What can we learn from the Three Vessel and Tracheal View?

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Abstract

Ultrasound examination of the fetal arches is important to highlight babies at greatest risk of perinatal collapse, those with ductus-dependent lesions. Diagnosis of those anomalies before discharge from home is difficult because the arterial duct is patent. Routine incorporation of the three vessel and tracheal view at screening is essential to better detect this important sub-group of babies with congenital heart disease in a timely manner.

Key words: fetal echocardiography, ductus-dependent cardiac anomalies, tree vessel and tracheal view

Introduction

Duct dependent lesions account for 15% of all major congenital heart disease (CHD) requiring surgery in the first year of life and are potentially life threatening if not recognised antenatally or early in the perinatal period[1]. A duct-dependent circulation is one that relies on patency of the arterial duct to provide adequate blood supply to the lungs and body and once the arterial duct has closed cardiovascular collapse may ensue. Antenatal diagnosis of isolated Coarctation of the aorta (CoA) or interrupted aortic arch (IAA) has been poor in the past. Of the 250 cases operated on annually (figures from the UK Central Cardiac Audit Database, CCAD), an antental diagnosis is made in only about 20% of cases[2,3]. While it is unlikely to be possible to diagnose all cases of CoA before birth, a large percentage can be recognised and it is probably easier to make this diagnosis in the fetus than in the neonatal period when patency of the arterial duct prevents the development

Šta možemo naučiti iz preseka 3 krvna suda i traheje?

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Apstrakt

Ultrazvučni pregled fetalnog aortnog i duktalnog luka je važan za pravovremenu detekciju budućih beba sa rizikom perinatalnog kolapsa, odnosno onih sa duktus-zavisnim lezijama. Njihova dijagnoza je pre otpusta iz porodilišta teška usled još uvek patentnog duktus arteriozusa. Rutinska primena pregleda u preseku tri krvna suda i traheje tokom skrininga kongenitalne srčane bolesti je esencijalna za bolju i blagovremenu detekciju ove važne podgrupe beba sa urođenim srčanim malformacijama.

Ključne reči: fetalna ehokardiografija, presek tri krvna suda i traheje, duktus zavisne kongenitalne srčane mane

Uvod

Duktus-zavisne lezije čine 15% svih slučajeva kongenitalne srčane bolesti (KSB) koji zahtevaju operativno lečenje u prvoj godini života i predstavljaju potencijalno životno-ugrožavajuća stanja ukoliko su nedijagnostikovana antenatalno ili u ranom neonatalnom periodu[1]. Duktus-zavisna cirkulacija se oslanja na prolaznost duktus arteriozusa koji obezbeđuje adekvatno snadbevanje krvlju pluća i tela novorođenčeta. U slučaju duktus-zavisnih anomalija, njegovo zatvaranje dovodi do kardiovaskularnog kolapsa. Antenatalna dijagnoza izolovane koarktacije aorte (CoA) i prekinutog aortnog luka (PAL) je u prošlosti bila veoma retka. Od 250 slučajeva operisanih godišnje u Velikoj Britaniji (podaci iz UK Central Cardiac Audit Database, CCAD), antentalna dijagnoza se postavi u svega oko 20% slučajeva[2,3]. Iako je malo verovatno da se svi slučajevi CoA otkriju pre rođenja, veliki procenat može biti prepoznat ili čak lakše dijagnostikovan u fetusa, nego u neonatalnom periodu kada patentnost duktus arteriozusa sprečava razvoj kliničkih znakova loše perfuzije donjih

of clinical signs of absent femoral pulses and poor lower body perfusion[4]. Failure to diagnose duct dependent lesions leads to increased stay in intensive care units and poorer condition at presentation to the cardiac unit[3,5]. In this lecture I will discuss the introduction of the extended cardiac views including the three vessel and tracheal and sagittal arch views and what we can leaern from them.

