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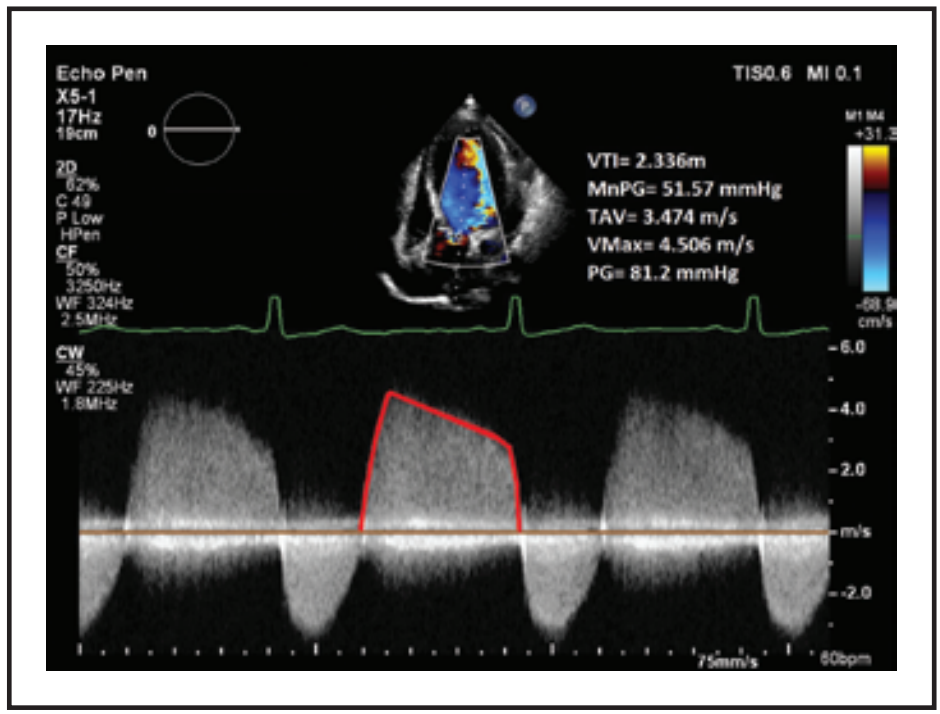

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About the Cover

This image is Figure 4B from Babitha Thampinathan and Cindy Chow's article. Pressure half time was 371 ms but likely inaccurate due to poor Doppler alignment of the eccentric jet as seen in Figure 4A.

Message from the Editor

Welcome to our first issue of 2021. I reviewed the editorial from last year's first issue and reflected on the 'normalcy' of the message. I chatted about regulation and expanding the sonographer's scope of practice and participation in research. Today, the words' unprecedented times' are top of mind as Canadians and our profession have had to adapt to the evolution of the COVID-19 pandemic and its impact on every person, especially front-line workers and our elderly in long-term care facilities. We are awaiting the arrival of more vaccines in Canada to ensure some protection for the most vulnerable and at-risk members of our population. Sonography Canada has taken a stand with the federal and provincial governments to ensure that sonographers receive the recognition and resources (e.g., PPE, vaccines) they deserve, as specialized healthcare professionals working on the front line.

This issue of the CJMS includes a case report, a pictorial essay, and a narrative review. The authors are from Canada and the United States. Our resident author Babitha Thampinathan, who has published extensively on cardiac topics in past issues of the *CJMS*, has partnered with fellow UNH cardiac sonographer Cindy Chow to produce a pictorial essay on a post-partum patient and the assessment of aortic regurgitation using 3-D Color Doppler echocardiography.

Robert Dima and Priya Appea, generalist sonographers from Hamilton Health Sciences & McMaster University/ Mohawk College, have teamed up with Dr. Theresa Semalulu to create a narrative review discussing enhanced patient care practice and an expanded scope of practice for sonographers in the care of patients with juvenile idiopathic arthritis. I take this article to heart because I hope this is a sign of the next step in patient care and the growth and progression of the Canadian sonographer.

And finally, we feature an article by Ray T. Yuen, an internal medicine clerk at the Detroit Medical Center in Detroit, Michigan, a credentialed Canadian generalist sonographer. He shares a case report on the blue nevus and how to differentiate it from melanoma on sonographic imaging.

As one-year ends and another starts, we say goodbye and welcome our editors and reviewers. First, I would like to thank Leonardo Faundez for his volunteer contributions. He has evaluated many articles and given vast amounts of feedback that have contributed to our articles and journal's quality as a whole. We will miss him. With much enthusiasm, we welcome three new reviewers, Lori Arndt from Alberta, who has graciously accepted to review generalist and vascular articles, Tony Li from Toronto, who will be our generalist & MSK reviewer, and Laura Thomas from Mohawk/McMaster in Hamilton, who will serve as our first resident reviewer for research and educational manuscripts.

Now, all we need are some articles from you for them to review! The publishers and I are at your service to answer questions or to provide mentoring to help you publish your manuscripts. The following link will take you to the *CJMS* manuscript submissions page: https://jsonocan.com/index.php/CJMS/user/register; you will need to register and create a password for submission. You can also reach me directly at editorCJMS@sonographycanada.ca.

This issue is in honour of all sonographers globally for what they do daily in their patient care practice.

Pushing the boundaries

Sheena Bhimji-Hewitt

*The opinion in this editorial is that of the Editor-in-Chief and not that of Sonography Canada or the Sonography Board of Directors.

Message de la rédactrice en chef

Bienvenue à notre premier numéro de 2021. J'ai passé en revue l'éditorial du premier numéro de l'année dernière et j'ai réfléchi à la "normalité" du message. J'ai discuté de la réglementation, de l'élargissement du champ d'activité de l'échographiste et de sa participation à la recherche. Aujourd'hui, les mots "une époque sans précédent" sont en tête de l'actualité, car les Canadiens et notre profession ont dû s'adapter à l'évolution de la pandémie COVID-19 et à son impact sur chaque personne, en particulier les travailleurs de première ligne et nos personnes âgées dans les établissements de soins de longue durée. Nous attendons l'arrivée de nouveaux vaccins au Canada pour assurer une certaine protection aux membres les plus vulnérables et à risque de notre population. Sonography Canada a pris position auprès des gouvernements fédéral et provinciaux pour s'assurer que les échographistes reçoivent la reconnaissance et les ressources (p. ex., EPI, vaccins) qu'ils méritent, en tant que professionnels de la santé spécialisés travaillant en première ligne.

Ce numéro du CJMS comprend un rapport de cas, un essai en images et un compte rendu narratif. Les auteurs sont originaires du Canada et des États-Unis. Notre auteur résident Babitha Thampinathan, qui a publié de nombreux articles sur des sujets cardiaques dans les précédents numéros de la RCMS, s'est associée à Cindy Chow, échographiste cardiaque de l'ONU, pour produire un essai en images sur une patiente post-partum et l'évaluation de la régurgitation aortique par échocardiographie Doppler couleur en 3-D.

Robert Dima et Priya Appea, échographistes généralistes de Hamilton Health Sciences & McMaster University/ Mohawk College, ont fait équipe avec le Dr Theresa Semalulu pour créer une revue narrative discutant de l'amélioration des pratiques de soins aux patients et de l'élargissement du champ d'activité des échographistes dans les soins aux patients atteints d'arthrite idiopathique juvénile. Je prends cet article à cœur car j'espère qu'il est le signe de la prochaine étape dans les soins aux patients et de la croissance et de la progression de l'échographiste canadien.

Enfin, nous présentons un article de Ray T. Yuen, interne au Detroit Medical Center à Detroit, Michigan, échographiste généraliste canadien diplômé. Il nous fait part d'une étude de cas sur le nævus bleu et sur la manière de le différencier du mélanome par imagerie échographique.

Alors qu'une année se termine et qu'une autre commence, nous disons au revoir et souhaitons la bienvenue à nos rédacteurs et à nos réviseurs. Tout d'abord, je voudrais remercier Leonardo Faundez pour sa contribution bénévole. Il a évalué de nombreux articles et donné de nombreux commentaires qui ont contribué à la qualité de nos articles et de notre journal dans son ensemble. Il va nous manquer. Avec beaucoup d'enthousiasme, nous accueillons trois nouveaux examinateurs, Lori Arndt de l'Alberta, qui a gracieusement accepté de revoir les articles généralistes et vasculaires, Tony Li de Toronto, qui sera notre examinateur généraliste et MSK, et Laura Thomas de Mohawk/McMaster à Hamilton, qui sera notre premier examinateur résident pour les manuscrits de recherche et d'éducation.

Il ne nous manque plus que quelques articles de votre part pour qu'ils puissent les examiner ! Les éditeurs et moi-même sommes à votre service pour répondre à vos questions ou pour vous fournir un encadrement afin de vous aider à publier vos manuscrits. Le lien suivant vous mènera à la page de soumission des manuscrits de la CJMS : https://jsonocan.com/index.php/CJMS/user/register ; vous devrez vous inscrire et créer un mot de passe pour la soumission. Vous pouvez également me contacter directement à l'adresse suivante : editorCJMS@sonographycanada.ca.

Ce numéro rend hommage à tous les échographistes du monde entier pour ce qu'ils font quotidiennement dans leur pratique des soins aux patients.

Repousser les limites

Sheena Bhimji-Hewitt

*L'opinion exprimée dans cet éditorial est celle du rédacteur en chef et non celle de Sonography Canada ou du conseil d'administration de Sonography.

