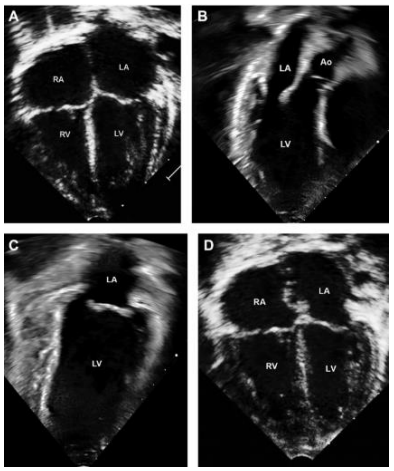
#ASEchoJC Twitter Chat
Thursday, May 2, 2024 – 8 PM ET



- Guidelines for Performing a Comprehensive Pediatric Transthoracic Echocardiogram

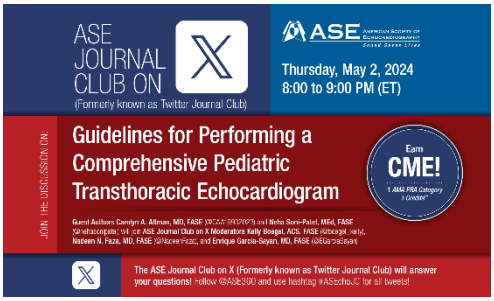
Moderators:

- Kelly Boegel,ACS, RCCS, RCS, FASE (@boegel_kelly)
- Nadeen N. Faza, MD, FASE (@NadeenFaza)
- Enrique Garcia-Sayan, MD, FASE (@EGarciaSayan)

Guest Authors:

- Carolyn A. Altman, MD, FASE (@CAA19932023)
- Neha R. Soni-Patel, MEd, BSME, RCCS, RDCS, FASE (@nehasonipatel)

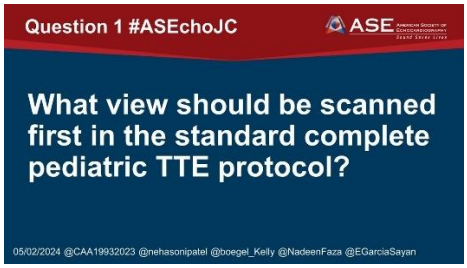
Introduction and Welcome:



@EGarciaSayan: 🙌Welcome to #ASEchoJC on the new @ASE360 pediatric TTE guideline https://bit.ly/3WnRHSj. Honored to be joined by authors @CAA19932023 @nehasonipatel & co-moderators @boegel_Kelly & @NadeenFaza

👉Follow #ASEchoJC to join the conversation, use the hashtag and get your ❓ answered

Question 1:



A1 Notable Responses:

@SIwa23288585: Situs Solitus!!

@boegel_kelly: Dextrocardia can be challenging to image.

🌟Follow the table below with suggested views with delineated transducer indicator directions.

🌟Make sure to follow lab specific protocols for imaging dextrocardia

Table 11 Protocol for patients with dextrocardia

View	Transducer indicator direction
Subcostal coronal (long-axis) view	Patient's left side
Subcostal sagittal (short-axis) view	Patient's lower extremity
Apical view	Patient's left side
Parasternal long-axis view	Patient's left shoulder
Parasternal short-axis view	Patient's left hip
Suprasternal long-axis view	Patient's head
Suprasternal short-axis view	Patient's left side

@SIwa23288585: #右胸心 撮像

✅基本的に心エコーの標準断面の撮像では、画面の右に体の左側がくるように撮ること一般的約束事。右胸心の時であっても基本的に体の左右関係とプローブ左右の関係へんこうしない。心血管構造の左右関係示すこと最優先!!

Monchichi2020: これ難しいなぁといつも思ってます。

右胸心でも左右関係変えないということは、長軸だと逆向きに見える？ということになるのでしょうか…🤔

今は、通常の表示と同じに見えるように画面を反転させるか、プローブの向きを変えるかにしてますが、そうしない方がわかりやすいのでしょうかと悩みます😓

@SIwa23288585: 瀧聞先生曰く`CHD左右関係最も大事｀とのことです。しかし画面反転法を否定してるわけではないですし、なれない方法で評価するのも・・・です。

@Monchichi2020: ありがとうございます😊

どちらが左とかわかるように画面とプローブマークの位置関係を記載するようにはしてます。

そこまでエコーを見てない先生方が見てもわかるように、表示は変えない方がいいのかなとも思っていて。

施設間でもここはいろいろあるようです。

@nehasonipatel: Lab choice! Start with EITHER subcostal or parasternal long axis views

Most important! Each lab consistently follows its own Standard Protocol see Table 8 in the guidelines - Standard views/sweeps/orientation

- Structures to image - Required/optional measurements

@EGarciaSayan: What view should be scanned first in the standard complete pediatric TTE protocol?

@CAA19932023: Consistency is key- everyone in the lab doing the same order and obtaining same data so nothing is over-looked

@boegel_kelly: Lab protocols are important!

@nehasonipatel: Print and LAMINATE IT! Perfect to refer to @ASE360

@nehasonipatel: Practice Practice Practice...the more you practice the more you will see in your routine echoes

@boegel_kelly: Practice makes perfect 🤣or at least more comfortable. Great tips being given by expert sonographer @nehasonipatel

@boegel_kelly: Due to complex anatomy or abnormal cardiac position in #CHD, pediatric TTE often requires off axis imaging with modified views for better visualization of individual structures. Important for the imager to 🧠outside 📦

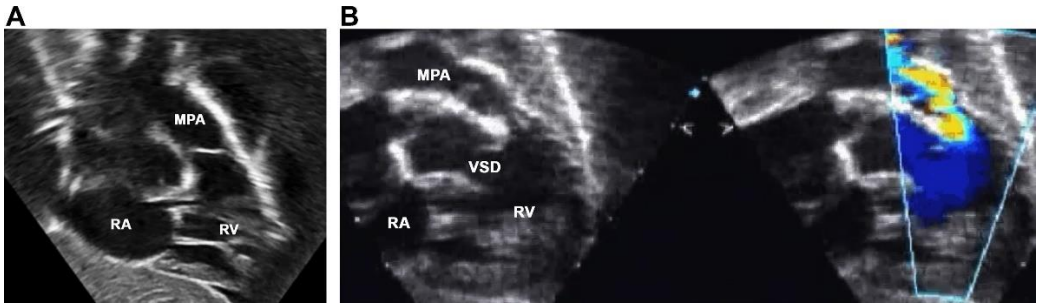
@CAA19932023: Off-axis view to remember is the

Right Anterior Oblique view!

