Catheterization and Cardiovascular Interventions 00:000–000 (2010)

Core Curriculum

Results of the Society of Cardiac Angiography and Interventions Survey of Physicians and Training Directors on Procedures for Structural and Valvular Heart Disease

Howard C. Herrmann,[1*] MD, FACC, FSCAI, Sandra Baxter,[2] PhD, Carlos E. Ruiz,[3] MD, PhD, FACC, FSCAI, Ted E. Feldman,[4] MD, FACC, FSCAI, and Ziyad M. Hijazi,[5] MD, FACC, FSCAI, on behalf of the SCAI Council on Structural Heart Disease

Background: Minimal information is available on the number and type of procedures being performed for structural and valvular heart disease, the physicians who perform these procedures, and on the training requirements for this emerging field. Methods: Surveys were performed using an online survey of members of the Society of Cardiac Angiography and Interventions (SCAI), including its Council on Structural Heart Disease and the Congenital Heart Disease Committee. The responses of 107 US-based interventional cardiologists were analyzed. A second questionnaire of a purposive sample of 10 training directors of US interventional cardiology programs was also performed. Results: Although many procedures (e.g., transseptal puncture, PFO, and ASD closure) are commonly performed by most respondents, others are limited to a significant minority of respondents (e.g., alcohol septal ablation, transcatheter valve repair, and implantation). In addition, the number of procedures performed varies greatly as does the training directors' estimate of the number necessary to gain proficiency. There is no single method being used to gain the requisite skills. A number of factors that limit the more widespread growth of this field were identified. Conclusions: The field of intervention for structural and valvular heart disease is new, growing rapidly, and will require a core knowledge base and new didactic methods. The cardiovascular community will be challenged to devise new training standards and credentialing approaches to serve interventionalists interested in this field. © 2010 Wiley-Liss, Inc.

Key words: valvular heart disease; interventional cardiology; structural heart disease; training

INTRODUCTION

The Society for Cardiac Angiography and Interventions (SCAI) was founded in 1978 as a professional association to develop basic criteria for training, performance, and interpretation of cardiac angiography to tabulate and evaluate morbidity and mortality of diagnostic and therapeutic procedures, to support research, self-assessment, and peer review, and to make recommendations to members, the public, and government agencies [1]. Over the ensuing years, the organization's mission has expanded to represent an increasing

[1]Cardiology Division, Department of Medicine, Hospital of the University of Pennsylvania, Gates Pavilion, Philadelphia, Pennsylvania
[2]Applied Research Analysts LLC, Reston, Virginia
[3]Division of Structural and Congenital Heart Disease, Department of Interventional Cardiology, Lenox Hill Heart and Vascular Institute of New York, New York, New York
[4]Evanston Hospital, Cardiology Division, Evanston, Illinois
[5]Rush Center for Congenital and Structural Heart Disease, Chicago, Illinois

*Correspondence to: Howard C. Herrmann, MD, FACC, FSCAI, Hospital of the University of Pennsylvania, 3400 Spruce Street, Gates Pavilion, Room 9038, Philadelphia, PA 19104, USA.
E-mail: howard.herrmann@uphs.upenn.edu

Received 7 June 2010; Revision accepted 17 June 2010

DOI 10.1002/ccd.22703
Published online 00 Month 2010 in Wiley InterScience (www.interscience.wiley.com)

Conflict of interest: Nothing to report.

© 2010 Wiley-Liss, Inc.

TABLE I. Abbreviations

Atrial septal defect	ASD
Balloon aortic valvuloplasty	BAV
Balloon mitral valvuloplasty	BMV
Balloon pulmonic valvuloplasty	BPV
Congenital heart disease	CHD
Intracardiac echocardiography	ICE
Left atrial appendage	LAA
Mitral regurgitation	MR
Patent ductus arteriosus	PDA
Patent foramen ovale	PFO
Percutaneous coronary intervention	PCI
Transcatheter aortic valve implantation	TAVI
Ventricular septal defect	VSD

number of physicians from multiple specialties, including interventional radiologists, cardiologists, pediatricians, and surgeons. New procedures have been developed including a number involving structural and valvular heart disease, which prompted the formation of a Council on Structural Heart Disease.

During a meeting of this Council in 2008, it became clear that there was a lack of current information on the number and type of procedures being performed for structural and valvular heart disease, the physicians performing them as well as training requirements for this emerging field. For this reason, the Council directed SCAI to commission two surveys—one of physicians who perform structural and valvular heart disease interventions and one of training directors—to obtain this information. This manuscript reports on the results of both surveys. A separate document relating to a core curriculum for training requirements is also published in this issue of the journal [2].