Case Report

Ray T. Yuen, BMRSc, CRGS, RVT, RDMS, RMSKS

Making a Difference: Blue Nevus versus Melanoma

About the Author

Ray T. Yuen is an Internal Medicine Clerk MS3 at the Detroit Medical Center in Detroit, Michigan

ABSTRACT

The blue nevus is an uncommon lesion that may appear worrisome due to its similar appearance to the sinister melanosarcoma. The blue nevus is a subset of dendritic melanocytic proliferations that is commonly believed to be remnant embryonal neural crest cells that failed to migrate from the dermis.

This is a case of a 58-year-old male who presented with a bluish lump on his right third finger for 6 months complaining of dull ache, swelling and decreased range of motion (ROM). The impression of the lesion was of a blue nevus, a benign tumour that required investigation and follow up due to concern for a melanoma. His pain and decreased ROM can be attributed to repeated use due to his trade and were later deemed as a red herring presentation.

Although histopathology continues to be the gold standard in the diagnosis and classification of melanocytic nevi lesions, ultrasound imaging can be considered as a quick tool to characterise and quantify such lesions as a preliminary exam to rule out more concerning features of melanomas.

Keywords: blue nevus; dendritic; melanoma; neural crest

Introduction

A blue nevus is usually a solitary blue mole that can take on a range of appearances. It may have an elevated profile like a plaque or papule or a flat profile like a macule. Its blue hue can take on a greyish or even blackish hue. It was first described as a subset of melanoma but in the 1900s pathologists learned that the true blue nevus was a benign lesion unlike the melanoma. Blue nevi are mostly discovered in the second decade or later. Congenital blue nevi and familial associations are rare. The commonly accepted theory about the aetiology of blue nevi suggests they were dendritic melanocytes arrested in their migration from the neural crest to the epidermis.[1] A reputable online source states that in the United States, the prevalence for the blue nevi is 3–5% amongst Asian populations, 1–2% in Caucasians and rarely found in blacks. Congenital blue nevi are rare at less than one case per 1000 population.[2]

Case Description

A 58-year-old male from a rural area presented with a very mild dull ache, swelling and difficulty when extending his right third finger. He declared no alleviating or aggravating factors, nor did it radiate anywhere. He would notice the onset of pain when he was using his hammer. He was a carpenter and worked with his hands. The patient was not in acute distress and appeared well oriented to time and place. In physical examination, there was a bluish induration on his dorsal right proximal interphalangeal joint that he claimed was the source of his pain. It was not tender when palpated. There was no discharge or bleeding.

A 15–18 MHz linear transducer was employed for the scan. The third finger was interrogated in short and long axis, with and without a standoff pad. Routine calliper and Doppler documentation were included in the scan. The patient was asked to extend and flex his finger to interrogate the lesion dynamically as well. The radiologist was invited to the room to inspect the lesion during the scan.

At the extensor surface of the third digit near the proximal interphalangeal joint was a 4 x 5 x 2 mm subcutaneous, well-circumscribed nodule with no internal vascularity (Figure 1). This nodule moved independently from the underlying extensor tendons. Dynamically, there were no impingement or extensor hood abnormalities. There were no concerning sonographic features identified. It was dictated as a tiny, benign-appearing subcutaneous nodule. The constellation of sonographic findings and clinical presentation were consistent with a blue nevus. Patient stated a dull ache at the same area of question but it was likely due to osteopathic disease processes that can be attributed to his work as a carpenter for many years.

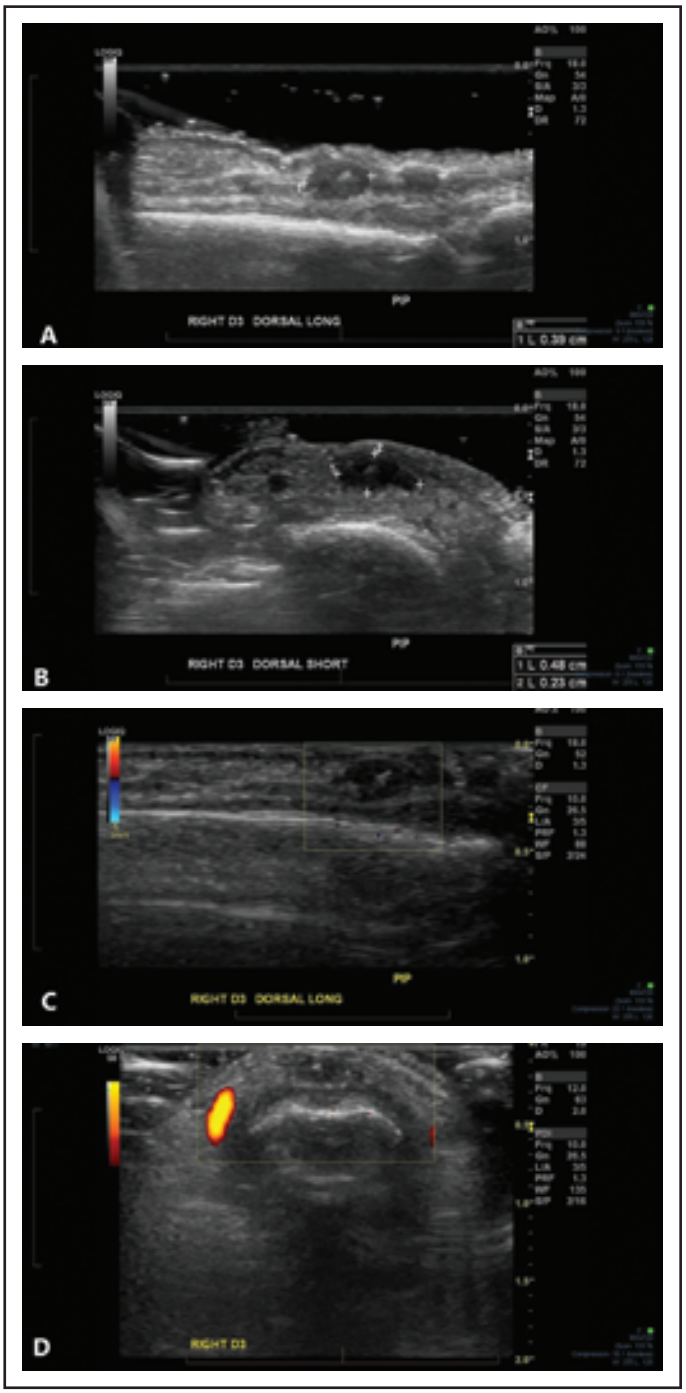

Figure 1. (A) Long axis right third proximal interphalangeal joint (PIPJ) demonstrating a 4mm long hypoechoic lesion with a nonspecific central echogenicity. (B) Short-axis of the PIPJ. (C) Colour-Doppler with adequate gain and low PRF exhibit no flow. (D) Power-Doppler exhibiting an avascular lesion in short axis.

Discussion

The blue nevus is a type of melanocytic tumour that is classed under dermal dendritic melanocytic proliferations. It falls under the same family as its more, well-known cousins such as the Mongolian spot and Nevus of Ota and Ito common in Asian

populations. Current literature describes two main subtypes of blue nevi: the dendritic blue nevus (DBN) (Jadassohn–Tièche Type) and cellular blue nevus (CBN) (Allen type). The pathologists believed there was a need to differentiate these benign lesions because they were often mistaken for the much more sinister melanosarcomas.[3] In one study, the DBNs constituted the majority cases at 74%, CBNs accounted for 1.5%, and combined featured blue nevi accounted for 24.5% of all cases.[4]

DBN usually presents during young adulthood (<age 40) but can also be found congenitally (Figure 2[5]). The female to male incidence ratio is roughly 2:1. The most common presentation is a <1cm papule with intense blue to indigo hue. Some may appear grey or even black. They commonly appear on skin surfaces (i.e., on face and extremities) but may rarely be reported involving bizarre surfaces (i.e., subungual, conjunctival, oral, vaginal, etc…). In histology, they are described as elongated bipolar melanocytes with spindle processes, containing generous melanin pigments in their cytoplasm.[3]

CBN share the same demographics with DBNs but the lesions can range from subcentimetre to multiple centimetres (Figure 3[5]). They have been reported not only on the scalp, back and buttocks but can also be found on mucosal surfaces. Histologically, the melanocytes are more plump and ovoid spindle cells with melanophages. The CBN may contain mitotic centres, pleomorphism and focal areas of necrosis that appoints a more sinister outlook. CBNs are also likely to be arranged in a nest pattern, grow faster, demonstrate atypia and dive deeper into the subcutis rather than DBNs. For these reasons, they are likely to present as larger lesions (>1cm).[3] Melanosarcoma can arise from this kind of blue nevus and are termed blue nevus-like melanoma (BNLM). BNLMs can arise in older patients (median age 44) and are larger than 3cm, with a depth of 5.5mm. These lesions are just as aggressive as conventional melanomas and they infiltrate lymph nodes and metastasize to the liver and the lungs as popular destinations.[6]

Figure 2. Common blue nevus (Tièche type) aka dendritic blue nevus. Reproduced with permission from author.[5]

Figure 3. Cellular blue nevus (Allen type). Reproduced with permission from author.[5]

Immunohistochemical markers such as HMB45, S100, anti-Melan-A and MIFT are commonly deployed as a combined panel of tests to detect for lesions of melanocytic origin. Used alone, HMB45 and S100 are sensitive but not specific in differentiating between malignant and benign melanocytic lesions because these two markers will test positive for lesions of neural crest origin.[7] Benign pigmented lesions and melanomas are first judged via the easy to remember

clinical criteria "ABCDE": Asymmetry, Border Irregularity, Colour variegation, Diameter >6mm and Evolvement. The blue nevus in this case was the classic round, well-demarcated, greyish-blue, less than 6mm. Its evolving status in regards to its evolution in size, shape, colour and symptoms (e.g.: discharge, tenderness, etc…) could not be ascertained given this was the patient's initial and final visit.[8, 9]

Sonographic features of this blue nevus was an *avascular*, 5mm, ovoid, well-circumscribed, hypoechoic and solid solitary lesion. It rests firmly *within the dermis layer* and has an unexplained central punctate echogenicity with no shadowing. Conversely, descriptors such as *vascular*, elliptical, spindle-shaped, potato-shaped (indication of depth), invasion into the hypodermis and heterogeneous are more consistent with melanosarcomas[10, 11] (Figure 4). A study by Bessoud et al. boasted an impressive 100% specificity and 34% sensitivity in differentiating melanomas from other benign pigmented lesions if internal Doppler flow is detected.[12] The low sensitivity can be attributed to technical limitations and the superficial nature of most melanocytic lesions.

