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Single Umbilical Artery in Foetus and Its Impact on New-born Outcome"-A case study

Dr. Sonu Prakash[1], Dr. Azizahmed Arbar[2], Dr. Tejaswini Yarazarvimath[3], Dr. Chidanand Kalburgi[4], Dr. Isha Kandwal[5]

[1]Assistant professor, Department of Kaumarbhritya, KAHER's Shri BMK Ayurveda Mahavidhalaya, Shahpur, Belagavi.
Email ID: sp2277423@gmail.com

[2]Professor and HOD, Department of Kaumarbhritya, KAHER's Shri BMK Ayurveda Mahavidhalaya, Shahpur, Belagavi.
Email ID: azizarbar@gmail.com

[3]PG Scholar, Department of Kaumarbhritya, KAHER's Shri BMK Ayurveda Mahavidhalaya, Shahpur, Belagavi.
Email ID: tejaswiniymath@gmail.com

[4]Assistant professor, Department of Kaumarbhritya, Ramkrishna Ayurvedic medical college, Bengaluru.
Email ID: dr.chidanandk0804@gmail.com

[5]PG Scholar, Department of Kaumarbhritya, KAHER's Shri BMK Ayurveda Mahavidhalaya, Shahpur, Belagavi.
Email ID: drishakandwal@gmail.com

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ABSTRACT

There are normally two arteries and one vein in the umbilical cord. The vein assists in transporting oxygenated blood from the placenta to the foetus, whereas the arteries are responsible for waste products and deoxygenated blood from the foetus to the placenta. On the other hand, a single umbilical artery may result from the atrophy or initial agenesis of one of the arteries.

A careful evaluation procedure was started to check for possible congenital defects at the NICU of our hospital, after a single umbilical artery was noticed in a new born during postnatal examination.

The aim of presenting this case is to contribute the comprehensive understanding of single umbilical artery (SUA) in new-borns by providing a detailed examination of its prenatal detection, postnatal implications, associated conditions, and long-term outcomes within a clinical context. By synthesizing both prenatal and postnatal diagnostic reports, this case aims to enhance the knowledge base of healthcare professionals, enabling them to recognize, evaluate, and manage SUA more effectively.

Keywords: *single umbilical artery, congenital anomalies, prenatal detection, postnatal implications*

1. INTRODUCTION

The arterial system forms during the fourth and fifth week of embryonic development. [1] The umbilical arteries, two of them, carry deoxygenated blood from the foetus to the placenta. [2] Once they reach the placenta, they split into smaller arteries called chorionic arteries, which then branch out into the villi. Inside these villi, there's a network of tiny blood vessels where oxygen and nutrients are exchanged between the mother and the foetus. The well-oxygenated blood then travels back to the foetus through the umbilical vein, bypassing some of the liver. This blood is about 80% saturated with oxygen, compared to the 98% saturation found in adult arteries. [3] The proximal portions of the umbilical arteries evolve into the internal iliac arteries and the superior vesical arteries. Postnatally, the distal segments undergo obliteration, forming the medial umbilical ligament. [4] Three theories exist regarding the cause of an absent umbilical artery: primary agenesis, secondary atrophy or atresia of the previously developed vessel, and persistence of the original allantoic artery of the body stalk. [1]

Clinical studies have reported an incidence of 0.5% for the most frequent congenital abnormality, which is the lack of one umbilical artery. According to autopsy records, this incidence may be up to four times greater. The frequency of afflicted twins is three to four times higher than that of singletons. [1]

The development of SUA can be greatly impacted by environmental factors. SUA is frequently linked to a number of clinically significant deformities, including digestive, urinary, cardiac, and other abnormalities. Eight to eleven percent of SUA cases had chromosomal abnormalities such as trisomy 13 and 18, but not trisomy 21. Additionally, the likelihood of growth issues during pregnancy is increased. [1]

