration.
- Permanent AF = AF in which cardioversion has either failed or not been attempted. However, the term permanent AF is not appropriate in the context of patients undergoing catheter and/or surgical ablation of AF because it refers to patients where a decision has been made not to pursue restoration of sinus rhythm by any means, including catheter or surgical ablation.
- Success:
  - A blanking period of 3 months should be employed after ablation when reporting outcomes.
  - Freedom from AF/flutter/tachycardia off antiarrhythmia therapy is the primary endpoint of AF ablation.
  - For research purposes, time to recurrence of AF following ablation is an acceptable endpoint after AF ablation but may under represent the true benefit.
  - Atrial flutter and other atrial tachyarrhythmias should be considered as treatment failures.
  - An episode of AF/flutter/tachycardia detected by monitoring.

Indications for catheter ablation:

- Symptomatic AF refractory or intolerant to at least one Class 1 or 3 antiarrhythmic medication.
- In rare clinical situations, it may be appropriate to perform AF ablation as first-line therapy.
- Selected symptomatic patients with heart failure and/or reduced EF.
- The presence of a left atrial thrombus is a contraindication.

Indications for surgical ablation:

- Symptomatic AF patients undergoing other cardiac surgery.
- Selected asymptomatic AF patients undergoing cardiac surgery in whom the ablation can be performed with minimal risk.
- Patients who prefer a surgical approach, have failed one or more attempts at catheter ablation, or are not a candidate for catheter ablation.

Anticoagulation: A patient's desire to discontinue warfarin is ***not*** a sufficient reason for AF ablation. Dr. Hugh Calkins, chair of HRS's scientific and clinical guidelines committee and director of the arrhythmia service and electrophysiology laboratory at Johns Hopkins, said, "We don't know even if the procedure is successful that you can safely stop your warfarin …That was one of the most important issues in the document …The consensus is that the recommendations are that decisions about anticoagulation with Coumadin (warfarin) or aspirin should be based on a patient's risk factors for stroke and not whether the AF procedure is deemed successful or

unsuccessful…And patients should be on Coumadin for at least two months post-procedure." Dr. Eric Prystowsky, former president of HRS and director of the Clinical Electrophysiology Laboratory at St. Vincent Hospital in Indianapolis, said, "The guidelines are clear. If you are a Chance 2 risk, then you need to be on warfarin therapy. Until someone takes that group of patients and analyzes them on aspirin only, I think it is too risky to stop anticoagulation. There are others who disagree, but personally I would be very cautious with that approach."

Asked if CMS and private payors are expected to adopt these guidelines, Dr. Calkins said, "The purpose of these guidelines was to focus on two issues – (1) patient care and research and (2) setting common definitions and training recommendations. The issue of reimbursement for AF is really a separate issue and was not part of our main focus. The fact that a consensus document has been produced…certainly speaks to fact that this is a medically-indicated procedure and should be reimbursed. But so far this does not involve CMS in any way…It is my understanding that, at the present time, catheter ablation is being reimbursed. It works, and it is growing rapidly." Dr. Josep Brugada, president-elect of EHRA and chief of cardiology at the Hospital Clinic at the University of Barcelona, said reimbursement is different in every European country. In some cases, the cost is part of the general hospital budget, and in other countries, reimbursement is procedure-based. Dr. Riccardo Cappato of Italy, president-elect of ECAS, added, "So far, the cost exceeds the reimbursement from healthcare providers. So…we are facing a reimbursement issue. We still don't know how this will be solved. We certainly can't offer (catheter ablation) to too many because costs exceed reimbursement, but we think documents like this, with a large consensus, may help."

Asked on which issues the task force did not reach consensus, Dr. Calkins said, "Technique. We agreed that electrical isolation of the PV (pulmonary vein) is the cornerstone of procedures. The vast majority said yes, we agree that it is the cornerstone and the most important thing to accomplish in an AFib procedure. And there was consensus that with persistent AF, you may need to do more than just electrically isolate PVs, but there was not a consensus on what to do next. There are different approaches. The best approach for persistent AFib outside of isolating the PV had no consensus." He estimated that just isolating the PV is sufficient in 75%-80% of patients with paroxysmal AF, but may be sufficient in ≤50% of patients with persistent AF.