Rotate counterclockwise from subcostal coronal view

-RV inflow and outflow tracts in same plane

-Display anterior deviation of conal septum in TOF:



@boegel_kelly: This is an excellent view to obtain Dopplers of subpulmonary obstruction!

@NadeenFaza: Do you use a standardized protocol like we do for adult TTEs?

@nehasonipatel: Yes! In our institution we follow the protocol. We start subcostal...you have to look at the neighborhood before you look at the house 😜

@nehasonipatel: Protocol should define location of needed measurements for accurate Z scores: PV annulus: PSL. Inner edge to inner edge during max valve opening in early to mid-systole (Fig 31A) MPA, LPA, RPA: PSAX inner edge to inner edge in mid-systole at largest dimension (Fig 13)

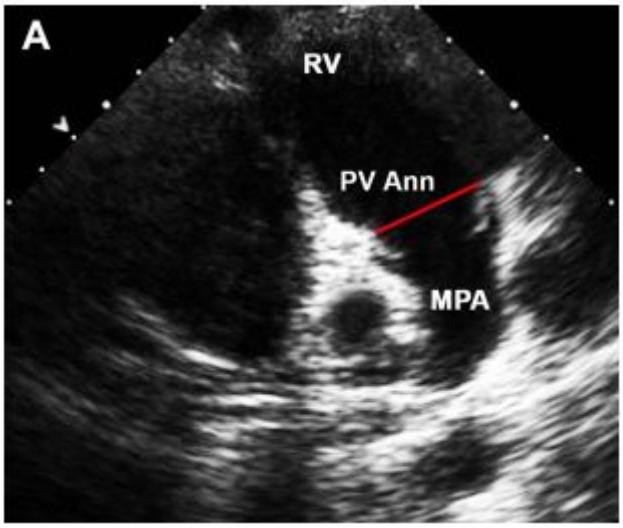
@EGarciaSayan: What view should be scanned first in the standard complete pediatric TTE protocol?

@NadeenFaza: Indications for initial and follow-up #Echofirst in children as per the @ASE360 guidelines!

Table 3 Indications for initial and follow-up TTE in children

Initial evaluation	• Abnormal fetal echocardiogram • Concerning maternal history during pregnancy • Signs, symptoms, or physical findings suggestive of heart disease • Abnormal test results suggestive of heart disease • Systemic or genetic disorders associated with heart disease • Family history of inheritable heart disease • Baseline before receiving a therapy that affects cardiac function
Follow-up study	• Established CHD before and after therapeutic intervention • Established CHD with potential for change in chamber size, hemodynamics, ventricular function, or valvar function • Established acquired heart disease • Systemic or genetic disorders with associated heart disease • Familial cardiomyopathy • Pulmonary hypertension • Therapy that affects cardiac function

@boegel_kelly:



@NadeenFaza: Sharing 🔑 points for AUC for pediatric #EchoFirst as specified by the guidelines!

-Suspected heart disease

-Established or acquired #CHD

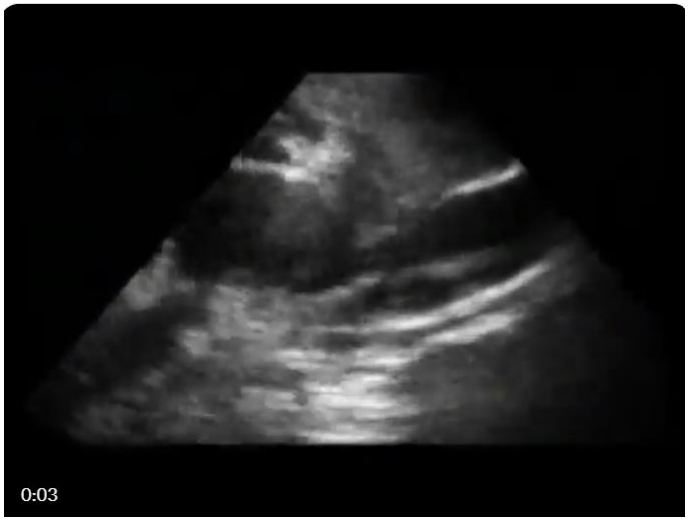
-Systemic/genetic disorders a/w 💔 involvement

-Significant family history of 💔 disease

Question 2:

A2 Notable Responses:

@EGarciaSayan: What is this standard pediatric TTE view called and what structures are demonstrated?



https://twitter.com/i/status/1786185621003756027

@CAA19932023: High right parasternal!

Shows SVC and IVC draining into the right atrium as well as the atrial septum

Figure 11 from Guidelines

@CAA19932023: Very helpful for assessing for sinus venous defects

@OungSavly: Exactly. It is crucial in terms of Sinus venosus ASD.

@boegel_kelly: Tip from the experts for right paraternal view in Peds TTE 😻

@nehasonipatel: This is one of my favorite views! You can even see the right atrial appendage here!

@OungSavly: Exactly. It is crucial in terms of Sinus venosus ASD.

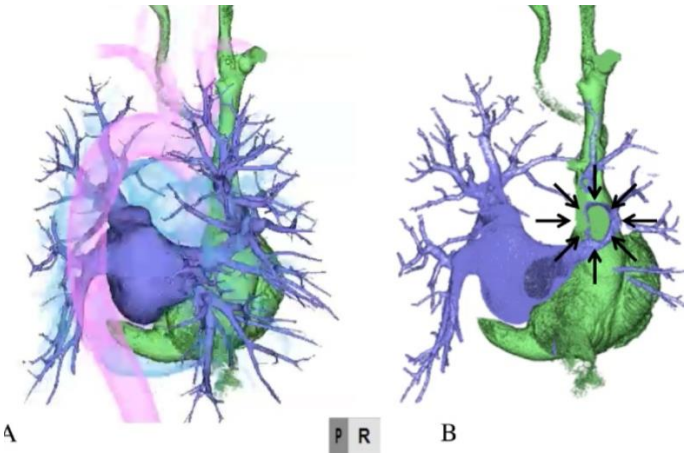
Question 3:

A3 Notable Responses:

@CAA19932023: Right upper pulmonary vein! Great view for assessing this structure when the RUPV is difficult to find on crab views...