Historical Development of Screening and Diagnostic Views

Four –chamber screening of the fetal heart was pioneered in the early 1980's and gradually became part of the antenatal screening for the detection of fetal anomalies during the following 20 years. Its success in detecting major CHD in practice however was only modest as most screeners could not recognise cardiac malformations present in a four chamber view alone and its ability to detect arch abnormalities was very limited. Early teaching concentrated on sagittal views of the aortic and ductal arches and the "candy cane" aortic arch and "hockey-stick" ductal arches formed part of the advanced views used by cardiologists to examine the arches. These planes produced sonographic images similar to those used in paediatric cardiac practice, which in part explains their popularity, even to this day. However, while continuity of the arch can be confirmed if ideal views can be obtained in this plane, because both arches cannot be visualised simultaneously discordance in size or sometimes lack of continuity can be misinterpreted. Thus CoA and IAA may be over looked in the sagittal plane, particularly if colour flow mapping is not used routinely at screening - which it is not in most centres even today.

The concept of the extended fetal echocardiogram was proposed by Achiron and his group as early as 1992[6]. These authors later proposed routine incorporation of the outflow tracts and the three vessel and tracheal view (3VT) into the screening for fetal abnormalities[7] but incorporation of these views into routine screening is only now happening in the UK. The relative slowness may in part be attributed to the impression that assessment of the crossover of the outflow tracts was difficult to learn as voiced in several publications including one by Yoo et al who, proposed the concept of the three vessel view (3VV) as an alternative to the great arterial crossover. They commented they felt it was as simple to achieve as the

partija tela i odsutnog femoralnog pulsa[4]. Neuspeh u postavljanju antenatalne dijagnoze duktus zavisnih lezija uzrokuje produžen boravak takve dece u jedinicama intenzivne nege i njihovo lošije stanje u momentu prijema u kardiološku jedinicu[3,5]. Zato ćemo u daljem tekstu objasniti u čemu je značaj ultrazvučnog pregleda na preseku tri krvna suda i traheje, three vessel and tracheal view (3VT), u odnosu na prošireni bazični ultrazvučni pregled fetalnog srca, koji obuhvata pregled na četvorokomornom preseku, preseku izlaznog trakta obe komore, preseku tri krvna suda, i sagitalni presek aortnog i duktalnog luka. Sledi i diskusija šta iz svakog od njih možemo naučiti.

Istorijski razvoj ultrazvučnog skrininga KSB i ultrazvučnih preseka fetalnog srca

Skrining KSB pregledom fetalnog srca u četvorokomornom preseku, započet ranih osamdesetih godina prošlog veka, tokom narednih 20 godina je postepeno postao deo antenatalnog skrininga u detekciji fetalnih anomalija. On je imao skroman uspeh u otkrivanju određenih krupnih srčanih mana, jer se na ovom preseku ne mogu prepoznati brojne važne malformacije, a detekcija anomalija aortnog luka je veoma limitirana. Zato se počelo insistirati na dodatnim sagitalnim presecima aortnog i dukatalnog luka. Njima se identifikuju aortni luk "candy cane"-oblika i duktalni luk "hockey-stick"-oblika. Oni su u praksu uvedeni za otkrivanje anomalija lukova, forsirani od strane pedijatara-kardiologa uključenih u skrining i dijagnostiku KSB. Na ovim presecima dobijene sonografske slike su slične onima koje se dobijaju u pedijatrijskoj kardiološkoj praksi, što verovatno objašnjava njihovu popularnost do današnjih dana. Ipak, na njima se kontinuitet aortnog i duktalnog luka može potvrditi samo ukoliko ih idealno prikažemo, što u praksi nije uvek moguće. Takođe, njima se oba luka ne mogu simultano prikazati, te se može propustiti uočavanje nesrazmere u njihovoj veličini, a nekad se i odsustvo njihovog kontinuiteta može pogrešno interpretirati. Zato se CoA i PAL mogu prevideti u sagitalnom preseku, naročito ukoliko se color doppler mapiranje ne koristi u rutinskom skriningu, što je danas slučaj u većini centara.