Asked if there is a trend for electrophysiologists to work together with surgeons in hybrid operating room/cath labs or AF centers, Dr. Calkins said, "It really depends on the local centers. If they are interested, it is great to work together…but there are many centers where EPs are interested and surgeons are not and vice versa. It's nice if they get together, but probably most AFib centers are either surgery – or catheter-oriented." Dr. Brugada said his center is a joint center, with EPs and a surgeon working together, "At a personal level, I am absolutely convinced it is very good to have a joint venture with surgeons." Dr. Cappato added, "This (guidance) document was useful to give a feeling that improved interactions between EPs and surgeons are a must in this field."

Is ablation first-line therapy for patients with paroxysmal AF and no/minimal heart disease? Speaking at a satellite symposium, Dr. Prystowsky said, "No, it is second-line in the guidelines…It is hard to say it is first-line…My guess is the next go-round on the guidelines there will be enough data to support first-line therapy…I personally have no problem with a very fine lab doing it first-line, but there are many people who don't have that skill set…You just have to fail one drug. On a personal level, I do think there are areas where I don't have a problem with first-line:

- Patients with very symptomatic AF who refuse anti-arrhythmic drug (AAD) therapy.
- Patients in whom the only AAD choice is amiodarone.
- Patients with BTS (brady-tachy syndrome) in whom AADs can be used only with an implantable pacemaker.
- Maybe patients at high risk for stroke who cannot take or refuse warfarin therapy, but there are ***no*** data on this."

Asked what the optimal ablation techniques are for patients with paroxysmal AF, Dr. Prystowsky said there are a variety of options – PV isolation, circumferential PV ablation, circumferential/antral PV isolation, electrogram-based ablation, ganglionated plexi ablation, etc. – but he added, "I think we really don't know the best approach. I think whatever approach you do, as long as you isolate the PV, is fine…I don't think there is one ideal approach."

Asked what the most appropriate endpoints of ablation for AF are, Dr. Prystowsky said, "I think we really don't have the answer to this. I'm not so sure I would go with the inducibility issue, but there are people who think that is very important."

Asked what defines long-term efficacy after ablation, Dr. Prystowsky said, "There is controversy with the FDA on endpoints:

- Absence of any AF. I think this is a ridiculous endpoint. To hold anything to that type of stern endpoint is silly.
- Absence of symptomatic AF. I think this is the best endpoint. I think this is the way to go.
- No or few AF events with previously failed AADs."

ROBOTICS

There was little in the way of hot new technology at HRS this year, but EPs pointed to robotics as perhaps the most exciting technology right now. Stereotaxis's Niobe magnetic navigation system was approved by the FDA in January 2003. Less than a week before HRS, Hansen Medical received FDA approval for its Sensei Robotic Catheter System, and just after

HRS, Hansen got a C.E. Mark for Sensei and the Artisan Control Catheter. Both Niobe and Sensei allow electrophysiologists to place mapping catheters in hard-to-reach anatomical locations more easily and more accurately than with manual approaches. Stereotaxis is approved for ablation (but not AF ablation), but Hansen is only approved for mapping in the U.S.

Hansen also announced a joint development and co-marketing agreement with St. Jude for Sensei and its Artisan Control Catheter with St. Jude's EnSite NavX Navigation and Visualization Technology, a 3-D cardiac mapping system. Dr. Frederick Moll, CEO/founder of Hansen, said the partnership is important, "This is an opportunity with St. Jude to do a deeper level of integration in imaging…The ease of use of 3-D imaging is incrementally improved. It also gives us the ability to advance in automatic, and we will be doing more and more of that."

Dr. Moll said Hansen has already started shipping Senseis in Europe, with two to Prague and one to a London hospital. In the U.S., Hansen has several letters of intent, and a "training" Sensei is installed at the Cleveland Clinic, but the first real customer has not yet been announced.