2. CASE REPORT

We present a case of a new-born with an isolated single umbilical artery (SUA) born to a 23 years old Gravida-2 mother. The parents have a second-degree consanguineous marriage. The first child was born through a normal vaginal delivery and is reported as healthy. There is no obstetric history of thyroid disorder, diabetes, or hypertension in the mother. A second-trimester Doppler ultrasound at 22 weeks +3days gestation confirmed the presence of SUA without concurrent foetal or placental anomalies(Fig-1). A Single Live Full Term Female baby was delivered via normal vaginal delivery with 40 weeks+2days of gestational age. Baby cried immediate after birth. One loose loop of cord with one knot around neck was present. Liquor was clear. Postnatal assessment revealed a female infant with stable vitals, of birth weight 3170gm with presence of single umbilical artery and vein was and no other dysmorphic features or congenital anomalies noted on examination. All Primitive reflexes were present and normal. Ballard's scoring for Neuromuscular and Physical growth was done.(1)According to Ballard score the Gestational age was 38weeks of baby and Anthropometry done after 24 hours of life Head circumference (HC)- 34cm,Chest circumference(CC)-32cm.,Length-48cm, Subsequent abdominal ultrasound on day 7 of life showed no abnormalities, with both kidneys appearing normal(Fig-2). Routine echocardiography, identified a Moderate sized fossa ovalis Atrial Septal Defect(ASD), Left to right shunt, Dilated right atrium and right ventricle, Paradoxical septal motion, Normally connecting pulmonary veins, Normal pulmonary artery pressure, Normal ventricular function (Fig-3).

3. DISCUSSION

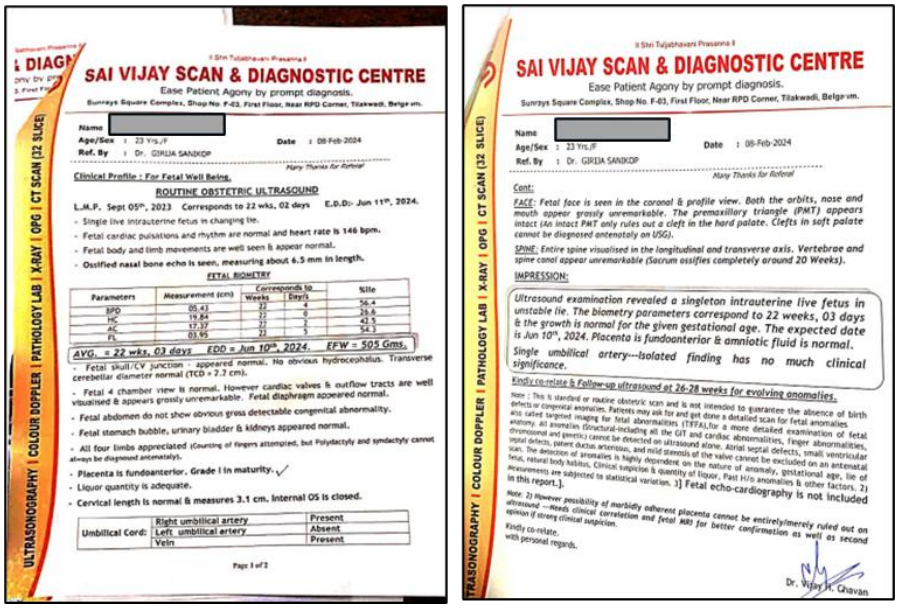
The prevalence of single umbilical artery (SUA) ranges from 0.2% to 0.87% and is more common in multiple pregnancies.[5] The umbilical cord evaluation in obstetric ultrasound includes identifying the number of vessels, crucial for detecting a single umbilical artery (SUA). [8] Colour Doppler ultrasound confirms SUA by visualizing one or both arteries near the bladder. This is especially useful in early pregnancy or cases of poor resolution. The umbilical arteries are apparent on high resolution transvaginal colour Doppler from about 12weeks onward [1]