Koncept proširenog bazičnog ultrazvučnog pregleda fetalnog srca je predložen od strane Achirona i saradnika još 1992. godine[6]. On podrazumeva inkorporaciju pregleda izlaznog trakta obe komore i pregleda na 3VT u rutinski skrining fetalnih anomalija[7], ali je on ušao u rutinsku praksu samo u Velikoj Britaniji.

four chamber view but alerted the screener to abnormalities of the outflow tracts[8]. This view shows the position of the pulmonary trunk and its branches, the aorta and right-sided superior vena cava viewed from the transverse plane in the fetal chest. In the normal heart the vessels are in straight alignment with a reduction in size from left to right in the normal fetal heart. The aortic and ductal arches however are not seen in this plane as it is obtained at the level of the carina which limits its diagnostic ability. The three vessel and tracheal view (3VT) is obtained in the same plane as the three vessel view, but a few millimetres cephalad and is the gold standard to detect duct dependent lesions, including those with abnormality confined to the aortic arch such as interrupted aortic arch and coarctation of the aorta which are life threatening if undiagnosed[1,3,5].

Using the 3VT view in screening

The 3VT shows the course of both the aortic and ductal arches, their relationship to the trachea and identifies additional vessels such as a persistent left superior caval vein or an aberrant subclavian artery. In the three vessel and tracheal view both arches can be measured simultaneously (Figure 1) and discrepancy in size or alteration in direction of flow readily appreciated thus potentially increasing the sensitivity for detection of coarctation of the aorta or interrupted arch at screening[9,10]. This plane also allows detection of "normal variants" such as right aortic arch, described in 0.1% of a large series of screened women[11] and persistence of the left superior vena cava - probably a more common finding than the 0.3% recorded postnatally. This often drains to the coronary sinus which is enlarged and may be associated with disproportion at the four-chamber view and is associated with hypoplasia of left sided structures, such as CoA, presumably due to reduced flow in early gestation[12].

Colour flow mapping allows easy identification of reversed flow in either the ductal or aortic arches signifying proximal obstruction, or atresia. It is not uncommon to see reversal of flow in severe coarctation of the aorta, or indeed to see this sometimes in normal pregnancies late in gestation when no pathology is identified postnatally. A colour flow map is useful to ensure the direction of flow in the pulmonary trunk as the size of the main pulmonary artery and duct may be normal, even in cases

Relativna sporost njegovog uključivanja u rutinsku praksu može se objasniti utiskom teškog ostvarivanja prikaza crossovera i procene izlaznih komornih traktova. To je i potvrdilo nekoliko publikacija, a jedna od njih je i ona od Yoo i saradnika, koji su predložili koncept 3 krvna suda, three vessel view (3VV), kao alternativu crossoveru velikih arterijskih sudova. Oni nalaze da je ostvarivanje pregleda u ovom preseku podjednako jednostavno kao četvorokomornog preseka srca, a pri tome 3VV omogućava i otkrivanje onih anomalija koje se nalaze u sklopu izlaznog trakta obe komore[8]. On pokazuje poziciju trunkus pulmonalisa i njegovih grana (krajnje levo postavljenog), aorte (centralno postavljene) i desnostrano postavljene gornje šuplje vene posmatranih u transverzalnom preseku grudnog koša. U normalnom srcu, na 3VV se vidi njihov pravolinijski raspored, a lumeni su im manji kako se ide od krajnje levog do krajnje desnog krvnog suda. Ipak, ovde se ne vide aortni i duktalni lukovi, što limitira dijagnostičke mogućnosti pregleda na ovom preseku. Presek 3VT se nalazi na skoro identičnom preseku, samo nekoliko milimetara cefalično u donosu na 3VV. 3VT je zlatni dijagnostički standard u detekciji duktus-zavisnih lezija, uključujući one sa poremećenim lumenom aportnog luka, kao što su CoA i PAL, koji predstavljaju životno-ugrožavajuće stanje ukoliko se na vreme ne dijagnostikuju[1,3,5].

