

# Variations of transesophageal echocardiography practices in India: A survey by Indian College of Cardiac Anaesthesia

Deepak Prakash Borde, Antony George<sup>1</sup>, Shreedhar Joshi<sup>2</sup>, Suresh Nair<sup>3</sup>, Thomas Koshy<sup>4</sup>, Uday Gandhe<sup>5</sup>, Murali Chakravarthy<sup>1</sup>

Department of Cardiac Anesthesia, Ozone Anesthesia Group, United CIIGMA Hospital, Aurangabad, <sup>5</sup>Department of Anesthesia, Hinduja and Lilavati Hospitals, Mumbai, Maharashtra, <sup>1</sup>Department of Anesthesia, Critical Care and Pain Relief, Fortis Hospitals, Bengaluru, Karnataka, <sup>2</sup>Department of Cardiac Anesthesia, Nayati Super-speciality Hospital, Mathura, Uttar Pradesh, <sup>3</sup>Department of Anesthesia, Pain Medicine and Critical Care Services, Aster Medcity, Cochin, <sup>4</sup>Department of Cardiac Anesthesia, Sree Chitra Tirunal Institute of Medical Sciences and Technology, Trivandrum, Kerala, India

## ABSTRACT

**Context:** Use of perioperative transesophageal echocardiography (TEE) has expanded in India. Despite attempts to standardize the practice of TEE in cardiac surgical procedures, variation in practice and application exists. This is the first online survey by Indian College of Cardiac Anaesthesia, research and academic wing of the Indian Association of Cardiovascular Thoracic Anaesthesiologists (IACTA). **Aims:** We hypothesized that variations in practice of intraoperative TEE exist among centers and this survey aimed at analyzing them. **Settings and Design:** This is an online survey conducted among members of the IACTA. **Subjects and Methods:** All members of IACTA were contacted using online questionnaire fielded using SurveyMonkey™ software. There were 21 questions over four pages evaluating infrastructure, documentation of TEE, experience and accreditation of anesthesiologist performing TEE, and finally impact of TEE on clinical practice. Questions were also asked about national TEE workshop conducted by the IACTA, and suggestions were invited by members on overseas training. **Results:** Response rate was 29.7% (382/1222). 53.9% were from high-volume centers (>500 cases annually). TEE machine/probe was available to 75.9% of the respondents and those in high-volume centers had easier (86.9%) access. There was poor documentation of preoperative consent (23.3%) as well as TEE findings (66%). Only 18.2% of responders were board qualified. Almost 90% of the responders felt surgeons respected their TEE diagnosis. Around half of the responders felt that new intraoperative findings by TEE were considered in decision-making in most of the cases and 70% of the responders reported that surgical plan was altered based on TEE finding more than 10 times in the last year. Despite this, only 5% of the responders in this survey were monetarily awarded for performing impactful skill of TEE. Majority (57%) felt that there is no need for overseas training for Indian cardiac anesthesiologists. **Conclusions:** In this survey of members of the IACTA, use of TEE has increased substantially, but still a lot of variations in practice patterns exist in India. There is urgent need for improving TEE certification and upgrade documentation standards, motivate use of TEE across all centers, promote awareness and usefulness of TEE use among surgical fraternity, monitor impact of TEE, and support separate remuneration policy in India.

**Key words:** Current practices in India, Indian College of Cardiac Anaesthesia; Transesophageal echocardiography survey

## INTRODUCTION

Transesophageal echocardiography (TEE) has evolved as a major monitoring and diagnostic tool in the last few decades. The

**Address for correspondence:** Dr. Deepak Prakash Borde, Ozone Anesthesia Group, First Floor, OPD Wing, United CIIGMA Hospital, Aurangabad - 431 001, Maharashtra, India. E-mail: deepakborde2482@gmail.com

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expansion of its use in perioperative period in the Indian scenario is indicated by an increasing number of centers incorporating perioperative TEE into their practice, which is reflected by an increasing sale of echocardiography equipment, increasing popularity of TEE conferences globally and attendance at the Indian Association of Cardiovascular Thoracic Anaesthesiologists (IACTA) TEE workshop.<sup>[1]</sup> The recently published perioperative TEE guidelines by the IACTA are intended for physicians in applying TEE appropriately in imaging structures, standardization of views, and help in managing patients in the perioperative period.<sup>[2]</sup> Despite attempts to standardize the practice of TEE in cardiac surgical procedures, variation in practice and application exists. Barriers to routine use of TEE in cardiac surgery include factors encountered in day-to-day practice of cardiac anesthesiologist including availability of equipment, credentials, privileges, experience, and expertise of the anesthesiologist, support provided by surgeon and hospital administration. Yet another important barrier is the absence of financial remuneration for the operator who performs TEE.

