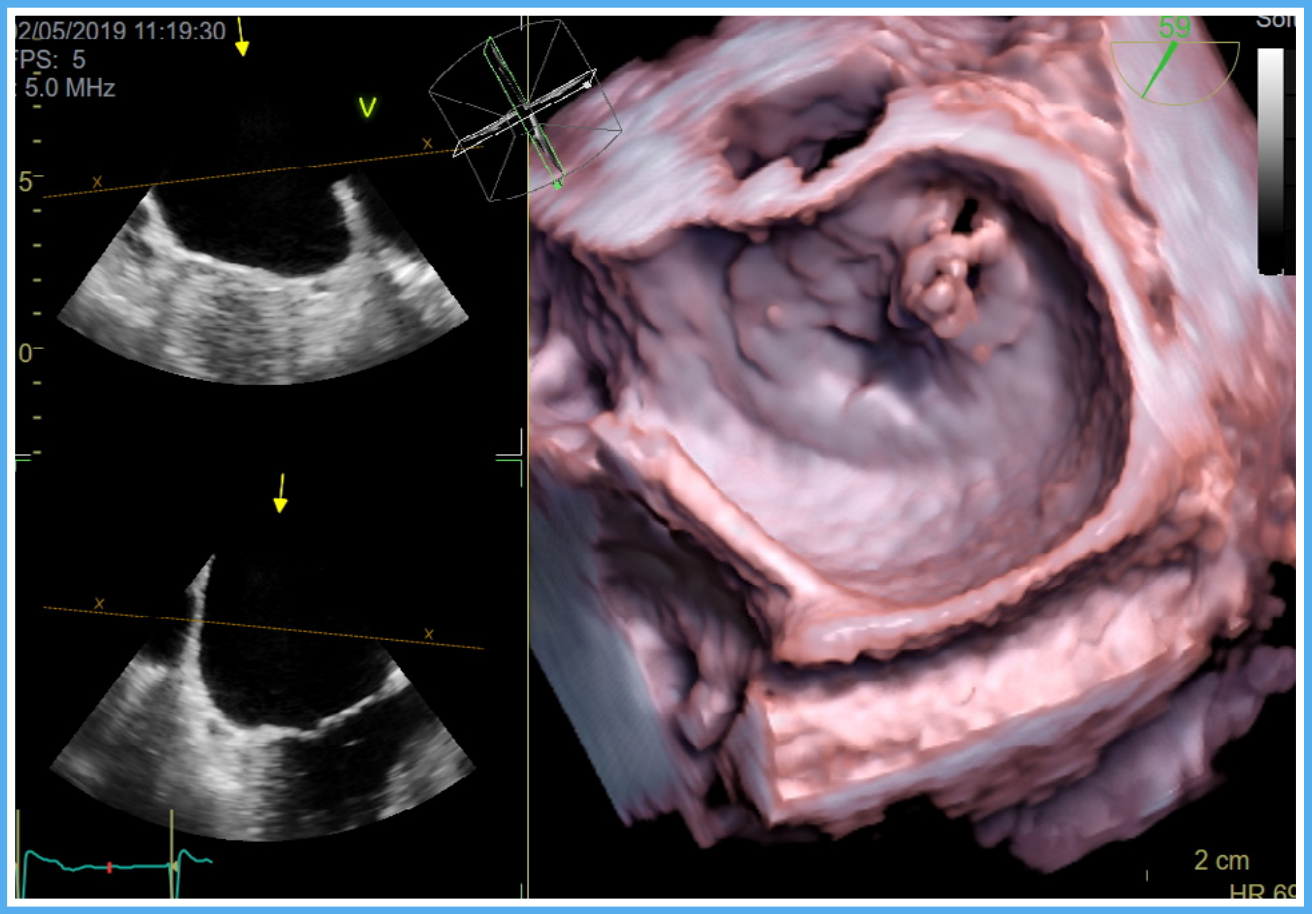
ECHO



VOLUME 12 ISSUE 7 **JULY 2023**

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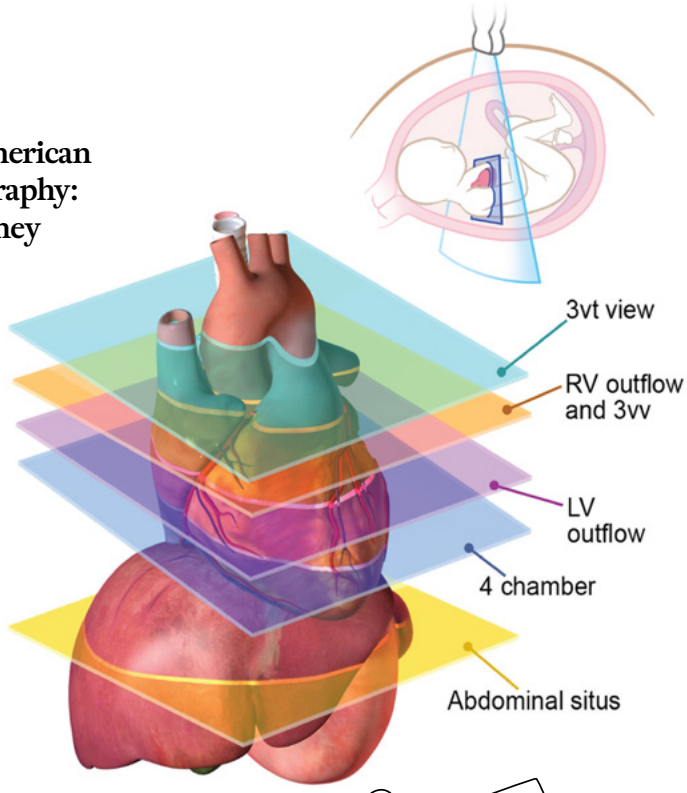
Discounted rates for ASE members. *To learn more and register, visit us at* ***ASEcho.org/Education***.

This text also appears in the July JASE. ***OnlineJASE.com***

Contents



AMERICAN SOCIETY OF ECHOCARDIOGRAPHY

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Cover art: "Perforated Mitral Valve Aneurysm" Luciano Belem, MD, Echo Lab and Valvular Infirmary, Instituto Nacional de Cardiologia, Rio de Janeiro, Brazil

EDITORS' NOTE

ASE is very grateful to our members who contribute to *Echo* magazine and values their willingness to share personal insights and experiences with the ASE community, even if they may not be in total alignment with ASE's viewpoint.

MEMBERSHIP IN THE AMERICAN SOCIETY OF ECHOCARDIOGRAPHY: AN UNFORGETTABLE JOURNEY

Contributed by ***Benjamin W. Eidem, MD, FASE****, Director of Pediatric and Congenital Echocardiography, Mayo Clinic and Professor of Pediatrics and Medicine at Mayo Clinic College of Medicine, Departments of Pediatrics and Cardiology, Rochester, MN*

As I look back over my years of membership in the American Society of Echocardiography (ASE), I am filled with both a sense of awe and a deep gratitude for all the opportunities that I have had to participate and grow in our Society. From my initial abstract presentation at the Scientific Sessions as a fellow over 25 years ago, I can't help but remember all the individuals at ASE who have shaped and guided my career, all the task forces and committees that I have been able to serve on, and all the leadership roles that have allowed me to more fully appreciate the depth and breadth of our Society. It has truly been an unforgettable journey! If you had asked me anywhere along this path if I would be the president of our Society, I would most certainly have dismissed that thought in a heartbeat. Yet here I am writing my initial "Blue Page" as ASE president. This is truly a testament that ***anyone*** in our Society can pursue and achieve meaningful leadership roles and build a successful and rewarding career at ASE.

> "This is truly a testament that *anyone* in our Society can pursue and achieve meaningful leadership roles and build a successful and rewarding career at ASE."

As the second pediatric cardiologist to become president of ASE, I must pause for a moment to recognize and thank the myriad of exceptionally talented congenital sonographers and physicians that have paved the way for this to occur. I must also pay tribute to the first pediatric cardiologist to be president of our Society, Dr. David Sahn, over 35 years ago. Dr. Sahn's innumerable contributions were foundational to ASE, and he set a very high bar for all those in our Society that have followed thereafter.