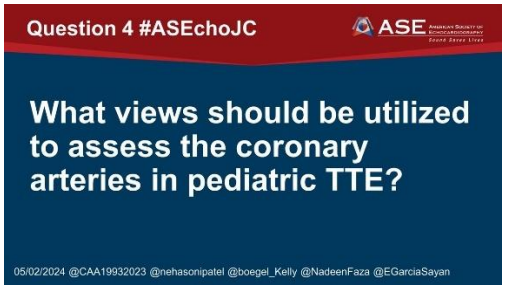
@SIwa23288585 a cavopulmonary window!!

https://pubmed.ncbi.nlm.nih.gov/32373242/



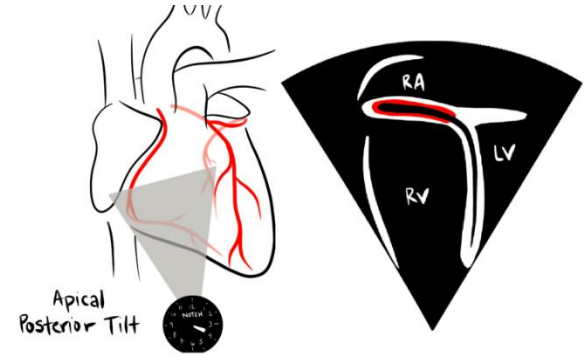
@BekaBakhtadze: Looks like a great view to look at the coronary sinus joining RA, I think I can see the thebesian valve too.

Question 4:



A4 Notable responses

@boegel_kelly: Many views besides standard PSAX imaging can be used. For example this apical posterior tilt to view the RCA



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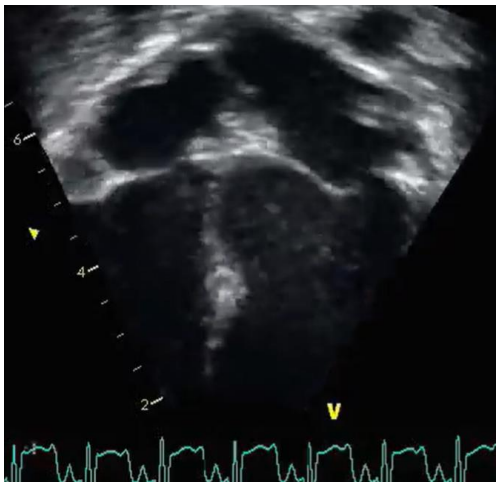
@EGarciaSayan: Pediatric TTE Guidelines: What views should be utilized to assess the coronary arteries in pediatric TTE?

@CAA19932023:



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@CAA19932023: Look at that RCA aneurysm in the distal right AV groove!

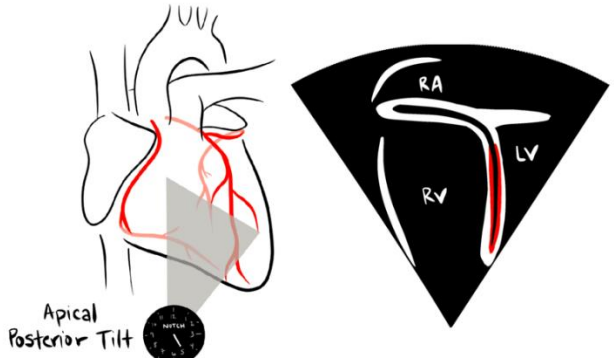
@CAA19932023: Can also see the posterior descending on parasternal long axis if you look carefully too

@nehasonipatel: We have a dilated coronary problem here 😂

@boegel_kelly: and the posterior descending

Posterior descending

- Best View: AP4 (F.8a,b,c) (posterior tilt with slight clockwise rotation)



@nehasonipatel: I've seen this really well when tilting to TV in PLAX...it will be at the bottom of the screen.

@SIwa23288585: indeed 🧐

@CAA19932023: Short axis is a great place to start imaging coronaries- but not the only view

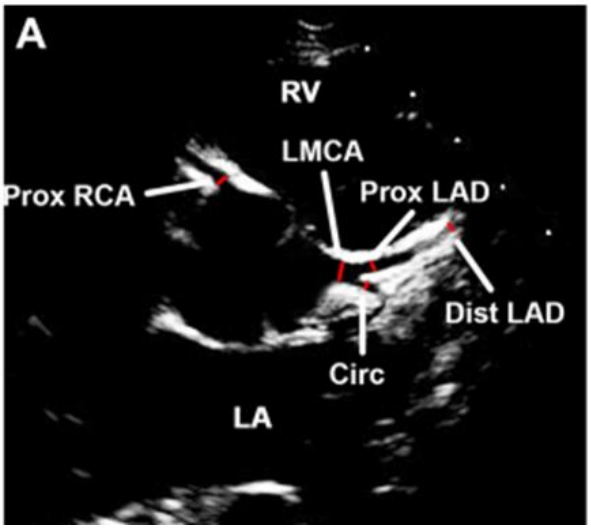
PS long axis:

RCA anterior origin from the aortic root

Circumflex in the left AV groove

Post descending in post interventricular groove: tilt rightward and posteroinferior

@boegel_kelly:



@nehasonipatel: Other views important for coronary evaluation too!