To understand these barriers in the Indian scenario, the authors conducted a survey among Indian cardiac anesthesiologists. This is the first survey conducted by recently structured academic cell of the Indian College of Cardiac Anaesthesia (ICCA), which is the research and academic wing of the IACTA. The additional aims of this study were to understand patterns of TEE use among cardiac anesthesiologists across India, especially in terms of center volume, impact of TEE in their clinical practice, experience, and accreditation of anesthesiologists.

We hypothesized that variations in practice of intraoperative TEE exist among centers and this survey aimed at analyzing them.

## SUBJECTS AND METHODS

The survey was developed by the authors and was tested in a pilot group of ten participants before sending the questionnaire to all participants. This survey was targeted at members of IACTA. The questionnaire focused on infrastructure of the facility, experience, and accreditation of the anesthesiologist and the perceived impact of TEE on their clinical practice.

The questionnaire was fielded using SurveyMonkey™ software, and the link <https://www.surveymonkey.com/r/IACTAICARETEESurvey> was sent by the author (who did not participate in data analysis) via E-mail to all members of IACTA from its database of members. The questionnaire and E-mail message are appended [Appendix 1]. The same author sent a follow-up E-mail after 2 weeks to nonresponders and partial responders. The participation in the survey was voluntary, and no incentives were offered to responders. The questions remained fixed and responders were reminded to complete the test in event of incomplete entry. There were 21 questions over four pages. All questions had a choice of multiple responses, of which one could be selected. Some questions had option for descriptive responses. Responders could alter the answers until submission but were blocked from duplicate attempts by internet protocol address check by SurveyMonkey™ software (SurveyMonkey, 1999 Palo Alto, CA). Data were collected from September 12, 2015, to February 03, 2016. The responses were automatically archived by SurveyMonkey database and were retrieved later for analysis. The author analyzing the responses was blinded to the identity of the respondent. Both complete and incomplete responses were analyzed. The Checklist for Reporting Results of Internet E-Surveys (CHERRIES) was used for reporting the results of the survey.<sup>[3]</sup> The data were analyzed using the Statistical Package for Social Sciences (SPSS Inc. 2007. SPSS for Windows, Version 16.0, Chicago, USA). More than one responder from the same facility was allowed.  $P < 0.05$  was considered statistically significant.

**RESULTS**

Survey links were sent via E-mails to 1222 IACTA members, of which 131 (10.7%) emails did not reach the intended recipient and 26 recipients opted out of the survey. The response rate was 29.7% (382/1222), of which 83.5% complete and 16.5% partial responses. Response of 293 respondents was considered adequate for margin of error of 5%.<sup>[4]</sup> Descriptive analysis was done on the basis of survey questions, and subgroup analysis was done to describe the salient points.

## RESULTS

**Infrastructure [Table 1]**

Fifty-four percent of the responders were from centers with an annual caseload of >500 cases (high volume), 32.5% From those with 200–500 cases (intermediate volume), and 13.6% From centers with <200 cases (low volume). 67.8% Of the responders reported tee use at their center in >100 cases, 16% for 50–100 cases, and 16.2% For <50 cases. 75.9% Of respondents had a dedicated echo machine/tee probe dedicated

