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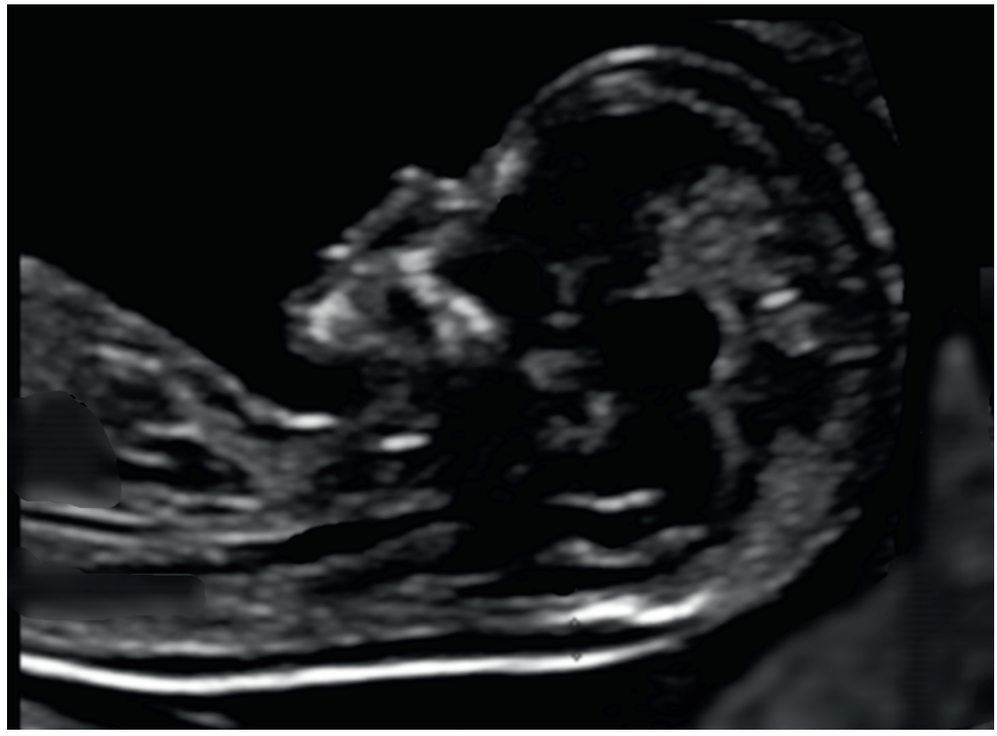

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About the cover

The cover image is Figure 1 taken from "The Ever Evolving 11–14-Week Scan" by Cathy Ridsdale and Jo-Ann Johnson. The NT measurement should be taken on a ML sagittal image with the nasal bone seen (should not see zygoma) magnified so only head and thorax are in image. Head should be in neutral position (flexion or extension will alter measurement). Amnion should be visualized. Demonstration of the brain stem (BS), intracranial translucency (ICT), cisterna magna (CM), nasal bone, upper palate, tip of the nose, ML spine are required for an accurate measurement.

Message from the Editor-in-Chief

This first issue of *CJMS* of 2023 brings to you the reader some practice-worthy reads. We have an information-filled document that Generalist obstetric sonographers will read, relish, and I am sure will post somewhere for reference. It was written by our reviewer Cathy Ridsdale, CRGS, CRVS, and Dr. Jo-Ann Johnson, MD, FRCSC, Ob/Gyn who share information about the latest guidelines for the 11–14-week scan and its evolution.

Prenatal Screening Ontario (PSO) resides under the umbrella of the Better Outcomes Registry & Network (BORN). This organization adds to the conversation of nuchal translucency (NT) and first-trimester ultrasound screening in the quality and practice improvement framework for sonographers conducting NT Ultrasounds in Ontario. It emphasises the importance of who, what, when and how NTs are done and how to ensure quality in this process.

Sonography Canada's professional liability insurance provider has shared a professional practice guide addressing the importance of "informed consent" and its vital role in all sonographers' practice.

The article by Sarah Kamaluddin will interest all of us inside and outside health care who are wondering about the association of viral disease, myocarditis and heart failures. I am sure all sonographers will find this an interesting read.

On a bittersweet note my tenure in the role of Editor-in-Chief of the *CJMS* comes to an end on March 15, 2023. It has been a wonderful four years of learning, relationship-building, and enabling the journal to develop in a direction wanted by Sonography Canada members. This journey would not have been as fun without you the author, the reader, Scott my right-hand man at our publishers, editors Kim, Marion & Megan, all of our many reviewers, colleagues, friends, and of course, everyone at Sonography Canada, especially Susan, Tara, Natalie & Megan who always had my back.

I would like to welcome your new editor in chief Amber Javaid, CRGS who will take over the editorial helm starting with Vol 14, Issue 2 of *CJMS*. Amber is from Red Deer Alberta, a sonographer and educator for many years.

I am off to push more boundaries and horizons…. Take care, have fun, be well and send your articles in to *CJMS*.

Yours truly,

Sheena Bhimji-Hewitt, MMedUS, FSC DMS, CRGS, CRVS, RDMS, RVT

Message du rédactrice en chef

Ce premier numéro de la CJMS de 2023 vous offre, à vous le lecteur, des lectures dignes de la pratique. Nous avons un document rempli d'informations que les échographistes obstétriciens généralistes liront, savoureront et, j'en suis sûr, afficheront quelque part à titre de référence. Il a été rédigé par notre examinatrice Cathy Ridsdale, CRGS, CRVS, et le Dr Jo-Ann Johnson, MD, FRCSC, Ob/Gyn, qui partagent des informations sur les dernières directives concernant l'examen de 11 à 14 semaines et son évolution.

Prenatal Screening Ontario (PSO) fait partie du Better Outcomes Registry & Network (BORN). Cette organisation ajoute à la conversation sur la clarté nucale (TN) et le dépistage par échographie au premier trimestre dans le cadre d'amélioration de la qualité et de la pratique pour les échographistes effectuant des échographies de la TN en Ontario. Il souligne l'importance de savoir qui, quoi, quand et comment les CN sont effectuées et comment assurer la qualité de ce processus.

Le fournisseur d'assurance responsabilité professionnelle de Sonographie Canada a partagé un guide de pratique professionnelle traitant de l'importance du "consentement éclairé" et de son rôle vital dans la pratique de tous les échographistes.

L'article de Sarah Kamaluddin intéressera tous ceux d'entre nous, à l'intérieur et à l'extérieur du secteur des soins de santé, qui s'interrogent sur l'association entre les maladies virales, la myocardite et les défaillances cardiaques. Je suis sûr que tous les échographistes trouveront cette lecture intéressante.

Sur une note douce-amère, mon mandat de rédacteur en chef de la CJMS prendra fin le 15 mars 2023. Ce fut quatre années merveilleuses d'apprentissage, d'établissement de relations et de développement du journal dans la direction souhaitée par les membres de Sonographie Canada. Ce voyage n'aurait pas été aussi agréable sans vous, l'auteur, le lecteur, Scott, mon bras droit chez nos éditeurs, les rédactrices Kim, Marion et Megan, tous nos nombreux réviseurs, collègues, amis et, bien sûr, tout le monde à Sonographie Canada, en particulier Susan, Tara, Natalie et Megan qui ont toujours assuré mes arrières.

J'aimerais souhaiter la bienvenue à votre nouvelle rédactrice en chef, Amber Javaid, CRGS, qui prendra la barre de la rédaction à partir du vol 14, numéro 2 de la CJMS. Amber est originaire de Red Deer en Alberta, elle est échographiste et éducatrice depuis de nombreuses années.

Je pars repousser encore plus loin les limites et les horizons..... Prenez soin de vous, amusez-vous, portez-vous bien et envoyez vos articles à CJMS.

Bien à vous,

Sheena Bhimji-Hewitt, MMedUS, FSC DMS, CRGS, CRVS, RDMS, RVT

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A Pictorial Essay/Literature Review

Cathy Ridsdale CRGS, CRVS, RDMS, RVT, BSc
Jo-Ann Johnson MD FRCSC

The Ever Evolving 11–14-Week Scan

About the Authors

Cathy Ridsdale is a team lead of a large ultrasound department in a community clinic in Edmonton, Alberta

Jo-Ann Johnson is a Professor Department Obstetrics and Gynecology at University of Calgary

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ABSTRACT

Advancements in ultrasound equipment have led to improved resolution of smaller structures. In turn, this has allowed for the evolution of the 11–14-week scan. At its inception, the first-trimester scan was used primarily to indicate the risk for aneuploidy in a fetus. However, as time passed, the ability to detect structural abnormalities complemented the risk for chromosomal abnormalities. This literature review will discuss the evolution of the 11–14-week scan up to current-day recommendations for population screening.

Keywords: 11–14-week scan; screening; aneuploidy

Introduction

Before the 1990s, amniocentesis was the gold standard method for detecting a chromosomal abnormality. Maternal age was used as a determining criterion for amniocentesis as it was an established risk factor for Trisomy 21 (Down syndrome), the most common chromosomal abnormality in infants. By age 35 the estimated incidence of Trisomy 21 is 1 in 350 live births. This increases to 1 in 200 live births by age 40.[1] Amniocentesis is associated with a risk for miscarriage, so there was the impetus to develop a non-invasive screening method for Trisomy 21. Research showed that an increased nuchal thickness correlated with an increase in aneuploidy, and its measurement could be performed on an ultrasound image of the fetal profile.[2] The 11–14-week scan (initially called the 11–13+6 week scan)[2] was developed in the 1990s to aid in the screening for aneuploidy, precisely Down syndrome. In the following 10 years, the scan evolved to encompass screening for other trisomies (13, 18) and Turner's syndrome (X0). The current first-trimester screen incorporates biochemical markers, nasal bone status, and the nuchal translucency (NT) measurement to ascertain the risk for aneuploidy. The addition of a standardized

checklist of fetal anatomy would permit the detection of congenital structural abnormalities, making the first-trimester screening more complete.

Evolution of the First Trimester Scan

The 11–13+6 week scan was introduced as a screening tool for Trisomy 21 (Down syndrome) in the 1990s. The scan included assessing the maternal environment, crown-rump length (CRL) measurement, fetal heart rate (FHR), chorionicity if multiples, and measurement of the NT.

In 2000, Nicolaides et al. determined the efficacy of the 11–13+6 week scan combined with maternal age to provide predictive screening for Trisomy 21 with a 75% detection rate.[2] They further demonstrated that with the addition of serum biochemical markers (free-beta-human chorionic gonadotropin [βHCG] and pregnancy-associated plasma protein-A [PAPP-A]), the detection rate for chromosomal abnormalities increased to 90%.[2] A large NT measurement (>3.5 mm measured when CRL is between 45 mm and 84 mm)[2] was also shown to be associated with other chromosomal abnormalities, syndromes, heart defects, defects of the great vessels, and fetal skeletal dysplasia.

Nicolaides et al. also showed that standardization of the method of measurement of the NT was essential for its' reproducibility and developed the Fetal Medicine Foundation (FMF London, UK) NT measurement criteria and the 11–13 weeks training/certification program, which has been widely adopted (https://fetalmedicine.org/education/the-11-13-weeks-scan). Figure 1 is an example of an NT measurement scan, showing the FMF criteria. The image was obtained ML on a fetus in a neutral position. The image is magnified to include only the chest and head. The nasal bone, skin line anterior to the nasal bone, nose tip, mandible tip, palate, intracranial translucency, and diencephalon are all demonstrated. The NT is measured at the thickest point with the calipers placed perpendicular to the NT, crosshairs "on" the borders of the NT.