PLAX: RCA anterior origin from the aortic root (Figure 10B)

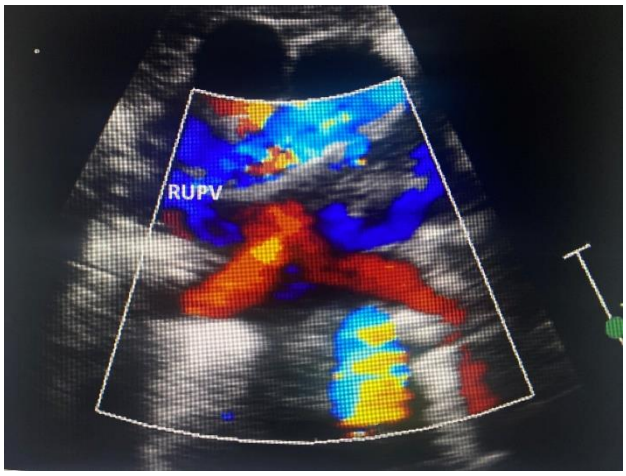
Circumflex in the left AV groove Posterior descending in post interventricular groove: tilt rightward and posteroinferior (Figure 10C)

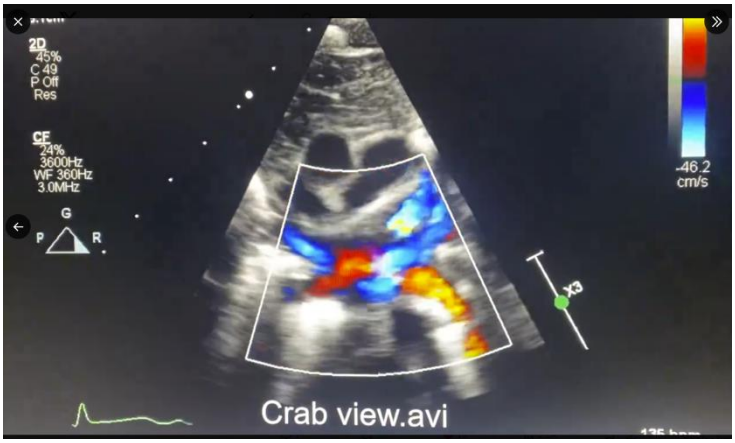
🦀 view from SSN SAX

Indicator at 🕒

RUPV sometimes difficult to see

If unable to visualize here try the subcostal window (images in 📝)





https://twitter.com/i/status/1786189004997881950

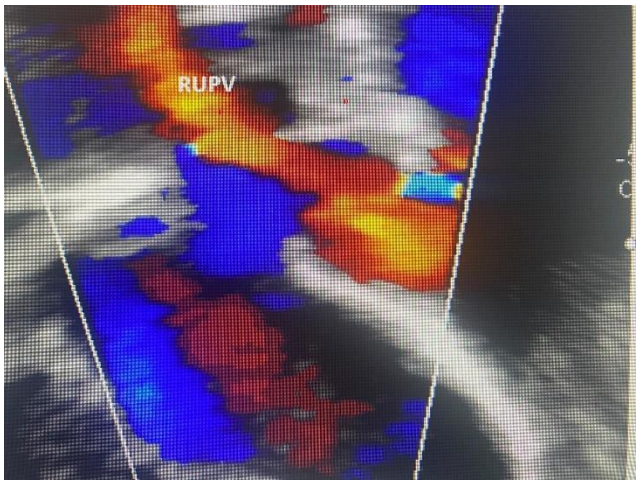
@EGarciaSayan: Which pulmonary vein is demonstrated on standard pediatric TTE view- subcostal sagittal (short axis)

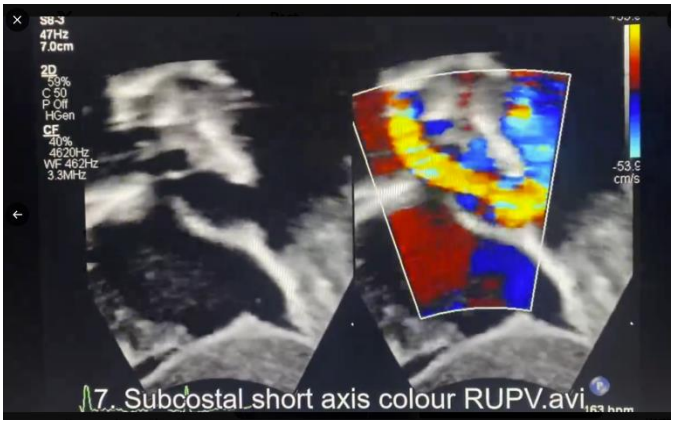
@boegel_kelly: To view RUPV from subcostal window

💗obtain a bicaval view with notch between 🕚and 🕛

💗angle posterior to the SVC

💗may need to decrease color scale or increase color gain to define flow





https://twitter.com/i/status/1786189073268556245

@CAA19932023: Perfect images to demonstrate the RUPV flow

@boegel_kelly: Coronary artery imaging from PSAX

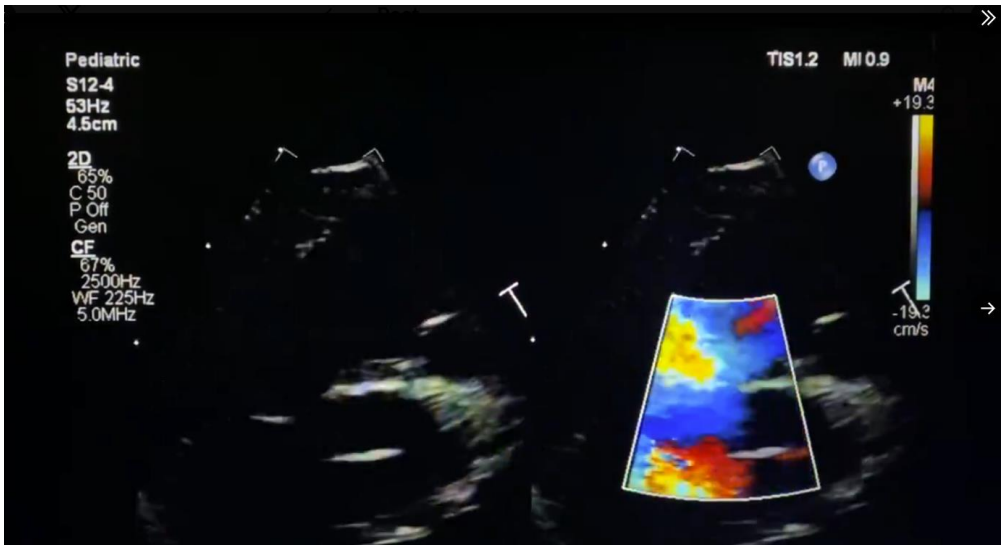
🔸LMC-🔁clockwise rotation angle to pt L axilla