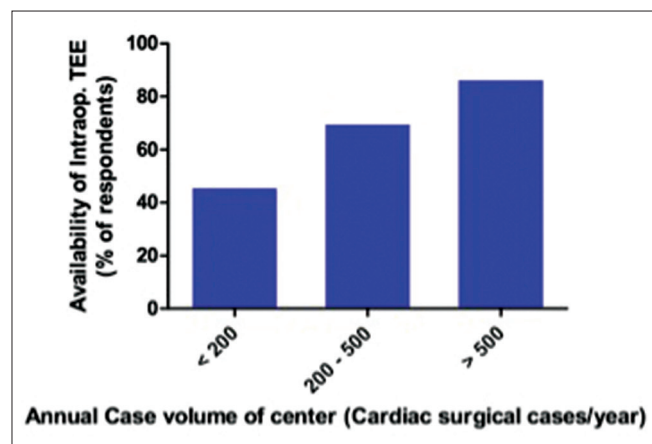
to the operation theater. More responders (86.9%) From high-volume centers had access to dedicated machine/probe for the operating theater compared to (70.2%) Intermediate-volume ( $P < 0.01$ ) And (46.2%) In low volume centers ( $P < 0.01$ ) [Graph 1]. Of those who had access to dedicated machine/probe in the operating theater, 61.7% Belonged to high-volume centers, compared to 30% ( $P < 0.01$ ) In intermediate-volume and 8.3% ( $P < 0.01$ ) In low- volume centers. 49.1% Of responders had access to either three-dimensional (3d) tee or epiaortic scanning. Only 36.8% Of high-volume centers lacked either 3d or external anal sphincter compared to 67.2% ( $P < 0.01$ ) Of intermediate-volume and 68.6% ( $P < 0.01$ ) Of low-volume centers.

**Documentation [Table 2]**

Routine preoperative consent for TEE insertion was performed by 23.3% of the responders. Two-thirds of the responders used some sorts of documentation for reporting TEE findings, whereas 29.6% conveyed through verbal opinion and 4.5% did not report the findings. Documentation of TEE findings also varied by center volume – 68.3% of high, 60.7% ( $P = 0.33$ ) of intermediate, and 19.1% ( $P < 0.01$ ) of low volume centers documented (electronic or verbal) TEE findings [Graph 2]. Only 67.3% documented complications of TEE, whereas 23.6% confined to a verbal reporting and the trend was similar across center volumes.

**Experience and accreditation [Table 3]**

Sixty-five percent of the responders had been practicing cardiac anesthesia for >5 years, 26.7% for 2–5 years, and 7.9% for <2 years. Use of dedicated echo machine/probe was not different between those with experience of <2 years (82.1%), compared to 77.9% ( $P = 0.95$ ) in intermediate experience and 76.7% ( $P = 0.71$ )



**Graph 1:** Availability of intraoperative transesophageal echocardiography according to case volume

in >5 years. Documentation of echo findings was absent in 28.6% of those with >5-year experience, 44.2% ( $P = 0.005$ ) in 2–5 years, and 21.4% ( $P < 0.01$ ) in <2 years.

**Table 1: Distribution according to center infrastructure**

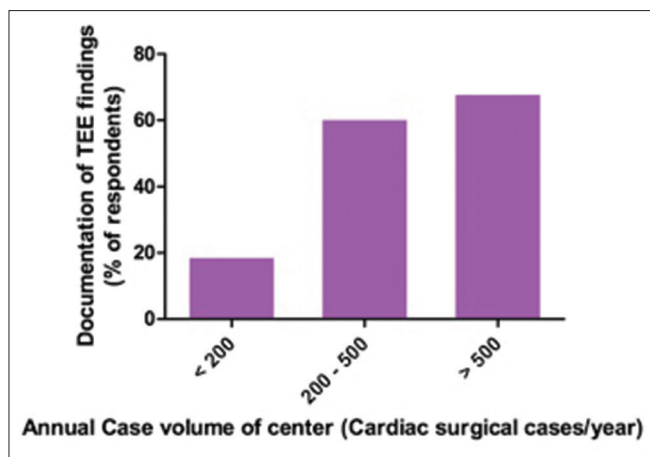
	n	Percentage of responders
Center volume (annual case load)		
<200	52	13.6
200-500	124	32.5
>500	206	53.9
Number of TEE performed annually		
<50	62	16.2
50-100	61	16.0
>100	259	67.8
Availability of dedicated TEE machine/probe in the operation theater		
Yes	290	75.9
No	92	24.1
Practice of 3D/epiaortic ultrasound		
3D	79	21.0
EAS	51	13.5
Both	55	14.6
None	192	50.9