Prenatal ultrasound assessment for SUA is typically conducted during the second and third trimesters.(6) In this case, a second-trimester ultrasound at 22 weeks revealed SUA without associated anomalies. Isolated SUA is a recognized risk factor for adverse pregnancy outcomes, including heightened risks of intrauterine and intrapartum deaths. Neonates with SUA also exhibit increased susceptibility to intrauterine growth restriction, prematurity, and mortality compared to those with a three-vessel cord. Additionally, this baby was not born prematurely with low birth weight.[7]

Previous studies have shown that a two-vessel cord can occur alone or with other anomalies, with reported incidences ranging from 13% to 50%.[5] In other studies found that 21% of karyotyping procedures were performed due to sonographically detectable structural disorders, with 13.5% of these cases showing abnormal karyotypes[5&9]. Urogenital and cardiovascular anomalies are commonly associated, while musculoskeletal, gastrointestinal anomalies are less frequent. This suggests a need for foetal echocardiography in cases of SUA due to the frequent co-occurrence of cardiac anomalies. SUA is linked to chromosomal disorders like trisomy 13 and 18, with absent LUA often seen in abnormal karyotypes. Even without other defects, isolated SUA may increase the risk of intrauterine growth restriction (IUGR). [10]

4. CONCLUSION

In conclusion, when a single umbilical artery is detected prenatally, a comprehensive sonographic assessment with echocardiography is essential to rule out associated anomalies. Foetal karyotyping should be considering only if additional anomalies are detected on ultrasound. [1] While this new-born showed no anomalies on renal ultrasonography, regular follow-up is necessary because there could still be an elevated risk of structural anomalies in the newborn, potential occult renal malformations like vesico-ureteric reflux (VUR). Vigilant monitoring and management of urinary tract infections (UTIs) are crucial, including post-treatment micturating cystourethrogram to rule out VUR. [5]



SAI VIJAY SCAN & DIAGNOSTIC CENTRE

Ease Patient Agony by prompt diagnosis.

Sunrays Square Complex, Shop No. F-03, First Floor, Near RPD Corner, Tilakwadi, Belgaum.

Name [redacted]
Age/Sex : 23 Yrs./F
Ref. By : Dr. GIRIJA SANJKOP
Date : 08-Feb-2024

Many Thanks for Referral

Clinical Profile : For Fetal Well Being.

ROUTINE OBSTETRIC ULTRASOUND

L.M.P. Sept 05th, 2023 Corresponds to 22 wks, 02 days E.D.D:- Jun 11th, 2024.

- Single live intrauterine fetus in changing lie.
- Fetal cardiac pulsations and rhythm are normal and heart rate is 146 bpm.
- Fetal body and limb movements are well seen & appear normal.
- Ossified nasal bone echo is seen, measuring about 6.5 mm in length.

FETAL BIOMETRY

Parameters	Measurement (cm)	Corresponds to Weeks	Days	%ile
BPD	05.43	22	4	56.4
HC	19.84	22	6	26.6
AC	17.37	22	2	42.5
FL	03.95	22	5	54.3

AVG. = 22 wks, 03 days EDD = Jun 10th, 2024. EFW = 505 Gms.

- Fetal skull/CV junction - appeared normal. No obvious hydrocephalus. Transverse cerebellar diameter normal (TCD = 2.7 cm).
- Fetal 4 chamber view is normal. However cardiac valves & outflow tracts are well visualised & appears grossly unremarkable. Fetal diaphragm appeared normal.
- Fetal abdomen do not show obvious gross detectable congenital abnormality.
- Fetal stomach bubble, urinary bladder & kidneys appeared normal.
- All four limbs appreciated (Counting of fingers attempted, but Polydactyly and syndactyly cannot always be diagnosed antenatally).
- Placenta is fundoanterior. Grade I in maturity.
- Liquor quantity is adequate.
- Cervical length is normal & measures 3.1 cm. Internal OS is closed.