The prognosis of a true blue nevus is good, and its definitive treatment is surgical excision. If the level of suspicion is low, then yearly surveillance at the minimum is warranted for these nodules until a trend is established. Risk of complication from true blue nevi is low and they rarely evolve from CBNs to BNLMs. BNLMs can recur after excision. Differentials of the blue nevus include the thrombosed wart, tattoo effect, dermatofibroma, desmoplastic melanoma, dermal spindle cell proliferation, amelanotic melanoma and the aforementioned BNLM.[1]

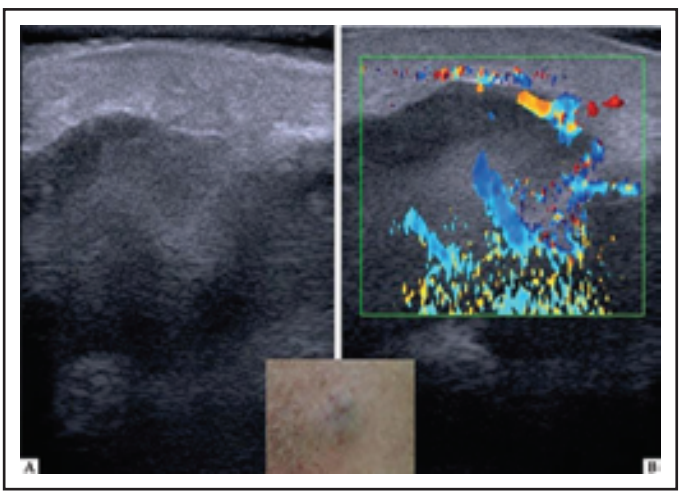

Figure 4. Metastatic melanoma. (A) HFUS, longitudinal view. Epidermis and dermis with normal appearance. In the subcutaneous tissue, irregular lesion with variable echogenicity. (B) Colour Doppler. Intralesional vascularity. Reproduced with permission from author.[10]

Conclusion

Ultrasound is important in this setting of a rural patient who may have limited time or resources to seek primary and specialist care for his now subacute 6 month lesion. Through clinical experience and sonography, it is possible to arrive at a satisfactory preliminary conclusion without the need for punch biopsy or excision. High frequency ultrasound with Doppler demonstrating lack of internal flow continues to be a simple and power tool in characterising blue nevi and other benign melanocytic lesions.

Acknowledgements

The author conveys his/her deepest thanks to Dr. Jan and R. Mekkes for allowing the use of the clinical images; and also Dr. Elisa Barcaui for allowing the use of an image from her journal. Special thanks also to Kathy Quenneville, Laura Bubar and Diane Kesti, past and current chairpersons of the ARDMS MSK examination board with whom I've worked. Lastly, the author's fondest gratitude goes to Rola Sleiman who was a supervisor, mentor and friend to the author for 6 years. Thank you.

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Article Name: Making a Difference: Blue Nevus versus Melanoma

Author: Ray T. Yuen, BMRSc, CRGS, RVT, RDMS, RMSKS

1. Melanocytes are derived from which of the following germ layer?

a) Ectoderm
b) Mesoderm
c) Endoderm
d) Trophoblast

2. Which of the following characteristic is not a criterion in the examination of a melanocytic tumor?

a) Asymmetry
b) Border
c) Color
d) Diameter
e) Elevation

3. Which immunohistochemical marker is sensitive in testing for tumors of neural crest origins?

a) HER2+
b) HLA-DQ8+
c) S100+
d) HLA-B27
e) CFTR

4. What is the preferred management for an asymptomatic low suspicion mole?

a) Radiation
b) Chemotherapy
c) Excision with wide margin
d) Surveillance
e) Mohs surgery

5. Which of the following is a risk factor in developing a melanoma?

a) Repeated use
b) Cocaine-use
c) UV radiation
d) Medication side-effect

Literature Review

Robert Dima, BMRSc, CRGS, DMS, PhD(c), Priya Appea, BMRSC, CRGS, Theresa Semalulu, MD

Rationale for an Integrative/Interactive Approach to the Diagnostic Ultrasound for Transitioning Patients with Juvenile Idiopathic Arthritis

About the Authors

Robert S Dima is a registered Canadian sonographer at Hamilton Health Sciences. Robert's research interests involve all aspects of medical imaging, professional development research and interprofessional research in healthcare.

Priya Appea is with the Department of Diagnostic Imaging, McMaster University Medical Centre, Hamilton, ON, Canada, and the Department of Diagnostic Imaging, The Hospital for Sick Children, Toronto, ON, Canada

Theresa Semalulu is with the Department of Medicine, Internal Medicine Training Program at McMaster University Medical Centre, Hamilton, ON, Canada

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ABSTRACT

Juvenile idiopathic arthritis (JIA) is a group of debilitating childhood rheumatic diseases. More than 50% of patients have persistent disease into adulthood. As a result, smooth transition from paediatric to adult care is essential for these patients, especially as disruption in care has been linked to poor outcomes. In the following manuscript, we provide a review of the literature on JIA transition, and a commentary on Diagnostic Medical Sonographer (DMS) role development and the use of ultrasound as an educational tool. In the context of the literature surrounding these topics, we present an argument for a potential new role of the DMS in the education and empowerment of children suffering from JIA transitioning to the adult care model. Barriers to, and advantages of this new role are discussed briefly, and an example framework of implementation is proposed.

Introduction

Juvenile idiopathic arthritis (JIA) encompasses a heterogeneous group of idiopathic inflammatory arthritides with an onset before the age of 16.[1] With the potential for significant disability, up to 60% of patients with JIA may have persistently active disease into adulthood.[1–3] Management of these patients is complex and often challenging, particularly as these patients will inevitably require a transition from paediatric care to adult care. This transition has been associated with poor outcomes such as increased disease activity, morbidity and mortality.[4, 5] There has been a push to view transition as more than just a transfer of care; rather as "the purposeful, planned movement of adolescents and young adults with chronic physical and medical conditions from child-centred to adult-oriented healthcare systems[6]." To this end, national policy in the UK has emphasized the importance of collaborative working to improve transition, and that the transition should stand by a holistic and a multi-agency approach.[7] In support of this concept, a recent scoping review[8] has found that for children with medical complexities, there are improvements in quality of life and emotional health post-transition when collaborative models of care are available.

The adult care setting is dependent on shared decision making as opposed to the paternalistic model of paediatric care and requires a certain level of understanding to enable competent decision making.[9] It was identified by 24% paediatric rheumatologists that the patients' "lack of knowledge about their own condition" as a barrier to support transition.[10] Also, lack of self-management skills is one of the most commonly cited barriers to a better-care transition.[11] Thus, the ability to build one's self-capacity and enhance self-management skills have been highlighted as key components necessary to enable young patients to independently navigate the adult care setting.[12] Interventions to enhance disease-related knowledge are likely to facilitate a successful seamless transition,[13–15] emphasizing the importance of patient education in this population.

Although we know that collaborative models of care improve quality of life and emotional health for these patients, Diagnostic Medical Sonographers (DMS) do not currently play a role in JIA patients' transition. We propose that the diagnostic ultrasound (US) exam may be an excellent tool which can serve a central role in the successful transition of children with JIA by enhancing disease-related knowledge, facilitating the development of better self-management skills and ultimately establishing a greater investment in one's health.

Methods

This article presents a narrative review of the literature on child to adult care transition in JIA patients and role advancement of the Canadian DMS. Our search strategy involved a systematic query of multiple databases (Google Scholar, ScienceDirect, MEDLine) restricted by Medical Subject Headings (MeSH): "juvenile idiopathic arthritis,""ultrasound,""advanced practice,""sonographer" and "transition." We restricted our search results to English-language peer-reviewed journal articles from 1990 to 2020.

Step 1. Review of abstracts. Reference list of articles identified by search engines were triaged into relevant publications on the basis of scope and content by reading of abstracts.

Step 2. Reading in full. Selected articles were reviewed by the authors and summarised into a table of

references. Articles were included or excluded after reading in full based on content relevance to JIA transition and sonographer role development.

Step 3. Summary and writing. The authors reviewed the articles and summarised the information into the present article, relevant to the topic of JIA transition and DMS role development.

Discussion

There has been growing interest in the use of diagnostic or point-of-care (POC) US as a tool to assist and enhance patient education. It has been proposed that direct visualisation of the affected anatomical structures and dynamic motion can equip patients with knowledge regarding their pathology and the underlying factors that contribute to their symptoms.[16] This unique process has the potential to empower patients to take an active role in their illness by facilitating a deeper understanding of their condition and how it affects them.

JIA patients already regularly undergo diagnostic ultrasound to assess disease progression, and this routine evaluation is only expected to increase in frequency given advancements in ultrasound technology and growing interest in the use of musculoskeletal (MSK) US. As a result, the routine diagnostic ultrasound is an excellent opportunity for patients with JIA to learn more about their disease process, visualise the manifestation and the causes of their symptoms and ultimately establish a greater investment in their own health. Transformation of the US exam from a check-up in which the patient themselves are passive observers, to an interactive and discussion-based activity, may help develop patient autonomy and correspondingly improve transition outcomes.