Asked if Sensei will expand the market or just compete with Niobe for the same customers, Dr. Moll said, "A little of both…We believe we have a better solution…but I also think it (the competition) will expand the market in the sense that a lot of the Stereotaxis sales are focused on EP labs or cath labs that already decided to renovate their hospital or cath lab…whereas we can target accounts that are not necessarily planning to renovate any time soon…Having more than one competitor is in some ways a good thing…Stereotaxis has preconditioned the market for remote navigation, and people are in tune with the idea. In that sense, they helped us with the introduction of the idea of remote navigation."

Asked who the buyers are likely to be for robotic systems over the next couple of years, Dr. Moll said, "Obviously, we want to start with high volume centers because we hope to augment system sales with disposable sales…Having said that, we do believe the attributes are equally applicable to academic and private institutions. At Intuitive (Dr. Moll formerly was with Intuitive Surgical, which sells the DaVinci surgical robot), it was thought we would be limited to big medical centers or academic, but smaller community hospitals and medical centers were equally represented in early sales…If there is a better way that is more precise or safer or enables better techniques, it will become standard-of-care over time. Robotic control of catheters is a dramatically better way to move around the tip of a tool, so it is my belief that over a reasonable period of time – 5-7 years – people will recognize it as a better way, and it will become standard-of-care."

Speakers were upbeat about the outlook for robotics. One said, "Stereotaxis and Hansen were novel and heavily discussed last year (at HRS), and they are pretty common now. They are growing faster." Dr. Carlo Pappone of Italy, who discussed the role of robotics at a satellite symposium sponsored, in part, by Stereotaxis, said, "In my opinion, it (robotics) may improve the quality, amplifying our performance, and stepping up learning. I don't need it, but we have millions of AF patients, and we can't cure them with AF programs only in 50 centers in the world…We need to offer every patient in every hospital the same know-how."

In his preliminary experience with robotics, Dr. Pappone said we've learned that robotics are feasible and introduce a "new" anatomy, but there is a learning curve. He predicted the next steps forward will be:

- **4-D navigation.**
- **Robotic catheters**, which he called "one of the main limitations" of robotics today. He said, "We need intelligent catheters – less mechanical steering and more sensors."
- **Integration.** "We should work outside the x-ray exposure with computer-assisted navigation, remote control, and 4-D. Today we have too many screens, too many (computer) mice, and too many keyboards. And too many operators. So it is expensive."
- **Simplification** – putting the information all on one screen to simplify it.
- More **communication/networking.**

EPs asked about the outlook for robotics generally agreed robotic systems are likely to become standard-of-care in 5-10 years, but adoption may be slow at first because of the cost. The early adopters appear to be large, academic medical centers and a very few large private practices, but few community hospitals, which are the very EPs the systems are most designed to help.

Some of the factors doctors cited as likely to influence their choice of a robotics system were:

- **Mapping.** Niobe and Sensei both can be used with either St. Jude's NavX or Johnson & Johnson/Biosense Webster's Carto RMT mapping system, though Niobe integrates more fully with Carto. However, numerous doctors said their choice would be dictated by their mapping system because they believe that Niobe works with either mapping system, but that Sensei works only with NavX. Thus, NavX users tended to favor Sensei, and Carto users to favor Niobe. For now, this bias may affect some sales.
- **Catheters.**
  - **Guidance.** Niobe uses magnetic-guided catheters, while the Sensei catheters are manually guided.
  - **Interchangeability.** Hansen claims Sensei can be used with almost any manufacturer's catheter while Stereotaxis's Niobe reportedly works only with J&J catheters.

