International Journal of Medical Science and Clinical Research Studies

ISSN(print): 2767-8326, ISSN(online): 2767-8342

Volume 05 Issue 01 January 2025

Page No: 33-38

DOI: https://doi.org/10.47191/ijmscrs/v5-i01-06, Impact Factor: 7.949

Single Isolated Umbilical Artery in A Healthy Newborn: Case Report

Manuel Andrés Miranda Guillermo[1], David Arsenio Martínez Góngora[2], Orlando Jesus Sarmiento Haydar[2], Juan Carlos Cachón Alpuche[2], Mónica Campos Sánchez[2], Dalia Lucía Gómez Aguilar[2], Héctor David Guillermo Brito [3]

[1]Gynecology and Obstetrics Resident, Facultad de Medicina de la Universidad Autónoma de Yucatán. Clínica Hospital Mérida ISSSTE. Calle 21 s/n Comisaría de Susulá, Mérida, Yucatán, México. CP 97314.

[2]Gynecology and Obstetrics Service, Facultad de Medicina de la Universidad Autónoma de Yucatán. Clínica Hospital Mérida ISSSTE. Calle 21 s/n Comisaría de Susulá, Mérida, Yucatán, México. CP 97314.

[3]Gynecology and Obstetrics Service, Hospital Lic. Ignacio García Téllez, T1, IMSS, Calle 41 número 101, Fénix. CP 97155. UADY. Universidad Autónoma de Yucatán, Medical School

ABSTRACT

Introduction: The umbilical cord (UC) typically contains two arteries and one vein. The presence of a single umbilical artery (SUA) is the most common anomaly associated with the umbilical cord and is linked to various congenital conditions. However, SUA can also appear as an isolated condition (ISUA), occurring without any accompanying fetal structural or chromosomal abnormalities.

Clinical case: The case involves a 37-year-old primiparous patient with inadequate prenatal care. She presents to our medical unit for the first time at 38.2 weeks of pregnancy, experiencing latent phase labor and presentation dystocia. The patient has been diagnosed with SUA since 21.5 weeks of gestation. The pregnancy was resolved through an abdominal delivery, resulting in the birth of a healthy newborn.

Discussion: Pregnancies involving fetuses with SUA are associated with an increased risk of various malformations, including renal, cardiac, nervous system, and gastrointestinal issues. These pregnancies may also lead to complications such as a small fetus for its gestational age, fetal growth restriction, abortion, preterm birth, and perinatal death. However, as illustrated in this case, SUA can occur without resulting in any adverse perinatal outcomes.

KEYWORDS: Newborn, pregnancy, Single umbilical artery, umbilical cord, congenital malformations, ultrasound.

ARTICLE DETAILS

Published On:
06 January 2025

Available on:
https://ijmscr.org/

INTRODUCTION

The umbilical cord (UC) is a vital, temporary vascular structure essential for transporting oxygen and nutrients from the placenta to the fetus. It begins to form in the fifth week of gestation and typically consists of three vessels: two arteries and one vein. The arteries are longer and narrower than the vein, coiling around it and sometimes developing sinusoids or protuberances along their path. The cord can coil up to 40 times. In cases of SUA, the normal spiraling of the cord is absent. Oxygenated blood travels to the fetus through the umbilical vein, while deoxygenated blood returns via the umbilical arteries. The cord is covered by the amnion, except near the fetal insertion point, where it is replaced by an epithelial layer. Surrounding the vessels is a loose, gelatinous connective tissue known as Wharton's jelly. This tissue, composed of a hydrophilic extracellular matrix, provides support to the umbilical vessels, helping to prevent excessive compression or distension. At the end of pregnancy, the umbilical cord has an opaline white color, and the vessels become transparent through the surrounding tissues. On average, it measures approximately 55 cm in

length, with normal variations ranging from 30 to 100 cm, and a diameter of 0.8 to 2 cm. [1, 2, 3, 4].