METHODS

Survey Population and Sample

The population of physicians appropriate for the first survey was unknown. SCAI's membership records do not include primary field of interest, and so a link to the preliminary version of the online questionnaire was emailed to all members (~3,400). Eighty-seven physicians responded. The final questionnaire contained 16 items and was pilot-tested with several SCAI members before final distribution. The questionnaire was formatted using Survey Monkey, an online survey publisher. An email with a link to the online questionnaire was sent to the initial 87 respondents, to all members of the Council on Structural Heart Disease, and to members of the Congenital Heart Disease Committee. A reminder email was sent 1 week later, along with a request asking members of the Council and Committee to forward the survey link to other appropriate interventionalists. A total of 107 US-based interventional cardiologists responded and included in this analysis.

The second email-based questionnaire was distributed to a purposive sample [3] of 10 training directors of interventional cardiology programs in the United States and all responded. This eight-item questionnaire focused on the content of their training programs and the number of various procedures a fellow should or must do in order to satisfy the local program requirements. It included the same items that were included in the physician survey relating to perceived barriers to the growth of structural and valvular heart disease interventions and documents they would like to see the Structural Heart Disease Council develop.

Survey Methodology

The final online questionnaire for physicians contained items focused on the following topics:

- Whether one personally and currently performs cardiac interventions for structural heart disease (e.g., valvular, left atrial appendage closure, perivalvular leak closure, alcohol septal ablation, and congenital heart disease);
- The type of patients treated (i.e., adults, children, or both);
- The number (using the response categories of none, 1–10, 11–20, 21–30, 31–40, and more than 40) of specific structural and valvular heart disease (SVHD) procedures personally performed in the last 12 months and the number of other procedures (e.g., coronary diagnostic, coronary PCI, peripheral PCI, and transseptal) personally performed in the last 12 months
- The medical setting, such as whether the respondent was the only structural and/or valvular heart disease interventionalist at their primary practice institution, the overall volume, and count of structural, valvular, as well as coronary procedures performed there (using response categories with larger intervals), and whether referrals for specific procedures occur because of unavailability of a percutaneous option at their institution
- The types of procedures the respondent does not currently do but anticipates performing within three years, and the resources for obtaining the necessary skills and training to perform them.
- The factors perceived as inhibiting more widespread growth of SVHD interventions and the type of document that should be developed by the SCAI Structural Heart Disease Council.
- Demographic characteristics of respondents including age, year completed training, and state where the primary practice institution is located.

Analysis

All practicing physician questions were closed-ended and mostly included a response field for comments.

Catheterization and Cardiovascular Interventions DOI 10.1002/ccd.
Published on behalf of The Society for Cardiovascular Angiography and Interventions (SCAI).

TABLE II. Demographic Data on Survey Respondents

	Respondents
N	107
Age (modal category)	50–59 years
(range)	30–60+ years
Year training completed	
Before 1980	12%
1980–1999	47
2000 or later	41
Patients	
Adult only	57%
Pediatric only	1
Both	42
Personally performs	
SVHD procedures (*n*, %)	73 (68%)

The analysis included running frequency distributions for each question. The training director questionnaire items reported here were also close-ended, and their analysis also involved running frequency distributions. A list of abbreviations used throughout this manuscript is shown in Table I. T1

RESULTS

Survey Respondents

A total of 107 US-based physicians responded to the survey request. Their demographic data are shown in Table II. They practiced in all regions of the country and 68% indicated that they personally and currently perform SVHD cardiac interventions. Ten training directors participated in the Training Directors survey. T2

TABLE III. Procedures Performed

Procedure	% Respondents performing	% Performers who do > 10 procedures/year	Referred to surgery because no perc. option
Transseptal puncture	85%	31%	6%
Intracardiac echo	85	57	4
PFO closure	87	57	6
ASD closure	88	55	7
VSD closure	55	6	27
PDA closure	60	34	7
Paravalvular leak Closure	33	5	28
Coronary fistula embolization	42	2	3
Alcohol septal ablation	29	14	12
Pulmonary vein stenting	27	3	4
LAA occlusion	14	5	13
BMV	58	15	13
BAV	78	28	15
BPV	58	19	3
Percutaneous MR repair	12	5	54
TAVI	11	9	65

TABLE IV. Methods to Obtain Skills for Future Anticipated Procedures

Courses at major meeting	67%
Participation in clinical trials	56
On my own, possibly with proctoring	55
Mini-fellowships at other institutions	45
Working with colleague at own institution	42

Procedures Performed

The majority of respondents (80%) performed closure of interatrial communication defects (PFO and ASD) and considered themselves proficient in the use of intracardiac echocardiography and transseptal procedures (Table III). However, <50% of these interventionalists performed more than 10 of these procedures annually. With the exception of balloon aortic valvuloplasty, less than 50% of the respondents performed other balloon valvuloplasty procedures, VSD, paravalvular leak closure procedures, and alcohol septal ablation (Table III). T3