Umbilical Cord:	Right umbilical artery	Present
	Left umbilical artery	Absent
	Vein	Present

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Cont:

FACE: Fetal face is seen in the coronal & profile view. Both the orbits, nose and mouth appear grossly unremarkable. The premaxillary triangle (PMT) appears intact (An intact PMT only rules out a cleft in the hard palate. Clefts in soft palate cannot be diagnosed antenatal on USG).

SPINE: Entire spine visualised in the longitudinal and transverse axis. Vertebrae and spine canal appear unremarkable (Sacrum ossifies completely around 20 Weeks).

IMPRESSION:

Ultrasound examination revealed a singleton intrauterine live fetus in unstable lie. The biometry parameters correspond to 22 weeks, 03 days & the growth is normal for the given gestational age. The expected date is Jun 10th, 2024. Placenta is fundoanterior & amniotic fluid is normal.

Single umbilical artery---Isolated finding has no much clinical significance.

Kindly co-relate & Follow-up ultrasound at 26-28 weeks for evolving anomalies.

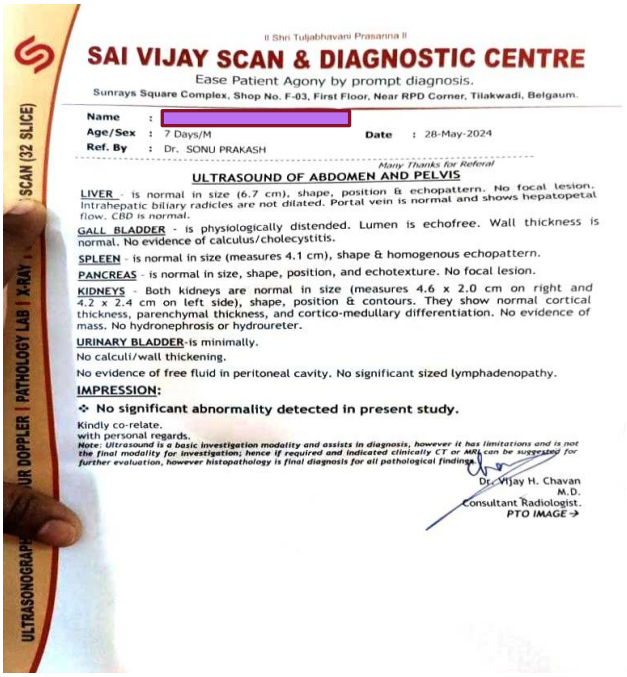
Note : This is standard or routine obstetric scan and is not intended to guarantee the absence of birth defects or congenital anomalies. Patients may ask for and get done a detailed scan for fetal anomalies also called targeted imaging for fetal abnormalities (TIFFA),for a more detailed examination of fetal anatomy. All anomalies (Structural-including all the GIT and cardiac abnormalities, finger abnormalities, chromosomal and genetic) cannot be detected on ultrasound alone. Atrial septal defects, small ventricular septal defects, patent ductus arteriosus, and mild stenosis of the valve cannot be excluded on an antenatal scan. The detection of anomalies is highly dependent on the nature of anomaly, gestational age, lie of fetus, fetanal body habitus, Clinical suspicion & quantity of liquor, Past H/o anomalies & other factors. 2) Measurements are subjected to statistical variation. 3] Fetal echo-cardiography is not included in this report.).

Note: 2) However possibility of morbidly adherent placenta cannot be entirely/merely ruled out on ultrasound ---Needs clinical correlation and fetal MRI for better confirmation as well as second opinion if strong clinical suspicion.

Kindly co-relate.
with personal regards.

Dr. Vijay H. Chavan

Fig.No-1 ULTRASOUND on 23WEEKS



II Shri Tuljabhavani Prasanna II

SAI VIJAY SCAN & DIAGNOSTIC CENTRE

Ease Patient Agony by prompt diagnosis.

Sunrays Square Complex, Shop No. F-03, First Floor, Near RPD Corner, Tilakwadi, Belgaum.