My vision for the presidency primarily focuses on our membership, with two key foundational questions: (1) What do individuals want/need to become ASE members, and (2) How do individuals grow as ASE members? These questions in essence constitute the "value proposition" of membership in our Society. I believe that addressing these questions effectively can be a cornerstone for the continued health and growth of ASE. My vision to achieve these focuses on three important initiatives: (1) ASE Matters, (2) ASE Mentors, and (3) ASE Educates.

My first initiative, ASE Matters, has two core principles. The first tenet focuses on expanded opportunities for leadership and service in our Society to foster career growth and satisfaction as well as a sense of ownership for our members. This includes (1) expansion of microvolunteer opportunities to promote initial member participation, (2) broadened strategies at the institutional, local society, regional, and national levels to foster engagement, and (3) utilization of our ASE social media to highlight and disseminate innovative leadership ideas. The second tenet involves the concept of ASE core groups. I envision core groups as dedicated areas for members with common professional interests to network, exchange ideas, engage in scientific research, and advance clinical management approaches. Core groups can enable a "shared vision" across multiple professions including sonographers, physicians, scientists, veterinarians, and those working in industry. I believe core groups will dovetail nicely with ASE's already established councils, committees, task forces, special interest groups, and affinity groups and will enable increased membership involvement.

My second initiative, ASE Mentors, is my vision for ASE to be a mentoring Society with dedicated mentorship involvement at all levels of our membership. I envision building a robust and successful mentorship program at ASE that will (1) facilitate the training of our next generation of mentors, (2) enable an effective mentor-mentee matching process, and (3) provide ongoing follow-up evaluation and education of mentors and mentees throughout their mentorship relationship. Mentorship opportunities, although present throughout our Society, are too often missed by many in our membership. Some individuals find the right mentors, but too often many do not. I believe that this mentorship program can also be an important corollary to our very successful Leadership Academy, producing trained seasoned mentors that can ensure that ASE's future leaders can find the mentoring that they need and deserve.

My final initiative, ASE Educates, includes my vision for ASE to be the leader in the education and training of adult sonographers in the area of adult congenital heart disease. The rapidly growing numbers of adults with either repaired or unrepaired congenital heart disease has magnified the need for education and training of our membership to address this very important cohort of patients. A current ASE writing group has been tasked with creating a much-needed statement detailing imaging in the adult with congenital heart disease. In addition, I believe that ASE is poised to be the go-to source for educational products to promote core competencies in adult congenital heart disease as well as hands-on training to develop dedicated imaging skills in this setting. ASE can and should be the leader in the development and implementationof strategies to address this shortfall.

In conclusion, I am grateful to all our members for the opportunity to be your president over the coming year. I look forward to working with all of you as we continue our unforgettable journey together at ASE!

This text also appears in the July JASE. OnlineJASE.com

Benjamin W. Eidem,
MD, FASE
ASE President

Sonographer

VOLUNTEER OF THE MONTH-JULY

Congratulations

Denise Ignatowski, BS, RDCS, FASE

Aurora St. Luke's Medical Center, Milwaukee, WI

Q&A

When and how did you get involved with cardiovascular ultrasound?

Like many people, finding cardiovascular ultrasound was an evolution. I always knew I wanted to be involved in the field of medical imaging. It felt like a beautiful marriage between my creative endeavors and my inclination towards science. A sort of right brain/left brain balance. And once I found cardiology in my early studies, I never looked back.

What is the name and type of facility/institution at which you work, and what is your current position?

After graduating, my first job was at Aurora St. Luke's Medical Center in Milwaukee, Wisconsin. I have never left. Recently, I celebrated 10 years at this location and am proud of what we've been able to build at St. Luke's. We have the largest TAVR program in the state of Wisconsin and one of the largest in the country. This has afforded us involvement in structural imaging and research trials. I got involved with the TAVR program and became a structural sonographer before that role even existed formally. I have had the opportunity to work closely with attending physicians, cardiology fellows, interventional cardiologists, and the Heart Valve Team.

We founded a diagnostic imaging school program 10 years ago and I have been fortunate to participate in educating and mentoring developing sonographers. For the last five years my role has expanded into leadership, and I currently manage three echocardiography departments within the health system. It has been a rewarding challenge to learn the inner workings of running a successful lab while supporting sonographer growth. Even through the pandemic, our lab retained staff and continued to grow without the need of travelers. We were even able to contribute new published research on prone scanning techniques to aid during the height of the pandemic. I am very proud of our team's achievements every day and especially during the pandemic.

When and how did you get involved with the ASE?

ASE has always been a part of my journey and is an amazing resource for education and guidelines for cardiac sonographers. And I've been blessed to have great ASE mentors during my education and throughout my career including Carol Mitchell and Matt Umland. When I was honored to receive the Alan D. Waggoner scholarship during school in 2012, it brought me to my first Scientific Sessions and really highlighted the community aspect of the organization which drove my continued passion for ASE.

Why do you volunteer for ASE?

At the heart of any organization is the community of people. The more I leaned on ASE for my own growth and education, the more important it was

for me to pass that to others. In both gratitude for what I have been able to experience but also in the hope that those after me will be able to achieve bigger and better for the organization.

What is your current role within ASE? In the past, on what other committees, councils, or task forces have you served and what have you done with the local echo society?

Currently, I am honored to be a part of the 3rd cohort of the ASE Leadership Academy. Learning among such great innovators, colleagues, and mentors has been a highlight in my journey with ASE. In the past, I have been honored to participate in local society efforts. Our hospital ran an ECHO Milwaukee in 2016 and 2017 where we held hands-on learning lab and formal presentations. I also served as an education coordinator representing our hospital within our local echo society, TEAM; Technological Echo Association Milwaukee-Area.

Prior to the Leadership Academy, I have spent my career reaching the ASE community through their conferences. In 2018, I was faculty for the hands-on learning labs at the ASE State-of-the-Art Echocardiography (SOTA) conference in San Diego. This is really our opportunity to teach advanced imaging techniques and programs that make up state-of-the-art echo. This conference also provided me with the opportunity to formally speak on malignant mitral valve prolapse and the pickelhaube spike, an echo sign that was discovered in our lab. I was able to return to SOTA in 2019 to formally speak and again participate in the hands-on learning labs. It was a great honor to reach such a large audience a second time. Since research and education have been a strong force within our lab at St. Luke's, it was natural to submit abstract posters to the ASE's Scientific Sessions in 2018 and 2019 which I was able to present during those conferences. In 2020, I was then invited to speak at the ASE's virtual Scientific Sessions. And in 2022 I returned to the Scientific Sessions to formally present and participate in a scanning session. Returning from virtual conferences to be in person again in 2022 made me appreciate the community even more. And behind the scenes, from 2019 to 2021, I volunteered on ASE'S CME committee which really widened my understanding of the academic process within ASE.

There are more opportunities than ever for sonographers to be involved in emerging fields and it's important for us to support the creation of diverse pathways.

What is your advice for members who want to become more involved in their profession or with the ASE?

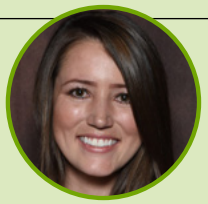
Stay active. It can feel daunting to take the first step. ASE does amazing work, nationally and internationally. We all can play a role, big or small, in each innovative stride. As the saying goes, every journey begins with a single step. So, keep up to date with the journal, try submitting an interesting case study you come across within the lab, or even volunteer your time with a committee within ASE.

What is your vision for the future of cardiovascular sonography?

When I think of the future of cardiovascular ultrasound, I'm drawn to the amazing career pathways developing for sonographers. There are more opportunities than ever for sonographers to be involved in emerging fields and it's important for us to support the creation of diverse pathways. For me, it has been exciting to participate in the evolution of more minimally invasive structural procedures for patients. The influence of echocardiography in the diagnosis, intra-operative imaging and post-procedural evaluation is immense. Structural echocardiography is driving innovation in our field and advancing our imaging technology along with it. The structural sonographer is one of many roles for sonographers as they progress in their career. I look forward to partnering with ASE in promoting future sonographer growth.