🔸LAD-🔁angle to pt L axilla

🔸Cx-more 🔁

🔸proximal RCA-slight 🔁angle to pt R axilla

🔆distal RCA-angle toward RV inflow to view in posterior AV groove



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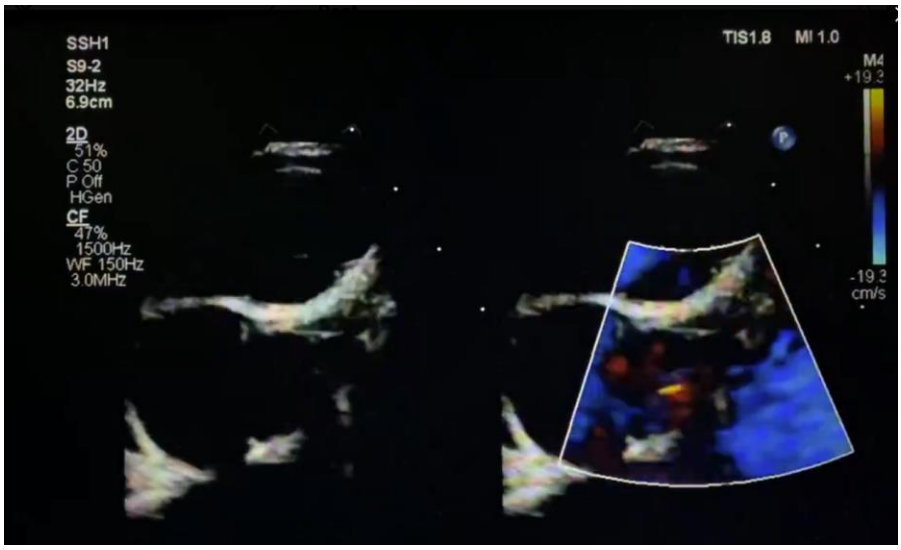

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@EGarciaSayan: Pediatric TTE Guidelines: What views should be utilized to assess the coronary arteries in pediatric TTE?

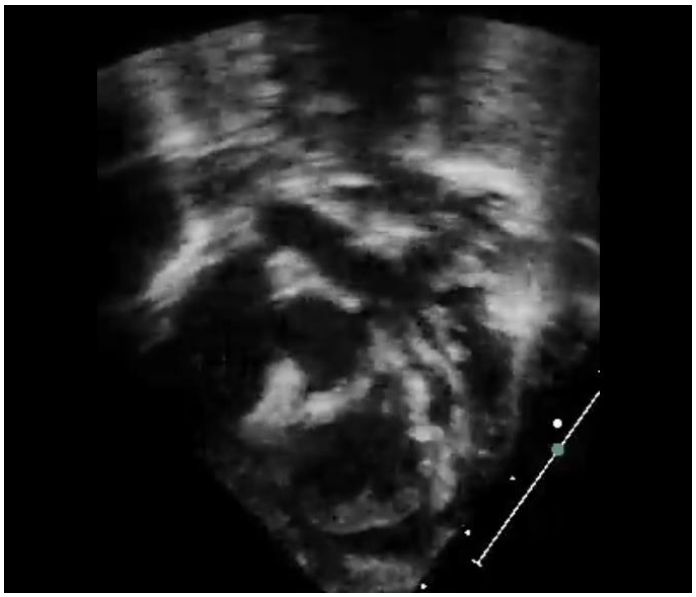
@CAA19932023: Other views important for coronary evaluation too!

Modified apical view:

-Tilt posterior: distal right CA in the posterior right AV groove

-Tilt anterior: left main CA and its bifurcation into the left anterior descending and circumflex Cas

@CAA19932023: Tilting anterior to see left main, LAD and circ



https://twitter.com/i/status/1786191005110124960

@NadeenFaza: use of pediatric #EchoFirst to assess the coronaries and evaluate for anomalies!