Name : [redacted]
Age/Sex : 7 Days/M
Ref. By : Dr. SONU PRAKASH
Date : 28-May-2024

Many Thanks for Referral

ULTRASOUND OF ABDOMEN AND PELVIS

LIVER - is normal in size (6.7 cm), shape, position & echopattern. No focal lesion. Intrahepatic biliary radicles are not dilated. Portal vein is normal and shows hepatopetal flow. CBD is normal.

GALL BLADDER - is physiologically distended. Lumen is echofree. Wall thickness is normal. No evidence of calculus/cholecystitis.

SPLEEN - is normal in size (measures 4.1 cm), shape & homogenous echopattern.

PANCREAS - is normal in size, shape, position, and echotexture. No focal lesion.

KIDNEYS - Both kidneys are normal in size (measures 4.6 x 2.0 cm on right and 4.2 x 2.4 cm on left side), shape, position & contours. They show normal cortical thickness, parenchymal thickness, and cortico-medullary differentiation. No evidence of mass. No hydronephrosis or hydroureter.

URINARY BLADDER-is minimally.
No calculi/wall thickening.

No evidence of free fluid in peritoneal cavity. No significant sized lymphadenopathy.

IMPRESSION:

❖ No significant abnormality detected in present study.

Kindly co-relate.
with personal regards.

Note: Ultrasound is a basic investigation modality and assists in diagnosis, however it has limitations and is not the final modality for investigation; hence if required and indicated clinically CT or MRI can be suggested for further evaluation, however histopathology is final diagnosis for all pathological findings.