TEE: Transesophageal echocardiography, EAS: Epiaortic Scanning, 3D: Three-dimensional

**Table 2: Distribution according to documentation of TEE consent, findings, and complications**

	n	Percentage of responders
Consent for TEE examination		
Yes	89	23.3
No	293	76.7
Documentation of TEE findings		
Verbal	113	29.7
Electronic	43	11.3
Document	208	54.6
None	17	4.5
Sterilization of TEE probe		
Soap	97	25.4
Cidex	260	68.1
Others	25	6.5
Documentation of complications of TEE		
Document	257	74.1
Verbal	90	25.9
None	0	0

TEE: Transesophageal echocardiography



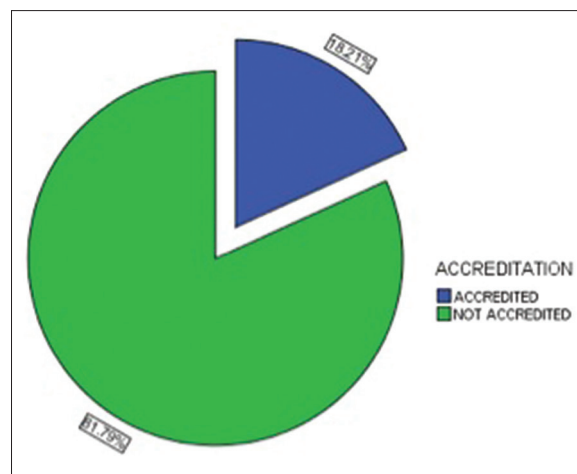
**Graph 2:** Documentation of transesophageal echocardiography findings according to case volume

Only 18.2% of the responders were board qualified by any national/international certifying board [Graph 3]. The incidence of board qualification was similar in those with >5-year experience, 2–5 years, and <2 years of 20.5%, 14.7% ( $P = 0.66$ ), and 14.2% ( $P = 0.2$ ), respectively. The accreditation rate did not vary according to center volume.

The frequency of remuneration for performing the TEE was dismal, and only 5.2% of responders were paid separately. This was similar across responders with varying experience in cardiac anesthesia (3.6% in < 2 years, 4.2% ( $P = 0.9$ ) in 2–5 years, and 5.2% ( $P = 0.77$ ) in > 5 years and did not change even with presence of accreditation (9.5% in those with versus 3.9% in those without accreditation ( $P = 0.12$ )).

**Impact of transesophageal echocardiography on clinical practice [Tables 3 and 4]**

When available, 57% of the responders used echo for all cases and 62% used TEE in the Intensive Care Unit. In 32.7% of cases, the indication of TEE was for valve surgery. New TEE findings were considered for decision-making—most of the cases in 48.1%, all cases in 16.3%, and rarely considered only in 35.8% [Graph 4]. In a vast number of responders, a change in surgical plan occurred in the past year based on TEE findings (70% responders more than 10 times; 21% responders more than 20 times; and 9% responders more than 50 times). In high-volume centers, there was higher incidence (84.46% of respondents) of change of surgical plans on basis of TEE findings as compared to intermediate-volume (77.42%,  $P = 0.15$ ) and low-volume centers (57.7%,  $P = 0.0001$ ). Around 40% of the responders reported that their surgical

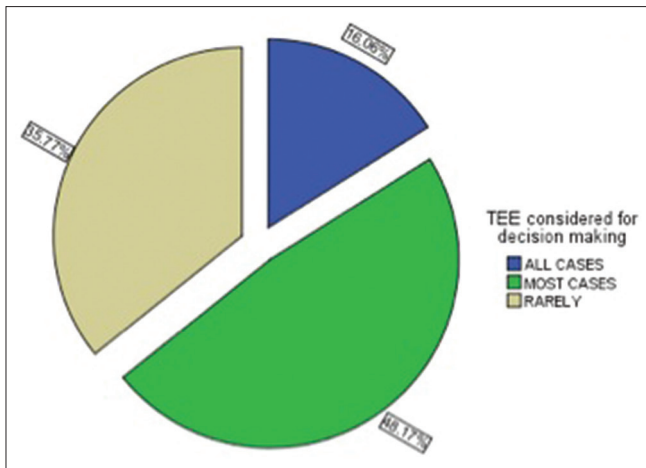


**Graph 3:** Percentage of accredited respondents

**Table 3: Distribution according to experience, accreditation, and overall impact of transesophageal echocardiography practice**