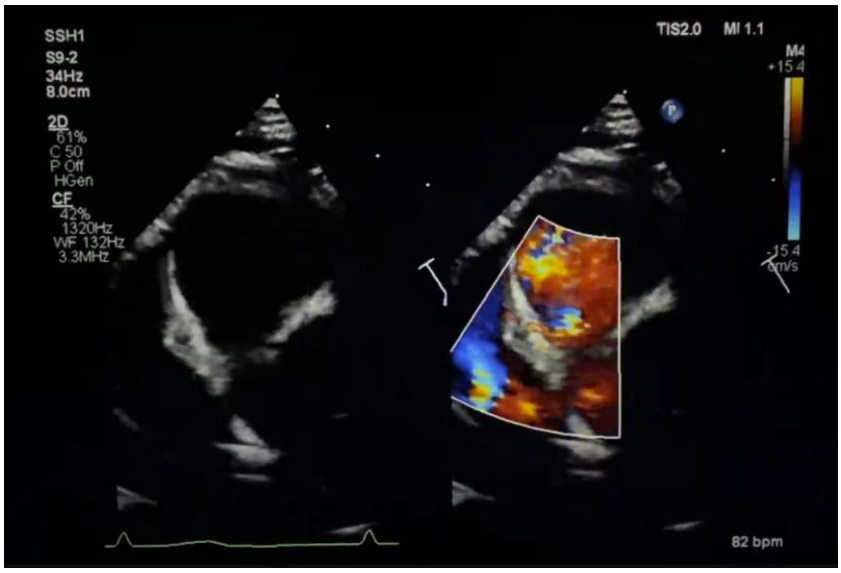
@boegel_kelly: Coronary arteries PLAX

💗LCA-lower window notch @ 10 🕙

💗LAD-lower window notch @ 10 🕙

💗Cx-lower window notch @ 10 🕙

💗RCA-(proximal segment only)high window to view origin of RCA



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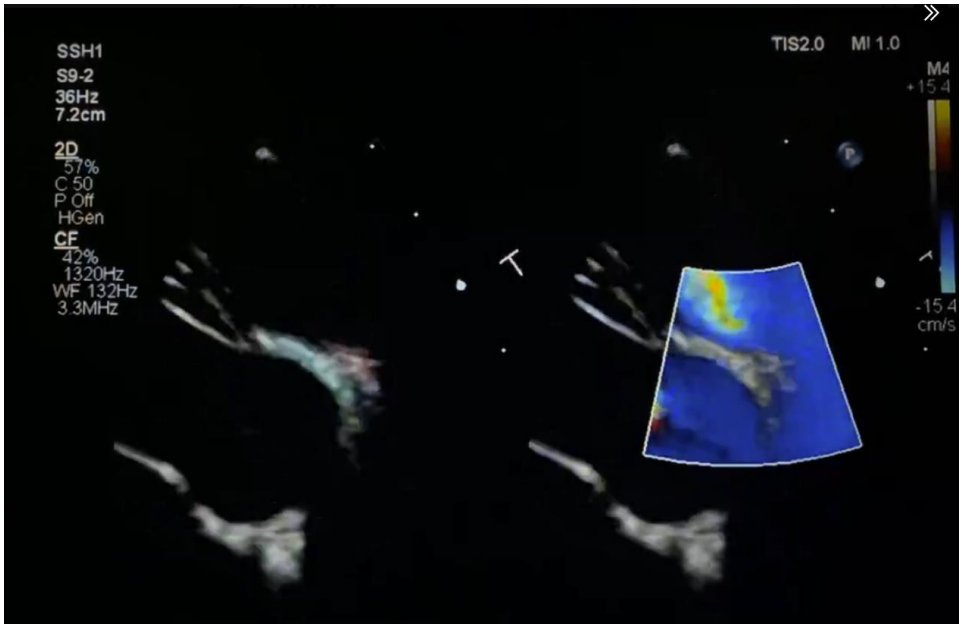
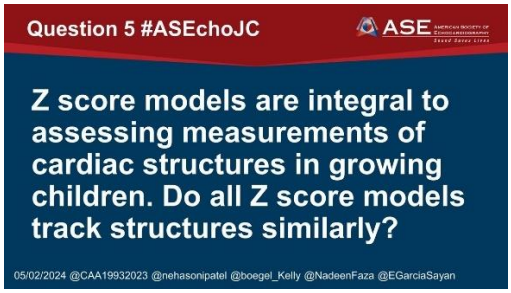


https://twitter.com/i/status/1786189912280359175

@NadeenFaza: 🦀 view! Love it! SAX view from SSN! Great to learn about the different pediatric #Echofirst views 🙌

@Slwa23288585: 🦀ｶﾆｶﾆview🥹

Question 5:



A5 Notable responses

@Slwa23288585: The Z score for #Kawasakidisease coronary artery diameter in JP uses the LMS method of nonlinear regression rather than the z score of linear regression.

https://kwsd.info

Z score by LMS_4

90cm, 14kg, BSA:0.597m^2, Male

Seg	mm	Z (SD)	CAL	Median (mm)
Seg1 RCA	2.0	0.69		1.78
Seg5 LMCA	1.8	-0.94		2.08
Seg6 LAD	3.0	3.13	small	1.71
Seg11 LCX	1.0	-2.07		1.52

[return to calculator]
[reference to LMS_4]
[z score project]

@nehasonipatel: No! There may be a wide range of Z scores for particular measurement in same pt depending on Z score model

Smallest structures can see significant differences

PHN vs prior: significant LAD Z score differences

Table 12: Z score models

@boegel_kelly: 🔑Use the same Z score model consistently in tracking measurements over ⏰

🔑Echocardiographic Z scores should be used in children

🔑Use same Z score model when trending measurements over ⏰ in the same patient & when assessing risk in a particular patient population

@EGarciaSayan: Pediatric TTE Guidelines: Z score models are integral to assessing measurements of cardiac structures in growing children. Do all Z score models track structures similarly?

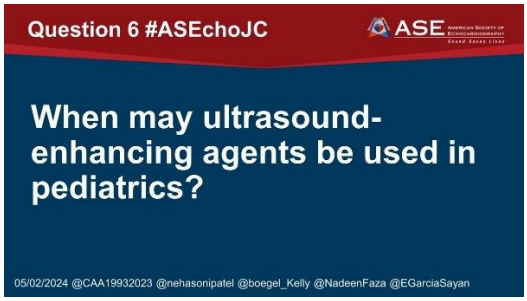
@CAA19932023: Remember Z score models are derived from normal hearts in "normal" size children. May be problematic in

Premature infants

Children with CHD

Obese pts: Excess adiposity disrupts usual relationships between BSA and the sizes of cardiovascular structure

Question 6:



A6 Notable responses

@nehasonipatel: Can also be useful for AVMs...count the heartbeats. Early bubbles seen in LV...possible atrial defect...late bubbles...possible arteriovenous malformation

@EGarciaSayan: Pediatric TTE Guidelines: When may ultrasound-enhancing agents be used in pediatrics?

@NadeenFaza: Can you use them at any age?

@boegel_kelly: Saline contrast can be used to assess for intra-cardiac or transpulmonary shunting or to detect an unroofed coronary sinus

@EGarciaSayan: Pediatric TTE Guidelines: When may ultrasound-enhancing agents be used in pediatrics?

@CAA19932023: UAE: LV opacification is only approved indication

Off-label uses includ detection and characterization of intracardiac masses, apical hypertrophic cardiomyopathy, LV noncompaction, and differences in regional myocardial perfusion at rest and with stress

@EGarciaSayan: Pediatric TTE Guidelines: When may ultrasound-enhancing agents be used in pediatrics? @CAA19932023 summarized approved and off-label indications for #UEA

@CAA19932023: UAE: may considered in peds when delineation of LV endocardium by 2DE challenging

Lumason (sulfur hexafluoride lipid–type A microspheres)

IS approved for pedi use- particularly in setting of obesity, prior cardiac surgery, perfusion imaging in KD, MISC, repaired CHD

@boegel_kelly: 🫧 Bubble study 🫧 Unroofed Coronary Sinus

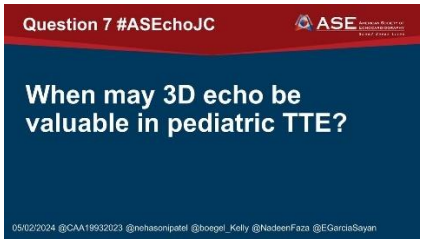
https://twitter.com/i/status/1786192985048453598

@EGarciaSayan: Pediatric TTE Guidelines: Utility of ultrasound-enhancing agents in pediatric TTE.