Dr. Vijay H. Chavan
M.D.
Consultant Radiologist.
PTO IMAGE

Fig.No-2 USG OF BABY AFTER BIRTH

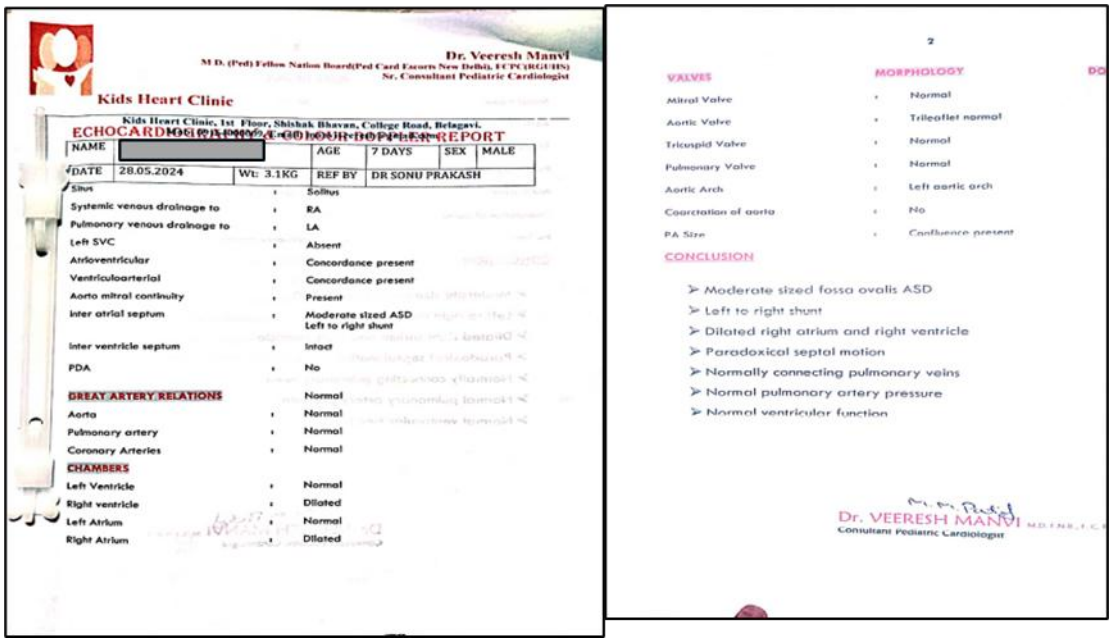


Fig.No-3 2D ECHO OF BABY AFTER BIRTH

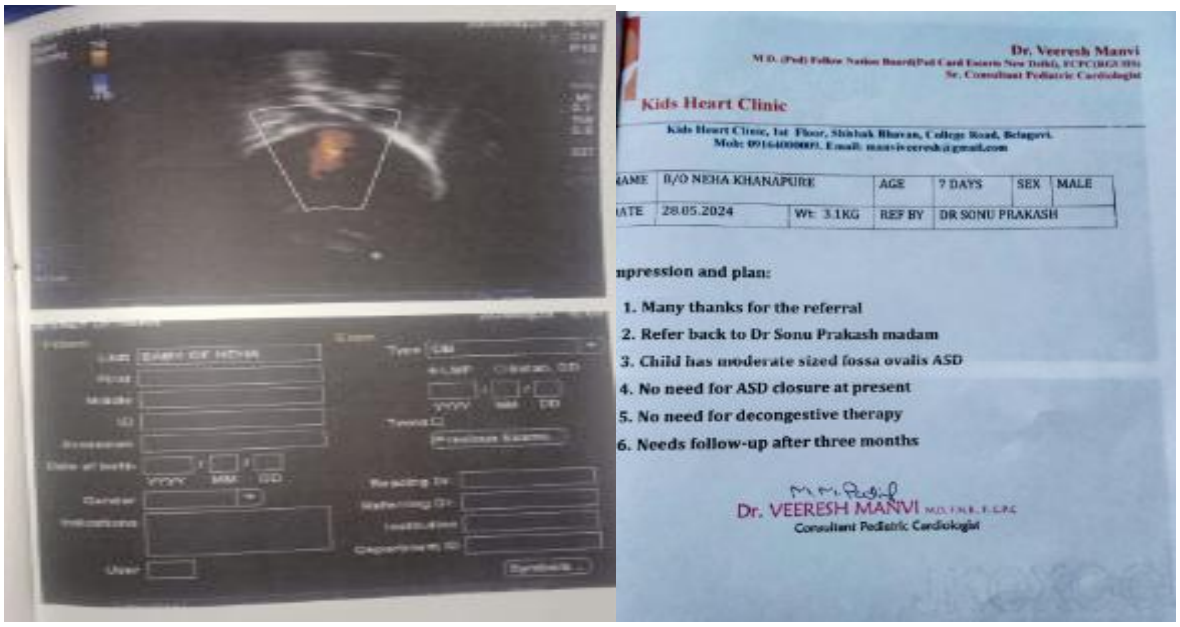
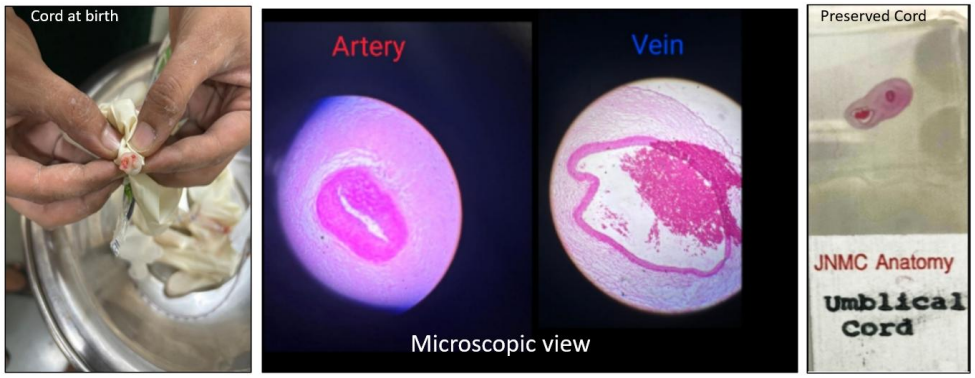


Fig.No-4 Original and Microscopic View of Umbilical Cord



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