The VExUS Exam

Contributed by ***August Longino, MD***, ***Katrina Leyba, MD***, *and* ***Edward A. Gill, MD, FASE***


Point of care ultrasonography (POCUS) has become increasingly common, so much so that for many practitioners, it is a routine part of their bedside physical exam

POINT OF CARE ULTRASONOGRAPHY (POCUS) has become increasingly common, so much so that for many practitioners, it is a routine part of their bedside physical exam.[1] An area of ongoing use and debate is the relevance of venous congestion in cardiac patients. Here we briefly summarize this discussion, and review a novel ultrasonographic technique for bedside assessment of venous congestion.

Historically, the arterial, rather than venous circulation, has been the primary focus of our diagnostic and therapeutic efforts with regard to vascular pathology. However, this is starting to change. As early as 1931, Winton demonstrated the effect of increased venous pressure on the mammalian kidney, showing the clinical importance of venous hypertension to be equal to that of arterial hypotension.[2] Contrary to a common physiologic misconception, organ perfusion pressure is not the difference between mean arterial pressure (MAP) and central venous pressure (CVP). Rather, it is precapillary arteriolar pressure (PAP, generally about 35 mmHg), minus postcapillary venular pressure (PVP). This gradient is critically important, and is disproportionately affected by changes in PVP,[3] which varies widely, ranging from 10 mmHg in euvolemia, to over 25 in patients with heart failure.[4, 5] Hence, 1) the pressure

gradient is much narrower than generally perceived and 2) Small increases in PVP can lower perfusion pressure, leading to hypoxia, hypercarbia, and deranged fluid dynamics at the tissue level that may not be apparent by simple assessment of MAP or CVP.[3]

There is increasing recognition that venous congestion is an underappreciated contributor to cardiac pathophysiology, including pulmonary and renal injuries.[6-10] As a field, we are learning that simple determination of fluid accumulation is insufficient, as it fails to capture the hidden dangers of venous hypertension. In essence, the mere presence of elevated jugular venous pressure may be the tip of the iceberg of ongoing organ damage. Therefore, increased vigilance against venous congestion may provide early warning of potential organ damage, allowing for more effective fluid management strategies.

Assessment of venous congestion by evaluation of the internal jugular vein has long been an essential component of the physical examination, but studies continue to show a high degree of intra- and inter-rater variability, and imperfect correlation with invasive measurements. CVP has previously been estimated by ultrasonographic assessment of IVC diameter and collapsibility, with normal IVC diameter being 2.1 cm or less and normal respiratory collapse being 50%. More recently, researchers have integrated ultrasonographic measurement of internal jugular vein height and its respiratory variation, with mixed results.[11, 12]

This background highlights the need for an economic, noninvasive means of evaluating vascular congestion. Hence, the Venous Excess Ultrasound (VExUS) exam was developed by Denault and Beaubein-Soligny. VExUS is a recently validated exam of the venous system, quantifying congestion in the vasculature and encapsulated organs, providing a noninvasive proxy for CVP. VExUS is a four-point exam integrating IVC hemodynamics with pulsed Doppler studies of the hepatic, portal and renal veins, together providing a more comprehensive evaluation of the venous system.[13] It builds on prior studies showing that pulsatility of the renal and portal veins indicates pressures in excess of the elastic capacitance of these systems.[6, 14, 15] Further, the hepatic vein is normal when there is forward flow (away from the liver) during both systole and diastole and it is markedly abnormal when there is systolic reversal of flow, a finding associated with increased rates of adverse renal outcomes.[16]

There is increasing recognition that venous congestion is an underappreciated contributor to cardiac pathophysiology, including pulmonary and renal injuries.

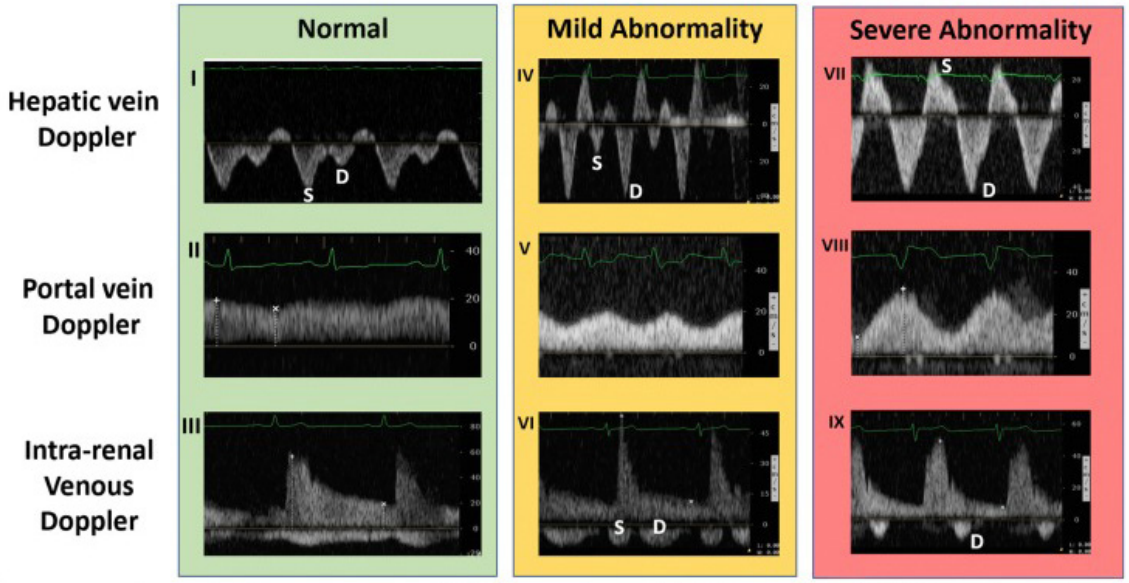
The VExUS concept was originally described by Rola et al. in 2015.[6] Since then the exam has undergone revision, with the development of a score based on normal, mildly abnormal and severely abnormal venous flow patterns in the hepatic, portal, and renal veins (Figure 1). A multidisciplinary team of intensivists, nephrologists, and emergency physicians developed the VExUS score in 2020.[13] The exam was prospectively tested in 145 patients undergoing cardiac surgery. The primary outcome of the study was a comparison of VExUS score to elevated CVP for prediction of postoperative acute kidney injury (AKI). The remarkable finding of this study was that the predictive value of a moderately abnormal VExUS exam was more specific than elevated CVP for predicting development of AKI, suggesting that this economic and noninvasive technique could prove to be a more precise tool than CVP when guiding fluid therapy.

Since that time, there have been no further prospective studies to corroborate the findings of the original trial. Neither have there been further robust physiologic studies comparing VExUS scores to invasively measured CVP or right atrial pressure.

The exam itself is straightforward to perform. With the patient supine, an experienced provider requires about 10 minutes to acquire the necessary views. Interpretation is more challenging, and requires integration of four organ-specific measurements into an overall VExUS grade. It should be noted that peer-reviewed literature on inter-rater reliability is still lacking.

▼ The Venous Excess UltraSound (VExUS) grading system prototypes combining inferior vena cava (IVC) diameter and venous Doppler waveform of the portal, hepatic and interlobular renal veins. Hepatic Doppler is considered mildly abnormal when the systolic (S) component is lower in magnitude than the diastolic (D) component, but still toward the liver while it is considered severely abnormal when the S component is reversed (toward the heart). Portal Doppler is considered mildly abnormal when a variation in the velocities during the cardiac cycle of 30 to<50% are observed, while is considered severely abnormal when a variation of≥50% is seen. Intra-renal venous Doppler is considered mildly abnormal when it is discontinuous with a systolic (S) and diastolic (D) phase, while is it considered severely abnormal when it is discontinuous with only a diastolic phase seen during the cardiac cycle.