@nehasonipatel: I wish all saline contrast studies were this definitive...Wow!

@CAA19932023: Flow in the RA and LA visualized-cool! That was from an injection in the left arm?

Question 7:



A7 Notable responses

@nehasonipatel: More everyday use-you can quantify ventricular volumes and function. Try looking at Valve morphology and Ventricular septum and outflow tract. But Pre surgical assessment for interventions involving complex intracardiac baffles or complex AV valve repair is gold with 3D

@EGarciaSayan: Pediatric TTE Guidelines: When may 3D echo be valuable in pediatric TTE?

@CAA19932023: My favorites for 3D echo are

-evaluation of DORV and ability to construct unobst

ructed outflows...

-assessing Left AV valves in AVSDs pre-op

@EGarciaSayan: Pediatric TTE Guidelines: When may 3D echo be valuable in pediatric TTE?

@boegel_kelly: #3D echo imaging is useful is gathering further information on size of #ASD and rims to determine if catheter closure device or surgical method would be most appropriate for the patient

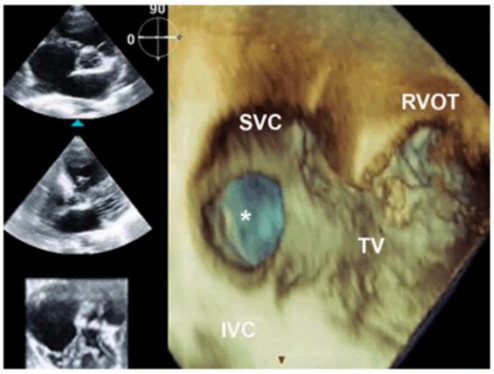


Figure 16 Three-dimensional echocardiography with multiplanar reconstruction: secundum atrial septal defect (*asterisk*) visualized from the right atrial aspect. *IVC*, inferior vena cava; *RVOT*, right ventrical outflow; *SVC*, superior vena cava; *TV*, tricuspid valve.

@SIwa23288585: 3Dエコー ASDカテ治療rim評価に最適!!

美画像ｽｺﾞｲ😳

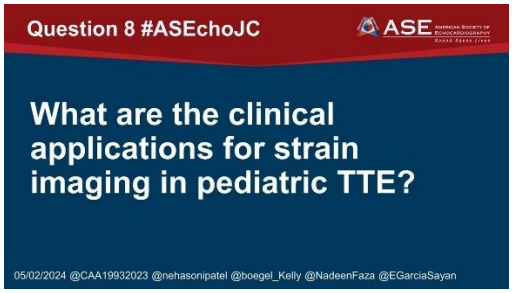
@EGarciaSayan: Pediatric TTE Guidelines: When may 3D echo be valuable in pediatric TTE?

@nehasonipatel: But...same classic rule applies...garbage in...garbage out...you need to have good 2D to get good 3D

@boegel_kelly: Garbage in = Garbage out always applies 🤣

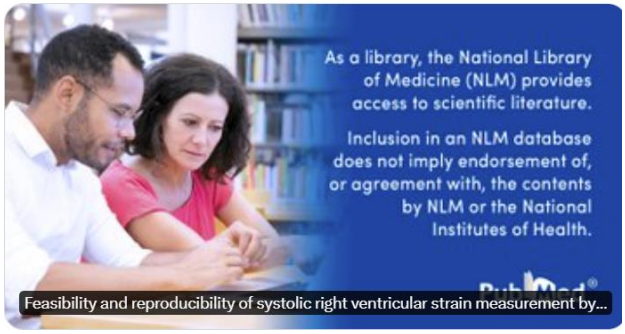
Listen to the experts!

Question 8:



A8 Notable responses

@SIwa23288585: As you know, children have a faster heart rate than adults, so it is necessary to set an appropriate frame rate for strain evaluation.



https://pubmed.ncbi.nlm.nih.gov/23880052/

@boegel_kelly: Make sure to Optimize those 2D images!

STE is most reliable when the 2DE image is optimized in terms of frame rate and tissue characterization. Because of faster heart rates in children, strain analysis requires HIGHER FRAME RATES for adequate sampling

@CAA19932023:

Strain utility in peds

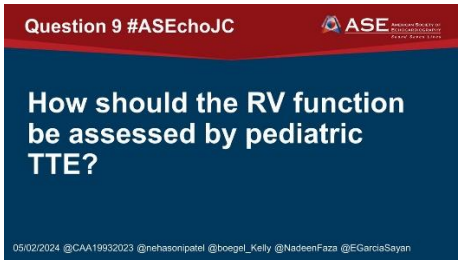
1. LV GLS: consider in all functional LV protocols, but particularly in children receiving chemotherapy

2. RV GLS in repaired TOF to assess for dyssynchrony and appropriate timing of PVR

3. GLS in single ventricles

@EGarciaSayan: Pediatric TTE Guidelines: What are the clinical applications for strain imaging in pediatric TTE? @boegel_Kelly highlights importance of 2DE image optimization.

Question 9:



A9 Notable responses

@boegel_kelly: 1 method

TAPSE- to evaluate RV longitudinal function

🔶 Optimize 2D image to obtain clearer MMode tracing

🔶 Narrow sector width to ⬆️ frame rates

🔶 Zoom annulus area to increase MMode waveform size to ease measuring

🔶 Align cursor parallel to annular motion for accuracy

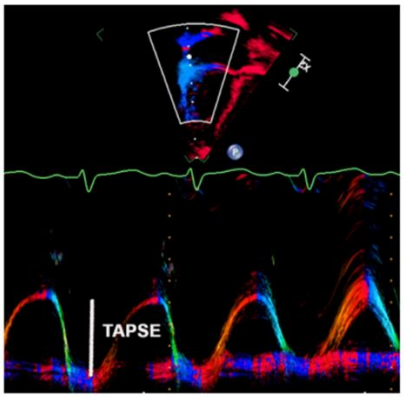


Figure 25 Color M-mode in the right ventricular-focused apical four-chamber view: Tricuspid annular plane systolic excursion (TAPSE) at the lateral tricuspid valve annulus.