The single umbilical artery (SUA) is characterized by the absence of one of the two umbilical arteries. It is one of the most common congenital defects of the umbilical cord and is associated with an increased risk of various congenital anomalies. When SUA occurs without any structural or chromosomal malformations in the fetus, it is referred to as isolated single umbilical artery (ISUA) [6].

SUA is the most common abnormality associated with UC. Pregnancies with fetuses having SUA face a higher risk of renal, cardiac, nervous system, and gastrointestinal malformations, as well as being small for gestational age, experiencing fetal growth restriction, abortion, preterm birth, and perinatal death. [7,8].

The origin of this pathology is linked to excess vitamin A, thalidomide, and dental and tonsil infections. [1].

The primary risk factors include pregnant women with diabetes, individuals of Caucasian descent, those with epilepsy, smokers, first-time pregnancies in young women or older women who have had multiple pregnancies, twin pregnancies, use of assisted reproductive technologies, abnormal results in biochemical screenings, and male newborns. [1,5,7,9].

The most common associated anomalies include genitourinary, cardiac, nervous system, gastrointestinal, musculoskeletal malformations, and abdominal wall defects, among others [7,10].

The most frequent chromosomal abnormalities in these cases are trisomy 18, trisomy 13, triploidy and monosomy X, almost always associated with a fetal structural anomaly [1,7].

The diagnosis of this pathology is made as an ultrasound finding during prenatal monitoring [6].

The next clinical case we will discuss involves the diagnosis and management of a patient with a fetus diagnosed with ISUA.

CLINICAL CASE

A 37-year-old woman, who is a first-time mother, visited our clinic for the first time without adequate prenatal monitoring. She reported having regular uterine contractions for the past six hours, experiencing scant vaginal bleeding, and expelling a mucous plug.

Upon direct questioning, she denied any congenital malformations or chromosomal abnormalities in her first-degree relatives. She has a history of smoking since the age of 15, currently smoking one cigarette a day. Two years ago, she underwent a cystectomy and right oophorectomy due to a hemorrhagic ovarian cyst, and she denies having any chronic or degenerative diseases. She is allergic to metoclopramide.

This is her first pregnancy, with regular menstrual cycles. The date of her last menstruation was November 5, 2024, placing her at 38.2 weeks of gestation at the time of questioning. Her prenatal care began at 21 weeks, and she has had two prenatal consultations as well as an obstetric structural ultrasound.

During the physical examination, her vital signs were within normal limits: blood pressure was 124/71 mmHg, heart rate was 92 beats per minute, respiratory rate was 17 breaths per minute, temperature was 36.6 ºC, and oxygen saturation was 98%. She weighed 79 kg and her height was 1.58 m, resulting in a BMI of 31.6. The uterine fundal height measured 30 centimeters, and the examination revealed a single live fetus with a heart rate of 156 beats per minute, in a transverse position with the anterior dorsum and the cephalic pole to the right. She was having three contractions within ten minutes, lasting 30 seconds each, and cervical dilation was at 3 centimeters.

Cardiotocographic recording is performed for 20 minutes, classified as category 1.

Laboratory tests on admission reported: hemoglobin 12.1 g/dl, hematocrit 37.8%, platelets 155 X10^3/uL, leukocytes 8.58 X10^3/uL, PT 11.0 sec., PTT 26.3 sec., INR 1.00, glucose 95 mg/dl, urea 24 mg/dl, creatinine 0.72 mg/dl, uric acid 4.9 mg/dl, cholesterol 216 mg/dl, triglycerides 255 mg/dl, total bilirubin 0.28 mg/dl, direct bilirubin 0.05 mg/dl, indirect bilirubin 0.23 mg/dl, ALT 23 U/L, AST 20 U/L, Alkaline phosphatase 185 U/L, DHL 128 U/L, GGT 9 U/L, blood group O positive, VDRL negative, HIV negative. General non-pathological urine examination.