Barriers to an interactive approach to the US exam include issues surrounding cost, time, education and, not least of all, the fact that the Canadian DMS is limited by their Scope of Practice. The Regulated Health Professions Act (RHPA), 1991 defines the following as a controlled act: "Communicating to the individual or his or her personal representative a diagnosis identifying a disease or disorder as the cause of symptoms of the individual in circumstances in which it is reasonably foreseeable that the individual or his or her personal representative will rely on the diagnosis."[17] This controlled act is not within the scope of practice of the DMS, and as a result, limits discussions between the sonographer and the patient. By the same act however, controlled acts may be performed by the DMS if delegated by a member of the College of Physicians and Surgeons of Ontario, providing a legal framework to enable sonographer-led discussions.

Currently, the DMS is part of the circle of care of JIA patients, but exists in isolation from a transition perspective. In view of the benefits of patient education for transitioning JIA patients, and the uniquely interactive and engaging nature of the US exam, the routine ultrasound check-up for JIA patients is likely an excellent opportunity for patient education and empowerment.

Framework for the Interactive Ultrasound

Here, we propose a broad conceptual framework to inform and support an interactive and educational ultrasound routine.

1. *Room Set-up*. It is important to set up the ultrasound room prior to the patient's arrival. The appropriate use of stand-off pads, towels, visual distractions such as TV shows, cartoons and so on, warm ultrasound gel and height-adjustable stretchers (for wheelchair patients) will help welcome the patient in a comforting way.
2. *Introduction of sonographer and role*. By verbally communicating the role of the sonographer and introducing oneself, we simultaneously engage the patient, encourage them that we are invested in their care and create an environment that is conducive to engagement and explicit discussion.
3. *Explanation of the procedure*. To enable a patient's investment in the procedure and to establish the sonographer-patient relationship, the patient should understand what the procedure is and why it is being performed. This crucial step is too often missed.
4. *Dynamic interactive imaging*. Throughout the procedure, the sonographer can demonstrate the anatomy being visualised, describe (where appropriate) the relevant imaging findings and correlate this with patient movements and anatomy. This process can facilitate joint decision-making and encourage

patients to follow recommendations by creating a link between the patient and the disease process.

5. *Involve the family*. If the family is present, this can be used as time to encourage and engage parents or other relations to learn about the disease process, helping to develop an environment of support for the patient.

A calm, positive environment coupled with visual biofeedback with real-time ultrasound imaging may play a crucial role in the rehabilitative process of patients by providing an opportunity for patient learning and empowerment. We feel that the DMS has a great opportunity to take on a supportive role for the patient in their vulnerable transition phase as well as provide excellent diagnostic services.

Conclusion

Better transition leads to better health outcomes for children with JIA, and collaborative healthcare models have been shown to improve their quality of life. The diagnostic ultrasound represents an opportunity for patient education and the development of patient autonomy, presenting a potential role for the DMS to facilitate the transition to adult care, which is a vulnerable time in the course of JIA. Enlisting sonographers as an educational resource to facilitate successful transition is a novel idea that has the potential to improve patient outcomes in a substantial way. Future initiatives in role development for the DMS should emphasize the educational value of the routine diagnostic ultrasound in these patients. Research initiatives, enabled by delegation of controlled act 1 under the RHPA 1991, should prospectively evaluate the efficacy of an educational ultrasound exam intervention in JIA patients undergoing transition.

All healthcare professionals should endeavour to raise their awareness of transition and the potential positive or negative implications that the process can have for individuals to ensure that they provide efficient and effective care.[18]

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Article title: Rationale for an Integrative/Interactive Approach to the Diagnostic Ultrasound for Transitioning Patients with Juvenile Idiopathic Arthritis

Author's Names: Robert Dima, BMRSc, CRGS, DMS, PhD(c), Priya Appea, BMRSC, CRGS, Theresa Semalulu, MD

1. What model of care improves quality of life and emotional health post-transition from a paediatric to adult health care setting?

a) Collaborative model
b) Transactional model
c) Independence model
d) Compassionate model

2. In adult patients with Juvenile idiopathic arthritis (JIA), direct visualisation of the affected anatomical structures and dynamic motion can equip patients with knowledge regarding their pathology and the underlying factors that contribute to their symptoms

a) True
b) False

3. According to this article a crucial barrier to an interactive approach between the sonographer and the patient with JIA during the ultrasound exam is

a) Regulation
b) Professional Practice
c) Evidence based practice
d) Sonographers Scope of Practice

4. In this article identify the framework described to support an interactive and educational ultrasound routine

1) Room set-up
2) Sonographers education
3) Explanation of the procedure
4) Introduction of sonographer and role
5) Dynamic interactive imaging
6) Involve the family

a) 1,2,3,4
b) 1,2,3,4,5
c) 1,3,4,5,6
d) 1,2,3,4,5,6

Pictorial Essay

Babitha Thampinathan, HBSc, RDCS, CRCS (AE), Cindy Chow, BA, RDCS, CRCS (AE)

Assessing the Severity of Aortic Regurgitation Using 3-D Color Doppler Echocardiography: A Pictorial Essay

About the Authors

Babitha Thampinathan is affiliated with Toronto General Hospital, Ted Rogers Center for Heart Research and Mohawk-McMaster University Institute for Applied Health Sciences.

Cindy Chow is a cardiac sonographer at University Health Network in Toronto.

ABSTRACT

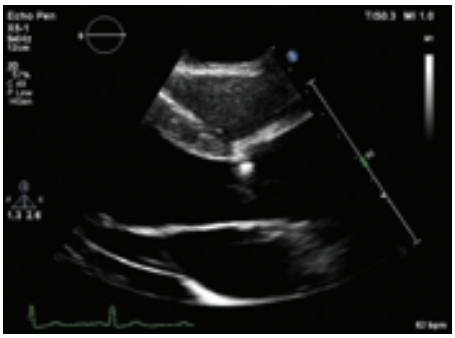
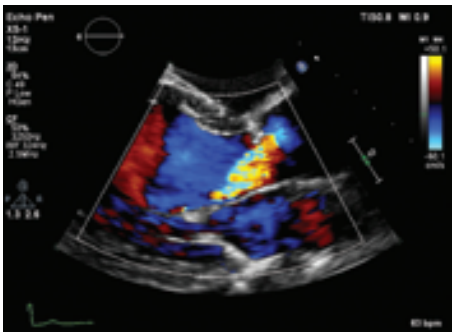
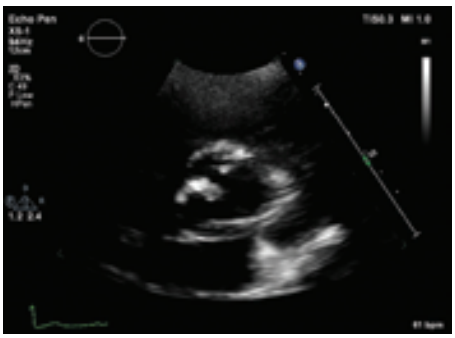
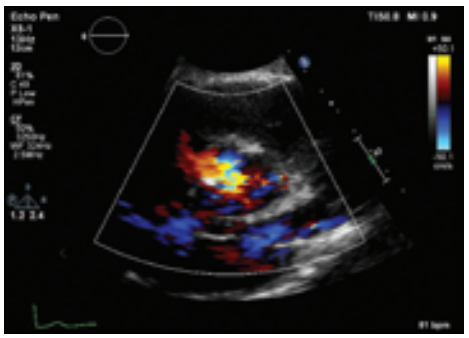
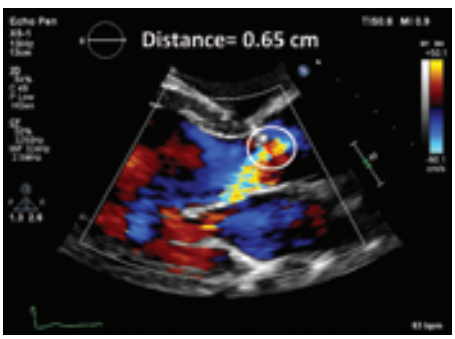
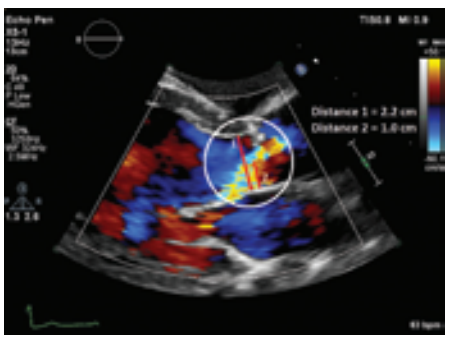
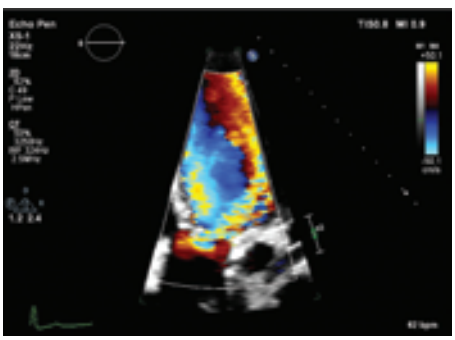
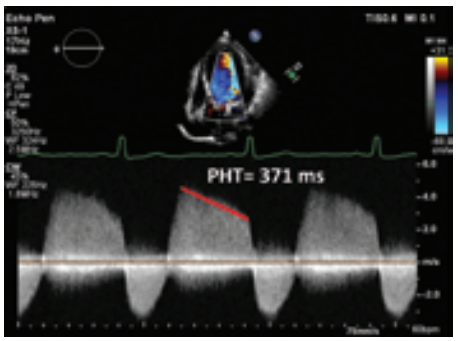
Transthoracic echocardiography (TTE) is the most common non-invasive diagnostic test that is being used all around the world to assess the heart. With the development of three-dimensional echocardiography over the last decade, accurate, and detailed imaging has allowed for significant improvements in the capability of assessing and understanding cardiac pathology.