	n	Percentage of responders
Experience of respondent (years)		
<2	28	7.9
2-5	95	26.8
>5	232	65.4
Accreditation		
Indian	38	11.0
American	17	4.9
European	8	2.3
None	283	81.8
In accredited responders, accredited by which board		
Indian	96	27.0
American	81	22.8
European	178	50.1
Respect given by surgeons for TEE diagnosis		
Yes	319	89.9
No	36	10.1
Cancellation of Valve repairs in the absence of TEE		
Yes	139	39.2
No	216	60.8
Support from surgeon for more TEE equipment		
Yes	243	68.5
No	112	31.5
Payment specific to TEE expertise		
Yes	20	5.2
No	362	94.8
Overseas		
Yes	129	39.4
No	198	60.6

TEE: Transesophageal echocardiography



**Graph 4:** Percentage of Respondents according to impact of transesophageal echocardiography on decision-making

colleagues would cancel valve repair cases if expertise in TEE was not available.

Almost 90% of the responders felt surgeons respected their TEE diagnosis. Surgical colleagues supported for more TEE-related equipment in 68.5% responders.

**National transesophageal echocardiography workshop and overseas training [Table 5]**

The Annual National TEE workshop organized by the IACTA is a rich source of knowledge and is quite popular among the clinicians. Around 50% of the responders reported that they had attended at least one National TEE workshop whereas around 15% responders have attended it more than once. Around 57% of them reported that there is no need for overseas training for Indian cardiac anesthesiologists.

**DISCUSSION**

This is the first survey in India which describes patterns of TEE use among cardiac anesthesiologists and its implications.

Similar surveys in other countries have been reported by Lambert *et al.*<sup>[5]</sup> in 2002 and by Dobbs *et al.*<sup>[6]</sup> in 2014. Lambert *et al.* surveyed TEE practices among all members of cardiovascular section of the Canadian Anesthesiologists' Society.<sup>[5]</sup> Dobbs *et al.* conducted an institutional-based survey across 200 institutions, representing 27 countries and 1727 anesthesiologists.<sup>[6]</sup> The response rate of our survey (29.75%) was lesser than 40.36% reported by Dobbs *et al.* and 48.4% seen in Lambert *et al.* This may be due to infrequent updating of IACTA database and inadequate participation from

**Table 4: Distribution according to impact of transesophageal echocardiography on practice of cardiac anesthesia**

	n	Percentage of responders
Procedures for which TEE is mostly used		
CABG	8	2.3
VHD	116	32.7
CHD	27	7.6
All cases	204	57.5
Impact of an undiagnosed finding on decision-making		
All cases	57	16.1
Most cases	171	48.2
Rarely	127	35.8
Number of times surgical plan was revised on basis of TEE opinion in the last year		
>10	209	69.7
>20	65	21.7
>50	26	8.7
Use of TEE in postoperative unit		
Yes	237	62.0
No	145	38.0

TEE: Transesophageal echocardiography, CABG: Coronary artery bypass graft, VHD: Valvular heart disease, CHD: Coronary heart disease

**Table 5: Distribution according to the attendance in the National Transesophageal Echocardiography workshop and about overseas training**

	n	Percentage of responders
Attendance in at least one National TEE workshop		
Yes	172	57.9
No	125	42.1
Is overseas training required for Indian cardiac anesthesiologists		
Yes	129	39.4
No	198	60.6

TEE: Transesophageal echocardiography

its members. However, it fulfilled CHERRIES criteria of 293 respondents for margin of error of 5%.<sup>[3]</sup>