For centers offering NT for aneuploidy screening using the FMF risk algorithm, the NT scans should only be performed by sonographers with FMF UK certification who comply with ongoing yearly audits to ensure the requirements were adhered to.[2]

As of 2003, evidence supported a correlation between fetal nasal bone ossification at 11–13+6 weeks

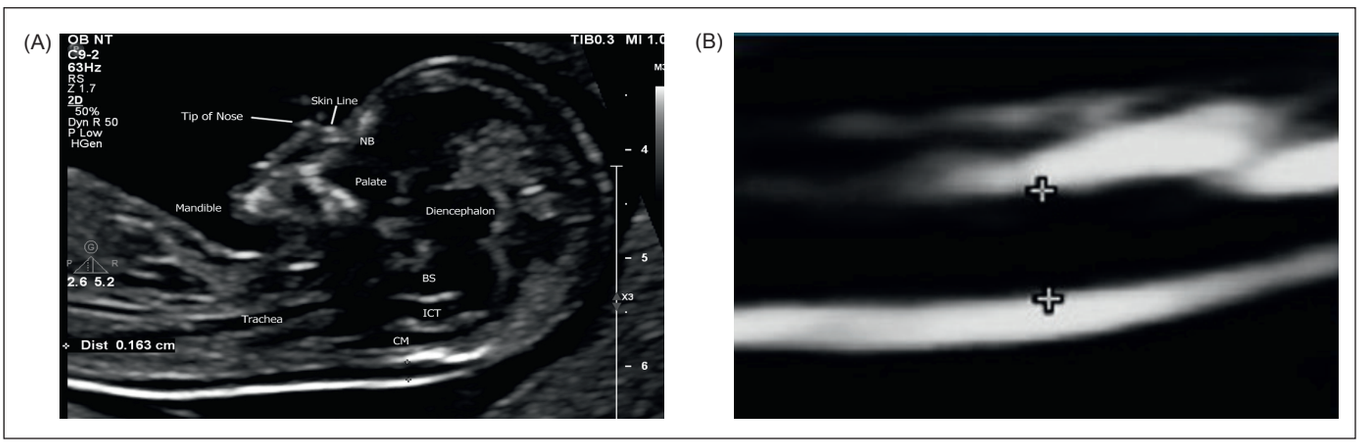


Figure 1. (A) The NT measurement should be taken on a ML sagittal image with the nasal bone seen (should not see zygoma) magnified so only head and thorax are in image. Head should be in neutral position (flexion or extension will alter measurement). Amnion should be visualized. Demonstration of the brain stem (BS), intracranial translucency (ICT), cisterna magna (CM), nasal bone, upper palate, tip of the nose, ML spine are required for an accurate measurement. (B) Calipers placed perpendicular to the nuchal translucency with the cross hairs "on" borders of NT.

and fetal trisomy. Cicero and others showed that the nasal bone was absent or hypoplastic in 60–73% of fetuses with Trisomy 21, 53–57% Trisomy 18, 32–45% Trisomy 13 and 9% of Turners syndrome at the 11–13+6 week scan.[3,4] Increased sensitivity for demonstration of the nasal bone was achieved if the assessment was performed after 12 weeks gestation.[3,4] As with NT, the FMF UK has developed a training and certification program for nasal bone assessment to ensure standardization of technique and compliance with ongoing quality assurance, allowing sonographers to become certified in nasal bone imaging in conjunction with NT licensing. https://fetalmedicine.org/education/the-11-13-weeks-scan. The MFM recommended protocol for the 11–13+6 week scan is displayed in Table 1.

From 2005-2007 evidence supported the additional evaluation of fetal anatomy at the time of the 11–13+6 week NT scan to detect major structural anomalies.[5] Improvements in ultrasound imaging provide better resolution of fine structures. By expanding the fetal anatomical survey during the first trimester, it is possible to detect approximately 50% of major abnormalities.[5]

In 2013 a systematic review of the literature for 11–14 week scans found the overall detection rate of fetal structural anomalies was 51% when a basic anatomy scan was included. This improved to 62% with the addition of endovaginal ultrasound.[6] Detection rates were improved to 67% when the patient had a known increased risk for abnormality (e.g., large NT).[6] The authors identified those factors that had a proven influence on screening performance. Changing the time frame to 12–14 weeks improved the detection rate even further. The inclusion of a standardized protocol, use of endovaginal scanning when visualization is suboptimal, sonographer training, and quality of equipment were all identified as factors that would improve detection rates with these scans.[6]

ISUOG (International Society of Ultrasound in Obstetrics and Gynecology) published the first practice guidelines the same year for the first-trimester anatomy scan.[7,8] The basic anatomy recommended on first-trimester ultrasound scan to detect not only aneuploidy risk but also structural anomalies is outlined in Table 2. Figure 2 demonstrates this anatomy.

Additional complementary papers detailed which anomalies should always be detectable, anomalies that are detectable approximately 50% of the time, and those that are not likely to be demonstrated in the first-trimester scan if anatomy is assessed. Syngelaki et al. provided a breakdown of anomalies and their relative probability of detection on a first-trimester anatomy scan (Table 3, Figure 3).[7]

Table 1. Current Protocol for 1st Trimester Screening Ultrasound

Protocol for the Nuchal Scan (First Trimester Screening Ultrasound)
Biometry: Crown Rump Length, Biparietal Diameter
Fetuses/Chorionicity if >1
Fetal Heart Rate
Placenta, Cervix, Adnexa
Amniotic Fluid Volume (qualitative assessment)
Nuchal Translucency
Nasal Bone

Table 2. Basic 1st Trimester Anatomy Protocol Recommended by ISUOG.

Basic 1T Anatomy Protocol (present / absent)
Cranium, Choroids, Profile
Midline Falx
Nuchal Translucency
Chest/Heart (situs)
Stomach
Cord Insertion (abdomen)
Bladder
Extremities • 3 segments (+hands/feet)
Placenta

Ultrasound Obstet Gynecol 2013; 41: 102-113.

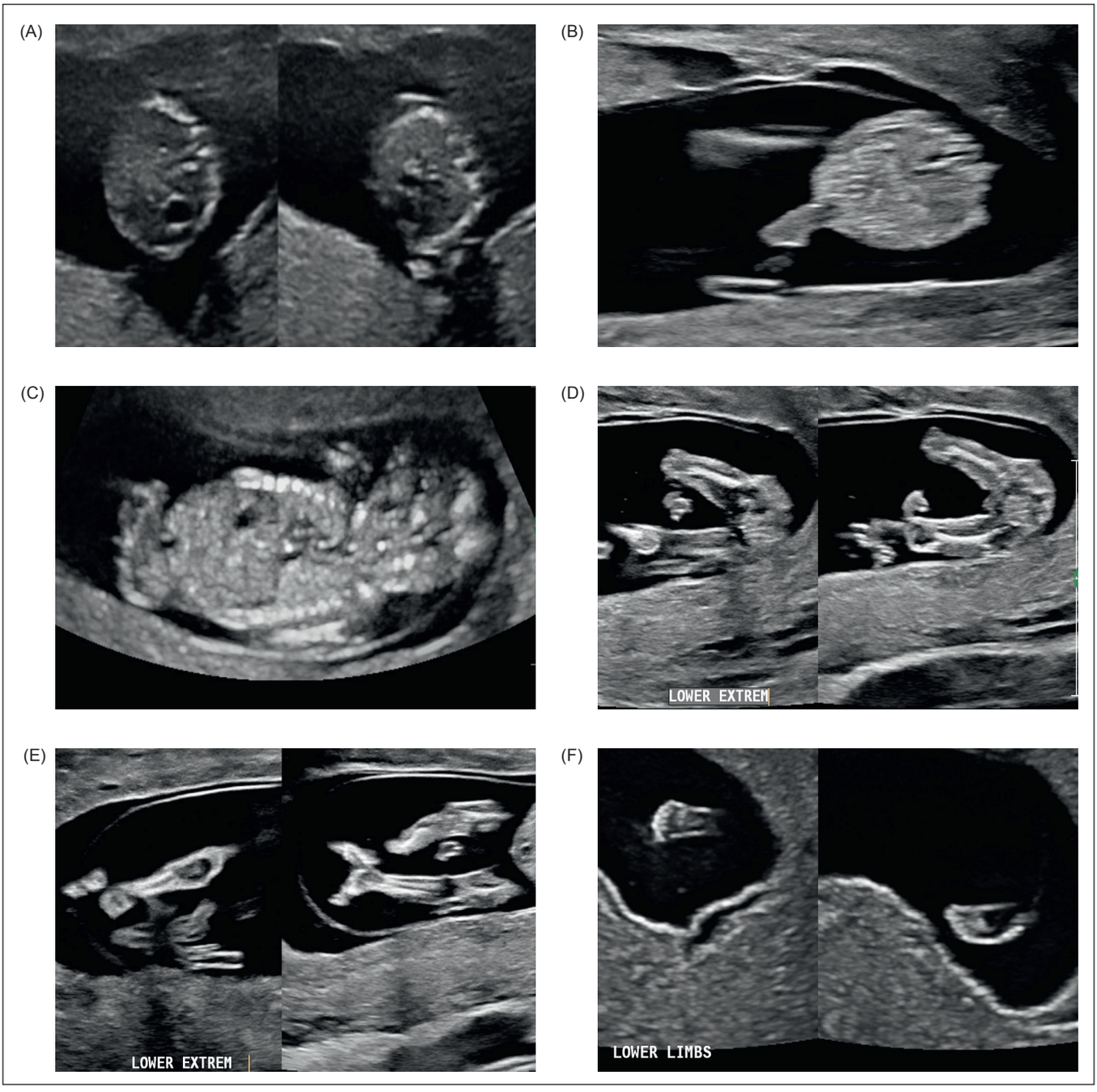


Figure 2. Anatomy recommended for First Trimester Basic Anatomy Scan. (A) Stomach in left quadrant, (B) Intact abdominal wall with cord insert, (C) Bladder in fetal pelvis (coronal image bladder/stomach/heart/lungs/diaphragm), (D,E,F) Major bones of lower extremity.

ISUOG updated its recommendations in 2019, but the only pertinent change was a recommendation that basic fetal anatomy should be reviewed whenever obstetric ultrasound is done at 11–14 weeks, while women with increased risk of fetal structural and genetic abnormalities can be offered enhanced screening if performed by ultrasound providers with appropriate imaging expertise.[9,10] The list of basic anatomy to be reviewed was unchanged from the 2013 guidelines.