The patient presents with a report from a structural ultrasound conducted at a private institution. The findings indicate a single, live fetus in a longitudinal position, with its back facing to the right. There are no morphological abnormalities observed. The estimated gestational age, based on fetometry, is 21.5 weeks, and the estimated fetal weight is 464 grams, which falls within the 70th percentile for this stage of pregnancy. The fetus is male, and the umbilical cord contains one artery and one vein, as confirmed by a cross-section of the cord.

The placenta is located anteriorly and is classified as maturity grade I, with the Chamberlain amniotic fluid measuring 4.0 cm. A Doppler assessment of the uterine arteries showed a pulsatility index (PI) of 0.77 for the right uterine artery and 0.82 for the left uterine artery, resulting in an average PI of 0.79, which is below the 95th percentile. The total and functional cervical length measures 32 mm and exhibits T morphology. No markers indicating potential chromosomal abnormalities were found during the second trimester ultrasound.

In the emergency room, an obstetric ultrasound was performed, revealing a single live fetus in a transverse position with the anterior dorsum facing up and the cephalic pole oriented to the right. The fetal heart rate was measured at 150 beats per minute. The estimated fetal weight was 2,980 grams, placing it in the 33rd percentile. Fetal movements were present, and the Phelan index was recorded at 8 cm. The placenta was Grade II, located fundically and

anteriorly. The umbilical cord was free and contained two vessels: one vein and one artery, as confirmed by visualizing a single vessel around the bladder (Figures 1 and 2).

Due to the high risk of dystocia associated with this pregnancy, a decision was made to terminate it via cesarean section. The procedure was performed smoothly, resulting in the delivery of a male newborn

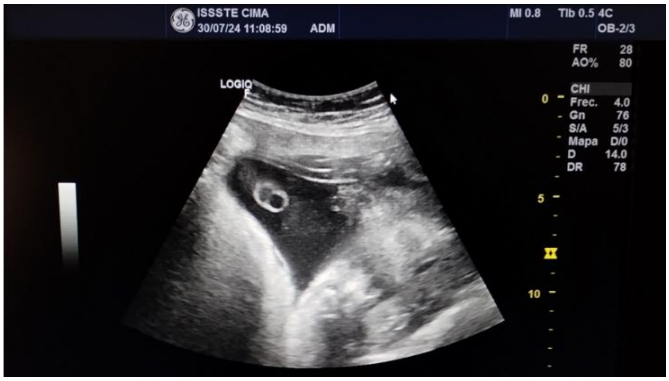

Figure 1. Cross-sectional ultrasound of the umbilical cord, showing two vessels. "Soda can tab" sign.

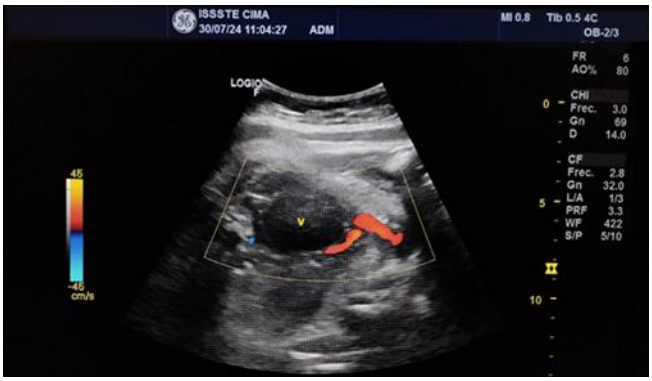

Figure 2. Ultrasound cross section of the fetal bladder (v). With color Doppler, the umbilical artery is observed on only one side of the fetal bladder.

Key details of the newborn include: - APGAR score: 8/9, gestational age: 38 weeks, weight: 2,875 grams, height: 47 centimeters, head circumference: 34 centimeters, chest circumference: 33 centimeters, abdominal circumference: 30 centimeters, lower segment: 19 centimeters, foot length: 8 centimeters, the amniotic fluid was clear with some lumps, and the umbilical cord was not coiled, consisting of two vessels—one vein and one artery. The placenta showed no apparent macroscopic alterations (Figures 3 and 4).