This survey describes the widespread penetration of TEE practice in cardiac surgical practice in India. More than 75% of the responders observed that they had dedicated TEE machine and probe in their operating room while around 67% responders performing more than 100 TEE examinations annually. However, there was considerable variation in several aspects of TEE practice depending on the center volume, experience, and accreditation of cardiac anesthesiologists. High-volume



centers have better availability of TEE machine/probe at their disposal, are more likely to take TEE-specific consent, and are more likely to document both TEE findings and complications if any due to TEE use. These aspects probably point to better TEE practices at centers that have higher case volume. Earlier multinational TEE survey on TEE in adult cardiac surgery has reported that TEE is performed more comprehensively in academic centers and that barriers to performing TEE for all cases are due primarily to lack of TEE equipment.<sup>[6]</sup> With availability of better resources, the number and quality of perioperative TEE examinations are expected to increase. High-volume centers were also more likely to have advanced imaging such as 3D TEE and epiaortic scanning. Thus, high-volume centers appear to be on the forefront of optimal TEE utilization and documentation. It is heartening to note that many centers already own exclusive TEE machine for the operation theater. With growth of the technique and ability to perform TEE, even the second and third tier hospitals should own their exclusive machine. Procuring dedicated echo machine would also promote the anesthesiologists to learn and practice not only TEE but also transthoracic, transcranial, and superficial structure (airway, central vessels, IVC diameter, peritoneal, and plural) scans, thus improving the patient care.

The survey identified that documentation of consent, findings, and complications of TEE are being performed only by a minority of cardiac anesthesiologists. It is also surprising that 4.5% of responders do not even verbally report the findings of TEE examination. It may be remembered that medical records are acceptable as per Section 3 of the Indian Evidence Act amended in 1961 in a court of law and are considered useful evidence.<sup>[7]</sup> It is often the only evidence, which may absolve the practitioner of negligence. Nonreporting of findings appears rampant. Hopefully, in future, automated reporting would be a welcome addition to modern TEE machines. The need to escalate educational stress on documentation appears to be the need of the hour!

The experience of cardiac anesthesiologist plays a crucial role in patient management. The majority of the responders in this survey had more than 5 years of experience in cardiac anesthesia. Clinicians with more experience had higher availability of TEE probe/machines, and they were more likely to be board qualified, too.

The impact of TEE in cardiac surgical practice was assessed by a variety of questions in this survey. Around

half of the responders felt that new intraoperative findings by TEE were considered in decision-making in most of the cases and 70% of the responders reported that surgical plan was altered based on TEE finding more than 10 times in the last year. This is in accordance to the literature. TEE performed by cardiac anesthesiologist is fast getting acceptance by surgical colleagues, and cardiac anesthesiologists have completely replaced cardiologist for TEE, with 90% of the responders in this survey feel that their surgical colleagues respect their TEE findings. Moreover, 70% of anesthesiologists felt that surgeons support their demand for more TEE-related equipment.

Credentialing is an important step in standardizing and improving practice in TEE practice. As a step forward, IACTA has started a Fellowship in TEE examination in 2010, and until now, six examinations have been held. The American Society of Echocardiography, Indian Academy of Echocardiography, University of Minnesota (USA), and University of Leipzig (Germany)<sup>[1]</sup> accredit this examination. However, only 18.2% of the responders were board certified (38, i.e., 11% IACTA; 17, i.e., 5% American Board; and 8, i.e., 2% were EACTA). In contrast, Dobbs *et al.* reported that 33% of respondents were accredited.<sup>[6]</sup> Accredited clinicians felt that their diagnosis is more valued, and the surgeons were more supportive of their request for echo infrastructure.

Only around 5% of the responders in this survey were monetarily awarded for performing impactful skill of TEE. This reflects poor recognition of this skill by hospital management. This is in sharp contrast with the previous multinational survey, in which around 57% of the hospitals charge for the TEE and 65% of the times it is charged by anesthesiologist.<sup>[6]</sup> A major point of difference between these surveys was accreditation of 65% of the responders by the American Board. Thus, certification process will not only improve the standards of the practice but also help anesthesiologist to get their due monetary share. This can be achieved only by coaxing surgeons and administrators of the hospital. Considering the dependence of surgeons on the input from TEE performed by the anesthesiologist, a reasonable payment is warranted. Remunerating will also encourage reporting because many insurance companies insist on report for all the examinations they pay for.

A substantial majority of responders are still not accredited, and it is true even for clinicians from

high-volume centers. The fact that accredited clinicians felt that their TEE diagnosis is more respected and that their surgical team was more supportive of request for an echo infrastructure should encourage practitioners.