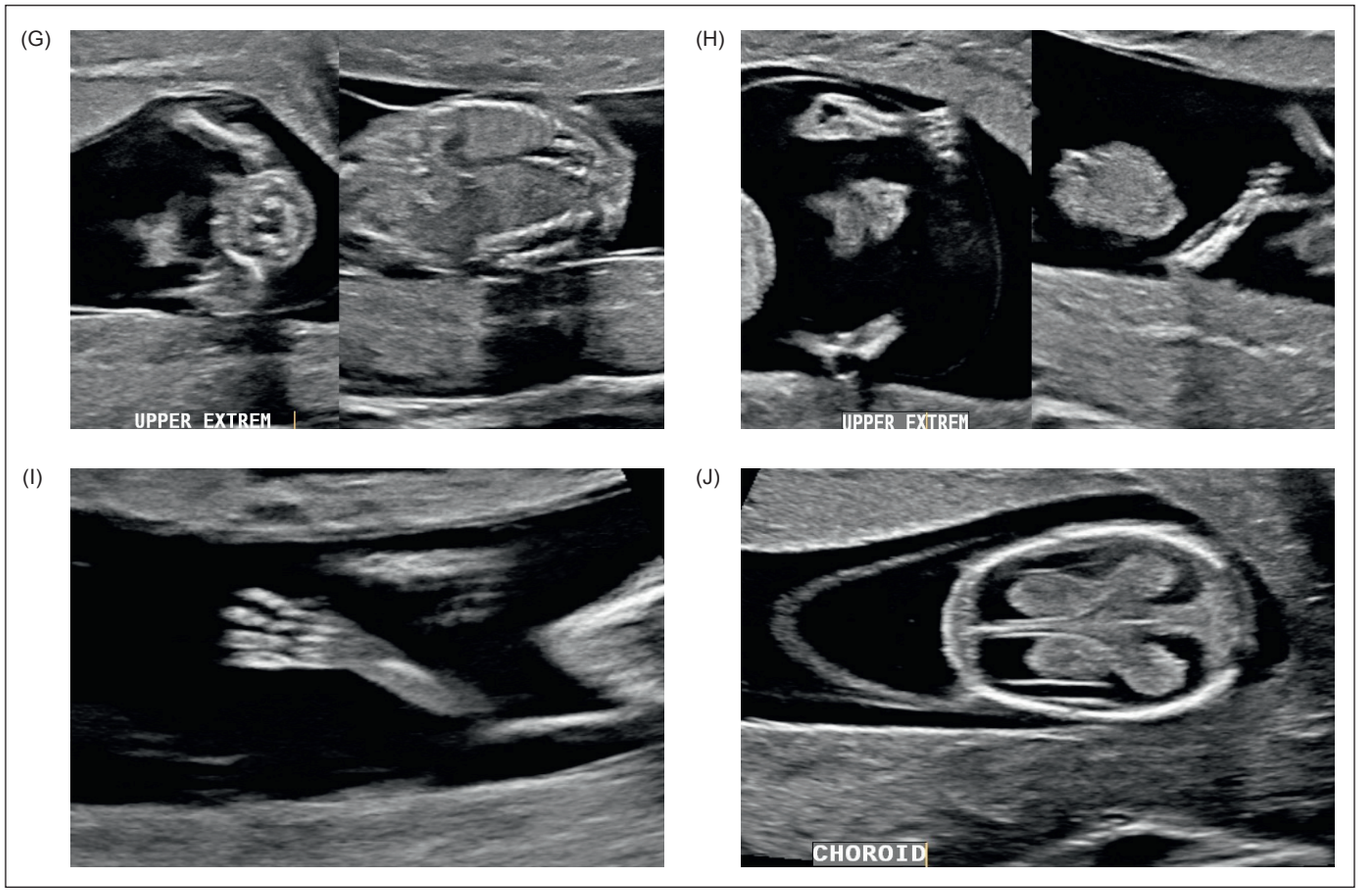
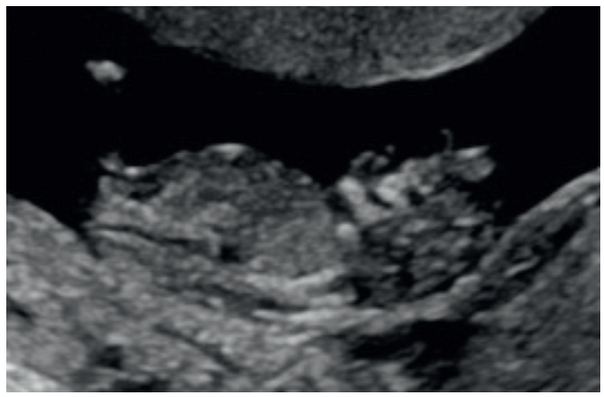


Figure 2. (G,H,I) Major bones of upper extremity, (J) Cranial ossification, choroid plexus.

Table 3. Breakdown of Anomalies Diagnosable, Potentially Diagnosable, and Likely Not Diagnosable In the First Trimester If Anatomy Scan Performed.[7]

Always Diagnosable (100%)	Potentially Diagnosable (~50%)	Likely NOT Detectable (<10%)
Anencephaly	Open Spina Bifida	Ventriculomegaly
Alobar Holoprosencephaly	Lower urinary obstruction	Agenesis of corpus callosum
Encephalocele	Fetal akinesia sequency	Isolated cleft lip
Pentalogy of Cantrell	Lethal skeletal dysplasia	CPAM
Ectopia Cordis	Dandy Walker malformation	VSD
Abdominal wall defects	Major heart defects	Unilateral renal agenesis, multicystic kidney, hydronephrosis, duplex kidney
Megacystis	Diaphragmatic hernia	Hypospadias
Phocomelia	Polydactyly	Talipes
Body Stalk Anomaly		

(A)



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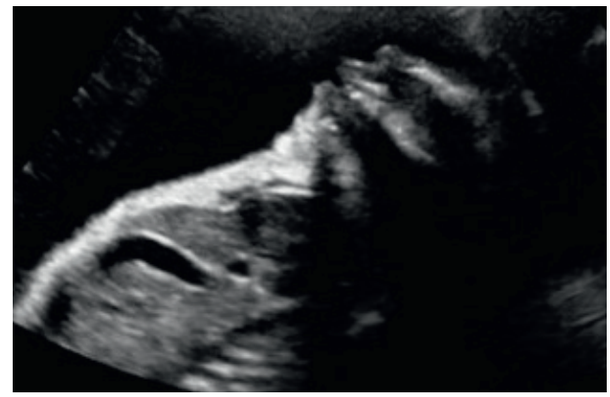

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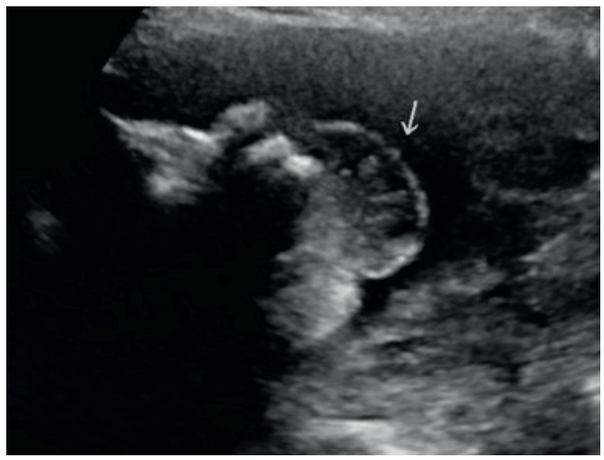

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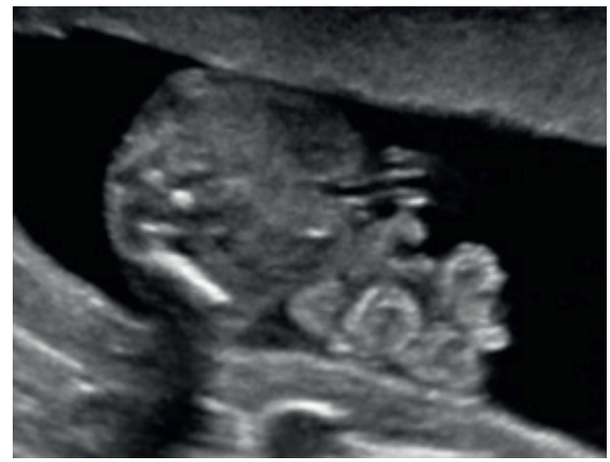

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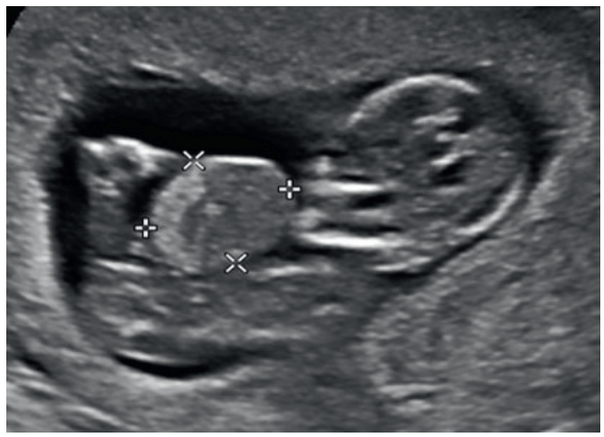

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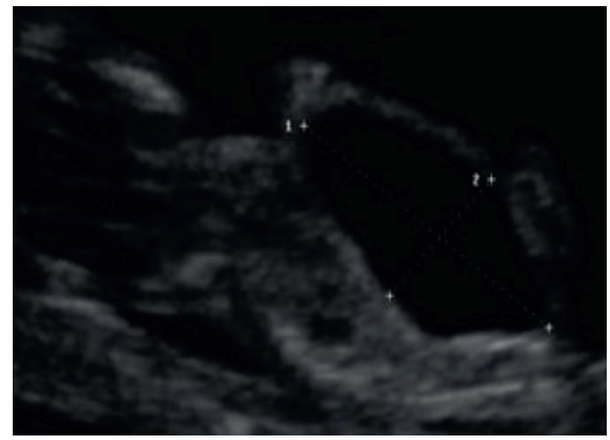