Introduction

A 30-year-old woman; 2 months post-partum had a previous history of bicuspid valve with moderate aortic regurgitation (AR) and normal left ventricle size and systolic function**.** She has no history of intervention on her valve. Her pregnancy and delivery were uncomplicated but she reported shortness of breath on exertion and when laying down. The transthoracic echocardiography (TTE) was performed as part of the routine clinical follow-up post-partum and was conducted on the Philips EPIQ 7 ultrasound system.

This pictorial essay demonstrates the limitations of traditional 2-D echocardiography assessments of eccentric AR as the acquisition of 2-D Doppler measurements are operator dependent and may not be reliably obtained with eccentric jets. By acquiring and correctly post processing 3-D transthoracic echo datasets, cardiac sonographers can provide additional information such as 3-D derived EROA which can be useful when determining the severity of AR. Particularly in the setting of eccentric AR, 3-D TTE has the advantage of unlimited plane orientation, which allows the exact shape and size of the true regurgitant orifice to be measured accurately especially in situations where transesophageal echocardiography is not an option.

Findings

Transthoracic 2-D and Doppler Images Acquired	2-D and Doppler Indicators of Severity
 Figure 1A  Figure 1B	• Figure 1A, 1B: TTE demonstrated a posteriorly-directed eccentric jet of aortic regurgitation (AR).
 Figure 2A  Figure 2B	• Figure 2A, B: 2-D showed a bicuspid aortic valve with an incomplete raphe, partially fused RCC-LCC.
 Figure 3A  Figure 3B	• Figure 3A: Color Doppler of vena contracta. The vena contracta width (VCW) was measured at 6.5 mm. • Figure 3B: Color Doppler jet width. Measurement of the jet width/LVOT diameter ratio was felt to be unreliable as the eccentricity would cause underestimation of AR severity.
 Figure 4A  Figure 4B	• Figure 4B: Pressure half time was 371 ms but likely inaccurate due to poor Doppler alignment of the eccentric jet as seen in Figure 4A.

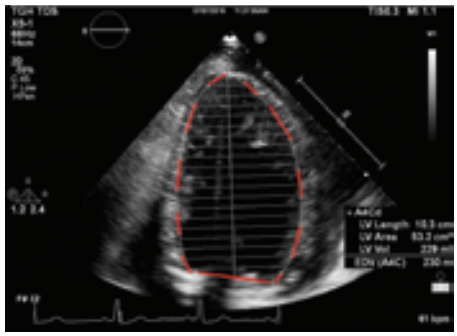


Figure 5A

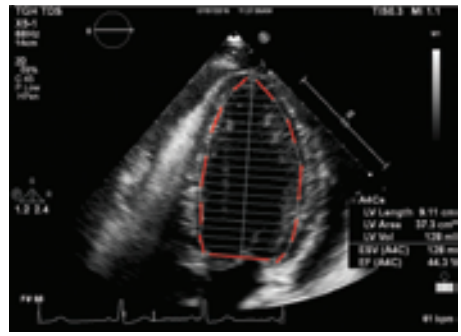


Figure 5B

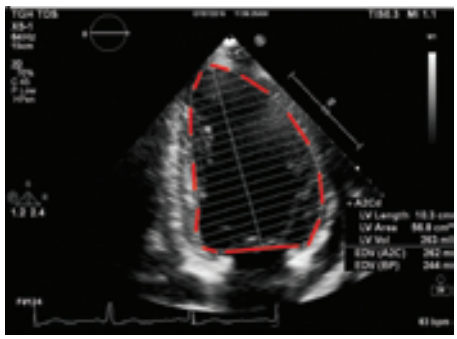


Figure 5C

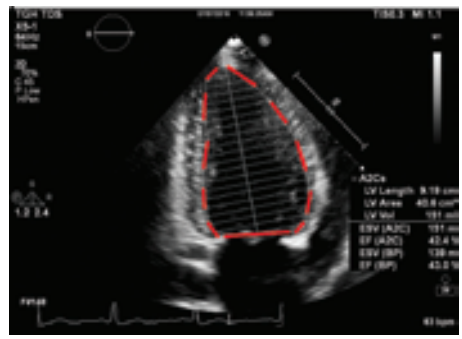


Figure 5D

- Figure 5A, 5B, 5C, 5D: LV enlargement. There is severe left ventricular dilatation (LVEDVi 150 ml/m^2; LVESVi 85 ml/m^2) and mild global systolic dysfunction (LVEF 43%).