The responders were asked about need for overseas training for Indian cardiac anesthesiologists; around 57% of them reported that there is no need for the same. Many of the responders reported in the descriptive responses that the scenario for training in India is fast changing and overseas training is generally not required. Members opined that such training might be required perhaps for only for 3D TEE. However, with initiative of IACTA to start 3D TEE workshop, probably, even this requirement may not be there in near future.

Based on these, the authors would like to make the following recommendations to the ICCA/IACTA:

- A standardized consent form for TEE is made available by the ICCA/IACTA to all its members
- Promote the use of standardized report for TEE findings available at [http://iacta.co.in/WP\\_iacta/Downloads/TEE\\_Log%20Book%20Revised%2022-05-2013.pdf](http://iacta.co.in/WP_iacta/Downloads/TEE_Log%20Book%20Revised%2022-05-2013.pdf)
- Educating the surgeons and administrators of tier 2 and 3 hospitals to procure TEE equipment
- A structured remuneration to be made after discussing with cardiac surgeons and the hospital administrators
- IACTA should ensure education of its members about the need for documentation of TEE examinations. It would not only benefit the patients but also protect the cardiac team in the event that the surgical indication/outcomes are challenged in the court of law
- IACTA must provide a recommendation about the requirement of TEE in tier 2 and 3 hospitals.

#### Limitations

Bias inherent to surveys exist, the analysis implies only the respondents and favors the respondent population only. Participation of multiple responders from the same institute would have led to duplication of data in favor of high-volume centers. Mode of data collection (E-mail) could also have introduced a selection bias. The response rate was less compared to previous surveys. There is need for robust database of all IACTA members, and authors urge members to respond to such surveys

for better understanding and planning future guidelines and recommendations unique to India.

#### CONCLUSION

Variations exist in the practice of perioperative TEE in India. There is urgent need for improving TEE certification and upgrade documentation standards, motivate use of TTE across all centers, promote awareness and usefulness of TEE use among surgical fraternity, monitor impact of TEE, and support separate remuneration policy in India.

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Nil.

#### Conflicts of interest

There are no conflicts of interest.

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## APPENDIX -1

(Introduction and Questions of the Survey)

### TEE questionnaire

Dear Colleague, TEE has become powerful weapon in cardiac anesthesiologist's armamentarium. This survey is to generate an opinion about the contemporary TEE practices by cardiac anesthesiologists in India. Kindly give your frank opinion. This survey does not require your personal details about you and your hospital.

### Center Specific

What is average number of cardiac surgical cases at your center annually? <200, 200-500, >500

What is number of Intraoperative TEE (IOTEE) performed annually? <50, 50-100, >100

Does your center have echo machine and /or TEE probe dedicated for OT? Y/N

What is mode of documentation of TEE report? Electronic/ Paper/None

Do you obtain separate consent for TEE? Y/N

How do you sterilize TEE probe? Cidex/ Wash with soap and water/ Any other method

How do you report the complications if any of TEE probe insertion?

Are you paid separately for performing IOTEE? Y/N

Do you use TEE in post op ICU? Y/N

Do you have access to 3-D TEE or epiaortic scanning?

**Anesthetist Specific:**What is your number of years of experience in Cardiac Anesthesia? <2, 2-5, >5

Are you holding any accreditation for TEE? Indian/ American/ European/ Any other/ NO

Please tick if your TEE exams are: Comprehensive/ Focused

Do you use IOTEE mostly for: CABGs/ Valve cases/ Congenitals/ All

Previously undiagnosed findings are considered for decision making: in all cases/ mostly/ rarely

- How many times in the past year the surgical plan has been revised because of your TEE opinion? >10, >20, > 50
- Do your surgeons respect your TEE diagnosis Y/N
- Does your surgeon cancel valve repairs if TEE is not available? Y/ N
- Does your surgeon support your request for more TEE machines and probes? Y/ N

Have you attended at least one National TEE workshop held by IACTA in Bangalore: Y/N

Do you think it is necessary for Indian cardiac anesthesiologists to go overseas for TEE training anymore? Y/ N