Figure 1.



	VExUS A	VExUS B	VExUS C	VExUS D	VExUS E
Grade 0	IVC < 2 cm	IVC < 2 cm	IVC < 2 cm		
Grade 1	IVC ≥ 2 cm **Normal** patterns *(All three of : I, II, III)*	IVC ≥ 2 cm **Normal** patterns *(All three of : I, II, III)*	IVC ≥ 2 cm **Normal** patterns **or** **mild** abnormalitie(s) *(Any combination of : I, II, III, IV, V, VI)*	**Normal** patterns *(All three of : I, II, III)*	**Normal** patterns **or** **mild** abnormalitie(s) *(Any combination of : I, II, III, IV, V, VI)*
Grade 2: Mild congestion	IVC > 2 cm **Mild** abnormality in **at least one** pattern *(At least one of : IV, V, VI)*	IVC > 2 cm **Mild** **or severe** abnormality in **at least one** pattern *(At least one of : IV, V, VI, VII, VIII, IX)*	IVC > 2 cm **Severe** abnormalities in **at least one** pattern *(At least one of : VII, VIII, IX)*	**Mild** **or severe** abnormalities **in at least one** pattern *(At least one of : IV, V, VI, VII, VIII, IX)*	**Severe** abnormalities **in at least one** pattern *(At least one of : VII, VIII, IX)*
Grade 3: Severe congestion	IVC > 2 cm **Severe** abnormalities **in at least one** pattern *(At least one of : VII, VIII, IX)*	IVC > 2 cm **Mild** **or severe** abnormalities **in multiple** patterns *(At least two of : IV, V, VI, VII, VIII, IX)*	IVC > 2 cm **Severe** abnormalities **in multiple** patterns *(At least two of : VII, VIII, IX)*	**Mild** **or severe** abnormalities **in multiple** patterns *(At least two of : IV, V, VI, VII, VIII, IX)*	**Severe** abnormalities **in multiple** patterns *(At least two of : VII, VIII, IX)*

The VExUS exam may well prove to be a valuable new tool, as we attempt to determine fluid management strategies for our patients.

VExUS has conceptual limitations. One of the main limitations of extrapolating global volume status from right heart pressures is that left heart failure, the most common cause of right heart failure, often precedes right heart failure. Hence, the absence of elevation of right sided pressures should not always lead to the conclusion that left heart failure is absent. Also, processes besides heart failure may alter visceral hemodynamics, including intra-abdominal mass lesions and positive pressure ventilation, among others.

Looking ahead, scrutiny of the venous side of the circulation will be essential to the care of our patients, as we move beyond the paradigm of "volume status". The VExUS exam may well prove to be a valuable new tool, as we attempt to determine fluid management strategies for our patients. However, more study of this technique is needed. Larger studies of patients with diverse pathologies, as well as studies comparing VExUS to invasively measured CVP, or peripheral venous pressure, as well as studies of feasibility and inter-rater reliability should be undertaken to evaluate the clinical relevance of this exciting new imaging technique.

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Sonographer Career Pathways –

Determining Your Journey

Contributed by ***Rita France, RDCS, RDMS, RT, FASE; Shiraz Maskatia, MD, FASE; Seda Tierney, MD, FASE; Jimmy Lu, MD, FASE;*** *and* ***Jennifer Hake, RDCS (PE, AE), RDMS (FE), FASE***





One of the most important paths can be provided within the department, simply by establishing a career ladder.

CAREER PATHWAYS FOR sonographers has been a popular topic in echo laboratories everywhere as leaders strive to keep staff engaged, reduce work-related stress injuries, and increase retention. Capitalizing on the strengths in the staff to achieve department goals and address these issues requires some out-of-the box thinking. Although many staff will be fulfilled by providing clinical support, others may be looking for a new challenge and all are looking for a means to increase their compensation to meet the challenge of rising inflation. This has sonographers looking both within and outside of the clinical setting to accomplish personal career goals.

One of the most important paths can be provided within the department, simply by establishing a career ladder. Establishing different levels with well-defined expectations of skills, experience and responsibilities provides a defined path for progression for those providing front-line clinical support. Establishing lead roles that may be filled by clinical sonographers is a means to tap the strengths and passions of a staff member keeping them more engaged while fulfilling needs within the department to accomplish institutional goals. Examples of these are a Scheduling Lead, an Education

Lead, a Research Lead, and a Quality Improvement Lead. Additional job roles which provide a mix of leadership and clinical responsibilities make it possible to spread the work of a growing department's education and operational responsibilities and allows the ambitious members of the staff to have opportunities for receiving and providing mentorship while continuing to advance within the organization. The roles of Technical Director, Associate Technical Director, and Education Coordinator are examples of how some labs have leveled up their hierarchy and spread the work of running the department.

There is also professional society involvement for those who enjoy patient contact but want to develop themselves professionally. This can begin locally but the optimal path to steepening learning curves on new technology and scientific research while expanding a professional network is by joining and volunteering within ASE. Education and mentoring opportunities are available through online articles, webinars, and the Scientific Sessions, where sonographers can find answers to provide the best care for the communities they serve while supporting the growth of the organization that serves their field. Many laboratories are now also requiring evidence of professional involvement as a means to develop individual and team growth while encouraging state-of-the art practices and high-quality care.

Other opportunities for sonographers to enrich their career include working as a travel sonographer or volunteering for mission trips to both give back and help fill their buckets. Please read the *Echo* magazine articles that were previously published in the November 2022 issue ("Interview with a Traveling Sonographer") and the March 2023 issue ("Echocardiography Around the World") to gain some insight regarding these options.

Participating in research may also be a requirement to move up the career ladder or it may be offered as a different way to engage staff within the lab. This may mean image acquisition and/or data mining but in research strong labs, sonographers may be encouraged to take active roles in initiation or preparation of a project for Internal Review Board submission. An interest in research within a laboratory may lead to a role outside of the clinical setting.

Here, we are sharing some alternative career paths our colleagues have chosen:

"I also think that working in hospitals taught me how to work well under pressure, how to juggle multiple things at once, as well as how to appropriately manage my time."

–Stephanie Schmidt

Stephanie Schmidt, RDCS (AE, PE)
Advanced Clinical Imaging Analyst
Minneapolis Heart Institute Foundation

After 11 years of imaging patients took its toll on her physical, mental, and emotional health, **Stephanie Schmidt, RDCS (AE,PE)**, took a role in a nonprofit organization as a part of a core lab as an Advanced Clinical Imaging Analyst. Although she is currently utilizing new skills in her analysis of CT and MRI images, Stephanie shared that her clinical years in echo provided an essential foundation of knowledge in cardiac anatomy and physiology. "I also think that working in hospitals taught me how to work well under pressure, how to juggle multiple things at once, as well as how to appropriately manage my time."

Julie Hinzman, RDCS, FASE, CTT+
Director, Clinical Research & Training
JenaValve Technology, Inc.

Julie Hinzman, RDCS (AE, PE) now works in the for-profit side of product research as a means to utilize her echo experience "to provide expert knowledge in the early stages of concept and design and procedure development to bring innovation to patients faster." "Demonstrating the ability to understand new or complex concepts and a willingness to learn will get you further in this industry than any degree. Collaborative mindsets, critical thinking skills and being analytical are key for industry roles." She advises that giving up direct patient care may be harder than you think and to seek out someone in a role that you may be interested to determine what responsibilities and expectations are for specific roles. "Work-life balance is still dictated by patients; however, it also gets dictated by timelines and/or company goals."

Industry roles may appeal to many sonographers desiring or requiring a change from direct patient care. **Sean Pistole, RDCS, RVT**, determined he needed a new adventure and had also had "started to have some issues with my elbow and shoulders." "Sales has always been an interest and applications gave me the opportunity to use the skills I had acquired over ten years of scanning, while letting me explore my abilities in the sales world." **Kim Fister, RDCS**, shared that "As a cardiac sonographer, my passion was always to be at the forefront of patient care. Over time, I came to realize that while direct patient care is essential, there are other avenues where one can impact patients on a broader scale."