Upotreba 3VT u skriningu KSB

3VT omogućava vizuelizaciju toka aortnog i duktalnog luka, procenu njihovog odnosa i pozicije međusobno, ali i u odnosu na traheju i identifikaciju dodatnih krvnih sudova, kao što su perzistentna leva šuplja vena ili aberantna arterija subklavija. U 3VT preseku oba luka se mogu simultano meriti (Slika 1), a eventualno uočena diskrepanca u njihovoj veličini i patološki smer kretanja krvi mogu povećati senzitivnost u otkrivanju CoA i PAL tokom skrining procesa[9,10]. Ovaj presek omogućava i detekciju "normalnih varijanti" kao što su desnostrani aortni luk, opisan u 0.1% slučajeva velikih skrining serija[11] i perzistentnu levu gornju šuplju venu – u praksi nešto češći nalaz, otkriven postnatalno u 0.3% slučajeva. Ona se često drenira u koronarni sinus, koji je u tom slučaju uvećan i može dovesti do disporoporcije srca na četvorokomornom preseku i do hipoplazije levostanih srčanih struktura, kao što je CoA, verovatno kao posledica redukovanog protoka krvi u ranoj gestaciji[12].

of pulmonary atresia with intact ventricular septum. Turbulent flow or aliasing is less common in the fetus, but may be seen in cases of aortic stenosis or critical pulmonary stenosis. Doppler velocity should be less than 1 m/s except in the duct where it is usually higher. While diastolic flow is usual in the second and third trimester fetal vessels (unlike postnatally) because of low distal placental impedance, high velocity diastolic flow 40 cm/s is a sign of ductal constriction.

Practical tips in interpreting the 3VT

Screening views should be simple and sensitive and the screening protocol must work well within the confines of time and the screeners' ability. At screening the three vessel and tracheal view can be imaged and interpreted as shown in Figure 1.

One important practical aspect is to ensure that the aortic arch is fully "opened out" and does not appear as a circle in the scanning plane. Familiarity is easily gained with this view and once the aortic and ductal arches are clearly imaged other more subtle findings may be recognised. The basic check list for the sonographer should include size, number of vessels, arrangement and alignment of the vessels and direction of flow if colour Doppler is used. More detailed cardiac assessment will include visualisation of the trachea and sometimes oesophagus, aberrant subclavian arteries running behind the trachea and identification of a bridging vein if there are bilateral superior caval veins. The azygous vein can be identified draining into the SVC that is sometimes referred to as the "Azygous vein arch"

The side of the arch is easily identified in the 3VT, with a little practice. The arch and the duct may pass to the same side as each other i.e. a right aortic arch and right duct or they may pass to opposite sides of the trachea and form the potential for a vascular ring once the ductal arch has closed postnatally[13]. It is

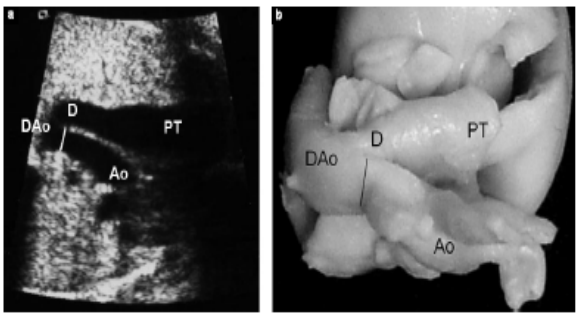

Figure 1. (a) Three vessel and trachea ultrasound image of an abnormal aortic arch showing the pulmonary trunk (PT) leading into the ductal duct (D). The isthmus is measured as shown by the line just before it enters the descending aorta (DAo) and the ductus measured directly above it. (b) Fetal heart specimen simulating the three vessels and trachea view of the ultrasound image and orientated in the same way. Ao, aortic arch.