- **Stiffness.** Hansen's catheters were described as "stiff," and Stereotaxis's as "very soft."
- **Force.** Stereotaxis supporters argued that the Niobe catheter contact force is, at least theoretically, more constant and, on average, about 10 g lower than with manual force. Hansen's catheter contact force varies, but mainly depends on the anatomy and the investigator. Quantitative data on applied contact force are not available. Hansen's Dr. Moll disputed criticism of the force needed with Sensei catheters explaining, "You command the catheter to go to a specific spot, and it goes there. You go to the wall, and then apply enough force to stay in the position…If you put enough pressure, it will ride with the movement of the heart. We have a force-sensor (Intellisense) that measures pressure, and you need very little force to do that."

➢ **Perforations.** Stereotaxis supporters also claimed that there are more perforations with Hansen's Sensei. Hansen's Dr. Moll dismissed this, saying, "This whole safety issue with Stereotaxis is a lot of hogwash…They created a story of safety differences, but there are no data to suggest that. They may not have had perforations, but they may not have been using the J&J ThermoCool (irrigated tip) catheter, so it is a ridiculous comparison to say one system using the ThermoCool has had perforations and the other hasn't…Our experience in Europe was two perforations, one with a manual transseptal puncture catheter, and the other with ThermoCool. And out of 87 patients, that gives us a very low perforation rate, which is less than the ThermoCool data in manual use…Stereotaxis is not doing ablation with ThermoCool, so it is comparing apples and oranges…We have a very strong safety record in clinical trials."

➢ **Cost.** A Hansen Sensei costs about $600,000 and, according to Dr. Moll, requires no installation costs. In contrast, a Niobe costs about $1.2 million, and most hospitals have to build a new cath lab or renovate an existing lab at a cost of $1million to $3 million.

➢ **Mobility.** The Niobe is a fixed piece of equipment, but the Sensei can be moved from one cath lab to another.

Comments on the outlook for Stereotaxis and Hansen included:

- *Maryland:* "We are building a new hospital, and we'll get either a Stereotaxis or a Hansen or both in 2-3 years in two rooms. Right now, neither has shown it improves outcomes. Until they do that, they are just a big expense."
- *Missouri:* "In the next decade, it is likely that physicians will make use of some form of remote navigation…It is premature to say one is better than another. We need to get the technology in a wider number of hands who don't have a bias, and see how they do…But I think this technology is catching on…Stereotaxis hasn't had all the catheters it needs, but it is getting better…The verdict is not in on the role of robotics in CRT lead placement."
- *Virginia:* "We just ordered both Stereotaxis and Hansen because we are a teaching school and need to train doctors on both…If they work as well as the companies say, I'll do 75%-100% of procedures with them, but my experience is they don't work that well. The potential is to use them for all ablations, but we will start with complicated cases…Most academic centers have both Carto and NavX, but there is not a lot of NavX, which is harder to use, in private practice. I would watch what private practices choose…Hansen is cheaper and easier to use, and it can move from room to room; Stereotaxis is immovable. But Hansen may have a higher perforation rate because it uses standard catheters designed for manual use. It is harder to perforate with the Stereotaxis catheter…The market for robotics will expand with the entry of Hansen because a lot of people hear $2.5 million for Stereotaxis and walk away, but Hansen is cheap enough that a lot of people who can't afford Stereotaxis will buy it…St. Jude marketing will help Hansen."
- *California #1:* "I'm not completely convinced about either of them. At this point there is good and bad to each, and both need more work."
- *Michigan:* "We are purchasing a Stereotaxis because we think it is better for the future. From a safety standpoint, it reduces patient and physician exposure to fluoroscopy. And no one from Hansen came to talk to us. Hansen doesn't coordinate as well with our Carto system, and the risk of a catheter perforation is higher when you do a manual push (with Sensei). With Stereotaxis, the catheter is pulled, so the perforation is less (common)."
- *North Carolina:* "We are considering either a Hansen or a Stereotaxis. Price will be the consideration since we have both Carto and NavX…Hansen won't expand the market because there is still a cut-off between the technology haves and have nots. The Stereotaxis concept and technology is more attractive and has more versatility."
- *Minnesota:* "We are shopping for a robotic system, either Stereotaxis or Hansen. We'll probably do Stereotaxis for the technology advantage."