Sean Pistole, RDCS, RVT, CTT+
CV Product Application Specialist
PHILIPS Healthcare- Ultrasound

Kimberly Fister RDCS PE, FE, AE
Global Product Development, CVUS
Lead Clinical Sonographer
GE HealthCare

> "Traveling can be tough, and I have slept on the floor in more airports than I care to admit."
>
> ***–Kimberly Fister***

Katie Fahey, MBA, RDCS (AE, PE)
AcuNav Volume ICE Clinical Sales Specialist
Siemens Healthineers

On the transition to industry, **Katie Fahey, MBA, RDCS,** comments that "a lot of people in the industry are not confident imagers, so it is very helpful to know and understand cardiac anatomy well from my days of scanning and being in the operating room or cath lab." Sean said, "I needed my years of working in the clinic to have the ability and confidence to go into different hospitals and be an ambassador for my company." As her clinical background trained her to be detail-oriented, Kim feels that trait has helped her when collaborating with a variety of team members while utilizing her "skills and experiences to provide feedback as the customer's voice, ensuring that our products meet both the needs and expectations of clinicians and patients. New or improved skills that were required in this transition were improved listening skills and increased confidence in their knowledge and skills when problem-solving with clients as well as the ability to manage multiple projects while being mindful of often tight deadlines." Kim shared that she has gained expertise in regulatory requirements, quality systems and clinical trials and that she has had the opportunity to gain more comfort and experience in public speaking.

Although they rarely perform imaging in their new roles, all three of these industry sonographers do travel with their work. Sean and Katie drive and fly within their regions with overnights expected. Kim travels both nationally and internationally and has now logged over a million miles in the air. She said, "traveling can be tough, and I have slept on the floor in more airports than I care to admit." And although there is a certain amount of flexibility in these roles, Sean advises that "work-life balance is the most difficult part of the job" and that "being organized is critical."

Sean also advises that sonographers be active learners, try to use multiple systems, and obtain multiple credentials to become more marketable. Katie shares that her bachelor's and master's degrees have also opened doors and will hopefully lead to opportunities in advanced leadership roles in the future.

The advice Kim shared is, "don't be afraid to step out of your comfort zone and embrace new challenges, as they can lead to valuable growth and development opportunities that can take your career to the next level." She also feels that "opportunities for advancement in industry for someone coming from a clinical background are numerous.... By leveraging your experience and expertise, you can contribute to the development of innovative medical technologies and help improve healthcare outcomes for patients worldwide."

> "I needed my years of working in the clinic to have the ability and confidence to go into different hospitals and be an ambassador for my company."
>
> ***–Sean Pistole***

Determining your own journey requires a realistic review of your experience and skills as well as knowledge of the growth options available to you in this field to define your path forward. **For more discussion and insight into career options, be certain to register for the upcoming 2nd Annual Echo in PCHD Virtual Experience September 30-October 1 with a planned session dedicated to this topic.**

THE WHO, WHAT, WHEN, WHY, AND HOW'S from ASE's New Fetal Echocardiography Guideline

This is a companion article for the recently released updated "Guidelines and Recommendations for Performance of the Fetal Echocardiogram: An Update from the American Society of Echocardiography." It provides a summary of key clinically relevant aspects of the guidelines and updates from the previous guidelines. However, practitioners should note that the tables for these guidelines are particularly useful in summarizing important points for use in practice and are referenced throughout this article.

Contributed by **Nelangi Pinto, MD, MS,** Division of Pediatric Cardiology, Department of Pediatrics, Seattle Children's Hospital/ University of Washington, Seattle, WA

WHY an update?

It has been almost two decades since ASE released its last guidelines on fetal echocardiography in 2004. Since then, advances in the field and increased collaboration have improved imaging and increased our understanding of fetal cardiac physiology and disease progression. The time had come for pediatric cardiologists who focus on fetal imaging to provide an updated statement on current best practices on fetal cardiac imaging and care to complement recent guidelines published by the AHA, AIUM, and ISUOG.

WHO needs a fetal echocardiogram?

One of the biggest questions that is debated in the literature is who needs a fetal echocardiogram. If fetal echocardiography was not a limited and costly endeavor, we would easily say fetal echocardiograms all around. Instead, pregnancies that are at low risk for fetal cardiac disease are screened during an obstetric anatomy scan. There is increasing debate about where to draw the line regarding who warrants referral for a fetal echocardiogram because of a condition that increases the baseline risk for cardiac disease and much literature published in this area since the last guidelines. These debates center around the need for additional testing when a screening anatomy scan is normal. However, there is huge variability in how well screening performs in different settings and prenatal detection of cardiac disease remains much lower than desired. Thus, these guidelines continue to recommend that certain fetal and maternal conditions should reach that convey an estimated risk of >3% of cardiac disease in their fetus based on available evidence still warrant fetal echocardiograms even in the setting of a normal screen (Table 1 in

Guidelines and Recommendations for Performance of the Fetal Echocardiogram: An Update from the American Society of Echocardiography) but goes into further detail by specific condition and compares these recommendations with AIUM and AHA guidelines. Again, these indications and referrals for fetal echocardiography must be considered within the local context and the sensitivity and specificity of the screening anatomy scan in the clinical practice of the provider as well as issues of access. Finally, the primary reason for referral which remains the strongest indication is of course an abnormal cardiac screening.

WHEN should you perform a fetal echocardiogram?

The best window for a transabdominal fetal echo is 18-22 weeks gestation which is similar to the timing of the anatomy scan. While we are increasingly pushing the envelope of how early we can image the heart when there is a concern or higher risk of fetal cardiac disease, first-trimester exams have a lower sensitivity and (78.6% and 98.9%) should be repeated in the second trimester. Serial fetal echos are necessary for abnormalities of the heart up until 34-36 weeks gestation; how many and how often depends on the condition and discretion of the care team.