Experience of Respondents

Most of the respondents (77%) work in an institution with at least one other structural interventionalist. The majority of those institutions are high-volume sites for nonstructural interventions: 62% perform > 500 PCI/year. Nonetheless, a sizable number of patients are referred for surgery at these institutions due to unavailability of a percutaneous option, despite suitability for percutaneous intervention. The highest numbers of referrals in this category were for VSD closure, paravalvular leak closure, and percutaneous therapy of mitral regurgitation and aortic stenosis (Table III). Only about 20% of respondents (range, 8–68%) anticipate doing new procedures in the next 3 years. The most anticipated procedures are transcatheter aortic valve implantation (68%), percutaneous repair of mitral regurgitation (42%), left atrial appendage occlusion (51%), and closure of paravalvular leaks (34%).

Training Issues

When asked how respondents envisioned obtaining the skills necessary to perform new procedures, the responses included all of the choices listed (Table IV) with courses at major meetings chosen most frequently. The respondents were asked to identify factors that may inhibit more widespread growth of structural and valvular heart disease interventions. The most significant factors identified were the lack of sufficient volume of suitable patients and of sufficient training programs (Table V). Although a minority concern, about one-third of respondents felt that the lack of T4 T5

TABLE V. Factors Inhibiting More Widespread Growth of SVHD Interventions

	% Listing factor as somewhat or extremely significant
Lack of sufficient volume of patients	71
Lack of sufficient training programs	62
Lack of good treatments/devices	55
Reimbursement issues	42
Surgeon resistance	35
Lack of transseptal skills	35
Lack of hybrid OR	34
Lack of certification or malpractice concerns	32
Lack of adjunctive imaging	18

certification and concerns relative to malpractice were inhibitory factors. In this regard, the majority (75–82%) of respondents indicated that they would like to see the Structural Heart Disease Council develop guidelines for training of fellows and credentialing guidelines in structural and valvular heart disease interventions. Only 19% of respondents favored the development of a specific board certification in this field.

Training Directors Survey

Of the 10 training directors, six train fellows in structural and valvular heart disease interventions. In three of these six programs, training involves a separate fellowship year. Didactic lectures are part of the training in five of the six programs.

The training directors rated the same three factors as most significant in inhibiting growth of SVHD interventions as did the physicians, although in a slightly different order: lack of sufficient training programs, lack of sufficient volume of patients, and lack of good treatments/devices. They also strongly supported the idea of the Structural Heart Disease Council developing guidelines for fellow training. Several questions focused on the number of procedures the respondent believes are necessary for a fellow in training to achieve proficiency. The training directors recommended that proficiency/certification be achieved by performing a minimum of 20 cases each for three types of procedures: PFO and ASD closure, percutaneous MR repair, and TAVI. As shown in Table VI, they also recommended that 11–20 cases would be sufficient for seven other procedures and 1–10 cases for the remaining three procedures listed.

DISCUSSION

Since the initial description of percutaneous transluminal balloon angioplasty for coronary artery disease more than 30 years ago, the field of interventional cardiology has undergone major growth and development. Specifically, new areas of therapeutic interventions have been undertaken by cardiologists, most notably in the areas of peripheral vascular disease and structural and valvular heart disease. With new technological advances, such as septal defect closure devices and transcatheter valve procedures, the arena of structural and valvular heart disease interventions is poised for explosive growth. However, little is known about the number and types of such procedures currently being performed and the physicians' background, training, and certification to do these procedures. For these reasons, the SCAI commissioned two surveys to obtain this information, the results of which are reported in this manuscript.

There are several key findings in the results of this survey. Many procedures are common to all respondents (transseptal puncture, use of intracardiac echocardiography, and PFO/ASD closure, Table III). However, others are limited to a significant minority of the respondents (alcohol septal ablation, percutaneous mitral regurgitation repair, transcatheter aortic valve implantation, and procedures for CHD). The number of procedures performed also varies greatly as does the training directors' estimate of the number of procedures necessary to gain proficiency (Table VI). There is no single method of training or number of procedures recommended that is being used to gain the requisite skills (Table IV). Finally, a number of factors continue to limit the more widespread growth of this field in addition to the limited number of patients, including the lack of sufficient training programs and good devices or treatments (Table V).