Stereotaxis's Niobe vs. Hansen's Sensei

Feature	Hansen's Sensei	Stereotaxis's Niobe
Catheter guidance	Manual/mechanical	Magnetic
Catheter stiffness	Stiff	Soft
Catheter contact force	Varies, but depends on anatomy and operator	Theoretically more constant and lower than manual force
Cost	~ $600,000	~ $1,200,000 plus new or refurbished cath lab
Moveable from one location to another	Yes	No
Pressure sensor	Yes	No
FDA approvals	Mapping	Mapping and atrial flutter ablation

- *Canada:* "We are the only Stereotaxis center in Canada. In three or four years, I think there will be five Niobes in Canada. When Stereotaxis gets an irrigated catheter, that will be big. Hansen does what I can already do; it offers me a way to sit down and do what I used to do standing. Stereotaxis offers an opportunity to do new things."
- *Pennsylvania #1:* "Economics are a concern in our area, so Hansen might have appeal based on cost. The question is: Does it affect efficacy? But it could be good for hospital marketing. It doesn't have enough patient value yet to justify the cost."
- *Pennsylvania #2:* "People tend not to use Stereotaxis as much as they predicted, so we are watching what others do before we get involved."
- *Washington:* "We have no plans for either Stereotaxis or Hansen because they are too expensive."
- *Florida:* "We don't have any plans right now for a robotic system, but we are always looking for the next best toy. Either would be good for most procedures, and we have both Carto and NavX. Hansen will expand the market because there will now be two sales forces out there increasing awareness. And the systems will allow EPs to consider arrhythmias they wouldn't have tried before."
- *California #2:* "I'd love to have one, but they are expensive, and no one knows yet which is best. But it is good technology, and it saves radiation exposure, and it is pretty efficient at getting catheters where you need them."
- *California #3:* "The technology is wonderful, but it is still too experimental for a community hospital."
- *New England:* "Initially I think Hansen and Stereotaxis will compete with each other rather than expand the market."

AtriCure

At a lunch sponsored by AtriCure, which has a bipolar RF ablation system for use by surgeons, three times more people show up than were expected, making it standing room only. The company made a low-key pitch for EPs and surgeons working together, but it was a message most EPs did not appear ready to accept. Most doctors questioned said they don't send patients to surgeons for ablation procedures, and they didn't expect that to change in the near future.

Miscellaneous

Other than robotics, interesting and cutting edge EP technologies appear to be:

Cell therapy. A speaker said, "The driving factor is intellectual curiosity, and it is a non-destructive ablation therapy, but it would be a disruptive technology." Potential targets include ventricular rate control in AF, post-operative AF, and ventricular tachycardia.

Better imaging, particularly integration of imaging, particularly with J&J's Carto and St. Jude's NavX. A speaker pointed out that CT provides good information on anatomy, PET identifies what is metabolically active, and Carto gives a view of electrical scars, "It would be nice to combine all three of these…Carto plus interventional MRI is further away, but not too far away."

Disposables. A small, private company, LifeSync, was getting some attention, particularly from EP nurses, with its disposable, radiolucent ECG leads. The leads reportedly work with most monitors, and there is a wireless Bluetooth option. LifeSync touts the disposable leads as a way to reduced hospital-acquired infections, and nurses liked that, but they were equally impressed with the idea of using the wireless feature to eliminate all the wires that hang off patients during stress tests. So far, a company official said, about 60 hospitals in the U.S. and Germany are using the LifeSync leads. The sales force is small (~15). An official said the best meeting for showing this product has been the Critical Care Nurses meeting. Comments at HRS included:

- *Kansas EP nurse:* "This will catch on."
- *Ohio:* "I like the disposable leads and the wireless feature. I'm taking some literature home."
- *Massachusetts:* "I hadn't heard about it, but now I'm interested, and I'll go look at it."

Radiation. CyberHeart's radiation for AF is interesting.