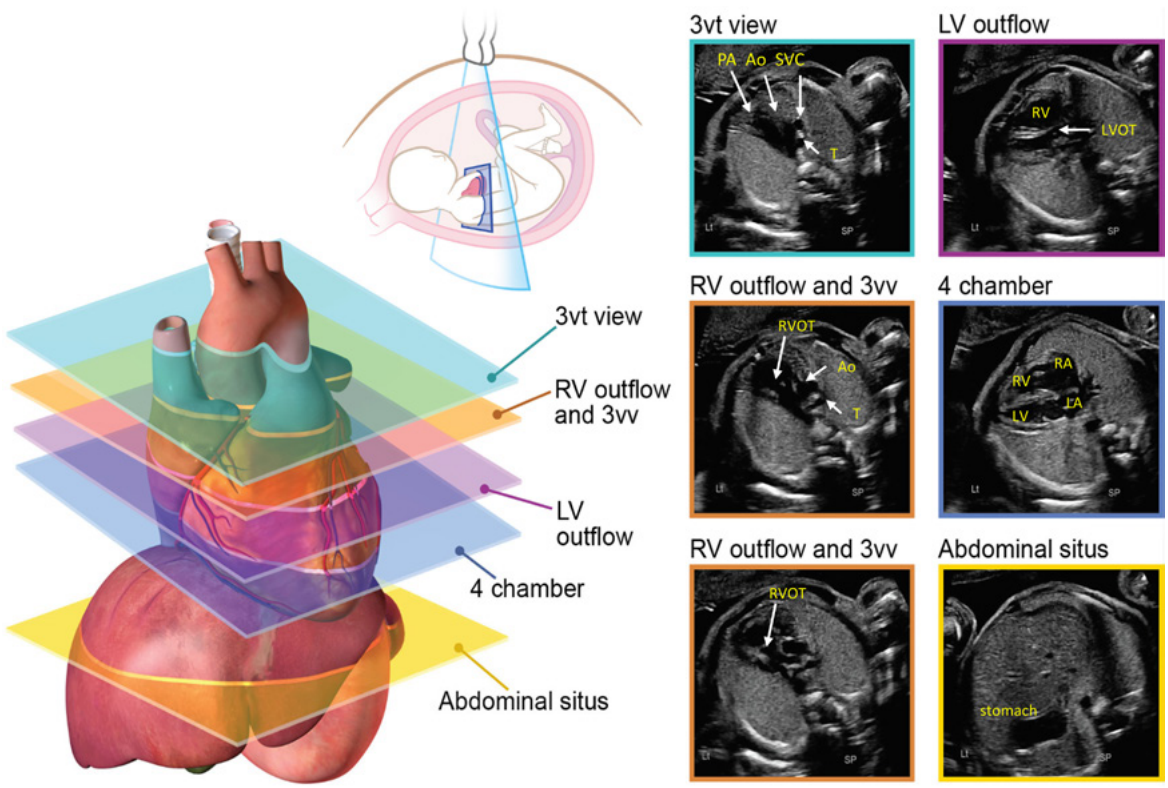


FIGURE 1 (from Figure 2 in Guidelines and Recommendations for Performance of the Fetal Echocardiogram: An Update from the American Society of Echocardiography). Axial planes suggested for screening the fetal heart at the time of the obstetric anatomic survey and as an initial series obtained during a fetal echocardiogram. Note that the images depict a fetus in cephalic presentation; breech presentation will result in mirror-image reversal from that shown here. 3VT, three vessels and trachea view; 3VV, three vessel view; Ao, aorta; DA, ductus arteriosus; LV, left ventricle; LVOT, left ventricular outflow tract; PA, pulmonary artery; RV, right ventricle; RVOT, right ventricular outflow tract; SVC, superior vena cava; T, trachea. Redrawn and adapted from Yagel 2001[113].

While there is no evidence of harmful effects of ultrasound on a fetus, the principle of As Low As Reasonably Achievable minimizes power output and duration of exam to decrease exposure.

WHAT equipment, settings, and images?

While there is no evidence of harmful effects of ultrasound on a fetus, the principle of As Low As Reasonably Achievable minimizes power output and duration of exam to decrease exposure. The size and frequency of motion of a beating fetal heart require a high spatial and temporal resolution in ultrasound imaging platforms. Frame rates should be above 40 Hz and higher for visualizing finer structures and performing advanced techniques such as strain. In addition to typical image optimization techniques in pediatric echocardiograms, fetal requires consideration of maternal and fetal position with flexible and comprehensive scanning to obtain the best imaging windows. Consideration of depth of field is particularly important when scanning through the maternal abdomen and the fetal cardiac image should be magnified to occupy at least 1/3 of the imaging screen. Multiple scanning planes and sweeps are required to visualize and interrogate all the structures that are recommended for inclusion in a fetal echocardiogram (**Figures 1 and 2**). These views include abdominal situs, three-vessel, and three-vessel trachea sweeps in addition to views discussed in the previous guidelines. The structures and use of modalities such as M-mode, color Doppler and color are detailed in the guidelines and do not significantly differ from the previous document except for the addition of newer tools such as power Doppler to visualize smaller vascular structures and those with low velocity flow.

The many HOWS...

HOW to assess rate and rhythm?

Rhythm/rate abnormalities are a frequent referral indication for fetal echocardiogram but of course, should be assessed in all fetal echocardiograms. References for normal values of heart rate by gestational age are published and deviations from these or typical rhythm warrant further investigation. While rate is relatively straightforward to assess, determining rhythm and specific atrioventricular conduction relies on assessing the relationship between mechanical atrio and ventricular contraction and may include assessments of timing. This relationship can be analyzed using several complementary echocardiogram modalities including M-mode of the atria and ventricles and simultaneous Doppler interrogation of mitral/aortic or tricuspid/pulmonary inflow and outflow, aortic and SVC, and/or pulmonary artery and pulmonary vein. Tissue Doppler, color M-mode, and isovolumic time intervals can also help deduce challenging rhythms. Finally, rhythm abnormalities require careful assessment for hemodynamic compromise covered further below.

HOW to assess function?

While often taken for granted in a "normal" study, accurate assessment of cardiac function with a combination of qualitative and quantitative imaging methods is a critical part of the fetal echocardiogram. A more detailed assessment of function and signs of hemodynamic compromise is essential for conditions with primary cardiac dysfunction, tumors, rhythm disturbances, a subset of structural heart disease, and fetal conditions or extracardiac pathologies that can impact cardiac output or resistance. These evaluations can be critical to determining eligibility and timing of interventions and or delivery. In general assessment, the function should include 2D imaging of systolic and diastolic function, Doppler and color Doppler of the atrioventricular valves, umbilical vessels, and the ductus venosus, and quantification of the cardiac size. Further quantitative assessments of function such as

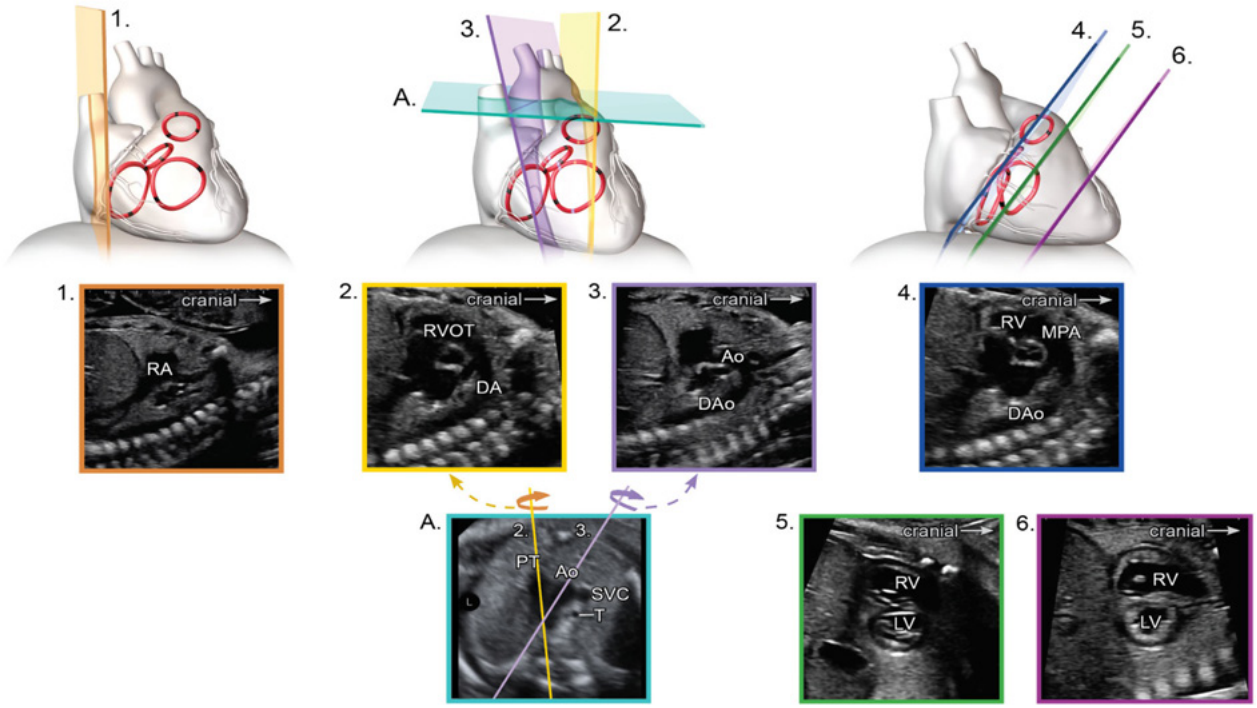


FIGURE 2 (from Figure 3 in Guidelines and Recommendations for Performance of the Fetal Echocardiogram: An Update from the American Society of Echocardiography). Sagittal and parasagittal planes for fetal echocardiogram evaluation. Ao, aorta; DA, ductus arteriosus; DAo, descending aorta; LA, left atrium; LV, left ventricle; MPA, main pulmonary artery; RA, right atrium; RV, right ventricle; RVOT, right ventricular outflow tract; SVC, superior vena cava.

the myocardial performance index and cardiac outputs are warranted when there is concern for the potential for or existing cardiac compromise. The cardiovascular profile score can be used in such cases. Tissue Doppler and strain are on the horizon for potential use as well.