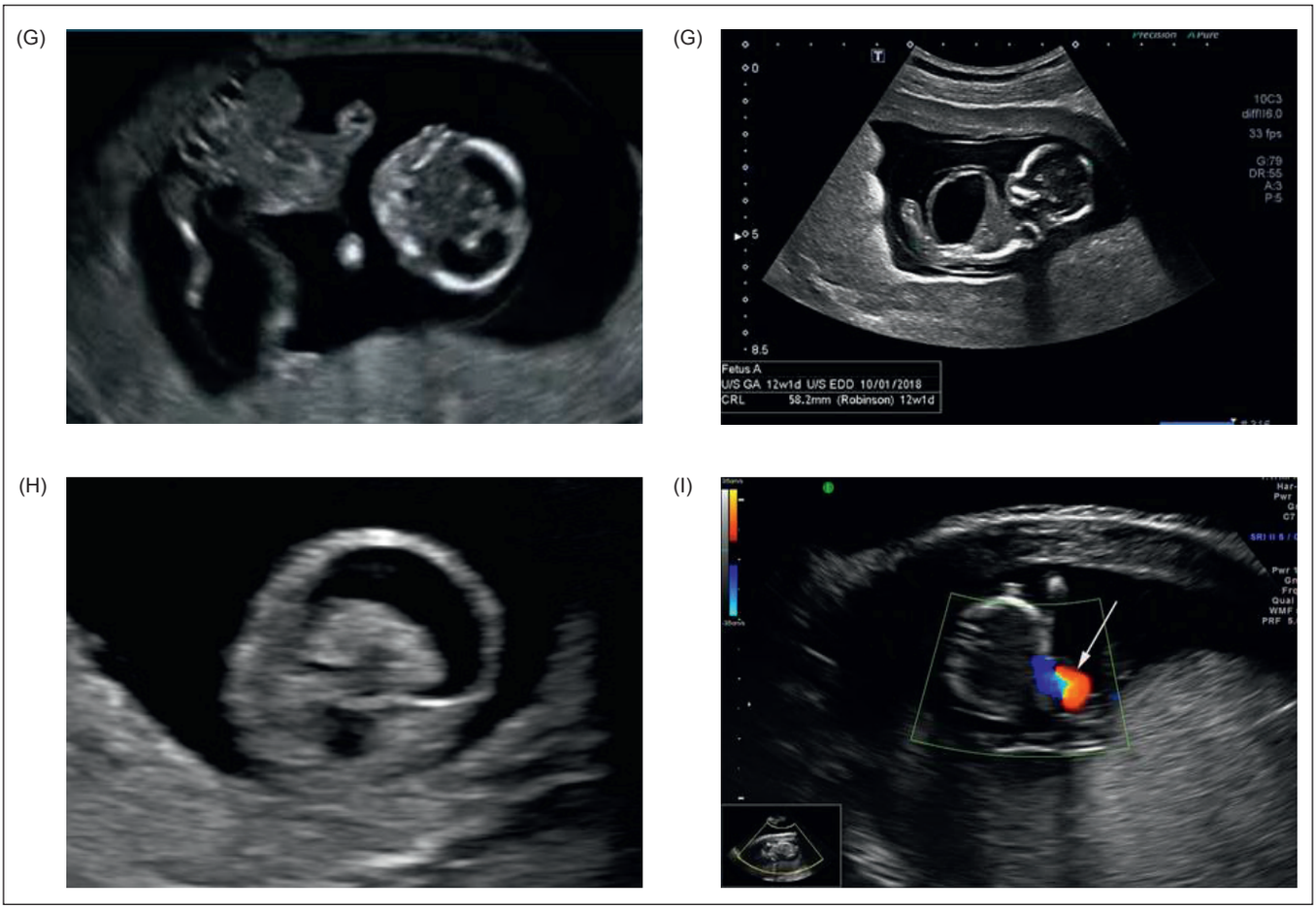

Figure 3. 8 Major anomalies are always detectable if an anatomy scan is performed in first trimester. (A) Acrania, (B) Anencephaly, (C) Encephalocele, (D) Gastroschisis (E) Omphalocele. (F) Body Stalk Anomaly, (G) Megacystis, (H) Holoprocencephaly, (I) Ectopia Cordis.

The most recent ISUOG practice guideline, published January 2023, sets a new recommended 2-tiered approach to the 11–14-week scan. The first tier utilizes the previously recommended anatomy scan as the minimum required testing assessment.[11–15] These minimum requirements are listed in Table 4. Image 4 illustrates the additional images needed in combination with those in Figure 2 to complete the minimum requirements for the 11–14 week scan. Abnormal findings from the first-tier scan or high-risk maternal risk factors would reflex the patient to the second-tier scan. This additional scan is a comprehensive and detailed assessment of the fetus that should be performed by technically qualified personnel at MFM or tertiary care centers. Recommended second-tier anatomy is outlined in Table 5.[15] Additional recommendations from the practice guideline include an assessment of uterine artery Doppler as a marker for increased preeclampsia risk and biochemical testing recommendations detailing appropriate usage[15] (outside the scope of this review).

Current Standard in Canada

Current standards in Canada recommend the first-trimester ultrasound be used for: dating, an indication-based early anatomic review, the NT measurement for aneuploidy, multivariable preeclampsia (PE) risk assessment, and use of open neural tube defect (oNTD) markers for screening where expertise and resources exist.[10] These standards do not include which anatomy should

Table 4. ISUOG New Guideline 2023 Minimum Scan Criteria for 11-14 Week Scan, Optimal Visualization After 13 Weeks.[15]

Minimum Requirements for Scan at 11-14 Weeks Gestation	
Anatomic Region	**Minimal Requirement for Scan**
General	Confirm singleton pregnancy
Head and Brain	Axial View of head to demonstrate: Calcification of cranium, contour/shape of cranium (no bony defects), 2 brain halves separated by interhemispheric falx, choroid plexuses almost filling lateral ventricles in their posterior two-thirds (butterfly sign)
Neck	Sagittal view of head and neck – confirm whether nuchal translucency thickness <95th percentile
Heart	Axial view of heart at level of four chamber view – heart inside chest with regular rhythm
Abdomen	Axial view – stomach visible, intact abdominal wall. Axial or sagittal view – bladder visible and not dilated
Extremities	Visualize four limbs, each with three segments
Placenta	Ascertain normal appearance without cystic structures
Biometry	Sagittal view – crown-rump length and nuchal translucency thickness Axial view – biparietal diameter.

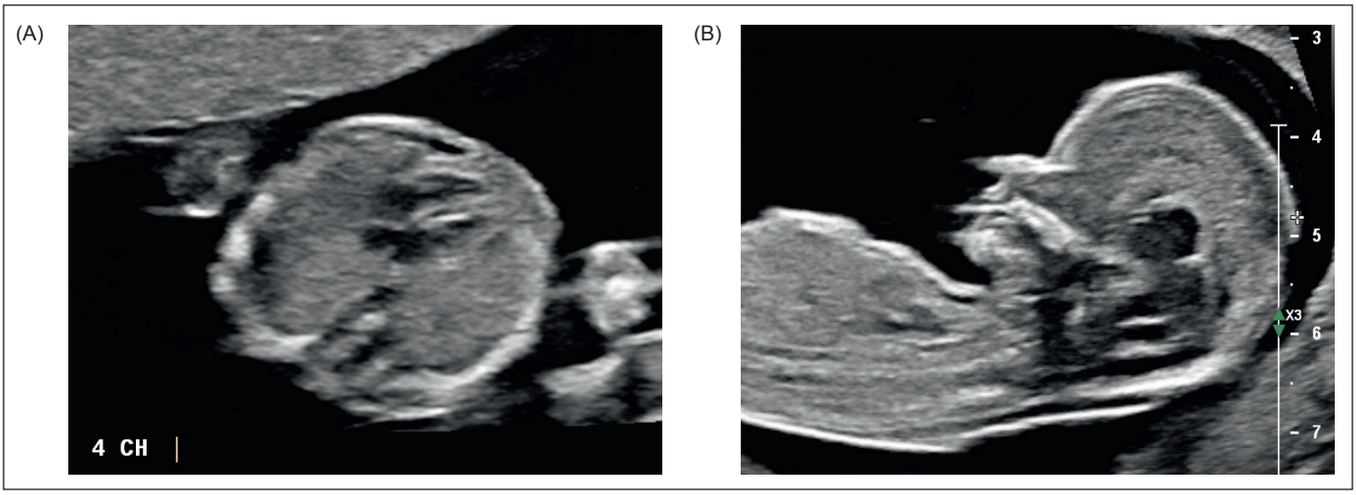

Figure 4. Additional images recommended by ISUOG 2023 guideline for minimal anatomy First Trimester Anatomy Scan. (A) Axial 4-Chamber Heart, (B) Profile (head/neck).

be included in the anatomic review. Equity of care across Canada is poor as many 11–14 week ultrasound exams are still performed using the protocol developed and implemented in 2003 (see Table 1). Other first-trimester providers have adopted the inclusion of some or all anatomy dictated by department protocols; there is no consistency across local, provincial, or national levels. As a result, all patients are not getting the same standard of care.

Discussion

Performing a first-trimester anatomy scan has determined clinical utility for multiple purposes. Patients with abnormal findings can be referred to a tertiary care/MFM site for a timely comprehensive scan. This maximizes the options parents have for pregnancy management; earlier access to genetic testing/counselling, additional time to consider termination of pregnancy (TOP), and earlier access to TOP.[13] An earlier anatomy scan can reduce maternal anxiety, especially in high-risk patients. Another advantage is with patients with increased BMI. Obesity is a risk factor for fetal anomalies and is known for decreasing the completion rate for routine ultrasound exams in the second trimester. Before the uterus leaves the maternal pelvis the fetus can more easily be scanned beneath

Table 5. ISUOG New Guideline 2023, Anatomical Structures That Can Potentially Be Visualized on Detailed Fetal Scan at 11-14 Weeks Gestation (in sagittal, axial and coronal view as needed).[15]

Detailed Fetal Scan Criteria	
Anatomic Region	**Minimal Requirement for Scan**
General	Confirm singleton pregnancy Overview of fetus, uterus and placenta
Head and Brain	Calcification of cranium, contour/shape of cranium (no bony defects), 2 brain halves separated by interhemispheric falx, choroid plexuses almost filling lateral ventricles in their posterior two-thirds (butterfly sign), thalami, brainstem, cerebral peduncles with aqueduct of Sylvius, intracranial translucency (fourth ventricle), cisterna magna
Face and Neck	Forehead, bilateral orbits, nasal bone, maxilla, retronasal triangle, upper lip, mandible, nuchal translucency thickness, no jugular cysts in neck
Thoracic	Shape of thoracis wall, lung fields, diaphragmatic continuity
Heart	Heart activity present with regular rhythm, establish situs, position – intrathoracic heart position with cardiac axis left (30-60 degrees), size – one third of thoracic space, 4 chamber view with 2 distinct ventricles on grayscale and color doppler in diastole, left ventricular outflow tract view on grayscale and color doppler, 3 vessel and trachea view on grayscale and color doppler, absence of tricuspid regurgitation/antegrade ductus venosus A-wave on pulsed-wave Doppler
Abdomen	Stomach – normal position in left upper abdomen, Bladder – normally filled in pelvis (longitudinal diameter <7mm), abdominal wall – intact umbilical cord insertion, two umbilical arteries bordering bladder, kidneys – bilateral presence.
Spine	Regular shape and continuity of spine
Extremities	Upper and lower limbs, each with three segments and free movement
Placenta	Size and texture normal without cystic appearance, location in relation to cervix and to previous uterine c-section scar, cord insertion into placenta.
Amniotic fluid and membranes	Amniotic fluid volume, amniotic membrane and chorion dissociated physiologically

a maternal pannus. The first-trimester anatomy scan objectives can usually be achieved with the ability to perform transvaginal ultrasound in combination with transabdominal scanning. When a first-trimester anatomy scan has been performed, the interpreting physician can consider the first and second-trimester anatomy scans to evaluate all imaging criteria. It is often easier to see the fetal profile and extremities in the first trimester than during the second trimester's routine exam. Finally, the entire fetus can be imaged in one view. A midline sagittal image of the fetus can assess as many as 12 different criteria in one image (CRL, profile, NT, Nasal bone, Maxilla, Mandible, Mid-brain, Bladder, Cord insertion, Extremities, Fetal sex, and Ductus venosus) (Figure 5).[13]

Non-invasive screening based on cell-free DNA (NIPS) has emerged as the best screening test for common trisomies (21, 13, 18). NIPS detects chromosomal abnormalities; it does not evaluate for congenital structural anomalies. Hence, whenever NIPS is done, it should be complemented by a first-trimester anatomy scan. While NIPS can be done before or after the first-trimester scan, there are certain advantages of offering it after the first-trimester scan. This is because NIPS may not be indicated if a large NT or fetal anomalies are detected due to the significant association with atypical chromosome abnormalities not detectable by NIPS. Either of these scenarios should elicit immediate referral for the comprehensive scan at tertiary care/MFM, allowing the patient to be provided the appropriate genetic counselling and testing options. In addition, structural anomalies (2–3%)[13] are far more common than chromosomal anomalies (1:700 overall incidence).[13] Performing the scan first ensures triage of patients