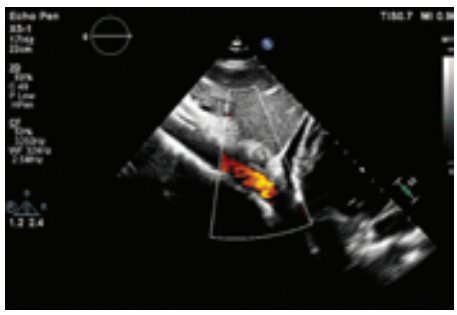


Figure 6A

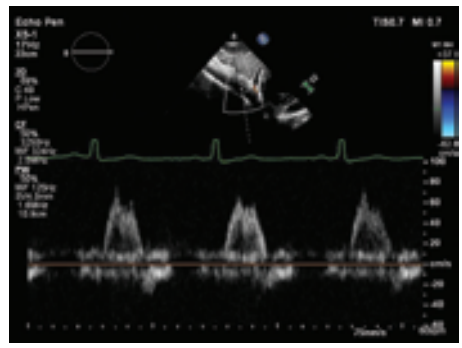


Figure 6B

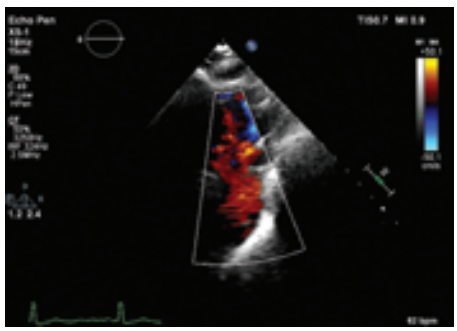


Figure 6C

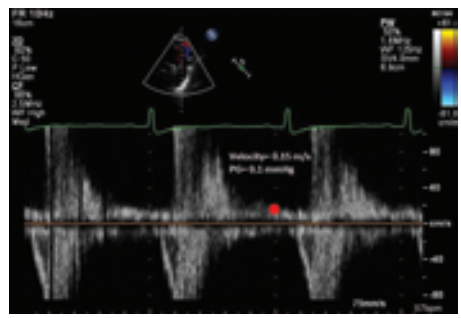


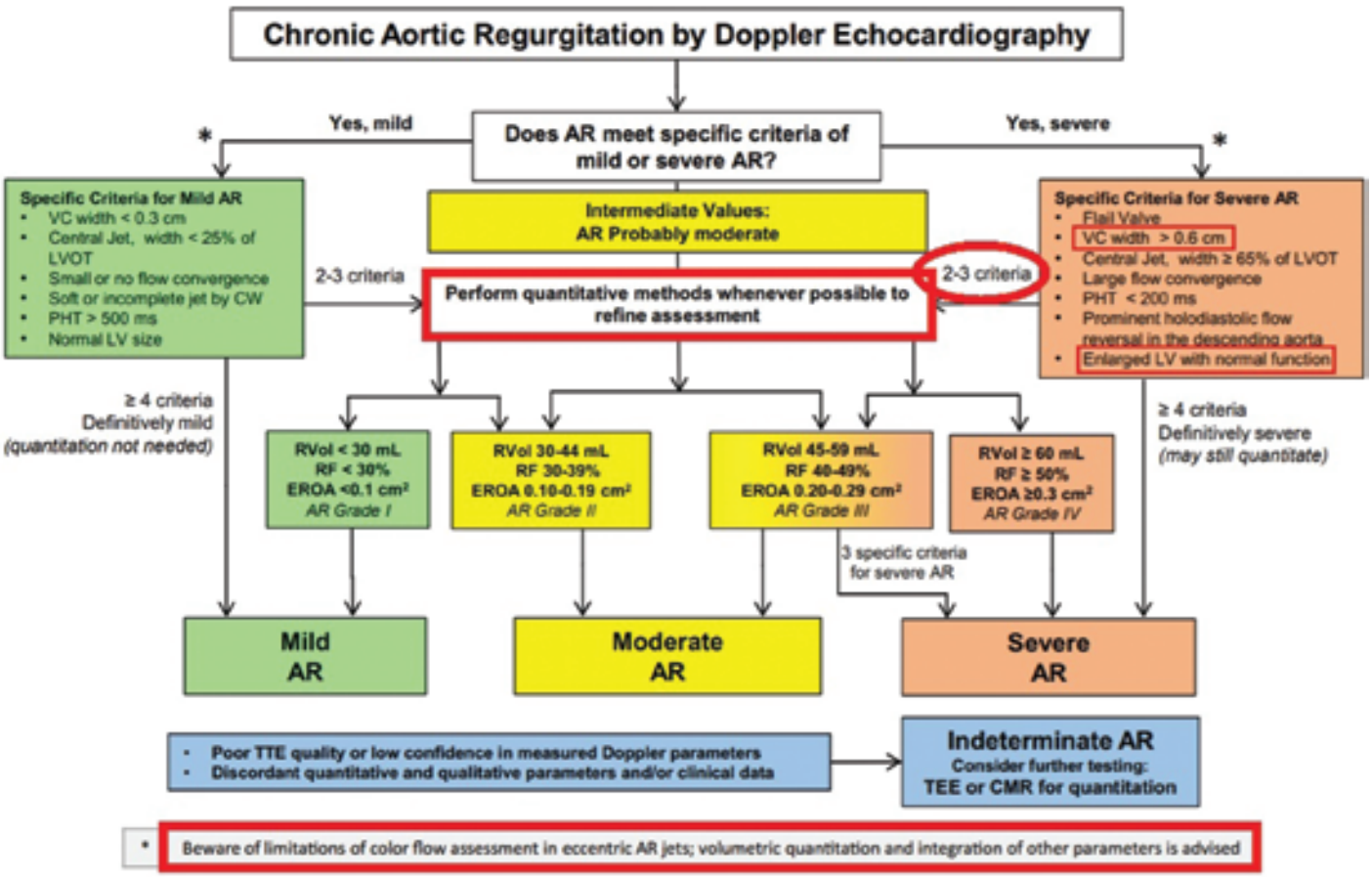
Figure 6D

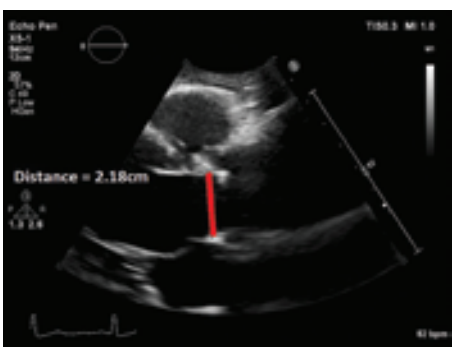
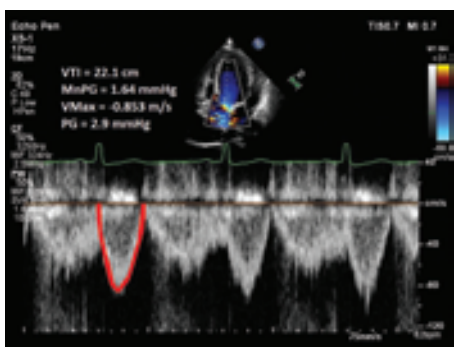
- Figure 6A, 6B, 6C, 6D: There was no holodiastolic flow reversal in the thoracic or abdominal aorta.

How Severe Is the AR?

According to the algorithm in Table 1 and based on the images acquired, two specific criteria were met for severe AR, vena contracta width, and LV enlargement. Quantitative measures were performed to clarify the severity of the AR jet as there was concern that it may be underestimated.

Table 1. Quantitative Doppler: Effective Regurgitant Orifice Area (EROA), regurgitation volume (RVol), and regurgitant fraction (RF) formulas and calculations[1,2]



Quantitative 2-D and Doppler Images Acquired	Volumetric Assessment
1) STROKE VOLUME METHOD: SV = CSA X VTI LVOT Diameter  Figure 7A LVOT Pulsed Doppler  Figure 7B	LVOT DIAMETER= 2.2 cm VTI LVOT= 22 cm $CSA_{LVOT} = \pi (LVOT_{DIAMETER}/2)^2$ $= 3.14 (2.2/2)^2$ $= 3.799\ cm^2$ $SV_{LVOT} = (CSA_{LVOT} \times VTI_{LVOT})$ $= 3.799\ cm^2 \times 22\ cm$ **= 83.58 ml**

Mitral Annulus Diameter

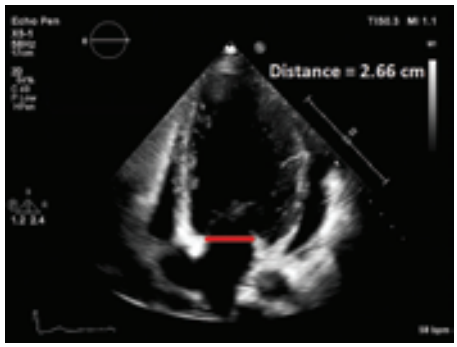


Figure 8A

Mitral Inflow Pulsed Doppler

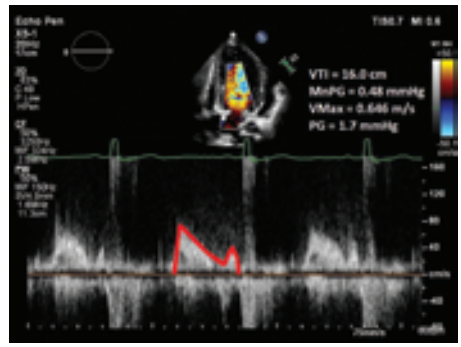


Figure 8B

MITRAL ANNULAR (MA) DIAMETER = 2.31 cm
VTI MITRAL INFLOW = 16 cm

$CSA_{MA} = \pi (MA_{DIAMETER}/2)^2$
$= 3.14 (2.31/2)^2$
$= 4.188\ cm^2$

$SV_{MA} = (CSA_{MITRAL\ ANNULUS} \times VTI_{MITRAL\ INFLOW})$
$= 4.188\ cm^2 \times 16\ cm$
$= 67.02$ ml (without MR)

$RVol = SV_{LVOT} - SV_{MITRAL\ ANNULUS}$
$= 83.58$ ml $- 67.02$ ml
= **16.56 ml**

$RF = RVol / SV_{LVOT}$
$= 16.56$ ml$/ 83.58$ ml
= 0.198 or **19.8%**

RVOT Diameter

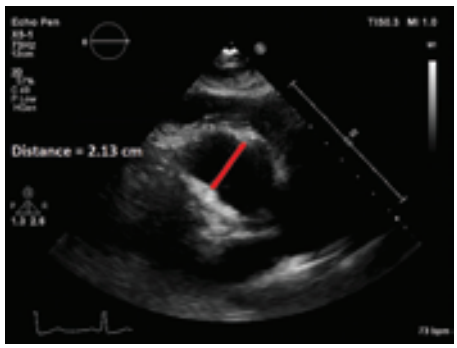


Figure 9A

RVOT Pulsed Doppler

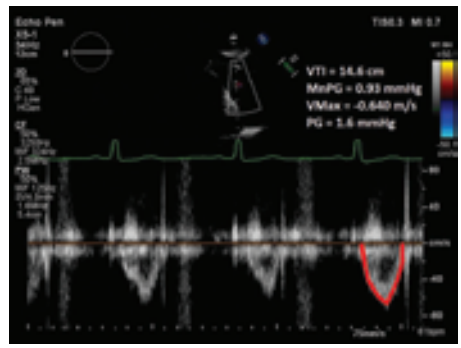


Figure 9B

RVOT DIAMETER= 2.13 cm
VTI RVOT= 14.6 cm

$CSA_{RVOT} = \pi (RVOT_{DIAMETER}/2)^2$
$= 3.14 (2.13/2)^2$
$= 3.561\ cm^2$

$SV_{RVOT} = (CSA_{RVOT} \times VTI_{RVOT})$
$= 3.561\ cm^2 \times 14.6\ cm$
$= 51.99$ ml

$RVol = SV_{LVOT} - SV_{RVOT}$
$= 83.58$ ml $- 51.99$ ml
= 31.59 ml

$RF = RVol / SV_{LVOT}$
$= 31.59$ ml$/ 83.58$ ml
= 0.377 or **37.7%**

2) Proximal Isovelocity Surface Area (PISA) METHOD

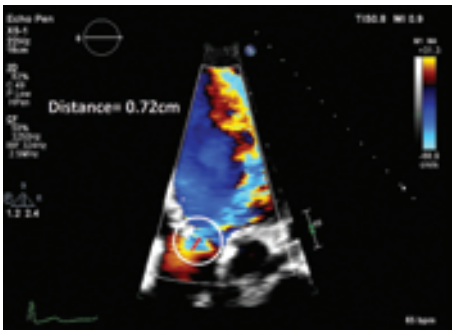


Figure 10A

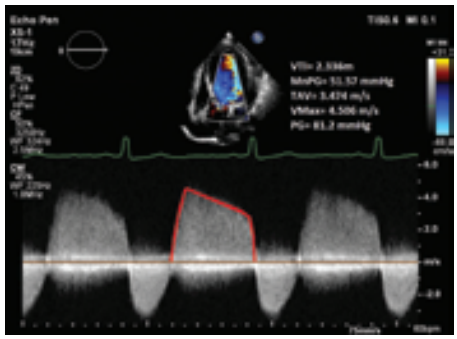


Figure 10B

Aliasing Velocity (V_{Alias}) = 31.3 cm/s
PISA Radius = 0.72 cm

Vmax $_{AORTIC\ REGURGITATION}$ = 4.5 m/s
VTI $_{AORTIC\ REGURGITATION}$ = 2.336 m

Regurgitant Flow Rate (RFR) = PISA ($2\pi r^2$) x V_{Alias}
= 2 x 3.14 x $(0.72\ cm)^2$ x 31.3 cm/s
= 101.89 ml/s

EROA = Regurgitant Flow Rate / Vmax $_{AORTIC\ REGURGITATION}$
= 101.89 ml/s / 4.5 m/s
= **22.64 mm^2**