Figure 1 (from the reference 9)

Slika 1 (preuzeta iz reference 9)
Prikaz normalnog ultrazvučnog nalaza na nivou 3VT i identičnih struktura samo na obdukcionom preparatu

Color doppler mapiranje omogućava laku identifikaciju reverznog toka u dukatalnom ili aortnom luku, ukazujući na njihovu moguću proksimalnu obstrukciju ili atreziju. Neretko se viđa i reverzni protok u izraženoj koarktaciji aorte, ali se on može videti kasnije i u normalnoj trudnoći, što potvrđuju naknadni postnatalni pregledi koji ne otkrivaju bilo kakvu patologiju. Color doppler mapiranje pokazuje da li je smer protoka krvi kroz plućno stablo normalan, što je veoma korisno s obzirom da veličina glavne plućne arterije i duktusa mogu biti normalni, čak i u slučaju pulmonarne atrezije sa intaktnim ventrikularnim septumom. Iako retki u fetusa, turbulentni protok i aliasing se mogu videti u slučajevima aortne stenoze ili kritične pulmonarne stenoze. Doppler protoci bi trebali biti manji od 1 m/s, izuzev u duktusu gde su obično visočiji. Dok je dijastolni protok kroz fetalne krvne sudove uobičajen u drugom i trećem trimestru trudnoće (za razliku od postnatalnog) zbog niskog distalnog placentalnog otpora, visok dijastolni protok od 40 cm/s je znak duktalne konstrikcije.

Praktični putokazi u interpretaciji nalaza na 3VT

Preseci fetalnog srca koji se koriste u ultrazvučnom skriningu KSB moraju biti jednostavni i senzitivni, a skrining protokoli dobro funkcionisati u granicama raspoloživog vremena i sposobnosti osobe uključene u skrining KSB. Skrining na nivou 3VT može se ostvariti i interpretirati kao što je pokazano na slici 1.

Važan praktični aspekt je da se osigura da je aortni luk u potpunosti "otvoren" i da se ne pojavljuje kao krug u ovom ultrazvučnom preseku. Familijarnost sa ovim presekom se lako postiže, a kada se jasno prikažu aortni i duktalni luk, lako se uočavaju i prepoznaju suptilniji detalji. Osnovna čeking lista ultrasonografiste na ovom preseku uključuje veličinu, broj, raspored i međusobni odnos posmatranih struktura, kao i pravac kretanja krvi ukoliko se koristi color doppler. Detaljniji pregled će uključiti i vizuelizaciju i procenu traheje,

much more straightforward to locate the transverse aortic arch and position of the descending aorta from transverse views through the fetal body than in sagittal views.

Dilated arterial vessels may be associated with aneuploidy and an enlarged vena cava found where there is interruption of the IVC with azygous continuation[14]. Abnormal vessel alignment is less common, but may be seen where there is anterior displacement of the aorta such as with a perimembranous ventricular septal defect or atrioventricular septal defect. Abnormal vessel arrangement is seen in complete transposition of the great arteries where the transverse aortic arch may be located to the left of the main pulmonary trunk or in double outlet right ventricle. More commonly however one might see just a single transverse great artery because only the most superior vessel is imaged. This occurs in conotruncal malformations such as transposition of the great arteries and Tetralogy of Fallot.

Cardiac Malformations in the 3VT

Cardiac malformations may be identified by abnormalities of vessel **size,** most often discordant in cases of left and right heart obstruction including CoA, HLHS and Tetralogy with Pulmonary Atresia; abnormal **number** of vessels in hearts with a solitary outlet such as common arterial trunk, or Tetralogy with Pulmonary Atresia with an absent duct ; or hearts may seem to have only one arch because of the **Arrangement** or **Alignment** of the outflow tracts. Aliasing or reversal of **Colour Flow** may be seen when there is aortic or pulmonary obstruction – either critical stenosis where there is still a jet of forward flow, or atresia. More complex malformations, such as those with isomerism of the atrial appendages, are often associated with bilateral superior caval veins thus forming a “four vessel and tracheal view”.