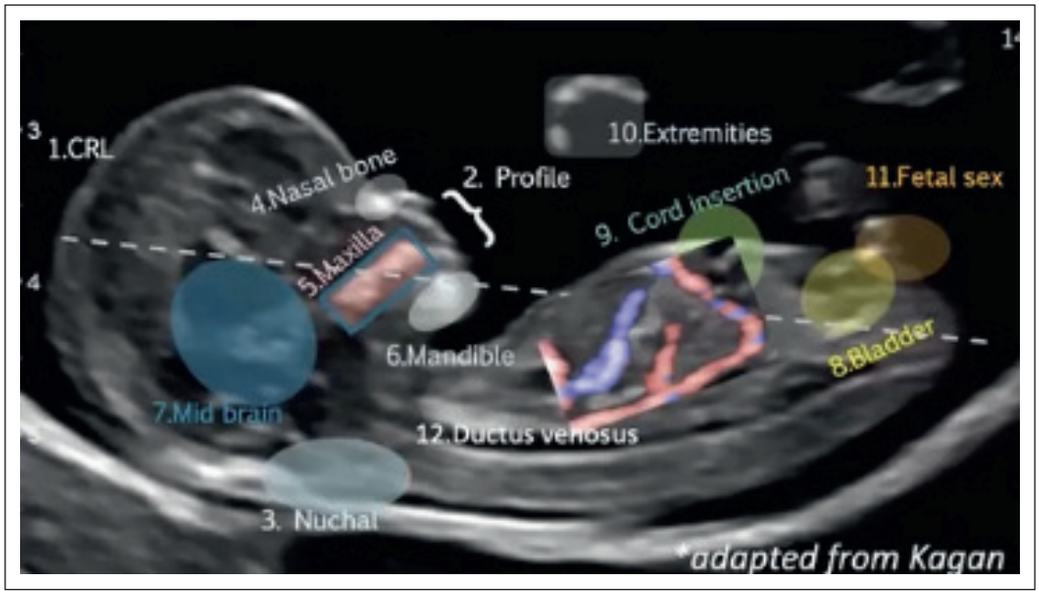

Figure 5. Demonstrates the fetal anatomy demonstrated on a good midline sagittal image of the entire fetus. This anatomy includes (1) CRL, (2) profile, (3) Nuchal translucency, (4) Nasal bone, (5) Maxilla, (6) Mandible, (7) Mid brain, (8) Bladder, (9) Cord insertion, (10) Extremities, (11) Fetal sex, (12) Ductus venosus. Hoopmann M, Kagan O. The Fetal Profil. Ultraschall in Med 2017; 38: 611–618.

to the appropriate subsequent testing (i.e., invasive testing amniocentesis or CVS versus NIPS). This approach also has the potential to be cost-effective, expedite referral to MFM/tertiary care, and decrease the incidence of undue parental expectation from negative NIPS result.

Conclusion

Including the basic minimal anatomy scan in first-trimester prenatal screening protocols will improve the detection of anomalies. This will offer parents more informed choices earlier in pregnancy. In addition, it will provide better utilization of NIPS-based cell-free DNA testing. In addition, ultrasound imaging will be better optimized for obese patients with the benefit of improved visualization of imaging criteria while the uterus is best positioned for imaging, and with the use of transvaginal sonography. Finally, it allows for the evaluation of imaging criteria from first and second-trimester anatomy scans, improving the completion rate of anatomy criteria and the subsequent management of the pregnancy.

Acknowledgement

Images were graciously provided by MIC Medical Imaging Edmonton AB through Cathy Ridsdale and the University of Calgary Fetal Medicine Department through Dr. Jo-Ann Johnson.

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Better Outcomes Registry & Network

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How is BORN Data Impacting the Quality of Nuchal Translucency Measurements?

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Keywords: BORN, fetal nuchal translucency, screening

The Nuchal Translucency Ultrasound

The fetal nuchal translucency (NT) is a collection of fluid that is present at the back of the fetal neck which is measured by sonographers in the first trimester (11-14 weeks) of pregnancy. The maximum thickness is 3.5 mm. Increased NT thickness can be associated with chromosomal differences, cardiac defects, and genetic syndromes.

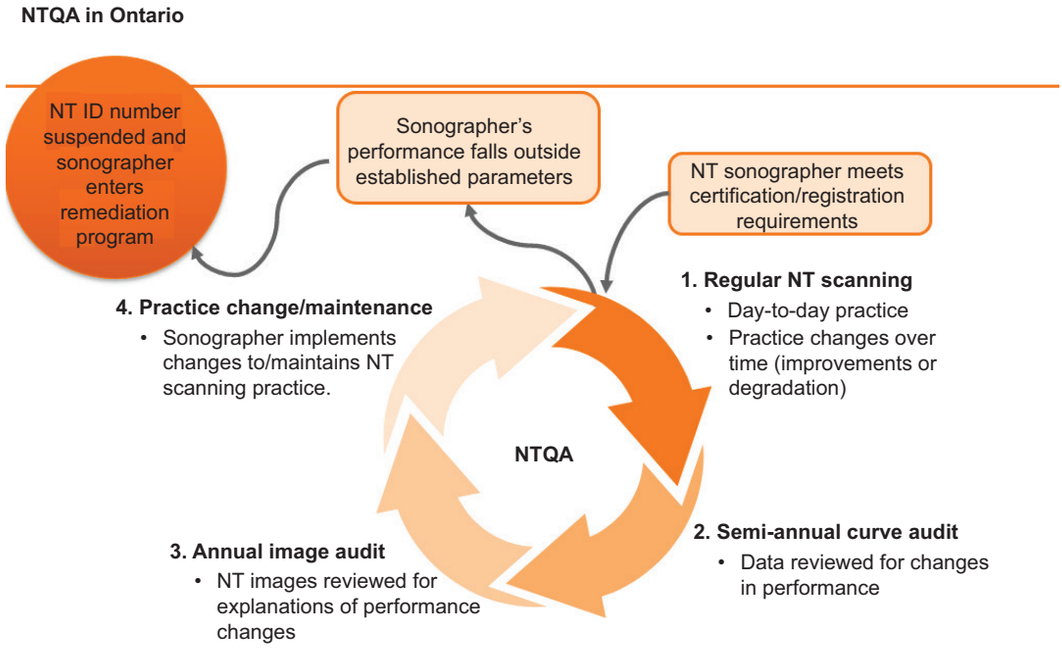
In Ontario, the NT measurement along with bloodwork and demographic information, is submitted to Ontario Multiple Marker Screening (MMS) laboratories. This information is used to calculate a patient's risk of having a pregnancy affected with Down syndrome or Trisomy 18.

What is BORN?

The Better Outcomes Registry & Network (BORN) is Ontario's perinatal, newborn and child registry which collects, interprets, shares and protects high-quality data through the BORN Information System (BIS). Prenatal Screening Ontario (PSO), a program within BORN Ontario, coordinates prenatal screening including the quality assurance of nuchal translucency ultrasound and first trimester screening.

NTQA Program

The Nuchal Translucency Quality Assurance (NTQA) program in Ontario supports NT registered sonographers in their practice by assessing their NT measurement performance and providing them with



actionable feedback to help them improve and/or maintain their skills. All sonographers who wish to provide NT measurements to the Ontario MMS labs must have their own Ontario NT ID number.

Steps to obtain an NT number include 1) Obtain the Fetal Medicine Foundation NT certificate, 2) Register with PSO at BORN Ontario, 3) Collect 15 NT/CRL data points and submit the application to Ontario MMS labs, 4) Receive an NT number. Each registered sonographer has a personalized NT performance distribution curve based on BIS data.

Summary

Professional bodies recommend that sonographers participate in a formal NTQA program if taking NT measurements, as measurement and screening quality can deteriorate over time. PSO's unique NTQA data based program allows sonographers to review their own NT distribution curve, understand biases and habits in their ultrasound practice, and enhance their performance.

To hear about one sonographer's personal experience with the NTQA program, see Katie's story: https://www.bornontario.ca/en/publications/born-2021-2022-annual-report.aspx

Visit the Prenatal Screening Ontario website (https://www.prenatalscreeningontario.ca/en/pso/for-sonographers/for-sonographers.aspx) to find information including:

- Obtaining an Ontario NT ID number
- Logging into the BORN Information System
- Accessing Resources and Point-of-Care Tools
- Maintaining NT Certification
- fetalmedicine.org

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Case Report

Sarah Kamaluddin, BA

Myocarditis Causing Heart Failure

About the Author

Sarah Kamaluddin is a recent graduate of Diagnostic Cardiac Sonography at Mohawk College in Hamilton, ON. She also holds a BA in Kinesiology and Health Science from York University, York

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Abstract

A transthoracic echocardiogram (TTE) and electrocardiogram (ECG) were ordered for a 25-year-old male Caucasian patient. The indication for the test stated shortness of breath and the sensation of a racing heart. The TTE uncovered severely reduced left ventricular systolic function, evidence of diastolic dysfunction, right side dysfunction, bi-atrial enlargement, moderate mitral regurgitation, and mild tricuspid regurgitation. In addition, the ECG revealed sinus tachycardia. Upon analysis of these findings and further investigation into the patient's clinical history, the supervising cardiologist determined probable viral myocarditis causing heart failure.

Keywords: cardiomyopathy, dilated cardiomyopathy, myocarditis, acute myocarditis, viral myocarditis, myocardium, cardiomegaly, sinus tachycardia, dyspnea

Introduction

This case study aims to demonstrate the importance of echocardiography and thorough investigation of medical history in diagnosing myocarditis. Myocarditis is an inflammatory disease of the cardiac muscle, specifically the myocardium. The etiology of myocarditis can be bacterial infections or viral infections, toxins, drugs, autoimmune diseases, or sarcoidosis.[1] Recent studies show that myocardial inflammation is frequently underdiagnosed or overlooked.[2] This demonstrates the significance of further research into the detection of myocarditis to help guide the management of the disease. This is especially important since the prevalence of heart failure is rising.[3] This is hypothesized to be a response to a rise in viral infections leading to an increased incidence of viral myocarditis and subsequent heart failure.[4]

Myocarditis can be described as a triphasic disease process. Starting with initial myocardial injury, leading to autoimmune myocardial injury, and progressing to Dilated Cardiomyopathy (DCM).[4] With DCM, the heart's chambers are dilated and thinned, making it more difficult to achieve sufficient blood flow throughout the body. Upon TTE assessment, the patient progressed to dilated cardiomyopathy (DCM).

Case Description

The 25-year-old Caucasian male initially went to his local hospital's emergency department, presenting with dyspnea and orthopnea. He expressed that he felt as if his heart was racing and felt some fatigue. Additionally, he reported that he was getting over a cold he had a couple weeks ago. He denied it was COVID-19, as he had taken multiple tests. Another COVID-19 test was taken during his visit, which also came back negative. His medical history was taken, uncovering he had asthma as a child. He was also obese, with a body surface area greater than 30. Otherwise, the patient was healthy and was not on any medication.