RVol = EROA x VTI $_{AORTIC\ REGURGITATION}$
= 22.64 mm^2 x 2.336 m
= 52.89 ml

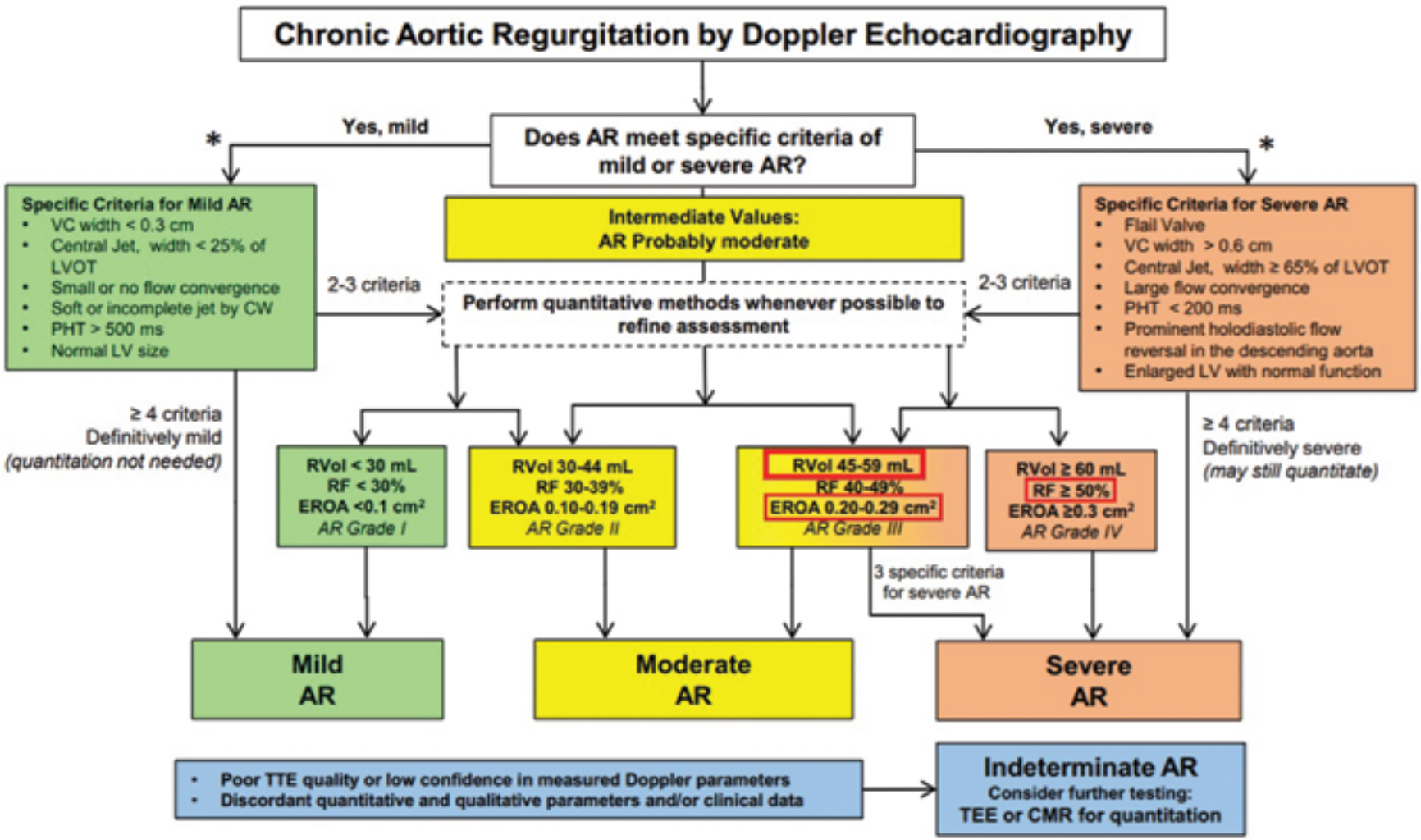
RF = RVol/ SV $_{LVOT}$
= 52.89 ml / 83.58 ml
= 0.63 or **63%**

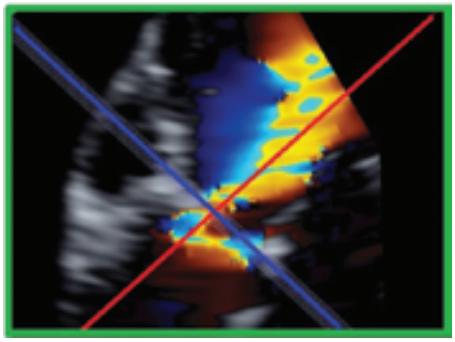
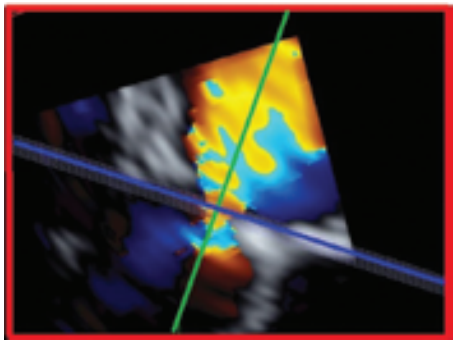
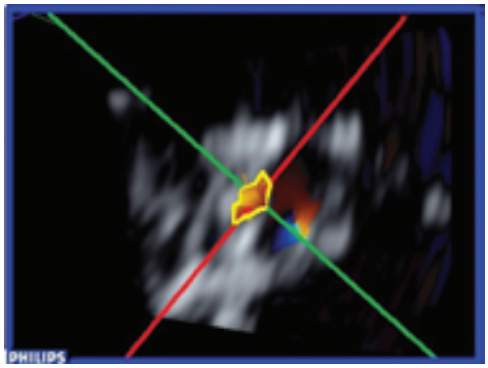
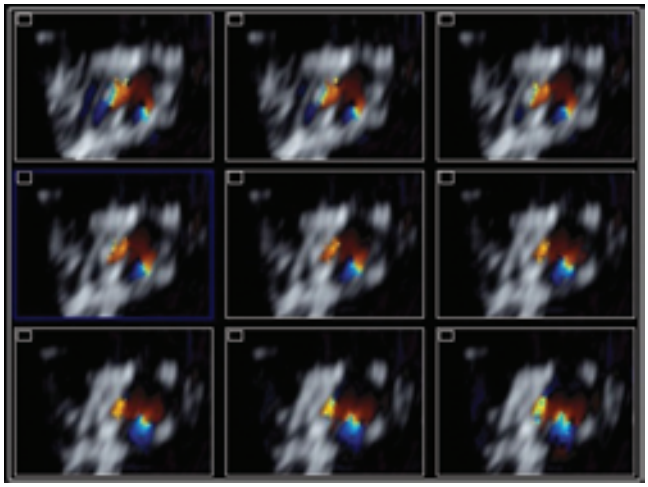
Zoghbi WA et al.[1]

Two different quantitative techniques were used. Using RVOT and LVOT stroke volumes, the calculated regurgitant volume was **31.59 ml**, and regurgitant fraction was **37.7%** (Figure 9) which is in the moderate range. The regurgitant volume calculated from 2D PISA was **52.89 ml/beat** (see Figure 10), which is more in the moderate to severe range. The calculated regurgitant fraction was **63%** (see Figure 10) which is in the severe range. The 2-D PISA radius measured 0.72 cm at an aliasing velocity of 31.3 cm/s. The calculated EROA was **22.64** mm^2 (Figure 10) which is more in the moderate to severe range. The quantitative methods resulted in different estimations of regurgitant volumes and regurgitant fractions.

Based on the algorithm, 2-D PISA technique was suggestive of moderate to severe AR. However, there was concern about the PISA technique due to challenges with Doppler alignment which results in errors when calculating the AR VTI and peak velocity. 3-D TTE full volume color Doppler datasets of the aortic valve were obtained and post processed.

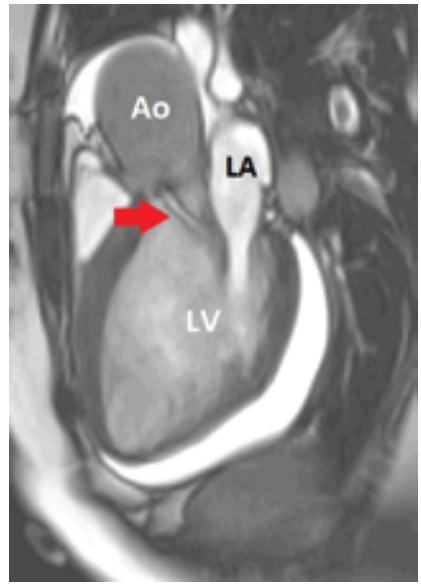
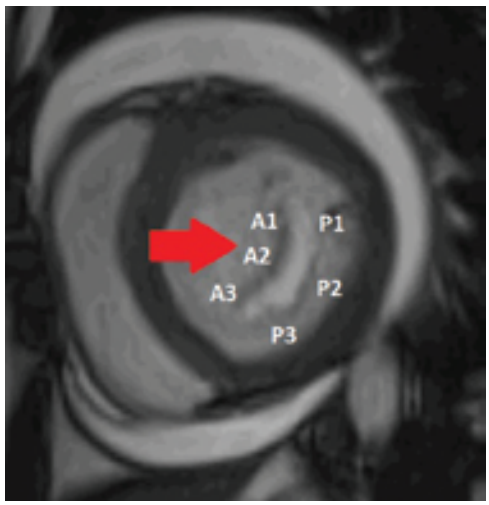
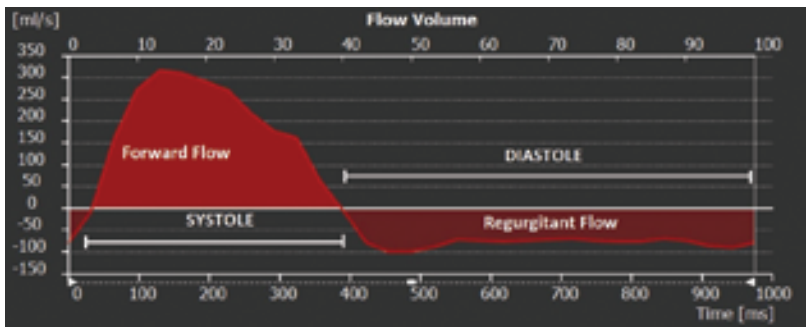
Table 2. Recommendations for Noninvasive Evaluation of Native Valvular Regurgitation: A Report from the American Society of Echocardiography Developed In Collaboration with the Society of Cardiovascular Magnetic Resonance