@EGarciaSayan: Pediatric TTE Guidelines: How should the RV function be assessed by pediatric TTE? @boegel_Kelly highlights technique for adequate TAPSE assessment.

@CAA19932023: Color M mode can really help in obtaining good RV strain images!

@CAA19932023: To assess RV systolic function

Use a combo of qualitative assessment and quantitative parameters

TAPSE and FAC are useful indices of RV systolic function (do not incorporate RVOT though!)

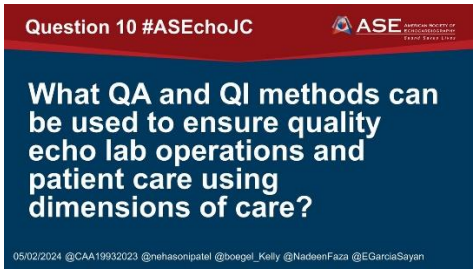
3DE RV volumes and EF, longitudinal strain may be useful in PH, repaired TOF

@EGarciaSayan: Pediatric TTE Guidelines: How should the RV function be assessed by pediatric TTE? @CAA19932023 discusses qualitative & quantitative methods for RV function assessment.

@CAA19932023: Keep in mind that while TAPSE and FAC are useful, they do not incorporate the RVOT in the measurement-

@EGarciaSayan: Pediatric TTE Guidelines: How should the RV function be assessed by pediatric TTE? @CAA19932023 discusses limitations of TAPSE assessment.

Question 10:



A10 Notable responses

@EGarciaSayan: Considering the importance of QA&QI in pediatric #EchoFirst, remember that @IACaccred has standards & guidelines for pediatric & congenital echocardiography.

https://intersocietal.org/wp-content/uploads/2023/07/IACPediatricEchocardiographyStandards2023B.pdf

@CAA19932023: The Guidelines provide great resource for QI/QA in your labs! Table 2 provides links to ACPC Quality Metrics related to Echo

Table 2 ACPC quality metrics related to pediatric and congenital echocardiography[13]

Quality metric	Highlights	Link
Comprehensive echocardiographic examination	Comprehensiveness examination assessment tool to determine whether all necessary structures were appropriately assessed by 2D imaging, color mapping, and spectral Doppler interrogation	https://cvquality.acc.org/docs/default-source/acpc/quality-metrics/study-comprehensiveness-metric-specifications.pdf?sfvrsn=787180bf_4
Initial transthoracic echocardiographic image quality	Image quality assessment tool to evaluate specific elements related to image orientation, 2D image appearance, and presentation of color and spectral Doppler analysis	https://cvquality.acc.org/docs/default-source/acpc/quality-metrics/acpc-qnet-metric-026-initial-echo-image-quality-as-of-4-18-2018.pdf?sfvrsn=ed5480bf_4
Echocardiographic diagnostic accuracy	Diagnostic accuracy tool to track errors in preoperative TTE, categorizing levels of clinical impact and error preventability	https://cvquality.acc.org/docs/default-source/acpc/quality-metrics/diagnostic-accuracy-metric-specification.pdf?sfvrsn=7e7180bf_4
Critical results reporting in pediatric echocardiography	Tracking tool to identify specific critical results, components that should be documented in the report, and the time for critical result reporting	https://cvquality.acc.org/docs/default-source/ACPC/Quality-Metrics/004critical-reporting-echo1816.pdf?sfvrsn=39528cbf_0
Adverse events with sedated pediatric echocardiography	Tracking tool to identify adverse events associated with sedation during the performance of an echocardiogram, categorizing them as minor, moderate, or severe events	https://cvquality.acc.org/docs/default-source/ACPC/Quality-Metrics/005aes-w-echo1092015.pdf?sfvrsn=4f528cbf_0
Application of the pediatric AUC to initial outpatient echocardiographic orders	Metric to determine the proportion of initial outpatient TTE performed for indications rated "rarely appropriate"	https://cvquality.acc.org/initiatives/acpc-quality-network/quality-metrics
Echocardiogram performed as an outpatient during the first year of life for arterial switch operation patients	Tracking tool to identify an echocardiogram performed in infants after the arterial switch operation for transposition of the great arteries, highlighting the necessary components of the examination	https://cvquality.acc.org/docs/default-source/default-document-library/021tga-asoecho06012016.pdf?sfvrsn=3f538cbf_0

@EGarciaSayan: Pediatric TTE Guidelines: What QA and QI methods can be used to ensure quality echo lab operations and patient care using dimensions of care? @CAA19932023 highlights Table 2 of the guidelines.

@boegel_kelly: QI methods to improve intraoperator variability.

💜We do quarterly QI presentations.

💜Echoes evaluated for all sonographers/fellows on team each Q

💜Tailored for specific topic (this Q we are doing IVC/hepatic evaluation)

@EGarciaSayan: Pediatric TTE Guidelines: What QA and QI methods can be used to ensure quality echo lab operations and patient care using dimensions of care?

@EGarciaSayan: Pediatric TTE Guidelines: What QA and QI methods can be used to ensure quality echo lab operations and patient care using dimensions of care? @nehasonipatel discusses components of QI & QA

@nehasonipatel: Lab QI/QA should look at:

Lab structure

Patient selection

Image acquisition and optimization

Image interpretation

Results communication

Pt outcomes

Satisfaction of patients, families, providers

@boegel_kelly: Important considerations for QI in your lab

@EGarciaSayan: ⏰ And that's a wrap! Thank you all for participating in tonight's #ASEchoJC on the new @ASE360 pediatric TTE guideline w/ guest authors @CAA19932023 @nehasonipatel & co-moderators @boegel_Kelly & @NadeenFaza. 👉If you missed anything, catch up by following the #ASEchoJC hashtag.

@CAA19932023: Thanks everyone!

@EGarciaSayan: Thank you so much @CAA19932023 for participating as a guest author in this event, and helping formulate the fantastic questions for discussion. I learned a lot!

@SIwa23288585: Thank you for your valuable time. I will ped_TTE echo study hard!!

See you 🧐

@EGarciaSayan: Thank you @SIwa23288585 for participating in this great event (esp considering the time zone!). Looking forward to future #ASEchoJC discussions.

@boegel_kelly: Thanks for joining everyone 💗