A Computed Tomography Pulmonary Angiogram was ordered for the patient to rule out pulmonary embolism. The test returned negative for pulmonary embolism; however, it showed infectious/inflammatory nodularity throughout the lungs and cardiomegaly. He was prescribed anti-inflammatory drugs for this finding, and blood work was also ordered. The blood work came back normal except for elevated troponin levels. Elevated troponin levels are a marker of myocardial damage and indicate a need for further testing. The patient was not admitted to the hospital, although a cardiologist consult was quickly arranged and an urgent echo and ECG were ordered.

The ECG displayed sinus tachycardia, explaining the racing heart symptoms the patient was feeling. TTE findings revealed that all heart chambers were dilated and there was severe global hypokinesis of the left ventricle (LV). The left ventricular systolic function was severely reduced with an ejection fraction (EF) of 20% calculated using Simpson's method (Figures 1-4). In the parasternal long axis (PSLAX) view the left ventricular internal diameter was 7.68cm measured in diastole (Figure 5). This indicates a severely dilated LV, as normal values range from 4.2-5.8cm for men. The left atrium dimension was measured in systole, dilated at 5.4cm (Figure 6) where normal values are less than 4.1cm in men. The right ventricle displayed mildly reduced global systolic function based on

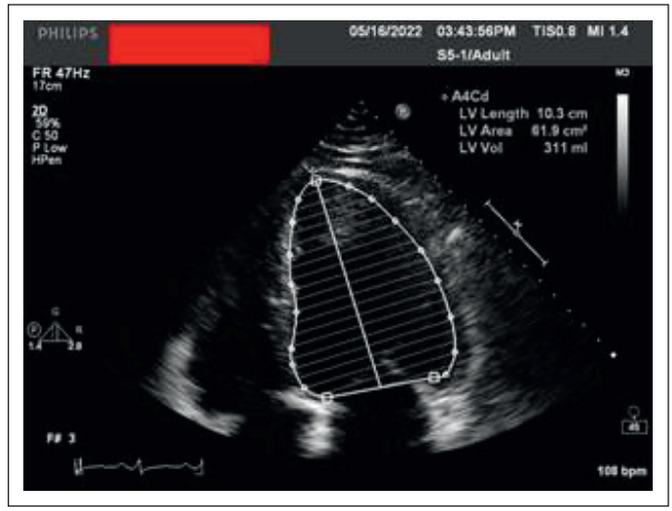

Figure 1. Trace of LV in diastole. Apical 4Ch for EF by Simpsons method.

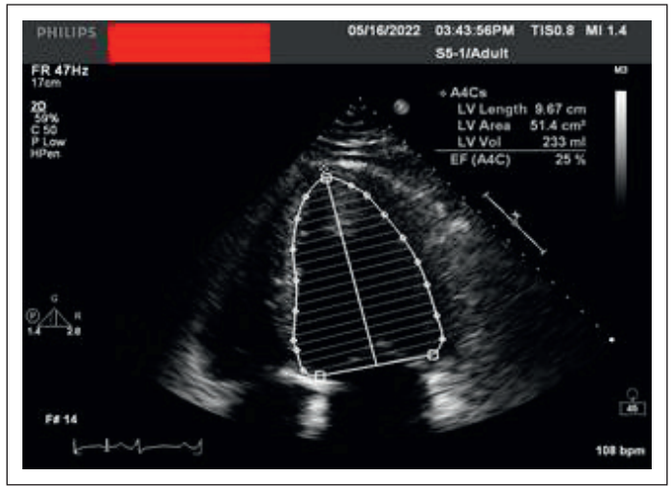

Figure 2. Trace of LV in systole. Apical 4Ch for EF by Simpsons method.

Tricuspid Annular Plane Systolic Excursion (TAPSE at 1 cm) and Tissue Doppler Imaging (TDI at 6.6 cm/s) in the four-chamber view. Biatrial enlargement was present, with a severely enlarged left atrium indexed (LAVi) to 72 mL/m^2, measured in the apical two-chamber view (Figure 7). Due to the dilation of the LV, apical tenting is present in the mitral valve (Figure 8). Subsequently, mitral regurgitation (MR) is seen in the apical 4-chamber view with colour doppler (Figure 9). The MR was calculated as moderate (Figure 10). Also present is Mild

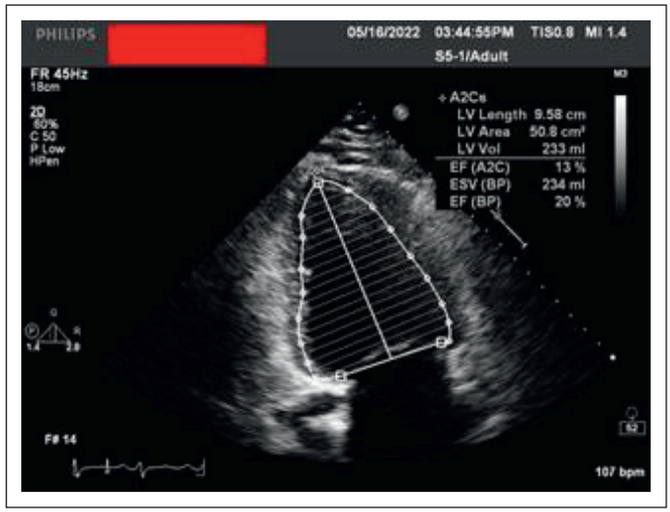

Figure 3. Trace of LV in systole. Apical 2Ch for EF by Simpsons method.

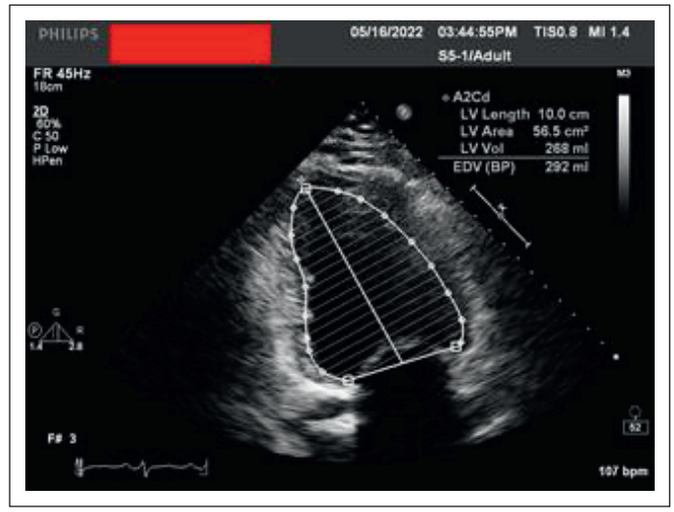

Figure 4. Trace of LV in diastole. Apical 2Ch for EF by Simpsons method.

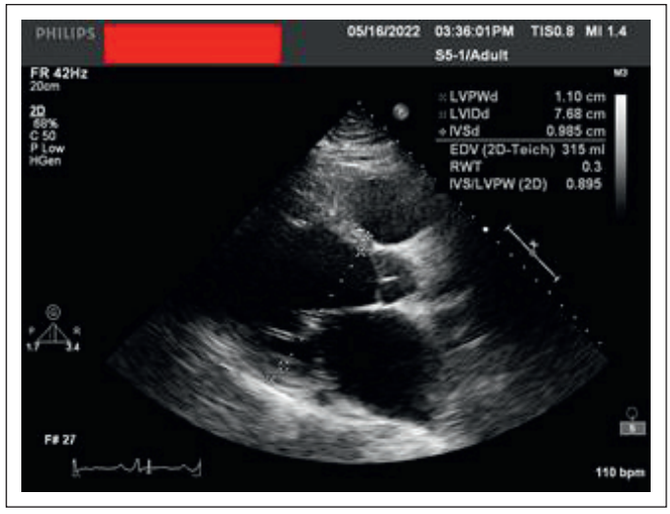

Figure 5. LVID is 7.68cm measured in diastole in PSLAX view. LV dilation.

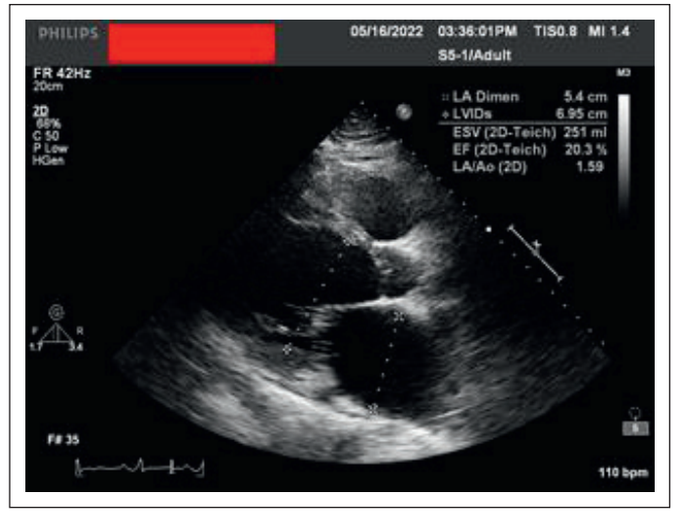

Figure 6. LA dimension was measured in systole, dilated at 5.4cm. LA dilation.

tricuspid regurgitation with Normal right-sided pressures (RVSP=28 mmHg, RAP= 8 mmHg). Lastly, the inferior vena cava (IVC) was normal in size but only partially responsive to inspiration.

Upon discovering these findings, the sonographer urgently informed the supervising cardiologist. The cardiologist then consulted with the patient immediately, after which the patient was sent to the emergency department of a nearby hospital. This patient was admitted to the hospital for three days, where Magnetic Resonance Imaging (MRI) was performed. The findings included patchy myocardial edema with an extracellular volume of 35%. Left ventricular EF was severely reduced at 17%, lower than detected with echocardiography. Myocardial scarring was also found at the basal anteroseptal segment and right ventricular insertions at the basal inferoseptal segments. Dilation of all the heart's chambers was also found.

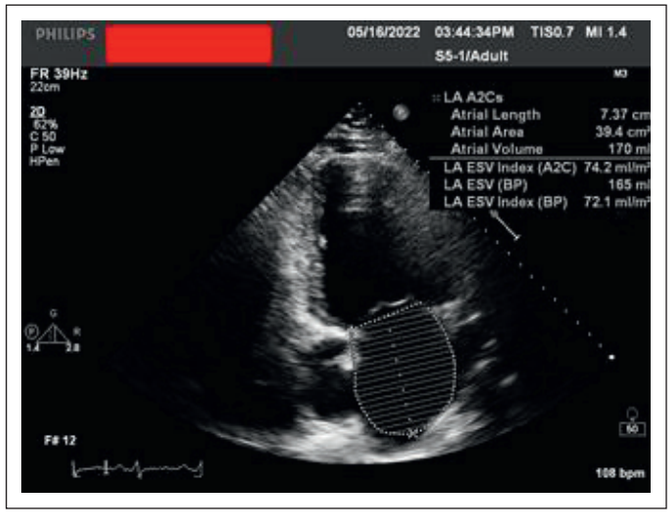

Figure 7. LAVi to 72ml/m^2, measured in the apical 2Ch view. Severely enlarged LA.