Isolated CoA may be suspected because of size discrepancy in the four chamber view, however this is by no means specific and the sensitivity of detection of coarctation of the aorta may be improved by including the 3VT in screening[9,10]. The specificity of diagnosis depends on assessment of the isthmus including the presence of a coarctation shelf and the detection of continuous flow at the isthmus, usually by also examining sagittal views of the arch.

ponekad ezofagusa, aberantne arterije subklavije koja protiče iza traheje i identifikaciju premošćavajućih vena u slučaju postojanja bilateralnih gornjih šupljih vena. Azigosna vena može se identifikovati kako se “drenira” u gornju šuplju venu, što se nekada naziva “azigosni venski luk”.

Identifikacija strane na kojoj se nalaze aortni i duktalni luk je laka u 3VT, čak i od strane ultrasonografiste sa malo iskustva. Aortni i duktalni luk mogu prolaziti sa iste strane npr. desni aortni luk i desni duktalni luk, ili mogu prolaziti suprotnim stranama u odnosu na traheju i formirati potencijalni vaskularni prsten onog momenta kada se postnatalno dukatalni luk zatvori[13]. U fetusa je jednostavnije locirati transverzalni aortni luk i poziciju descendentne aorte transverzalnim presekom nego korišćenjem sagitalnih preseka.

Prošireni arterijski sudovi mogu biti povezani sa aneuploidijom, a uvećana vena kava može biti prisutna u slučajevima gde je prekid donje šuplje vene praćen azigosnom kontinuacijom[14]. Abnormalna pozicija krvnih sudova na 3VT je retka, ali se može videti u slučaju prednje dislokacije aorte, na primer u perimembranoznim ventrikularnim septalnim defektima ili atrioventrikularnim septalnim defektima. Abnormalni raspored krvnih sudova na 3VT se viđa kod kompletne transpozicije velikih atrterija gde je transverzalni aortni luk lociran levo u odnosu na glavno plućno stablo ili u slučaju double outlet right ventricle. Češće se ipak viđa samo jedan krvni sud i to se vizuelizuje onaj koji je superiornije pozicioniran. Ovo se viđa u konotrunkalnim malformacijama kao što su transpozicija velikih krvnih sudova i tetralogija Fallot (TF).

Srčane malformacije koje se mogu identifikovati pregledom na 3VT preseku

Srčane malformacije mogu se identifikovati uočavanjem abnormalnosti **veličine** krvnih sudova**,** koji su obično diskordantni u slučajevima obstrukcije levog ili desnog srca (CoA, sindrom hipoplastičnog levog srca i TF sa pulmonarnom atrezijom); abnormalnog **broja** velikih krvnih sudova srca sa solitarnim izlazom, kao što su zajedničko arterijalno stablo, TF sa pulmonarnom atrezijom i odsutnim duktusom; ili srce može izgledati da ima samo jedan luk usled poremećenog **odnosa** ili **pozicije** izlaznih komornih traktova u specifičnim tipovima KSB. Fenomen aliasing-a ili reverznog protoka identifikovanog **color dopplerom** može se videti u slučaju aortne ili pulmonarne obstrukcije

Diagnosis of an interrupted aortic arch may be more difficult, but the head and neck vessels are supplied retrogradely by flow from the arterial duct and location of the interruption and its extent can be defined from sagittal views.