A number of lessons relating to training and certification can be gained from examining the field of coronary intervention. For PCI, training initially occurred via observation, proctorship, and live demonstration

TABLE VI. Training Directors' Estimate of Number of Procedures Necessary for Proficiency or Certification

1–10 procedures
VSD closure
Paravalvular leak closure
Pulmonary vein stenting
11–20 procedures
Transseptal puncture
Intracardiac echo
PDA closure
Coronary fistula embolization
Alcohol septal ablation
LAA occlusion
Balloon valvuloplasty (mitral, aortic, and pulmonary)
20–50 procedures
PFO and ASD closure
Percutaneous MR repair
TAVI

Catheterization and Cardiovascular Interventions DOI 10.1002/ccd.
Published on behalf of The Society for Cardiovascular Angiography and Interventions (SCAI).

courses [4]. Knowledge was transferred from mentors to more junior colleagues, and experience was gained by "on-the-job" training [4]. The first attempt to provide guidance to this field was the 1995 Core Cardiovascular Training Symposium (COCATS) consensus statement that provided guidelines for fellowship training [5]. A recent update (COCATS 3), published in 2008, reflects current Accreditation Council for Graduate Medical Education (ACGME) standards [6]. These standards require demonstration of training and competence at ACGME accredited institutions to allow for evaluation and certification in interventional cardiology by the American Board of Internal Medicine.

The COCATS 3 document includes recommendations from 10 separate task forces in various areas of cardiovascular training [6]. None of these specifically address the area of structural and valvular heart disease, with only task force nine (Training in Care of Adult Patients with Congenital Heart Disease) addressing any of the procedures performed within this new field. There is a clear need to consider how both fellows and interventionalists experienced in other areas train, are evaluated, and are possibly certified for procedures in structural and valvular heart disease. The first step in considering these issues is to understand what procedures are currently being performed, how many are being done, and what current practitioners think about these issues. An additional task force in this area should be considered for the next COCATS revision.

In this and the accompanying manuscript [2], we have highlighted some of the difficulties in developing comprehensive guidelines for training and certification. The field of structural and valvular cardiac interventions has a number of unique aspects when compared with coronary interventions. Similar to peripheral interventions, there is a separate knowledge base that is not routinely acquired during adult cardiovascular fellowship. This field bridges adult and pediatric cardiology and adult congenital heart disease and will require a unique core curriculum. As suggested by Ruiz et al, [2], in addition to the core knowledge base, there may need to be an emphasis on basic technical skills (e.g., intracardiac echocardiography and transseptal puncture) as volume for specific procedures may be too low to use this as the only guideline for competency. Some of the most complex and technically demanding procedures, such as VSD and paravalvular leak closure, occur least commonly. This fact may explain the somewhat surprising finding from the training directors survey that only 1–10 procedures may be necessary for proficiency or certification in these procedures (Table VI). This paradox highlights the need for other methods of training and assessment of core competency using a core curriculum as detailed in the accompanying manuscript [2].

This survey is limited by a relatively low response rate, regardless of which response metrics for web-based surveys are used [7]. The small number of respondents, in addition to the use of a convenience sample rather than a random sample, makes it impossible to generalize the results. Given that this was the first survey of its kind, however, the resulting data were deemed suitable for limited analysis.

In conclusion, the field of intervention for structural and valvular heart disease is new, growing rapidly, and will require a new core knowledge base as well as new didactic methods. The procedures performed for these diseases are less common, and the diseases themselves are more diverse. Volume requirements will likely differ for each procedure. Nonetheless, some basic skills cross over between diseases and procedures, making them a requirement for all of these. The cardiovascular community will be challenged to devise new training standards and credentialing approaches to serve interventionalists interested in structural and valvular heart disease.

REFERENCES

1. Baltave HA, Elliot LP, Gensini GG, et al. The society for cardiac angiography: Its purpose, effects, and goals. Cathet Cardiovasc Diagn 1981;7:217–224.
2. Ruiz C, Feldman TE, Hijazi ZM, et al. Interventional fellowship in acquired and congenital structural heart diseases: Core curriculum. Cathet Cardiovasc Interv 2010; DOI 10.1002/ccd.22702.
3. Babbie ER. The Practice of Social Research, 11th ed. Belmont, CA: Wadsworth; 2006.
4. Rihal C, Barsness GW. Training program guidelines, case numbers, and recertification in cardiac catheterization and interventional cardiology self-assessment program. In: Moliterno DJ, editor. CathSAP version 3. American College of Cardiology; 2008. pp 1123–1129.
5. Pepine CJ, Babb JD, Brinker JA, et al. Guidelines for training in adult cardiovascular medicine. Core Cardiology Training Symposium (COCATS). Task Force 3: Training in cardiac catheterization and interventional cardiology. J Am Coll Cardiol 1995;25:14–16.
6. Beller GA, Bonow RO, Fuster V. ACCF 2008 recommendations for training in adult cardiovascular medicine core cardiology training (COCATS 3) (Revision of the 2002 COCATS Training Statement). J Am Coll Cardiol 2008;51:335–338.
7. Evsenbach G. Improving the quality of web surveys: The checklist for reporting results of internet E-surveys. J Med Internet Res 2004;3:E34.