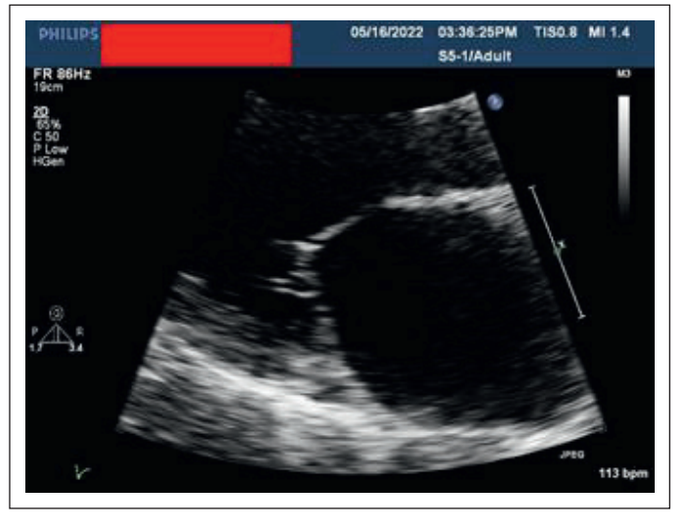

Figure 8. Apical tenting of the MV in zoomed PSLAX view.

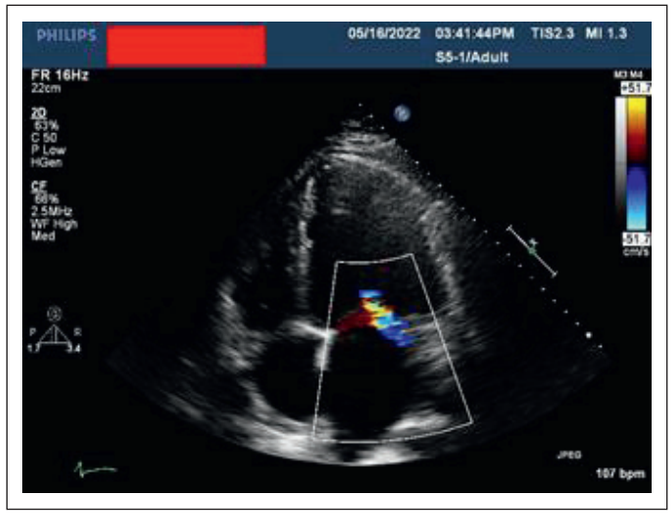

Figure 9. Eccentric MR seen in apical 4ch view with colour doppler.

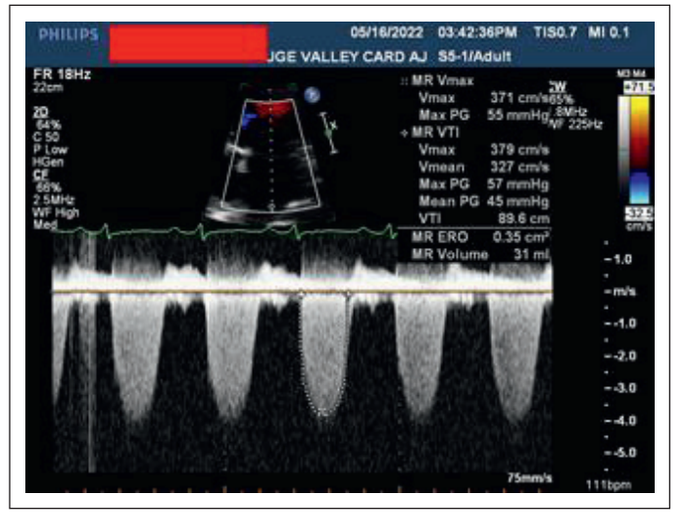

Figure 10. Pulse wave spectral doppler of moderate MR calculated by PISA method.

Discussion

These findings reflected acute myocarditis and led to its diagnosis in the context of DCM. The TTE effectively determined the function of the heart and wall motion abnormalities leading to the patient's admittance to the hospital. Myocarditis causing DCM was a probable diagnosis following the patient's history of flu-like symptoms only a couple weeks before the onset of dyspnea and heart racing. This indicated to the cardiologist that viral myocarditis would be the probable diagnosis of the patient's heart failure. Without the knowledge of previous viral infection, a differential diagnosis of DCM could have been made. This is significant as it highlights the importance of obtaining a previous medical history. It also indicates the importance of using various imaging techniques to help in diagnosis. The MRI results further supported this diagnosis as scarring indicated myocardial damage from viral infection.

A treatment plan was developed, and medical therapy was prescribed to the patient for the treatment of heart failure. This includes drugs for increased heart rate, blood pressure, and volume overload, specifically, Carvedilol, Perindopril, Lasix, Spironolactone, Forxign, and Lancora. In addition, the patient will be monitored closely and continue timely follow-ups due to the severity of heart failure. Rehab services were also offered to the patient, including cardiovascular rehabilitation assessment, lifestyle coaching, guided exercise training, and nutritional support.

Conclusion

With myocarditis, damage to the myocardium leads to myocyte injury, leading to heart muscle inflammation. This can lead to ongoing myocyte damage and potential heart failure causing death. This is significant as a viral infection is typically the most common cause of myocarditis in the western world.[5] Since myocarditis can present itself in an array of symptoms ranging from mild dyspnea to sudden death, it is difficult to diagnose. Often, it is a diagnosis of exclusion based on clinical presentations and imaging findings.[2] Thus, TTE was an integral step in determining diagnosis as it revealed severe global hypokinesis and severely reduced EF with DCM. However, more research is still required on detecting viral myocarditis to adequately and more promptly treat the consequences of the disease.

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Principles of Consent

Kathryn Frelick, H.B.Sc, LL.B
Maddi Thomas, BA, JD

Does My Patient Understand What I Am About To Do?

About the Authors

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Maddi Thomas is an articling student at Miller Thomson in the Toronto office. She has spent much of her articles working with the Health Group. Prior to and during law school, Maddi worked at several health policy institutes in Toronto and Montreal.

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Introduction

A 17-year old patient walks into your office for an ultrasound exam of their abdomen.

- Do you, as the sonographer, need to obtain consent prior to performing the procedure, or was it the responsibility of the patient's referring physician to get consent?
- Can a 17-year old patient give consent?
- What qualifies as informed consent in this situation? What are best practices for obtaining informed consent?

This article will help you, as a sonographer, answer the above questions and provide you with a broad understanding on the principles of consent.

Overview: What is Consent to Treatment?

Generally, the following elements are required for a patient to provide consent, either expressly or impliedly,[1] to treatment or medical care:

- the patient must be *capable* to consent;
- consent must *relate to the specific treatment or procedure*;
- consent must be *informed*;
- consent must be given *voluntarily*; and
- consent must not be obtained through *misrepresentation or fraud*.

While these broad principles underlie the doctrine of consent, provincial regulatory bodies, certain provincial legislation and common law (i.e. case law or judge-make law) impose specific requirements related to informed consent.[2] Thus, the information in this article is general in nature and does not represent an exhaustive list of a sonographer's legal responsibilities, nor is it a substitute for obtaining legal advice.

Broad Principles of Consent

The term 'treatment' is broad, and includes anything that is done for a therapeutic, preventative, palliative, diagnostic, cosmetic or other

[1] *Health Care Consent Act*, section 11(4).

[2] See: *Health Care Consent Act* in Ontario or *Health Care Consent and Facilities Admission Act* in British Columbia.

health-related purpose, such as a procedure.[3] There are a number of criteria that apply for patient consent to treatment to be valid in Canada:

The Patient Must Have the Capacity to Consent

Consent can only be valid if the person providing the consent has the capacity to provide it. Sonographers and other health professionals can rely on a presumption of capacity, unless it is not reasonable in the circumstances to do so. For example, questions relating to capacity typically arise in situations where a patient is a minor, or where an individual has been diagnosed with cognitive impairment or disability. However, these factors alone do not determine capacity, which may fluctuate with time or depending on the treatment/procedure. A minor or someone with cognitive decline and impairment can still provide a valid consent to a treatment/procedure in certain circumstances. It is the healthcare professional's responsibility to assess the individual's capacity to provide consent.

Although it is the responsibility of the health professional obtaining consent to determine capacity, capacity is a legal test. For example, Ontario's *Health Care Consent Act* provides that a person is capable with respect to a treatment if the person is able to understand the information that is relevant to making a decision about the treatment … and able to appreciate the reasonably foreseeable consequences of a decision or lack of decision. In the leading case on this issue, the Supreme Court of Canada noted it is the *ability* to understand and appreciate that is important in making this determination, rather than actual understanding or appreciation.[4] As long as the person is able to appreciate the nature and consequences of a medical procedure, he or she may give a valid consent. There is no specific age at which an individual can give consent. The ability of a young person to provide consent will depend upon the individual's level of maturity and intellect as well as the seriousness and complexity of the treatment involved.

If there are concerns about capacity, refer to your province's practice guidelines or legislation to determine who the patient's substitute decision maker may be. If there is any question as to whether the patient may not appreciate the nature and consequences of the consent discussion due to a language barrier, the healthcare practitioner requesting the intervention must ensure that an interpreter is involved.

Consent Must Relate To The Treatment

The consent that a patient provides must relate to the specific treatment/procedure that the healthcare practitioner is proposing or recommending.

The healthcare practitioner does not have to obtain a patient's consent for every single step of a treatment plan. If the method of treatment that is being proposed for a patient consists of a course of treatment over a period of time, it is not necessary to obtain a separate consent for each stage of the treatment. However, the entire course of treatment should be discussed with the patient.

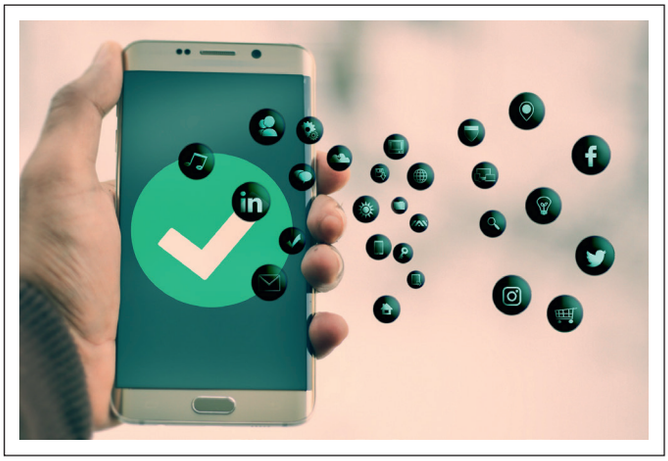
If the healthcare practitioner is including other individuals in the administration of the procedure to a patient (i.e. sonographers, student sonographers, etc.), then they must ensure that the patient is advised of the fact that others will be involved in providing treatment and the patient consents to their involvement.

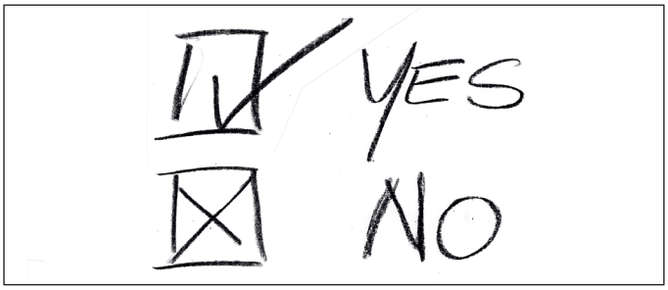
Consent Must be Informed

This is a major component of consent in a healthcare setting. For consent to a treatment/procedure to be considered valid, it must be **"*informed*" consent.** In order to be informed:

- The patient must have been given an ***adequate explanation*** about the ***nature*** of the proposed examination or procedure. This means that the person must receive the information that a "reasonable person" in the same circumstances

[3]See for example, Ontario's *Health Care Consent Act* at section 2.
[4]See for example, the Supreme Court of Canada decision in *Starson* v. *Swayze* [2003] S.C.R. 722





would require in order to make a decision about the treatment.