Interpretation of the sagittal views of the arches should include the following: the arch should be opened fully, head and neck vessels should be identified from the aorta and its continuity confirmed by energy or velocity mapping. The left pulmonary artery may be seen running in a similar direction to the duct and pulmonary veins can be seen entering the left atrium, lying just in front of the descending aorta. This view should be used to look for major aorto-pulmonary collateral arteries that are found with extreme pulmonary branch hypoplasia in conditions such as Tetralogy of Fallot with pulmonary atresia. An interrupted aortic arch may be mistakenly overlooked because with slight fetal movement the ductal arch is superimposed over the aortic arch and it is easy to mistakenly attribute the origin of the head and neck vessels wrongly to a large continuous vessel. It is important to be sure that both arches have been identified separately if there is a suspicion of interrupted aortic arch.

Vascular Rings and Obstructions

A right sided aortic arch with mirror image branching is very commonly associated with structural cardiac malformation whereas a right aortic arch with aberrant branching patterns is more likely associated with aneuploidy and only rarely with cardiac malformation[13,15-17]. Fetuses found to have a right aortic arch at screening comprise about 0.1% screened pregnancies[11] and should have more detailed evaluation, but not necessarily karyotyping.

Several combinations of aortic arch and duct may cause obstruction (Table 1, from reference 13). This rarely occurs in utero, but a double aortic arch may produce a vascular ring causing obstruction to the fetal trachea and manifest by bilateral bright lungs that are “hyperinflated” because of entrapment of amniotic fluid, known as congenital high airways obstruction syndrome (CHAOS).

Aneuploidy

Fetuses with a left arch and an aberrant right subclavian artery (ARSA) rarely have CHD and it rarely

– bilo kritične stenoze (gde ipak postoji i mlaz anterogradnog protoka) ili atrezije. Složenije malformacije, kao što su one sa izomerizmom atrijalnih aurikula, često su povezane sa postojanjem bilateralnih gornjih šupljih vena formirajući “four vessel and tracheal view”.

Sumnju na izolovanu CoA može izazvati diskrepanca u veličini krvnih sudova vizuelizovanih na četvorokomornom preseku srca, ali na ovom preseku ovaj nalaz nije dovoljno specifičan, a senzitivnost u otkrivanju CoA može se poboljšati uključujući i 3VT u skrining[9,10]. Specifičnost dijagnoze zavisi od procene istmusnog dela aorte, uključujući nalaz koarktacionog nabora i detekcije tipa protoka krvi kroz istmični deo, B-mode i collor/power dopler pregledom sagitalnih preseka lukova. Postavljanje dijagnoze PAL-a može biti teško, ali na nju ukazuje postojanje retrogradnog protoka krvi kroz krvne sudove vrata i glave koji pristiže iz duktus arteriozusa. Lokacija i obim PAL-a se može definisati korišćenjem sagitalnih preseka.

Pravilna interpretacija sagitalnog preseka aortnog luka podrazumeva: da je luk u potpunosti vizuelizovan, da su identifikovani krvni sudovi glave i vrata kako se odvajaju od aorte, procenu integriteta aortnog luka (upotrebom power ili collor dopplera). Leva pulmonarna arterija se vizuelizuje tako što ima sličan pravac kao duktus arteriozus. Ušće pulmonarnih vena u levu pretkomoru mora biti prikazano kako leži neposredno ispred descendentne aorte. Ovaj presek se koristi i u detekciji velikih aorto-pulmonarnih kolaterala koje postoje u slučaju ekstremne hipoplazije grane pulmonarne arterije u stanjima kao što su TF sa pulmonarnom atrezijom. Previd PAL-a može nastati jer se čak i sa diskretnim fetalnim pokretima duktalni luk, kao veliki krvni sud bez prekida integriteta, može superponirati iznad aortnog luka i pogrešno mu se pripisati poreklo krvnih sudova glave i vrata. Veoma je važno da se oba luka jasno, a separatno identifikuju u slučaju postojanja sumnje na PAL.