HOW to assess structural abnormalities?

A significant portion of these guidelines are devoted to imaging structural heart defects in the fetus. The updated document expands significantly on key considerations and additional imaging to guide management and counseling for structural abnormalities. This is divided into major sections for single ventricle heart disease, complex atrioventricular connections, "look-alike" outflow tract anomalies, progressive lesions (such as stenosis or valve regurgitation), and isolated arch abnormalities. The common themes across the general approach to imaging among all these lesions is that detailed, comprehensive, and serial assessment

The updated document expands significantly on key considerations and additional imaging to guide management and counseling for structural abnormalities.

Diagnosis and ongoing assessment of fetuses with cardiac disease by fetal echocardiography allows for multidisciplinary comprehensive care, counseling, and support.

of the fetal heart is important to appropriate counseling, prognostication, delivery, and intervention planning. This includes imaging at a minimum, determinants of ventricular adequacy (size and function), ductal dependency of either systemic or pulmonary blood, semilunar and atrioventricular valve competence, and ventriculoarterial relationships. However, many important aspects require further in-depth imaging depending on the type of anatomic defect observe. Key imaging pearls that allow such assessment for each anatomic subset are presented in the guidelines, while specific detailed imaging recommendations by type of defect are presented in a comprehensive table (Table 13 from Guidelines and Recommendations for Performance of the Fetal Echocardiogram: An Update from ASE, partially reproduced here) to guide the practitioner. As an example, the detailed evaluation of single ventricle fetal heart disease would include complete standard planes and Doppler examination plus assessment of:

- Morphology of dominant ventricle
- Ductal dependency of either systemic or pulmonary blood flow as determined by direction of ductal flow, outflow tract obstruction, and size of downstream vessels (pulmonary arteries and aortic arch and isthmus)
- Restriction of flow at the atrial septum, pulmonary venous Doppler VTI
- Atrioventricular valve regurgitation and ventricular function
- Systemic or pulmonary venous abnormalities that could impact outcome or repair

The WHY?

Diagnosis and ongoing assessment of fetuses with cardiac disease by fetal echocardiography allows for multidisciplinary comprehensive care, counseling, and support. What we learn from our fetal cardiac imaging, allows us to optimize the perinatal and delivery plan for the fetus and family. In certain cases, with evolving disease, fetal cardiac imaging is critical to determining the timing and need for delivery and/or prenatal or postnatal intervention. Existing risk stratification systems in the literature can facilitate coordination and communication of care plans. Evolving knowledge around additional techniques such as maternal hyperoxia, imaging modalities such as fetal MRI, and advanced echo techniques may provide additional prognostic information. This knowledge will further our efforts to provide accurate prognoses and timely care, which is of course the why which drives those of us who practice in this field.

What we learn from our fetal cardiac imaging, allows us to optimize the perinatal and delivery plan for the fetus and family.

Category	Suspected when:					
Single ventricle and ventricular disproportion	Axial chest view shows clear lack of two symmetric ventricular chambers					
Lesion	**Key observations**	**Common venous variations**	**Specific AV valve issues**	**Outflow imaging**	**Additional measurements**	**Other key points**
Unbalanced AVSD (right or left dominant)	Presence of AVSD features with a single AV valve, +/- primum atrial septal defect, +/- inlet ventricular septal defect	Course and laterality of SVC and IVC, primitive azygous systems, separate hepatic connections; TAPVR	Common valve regurgitation; may be progressive En face imaging of the AV junction required	Define ventriculo-arterial connections Outflow tract of the hypoplastic ventricle may be stenotic or atretic; may need to assess serially	Measure right and left AV valve diameter or area (Figure 23) Cohen index AVVI RV:LV inflow angle [137]	For assessment of balanced AV valve see below ("Common atrioventricular valve") Consider right or left atrial isomerism/ heterotaxy
Tricuspid atresia	Absent AV connection, small RV, VSD	Bilateral SVC Benign A-wave reversal in DV	Mitral valve prolapse, dilation, or regurgitation	Define ventriculo-arterial connections, may be transposed Outflow tract from the morphologic RV may have subvalvular or valvular stenosis; Assess blood flow in arches for possible ductal dependent	Can measure VSD dimensions in two orthogonal planes	VSD obstruction can be progressive, compromising blood flow to the outflow tract off the RV (leading to pulmonary stenosis, coarctation)
Hypoplastic left heart syndrome	Small LV on 4-chamber view with mitral and aortic stenosis or atresia	Bilateral SVC	TR with RV dysfunction may increase the risk of a fetal death and postnatal morbidity/mortality	Assess aortic valve patency, size of the ascending aorta, and transverse aortic arch Color Doppler interrogation of pulmonary valve Direction of flow in the distal transverse aortic arch	Measure the ascending aorta diameter, which can be predictive of postnatal outcomes after the Norwood procedure [138]	Evaluate for atrial septal restriction - pulmonary vein Doppler VTI forward: reverse ratio < 3 predicts inadequate left atrial egress and increased likeliness for neonatal emergent atrial septoplasty [139]
Double inlet left ventricle	Both AV valves open into the morphologic LV, 4-chamber view shows "large" VSD or absent ventricular septum	Bilateral SVC	Assess size of each AV valve (one valve may be stenotic or atretic), as well as degree of valvular regurgitation AV valve may straddle into outlet chamber	Define atrioventricular and ventriculo-arterial connections (may have D- or L-looped ventricles, DORV) Assess patency of out-flow tract connected to the morphologic RV for subvalvular or valvular obstruction		At risk for complete heart block with L-looped ventricles If left AV valve is hypoplastic or atretic, assess adequacy of atrial septal defect

Excerpt from Table 13 in Guidelines and Recommendations for Performance of the Fetal Echocardiogram:
An Update from the American Society of Echocardiography: Guidance for disease-specific anatomic, physiologic, and functional evaluation for commonly encountered fetal congenital heart disease (CHD) lesions. This general information is not comprehensive and does not replace lesion-specific literature regarding fetal cardiac anatomy and physiology in congenital heart disease

Highlights from the ASE 2023 CARDIOVASCULAR ULTRASOUND TRENDS REPORT

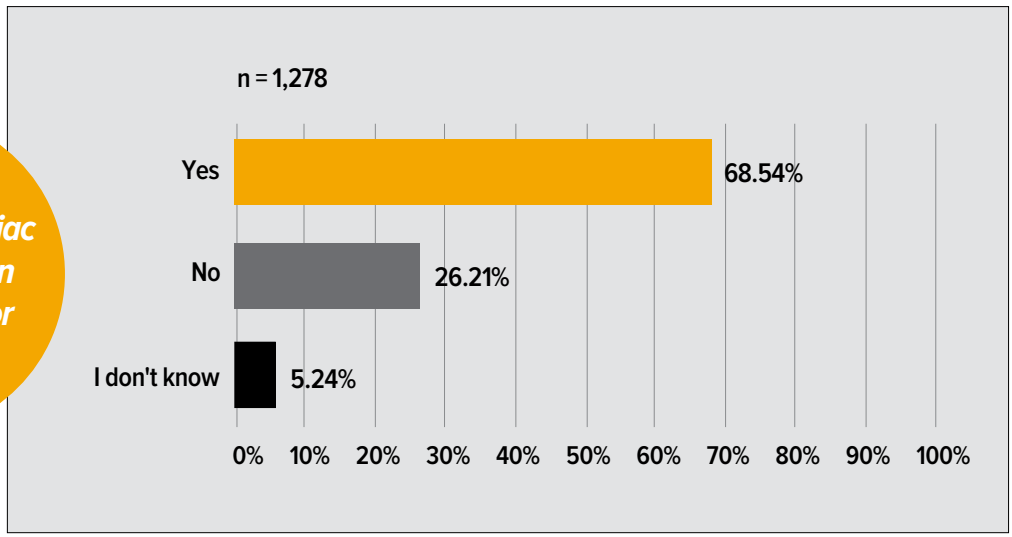
Contributed by **Meredith Morovati, MBA,** ASE Vice President of Business Development & External Relations

IN FEBRUARY OF 2023, NEARLY 1,500 people, which included ASE members and nonmembers, volunteered to participate in ASE's 2023 Cardiovascular Ultrasound Trends Survey. Participants answered a wide range of questions including topics about day-to-day practice management and equipment use to more specialized areas of echo application and innovation. The survey offers a point-in-time snapshot of practices, challenges, and opportunities shaping the field of echocardiography and cardiovascular ultrasound technology. The survey results help inform the development of ASE programs and resources and are shared, in full, with ASE's Industry Roundtable partners. ASE is pleased to present a few key takeaways and notable trends.