- The patient must understand the examination or procedure's ***expected benefits or anticipated outcome***;
- The patient must understand the ***material risks and material side effects*** involved and ***alternatives available***.

To be clear, while providing a patient with an explanation of the treatment/procedure, as a healthcare professional you should touch on the nature of the treatment/procedure, the expected benefits, risks and side effects of the treatment/procedure, and the likely consequences of having or not having treatment.

In Canada, the healthcare practitioner proposing the procedure is required to advise a patient about attendant, material and special risks. ***Attendant risks*** are those that are more common. ***Material risks*** are those that are less common, but serious should they occur. Material risks can differ between patients, so the healthcare practitioner should take into account the patient's health and condition when considering what risks are material. Finally, ***specific risks*** include those that are possible with respect to the specific patient.

Healthcare professionals are expected to listen, too. In order for consent to be informed, the patient must be given the opportunity to ask questions, and to receive understandable answers prior to undergoing treatment. Ultimately, the information provided must permit the patient to reach an informed decision about ***whether or not*** to undergo the treatment/procedure. Importantly, consent to the treatment/procedure also includes the right for an individual to ***refuse*** treatment.

Consent Must Be Given Voluntarily

The consent obtained should be free of undue influence and coercion. The patient must not feel pressured or obligated to proceed with the proposed treatment/procedure. Not only should the healthcare professional ensure that the patient does not feel pressured to proceed by another person, the healthcare provider must also ensure that they are not advocating the treatment plan or procedure in such a way that the patient feels they have no choice but to proceed.

Consent Must not be Obtained Through Misrepresentation or Fraud

Consent cannot be properly obtained where there has been a misrepresentation of material information. While the healthcare provider is free to provide the patient with their opinion as to the best course of action, they should be as objective as possible when presenting the information to the patient. Accurate and impartial information on all treatment alternatives must be provided.

Consent can be Implied or Express

Informed consent may be implied or express. Implied consent occurs either by the words or behaviour of the patient or by the circumstances under which treatment is given. An example of implied consent could be a patient arranging and

attending an appointment with a healthcare professional, and answering questions related to their medical history.

Express consent is directly given, either orally, in writing, or by gesture. Where consent is given orally, the sonographer should document the patient's verbal consent in the health record.

Where there is doubt, it is preferable that consent be express. It is prudent for a sonographer to obtain express written consent if the exam is related to a patient's breasts, genitals or rectum.

A Sonographer's Obligations Related to Consent

As healthcare providers, sonographers have a legal duty to ensure that, prior to carrying out any type of procedure with a patient, the patient has consented to that procedure. Failure to ensure informed consent has been obtained may expose you to a potential civil claim and/or proceedings before your provincial regulator.

The healthcare practitioner who proposes the investigation or treatment is ultimately responsible for ensuring the patient has provided informed consent. While the sonographer *should* be able to rely on the informed consent obtained by the physician/authorized health professional, it is still important to verify the individual's consent and to understand the consent process and your obligations to the patient. There is no protection from liability for a health practitioner who acts in reliance upon an apparently valid consent or refusal, and thus circumstances may arise that will require you to ensure that informed consent has been obtained.

In addition, the healthcare facility in which the treatment/procedure is provided may also have responsibility for ensuring that there are policies and procedures in place as well as quality assurance monitoring to ensure that all of the rules governing informed consent are complied with on a consistent basis. The healthcare facility may have its own requirements that sonographers must follow when providing treatment. For example, a healthcare facility may have a policy that requires patients to sign a written consent prior to receiving any treatment. Note that while a consent form will provide evidence of consent, it is not consent itself. Ensuring that your workplace has policies on informed consent in place will help to mitigate legal liabilities.

Responsibility Checklist

Confirm that Informed Consent Has Been Obtained: Before beginning the treatment/procedure, you should review the patient's record to ensure that the informed consent discussion has been documented. The physician or other authorized health professional should have documented this discussion, including the fact they spoke to the patient, identified the treatment plan/procedure, identified your involvement in the treatment, advised them of the risks and benefits, advised them of any alternatives, made a note of any questions that the patient had and whether the patient provided consent. The patient record may also include a signed treatment plan. You may also have a discussion with the patient to ensure that they have provided informed consent.

Explain to the Patient What You are Going to Do and Why: Take the time to talk to the patient and explain what you are going to do and why. Be confident that the person consenting to the treatment/procedure has the ability to appreciate the nature and consequences of the consent discussion. If you suspect that the patient does not understand the treatment/procedure or if you have any doubt about the patient's capacity to provide informed consent, you should not proceed. Similarly, if the patient resists the treatment/procedure or withdraws their consent, you should not proceed. Instead, refer the patient back to the physician/authorized health professional for a capacity assessment and/or consent discussion. You should also document your discussions and actions in the appropriate patient record.

Do Not Proceed With the Treatment/Procedure If There is Doubt About the Patient's Capacity or Consent: In a medico-legal action where informed consent is an issue, the patient will claim that the healthcare provider proposing the treatment/procedure did not provide them with all of the necessary information to make an informed decision. The patient may also allege that the healthcare professionals involved in their treatment failed to ensure their on-going consent or respect their decision to withdraw consent. If you have documented your discussion, that will be helpful in corroborating your argument that you took reasonable steps to ensure that treatment was not done unless a valid consent was given.

Conclusion

Think back to the practice scenario in the introduction: can you answer each of those questions? Did any of your answers change?

Consent is an important practice point for all healthcare professionals, including sonographers. Make sure you are up to date with *specific provincial obligations* related to consent. You are not alone when navigating decisions related to informed consent and other complex practice risk questions. Sonography Canada members participating in the Professional Liability Insurance program may have access to specialist support provided through the Miller Thomson On Call™ Berkley Support Program. Please contact us mtoncall@millerthomson.com or 1.800.387.4452.

CJMS Article: Sonography Canada CPD Credit

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The CJMS: Pushing Boundaries and Broadening Horizons

By Susan Clarke, MBA, Executive Director, Sonography Canada

Sonography Canada is proud of its professional journal. The first issue of the *Canadian Journal of Medical Sonography* (CJMS) was published in 2010 under the leadership of Mr. Kim G. Boles, CRGS, CRVS, RDMS, RVT, Chair of the Board of Directors of the Canadian Society of Diagnostic Medical Sonographers, Sonography Canada's predecessor organization. At the time, the Society wished to create a more rigorous, professional educational tool that would be distinctly different from its *Interface* newsletter which was a vehicle for society, membership, and legislative news. Mr. Boles touted the CJMS as "an exciting advancement for Canadian sonography with a mandate to inform Canadian sonographers on the merits, benefits, and aims of continuing professional development, professional certification, licensure, and self-regulation."

Over the past 13 years, the CJMS has evolved with the passion, commitment, and guidance of several editor-in-chiefs, each one leaving their indelible mark on the Journal. Over the past four years, Sheena Bhimji-Hewitt, MMedUS, DMS, FSC, CRGS, CRVS, RVT, RDMS (pictured left) has served in this capacity and is now stepping down from this role. In 2022, she was awarded the Sonography Canada Fellowship Award for her successful 20-year career as a professor at the Michener Institute of Education at UHN, her active involvement with Sonography Canada, including a term as Chair of the Board of Directors, and of course, for her 4-year term overseeing the publication of the *CJMS*.

When asked how she would describe her experience as editor-in-chief, she responded: "It fulfilled my love of language, maximized my attention to detail, and allowed me to organize interesting literature into well formatted articles that met the criteria for evidence-based practice." The *CJMS* was a tangible way for Sheena to live by the motto she includes in her email signature: "pushing boundaries and broadening horizons".

While this role allowed her to become engaged in Sonography Canada in a whole new way and to challenge herself, she in turn challenged the team of editors, reviewers, and authors to bring the journal to the 'next level' by increasing the standards and expectations related to evidence-based content. For Sheena, producing the *CJMS* meant "publishing sonography research and case reports that clearly establish us as experts in our field of knowledge and pushing the boundaries of our scope of practice."

The *CJMS* is a vehicle that positions and documents sonography as a unique and specialized medical profession that is an essential part of Canada's healthcare system. Each day, our members care for thousands of patients, some of which present sonographers with unique and challenging situations that help advance the profession. These are the sources of the content featured in the *CJMS*.

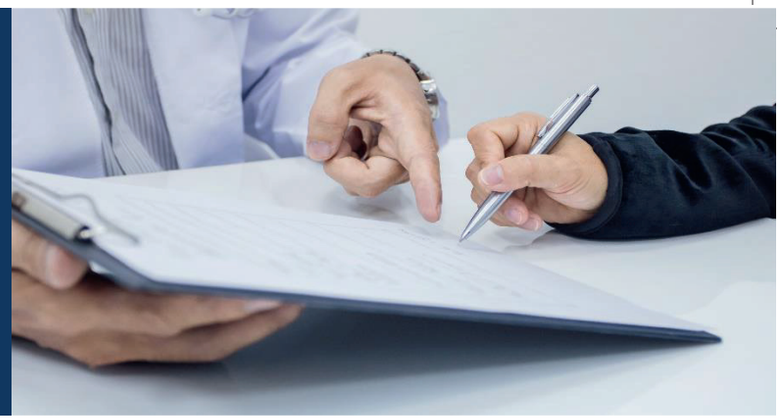
Our departing editor-in-chief invites all practicing sonographers to expand their perception of continuing professional development (CPD). "CPD is always perceived as receiving knowledge rather than

sharing knowledge. CPD credits cannot only be earned by reading *CJMS* articles and completing the related quizzes but also by writing the articles themselves. Not only should published articles be worth CPD credits, but they should also be recognized as an important and valuable achievement worthy of a more competitive advantage for author-sonographers in the workplace."

Professor Bhimji-Hewitt went on to say that "the current level of rigour achieved in the *CJMS* matches that of many other professional journals. Therefore, the reach of its content should expand beyond Sonography Canada's membership and be made available globally."

Well said. The Board of Directors has taken Sheena's advice and plans are underway to transition the CJMS to a fully open access, online publication in 2023.

PATIENT CONSENT: WHAT SONOGRAPHERS NEED TO KNOW



BROAD PRINCIPLES OF CONSENT

01 The patient must have the **CAPACITY** to consent.

02 Consent must **RELATE TO THE TREATMENT**.

03 Consent must be **INFORMED**.

04 Consent must be given **VOLUNTARILY**.

05 Consent must **NOT** be obtained through misrepresentation or fraud.

YOUR RESPONSIBILITIES

01 Confirm that informed consent has been obtained.

02 Explain to the patient what you are going to do and why.

03 Do not proceed with the treatment/procedure if there is doubt about the patient's capacity or consent.

04 Make sure you are up to date with specific provincial obligations related to consent.

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