Improved tools. A speaker said, "Irrigated catheters were exciting a little while back…but now we are looking to burn better." She pointed to:

- **J&J's** ThermoCool catheter, which she described as an improvement over intramural needles.
- Laser balloons, such as **CardioFocus's,** where you can translate and rotate the arc.
- Balloon catheters, such as **CryoCath's** CryoBalloon, which she said "take operator dependence out of the loop."
  - *Canada:* "It if works and the long-term results are good, it makes sense. It is easier to put something in the PV than do spots around the PV."
  - *Pennsylvania:* "I worry about the long-term efficacy. There is a high recurrence rate with regular cryo now."
  - "It has the potential to be very valuable if the preliminary results hold up. It probably speeds up the procedure. I'd try it if the data are good. At the end of the day what will drive the decision is procedure time, providing safety and efficacy are the same as RF."

- "There is less chance of permanent damage with the CryoBalloon."
- *Utah:* "CryoBalloon has some potential, but I want data. The question is: What do you have to do to get it to work? Safety could be an advantage."
- *Colorado:* "It is interesting, but so far it is small studies. It is promising, but until there are reproducible results in a larger number of patients, the jury is still out. It could make AF ablation simpler, shorter, and safer. If it takes us there, it will catch on, but it is in its infancy…AF ablation is such a moving target. There is a lot of technology being developed."

A German study compared cryotherapy (not the CryoBalloon) to RF ablation for atrial flutter. Researchers concluded that both energy forms showed similar acute success rates, but the clinical long-term success rate and persistence of bi-directional conduction block was significantly better with RF. Cryotherapy had reduced efficacy long-term ($p<.05$), and procedure time was longer with cryotherapy. There was no difference in fluoroscopy time.

Cryotherapy vs. RF Ablation

Measurement	RF n=79	Cryotherapy n=76
Acute success	92.4%	93.4%
Atrial flutter recurrence	0	6.6%
Bi-directional conduction block	84.9%	63.5%
Energy delivered	27,515 J/sec	2,640 J/sec
Fluoroscopy time	14 minutes	17.5 minutes (p=Nss)
Procedure time	90 minutes	118 minutes
Pain perception on VAS-IQR	60	0 (p<.01)
Long sheath used	8 patients	2 patients (p=0.05)

Data. Among other data reported at the meeting that HRS officials considered particularly newsworthy were:

- The **ISAR-Risk** trial found that the mortality rate in post-MI patients with preserved LVEF and abnormal autonomic markers is equivalent to that of patients with depressed LVEF. The researchers concluded that ICD trials are feasible in these patients, provided heart rate turbulence (HRT) and deceleration capacity (DC) are used to identify the high risk group.
- **PREPARE**, a prospective, non-randomized, 658-patient trial, sponsored by Medtronic, found that an aggressively programmed ICD reduces shocks better than physician-tailored programming in primary prevention patients.
- The **DAVID-II** trial which provided further evidence as to why pacing the lower chamber of the heart can be deleterious.
- The **VTACH** trial found that patients with an indication for an ICD did ***no better*** with VT ablation plus an ICD than an ICD alone. VTACH was a prospective, randomized, two-year, European trial in 105 patients with a history of MI, reduced EF (<50%), and hemodynamically stable VT. However, EPs at HRS were not convinced by these results. Several pointed to other studies that have found conflicting results, and they said that they will continue to do combination ablation/ICD therapy in these patients.

♦

VTACH Results

Measurement	Ablation + ICD n=50	ICD alone n=55	p-value
Primary endpoint: Time to first recurrence of VT	9.1 months	5.4 months	Nss, 0.30
Secondary endpoint: Death	4 deaths	3 deaths	Nss
Any VT event	66%	72%	Nss, 0.23
Mean number of VT events per year	9.2	19.6	Nss, 0.23
Total number of VT episodes	640	1,421	Nss, 0.06
VT storm	10 patients	15 patients	Nss, 0.33
Mean number of appropriate ICD therapies per patient and year of follow-up	12.8	26.8	Nss, 0.06
Patients with >2 VT events per year of follow-up	31%	53%	0.049