Vaskularni prstenovi i obstrukcije

Desnostrani aortni luk sa grananjem po tipu “odraza u ogledalu” je veoma često povezan sa strukturnim srčanim malformacijama dok je destostrani aortni luk sa aberantnim načinom grananja češće povezan sa aneuploidijama i samo u izuzetnim slučajevima sa srčanim malformacijama[13,15-17]. Fetusi sa desnostranim aortnim lukom čine svega 0.1% slučajeva svih fetusa podvrgnutih skriningu KSB[11] i zahtevaju detaljniju evaluaciju, ali određivanje kariotipa nije obavezno.

causes dysphagia after birth, but has been described in 15 – 20% of fetuses with Trisomy 21 which is 10-fold the population incidence. It has therefore been proposed as a useful marker of aneuploidy, although not yet adopted routinely in large screening programmes[18]. The ARSA is easily identified running behind the trachea and the risk of vascular ring is low if the duct is left sided and enters the aorta, but may occur if the duct is right-sided, entering the ARSA (Table 1).

Conclusion

In conclusion, examination of the arches is important to highlight babies at greatest risk of perinatal collapse in whom detection of CHD before discharge from home is difficult because the arterial duct is patent. Routine incorporation of the three vessel and tracheal view at screening is essential to better detect this important sub-group of babies with congenital heart disease in a timely manner.

Table 1 List of aortic arch anomalies

Aortic arch anomaly	*Ring*
Right AA with mirror-image branching	
With left ductus from the innominate artery	No
With right ductus from the aorta	No
Right AA with an aberrant left subclavian or innominate artery	
With left ductus from the aberrant artery	Complete
With right ductus from the aorta	Incomplete
Left AA with an aberrant right subclavian or innominate artery	
With left ductus from the aorta	Incomplete
With right ductus from the aberrant artery	Complete
Double AA	
With left ductus	Complete
With right ductus	Complete
Circumflex retroesophageal AA	Complete or incomplete
Cervical AA	
Double-lumen AA (persistent fifth AA)	

AA, aortic arch; ductus, ductus arteriosus.

Table 1. (from reference 13)

Tabela 1 (preuzeta iz reference 13) Lista mogućih aortnih anomalija sa ishodom eventualnog vaskularnog prstena

Nekoliko kombinacija aortnih i duktalnih lukova mogu izazvati obstrukciju (Tabela 1, preuzeto iz reference broj 13).

Ovo se retko dešava in utero, ali dupli aortni luk može uzrokovati vaskularni prsten koji će stvoriti obstrukciju fetalne traheje, što će se manifestovati bilateralnim svetlim plućima koja su "naduvana" zarobljenom amnionskom tečnošću, što je poznato kao sindrom kongenitalne obstrukcije gornjih disajnih puteva, *congenital high airways obstruction syndrome* (CHAOS).

Aneuploidije

Fetusi sa levostranim aortnim lukom i sa aberantnom arterijom subklavijom, *aberrant right subclavian artery* (ARSA), retko imaju KSB i retko uzrokuju disfagiju nakon rođenja, ali sačinjavaju čak 15 – 20% svih fetusa sa trizomijom 21. Identifikacija ARSA nosi10 puta veći rizik postojanja trizomije 21. Zato je ARSA koristan marker aneuploidije, iako još uvek neprihvaćen u rutinskim skrining programima[18]. ARSA se lako identifikuje iza traheje, a rizik nastanka vaskularnog prstena je mali ako je ductus levostran i uliva se u aortu, mada može nastati u slučaju destostranog ductusa, koji se uliva u ARSA (Tabela 1).

Zaključak

Pregled aortnog i duktalnog luka je veoma važan da bi otkrili bebe pod rizikom perinatalnog kolapsa, a kod kojih je detekcija KSB pre otpusta iz porodilišta teška usled još uvek patentnog duktus arteriozusa. Rutinska primena pregleda u 3VT tokom skrininga KSB je esencijalna za bolju i pravovremenu detekciju ove važne podgrupe beba sa KSB.

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