3D Post-Processed Color Doppler Dataset Images	3-D Assessment
 Figure 11A  Figure 11B	• Figure 11A, 11B: Post processing the 3D color doppler datasets involved using multiplanar reconstruction by aligning the AR jet in the orthogonal planes (green, red, and blue) during mid-diastole.[1] • The aliasing velocity was set between 50 and 60 cm/s. • The cross-sectional plane was placed through the narrowest portion of the jet, the vena contracta, perpendicular to the direction of the jet.
 Figure 12A  Figure 12B	• Figure 12A, 12B: From the en-face view of the vena contracta, the 3D-EROA of the narrowest cross-sectional area of the regurgitant jet was measured by manual planimetry obtaining a value of 0.36 cm^2. • The RVol was calculated by multiplying the 3D-EROA with the velocity-time integral of the AR jet. RVol = 3D EROA x VTI $_{\text{AORTIC REGURGITATION}}$ = 36 mm^2 x 2.336 m **= 84.10 ml**

Zoghbi WA, et al.[1]

The 3-D regurgitant volume was calculated as 84.10 ml/beat, **consistent with severe aortic regurgitation.** However, the CW Doppler that was used for the VTI to calculate the 3-D regurgitant volume was felt to be unreliable due to the eccentricity of the AR jet.

Cardiac Magnetic Resonance Images Acquired	CMR Assessment
 Figure 13A  Figure 13B	• Figure 13A, 13B: CMR imaging shows the aortic regurgitation appearing as a black stream (red arrow) in the light grey LV chamber during diastole in the three-chamber cine.
 Figure 14.	• Figure 14: The short axis cine shows restriction of the anterior mitral valve leaflet motion during diastole caused by the eccentric AR jet. This is also be seen in the above three-chamber cine. This restricted orifice could cause an inaccurate PW Doppler tracing of the mitral inflow on echo. The inaccurate tracing and measurement could explain the lower regurgitant volume that was calculated noting that the forward flow by 2D echo (83.58 ml) was similar to the forward flow by CMR (82 ml).
 Figure 15.	• Figure 15: Phase contrast imaging for the volumetric assessment of AR found a forward flow during systole of 82 ml/beat, reverse (regurgitation) flow of 52 ml/beat during diastole, and net forward flow of 30 ml/beat (1.8 L/min) resulting in a regurgitant fraction of 63%.

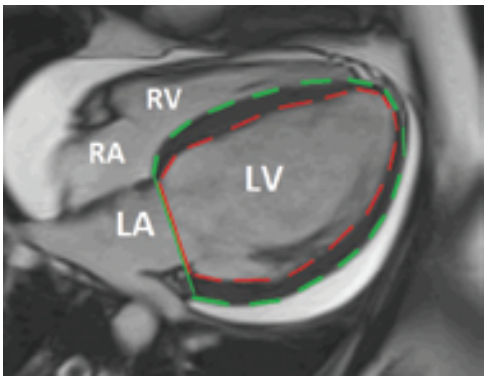


Figure 16.

- Figure 16: CMR demonstrated severe LV dilatation (LVEDV 299 ml, indexed 177 ml/m^2, LVESV 161 ml, indexed 96 ml/m^2) with mildly reduced systolic function (LVEF 46%).

Given the recent pregnancy and reduction in LVEF, there was a concern regarding whether it was related to a postpartum cardiomyopathy or significant worsening of the AR, potentially being underestimated by 2-D echo assessments. The patient refused to undergo a transesophageal echocardiography procedure.

In cases where 2-D and 3-D TTE acquisition is limited due to poor imaging windows, cardiac magnetic resonance (CMR) imaging can provide additive clinical decision-making information about regurgitant volumes and regurgitant fractions.[2] As quantitation of AR is more reproducible with CMR imaging than echocardiography,[2] CMR was performed for accurate assessment of LVEF, assessment of AR severity, and identification of other potential causes for reduction in LV function.

Conclusion

The final conclusion was that there was severe AR, severely dilated LV with mildly reduced LVEF 46%. The patient underwent aortic valve replacement. 2-D echocardiography can provide important information about cardiac structures; however, there are limitations such as operator variability or suboptimal acoustic imaging window that may cause a diagnosis to be missed.

In cases where the valvular regurgitation appears eccentric, careful evaluation using 3-D datasets provide valuable information such as 3-D derived EROA to accurately determine the severity of AR. If highly trained cardiac sonographers are able to acquire, post-process, and provide these measurements, it can have significant impact how clinical decisions are made in managing a patient. 3-D TTE has the advantage of unlimited plane orientation, which allows the exact shape and size of the true regurgitant orifice to be measured accurately especially in situations where transesophageal echocardiography and CMR is not an available option.

References

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Article title: Assessing the Severity of Aortic Regurgitation Using 3-D Color Doppler Echocardiography: A Pictorial Essay

Author's Names: Babitha Thampinathan, HBSc, RDCS, CRCS (AE), Cindy Chow, BA, RDCS, CRCS (AE)

1. The authors contend that in cases where valvular regurgitation is eccentric, 3D datasets add information to help assist the degree of severity of the regurgitation.

a) True
b) False

2. As per ASE guidelines, mild aortic regurgitation demonstrates all the following factors except:

a) EROA <0.1 cm^2
b) Regurgitant Volume <30mL
c) Prominent holodiastolic flow
d) Vena contracta width <0.3 cm

3. An enlarged left ventricle with normal function holodiastolic reversal in the descending aorta and a pressure half time of less than 200ms are all indicative of:

a) Mild aortic regurgitation
b) Moderate aortic regurgitation
c) Severe aortic regurgitation
d) Any of the above.

4. In the stroke volume method, the CSA stands for:

a) Cardiac stroke area
b) Calculated stroke area
c) Canadian space agency
d) Circumferential Surface Area

5. Where 2-D and 3-D image acquisition is challenging the following modalities may assist in clinical decision making:

a) Transesophageal echo
b) Cardiac magnetic resonance imaging
c) Dobutamine stress echocardiography
d) a. and b.
e) all the above

Sonographers: Worthy of recognition

In 2020, Sonography Canada launched the **#SonographersSaveLives** campaign to increase awareness, understanding, and appreciation of the profession of diagnostic medical sonography by employers, governments, allied health professionals, and the public. The goal is for everyone in the healthcare system to acknowledge, recognize, and appreciate that sonographers are well-trained medical professionals with unqiue skills, competencies, and challenges, who serve as integral members on the healthcare team.

As the impact of the COVID-19 pandemic became known, it was apparent that sonographers were not always recognized for their role. In the COVID-19 environment, sonographers are at a higher risk of exposure to the disease due to the very nature of their work. Unlike other diagnostic medical imaging procedures, like X-rays and MRIs, ultrasound exams do not comply with guidelines for social distancing.

In addition to greater risk of disease transmission, there are additional work-related areas of concern inherent to the profession. Ultrasound exams involve repetitive physical exertion which often leads to repetitive strain injuries (RSI) that have an impact on sonographers' careers, and on healthcare operations and costs.

"*The COVID-19 pandemic exacerbated an already challenging environment marked by staff shortages as well as increased and sometimes contradictory demands for more productivity in the workplace. The #SonographersSaveLives initiative will address all of these issues*", said Victor Lee, Chair of the Board of Directors for Sonography Canada.

In 2020, Sonography Canada issued a number COVID-19 statements alone and in conjunction with other organizations:

- **March 2020**: Sonography Canada issued a position statement on sonographers and COVID-19 that received an endorsment by the Canadian Association of Radiologists.
- **May 2020**: Sonography Canada sent a letter to the Premier of Ontario advocating that sonographers be added to the list of healthcare professionals eligible to receive pandemcic pay for frontline workers.
- **December 2020**: Sonography Canada corresponded with federal and provincial governments urging them to include sonographers in Stage 1 of the COVID-19 immunization schedule.

Issues related to the COVID-19 pandemic, the rise of systemic work-related health concerns and the gradual regulation of sonography in Canada have led Sonography Canada to assume a more proactive advocacy role on behalf of its members. Ensuring that diagnostic medical sonographers are recognized for their contributions to the quality of care and patient outcomes has become, and will continue to be, a strong priority for the organization.

The #SonographersSaveLives campaign is designed to be an ongoing effort that will continue throughout 2021 and beyond. Susan Clarke, Executive Director of Sonography Canada, had this to say about next steps: "*Sonography Canada is proud to be the voice of sonography professionals in Canada. As a next step, we will invite our members to join their voices with ours using a grassroots toolkit that will empower our members to promote their role in their workplaces and their communities for even greater impact.*"

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Key Events for 2021

MAY 29

AGM and Education Day

Help shape the future of your association AND take advantage of high-quality CPD (free for members)*

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FRAMING THE FUTURE
MAY 29, 2021 AGM & EDUCATION DAY
SONOCON

OCTOBER 1-3

SonoCon 2021

Education Summit: Learn from the experts, connect and network with your peers and colleagues*

SUMMIT 2021
Sonography Canada | Échographie® Canada
ADJUSTING FOCUS
SEPTEMBER 30–OCTOBER 2, 2021
SONOCON

OCT 3-9

Sonography Week 2021

It's all about you — Celebrate sonographers as essential members of the healthcare team.

*Virtual events