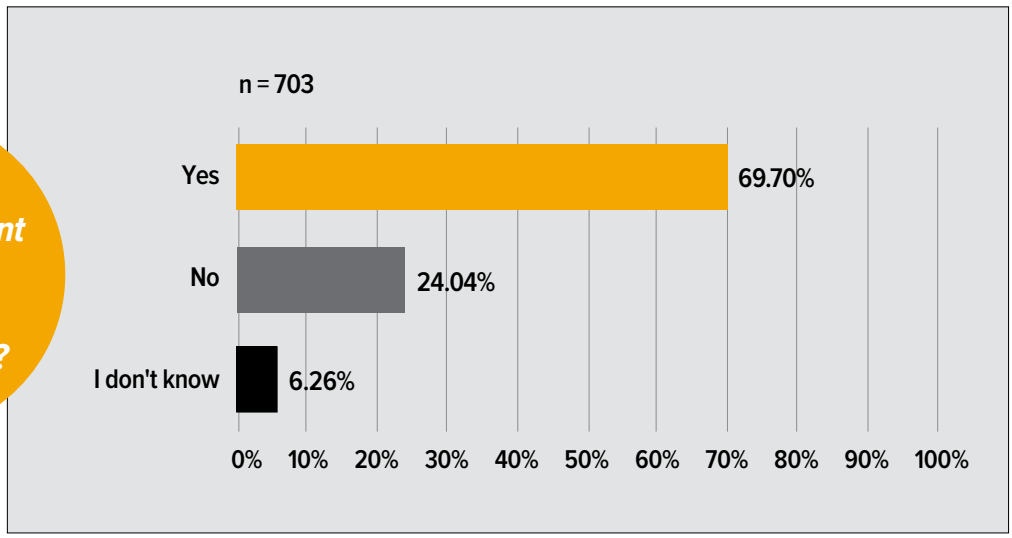
Practice Management

Workforce trends have shifted since ASE's previous survey in December 2021. One notable item is the increase in cardiovascular sonographer staff shortages. Image acquisition by trained professionals is a key component of cardiovascular ultrasound. The majority of survey respondents shared that there was a shortage of sonographers in their intuitions. Further, respondents who answered "yes" (55% of total respondents) to the question "does your echo department hire per diem or travel sonographers," attested that the use of per diem or travel sonographers has increased.

Is there a shortage of cardiac sonographers in your echo lab or institution?



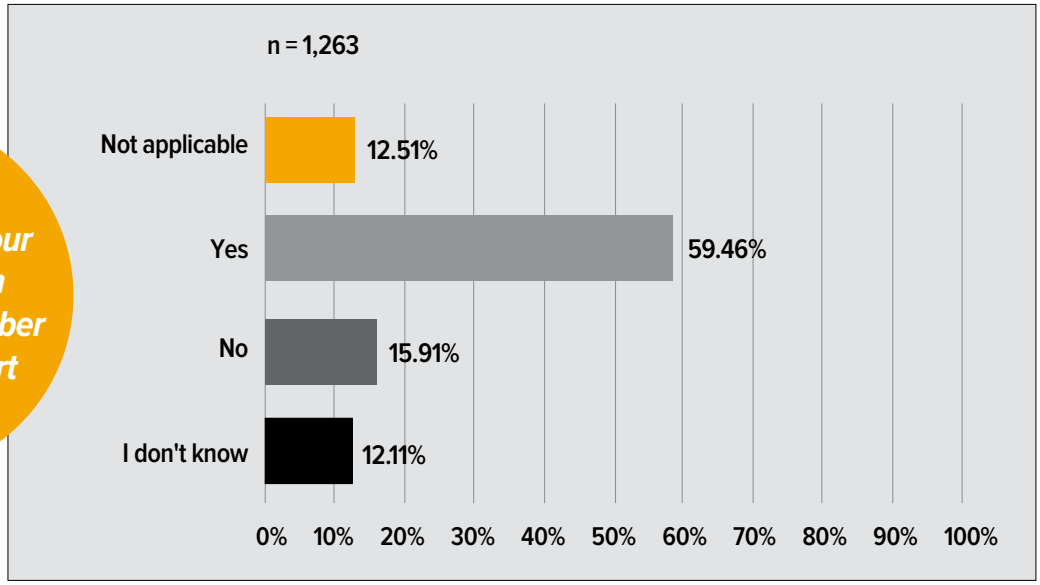
Does your echo department hire per diem and/or travel sonographers?



Structural Heart Disease and Interventional Procedures

The benefit of echocardiography for structural heart procedures is well established. This year, 59% of respondents reported an increase in these procedures. This compares to 51% of respondents reporting a similar increase in the 2021 survey.

In the past 12 months, has your lab or institution increased the number of structural heart procedures?

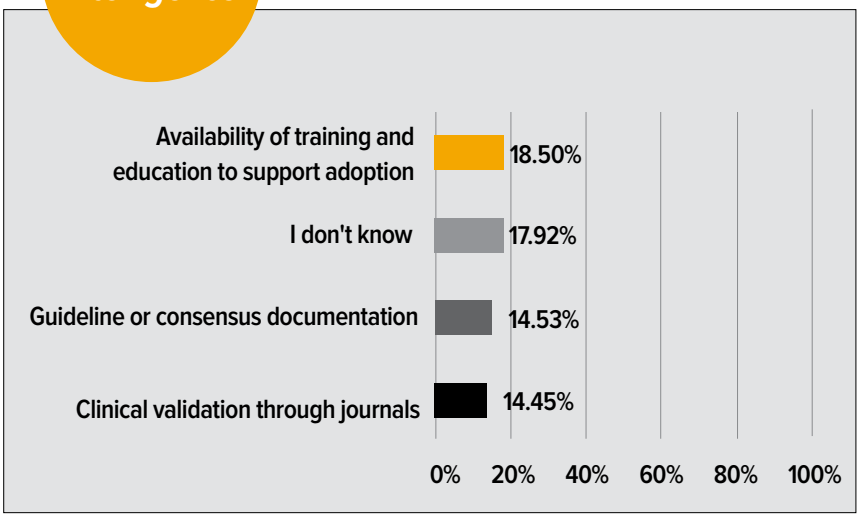


New Emerging Technologies and Applications

Finally, respondents surveyed this year continue to signal the need for clarity and education on new technologies which include 3D Printing/Visualization, Artificial Intelligence, and Telemedicine.

When asked "chose which factor you think is the most important when considering to adopt (a new technology)" the choice "I don't know" ranked either second or first. This suggests that these technologies, some already in practice, still have unclear ROI when in clinical settings. This presents an opportunity for more education and discourse.

Artifical Intelligence



These and other findings from ASE's Cardiovascular Ultrasound Trends Survey offer invaluable insight into factors driving decision-making, echo innovation, and patient care. We are very grateful for the clinicians who participated in the Trends Survey and look forward to sharing our findings and keeping you informed.

American Society of Echocardiography

ASE 2024

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To advance cardiovascular ultrasound and improve lives through excellence in education, research, innovation, advocacy, and service to the profession and the public.