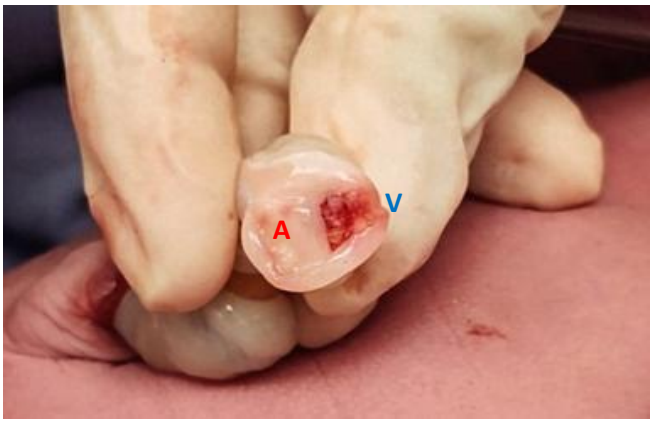

Figure 3. Umbilical cord after cutting. Two glasses are seen. Vein (V in blue) and artery (A in red).

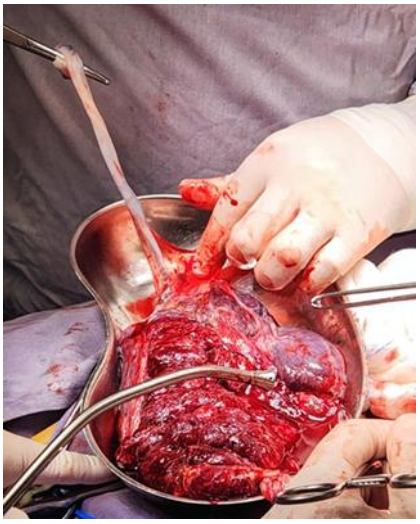

Figure 4. Placenta and umbilical cord. Note the uncoiled umbilical cord.

Upon physical examination, no structural abnormalities were found in the newborn. Heart sounds were rhythmic, with appropriate intensity and frequency. The abdomen exhibited present peristalsis, was soft and depressible, and no masses or organ enlargement were palpable. Esophageal patency was confirmed using a 10 Fr probe. The umbilical stump was ligated, with one artery and one vein, resulting in an artery-to-vein ratio of 1:1. The genitalia were phenotypically male, with both testicles palpated in the scrotal sacs. The anus was patent, also confirmed with a 10 Fr probe.

The extremities of the newborn were symmetrical and well-nourished, demonstrating preserved tone, strength, sensitivity, and mobility. Both Barlow, Ortolani, and Pistón tests were negative, and primitive neurological reflexes were elicitable on both sides.

The following day, the newborn underwent an ultrasound of the kidneys and urinary tract. The results showed that the right kidney measured 35 x 18 x 22 mm with a volume of 7 cc, and the left kidney measured 34 x 19 x 19 mm with a volume of 6 cc. Both kidneys were normal

in shape, size, and echogenicity, and exhibited an adequate corticomedullary relationship, without any evidence of stones or dilatations. No focal lesions were observed, and the bladder was not distended.

Subsequently, both the mother and newborn displayed adequate clinical progress, allowing for their discharge after a 48-hour hospital stay. One week later, the newborn underwent neonatal metabolic screening, which returned negative results for all markers.

As our clinic provides secondary level care, the pediatric service refers patients back to the primary care family medicine unit for monitoring healthy child development, including weight and height.

DISCUSSION

Understanding the embryology, anatomy, and physiology of the umbilical cord is essential for comprehending its development during gestation and potential variants, which may sometimes have a favorable prognosis if they occur in isolation. [3].

Single Umbilical Artery (SUA) is the most common abnormality associated with umbilical cord conditions, though its prevalence varies based on the population studied. In terms of gestational age, SUA is found in about 5.9% of cases between 11 and 14 weeks, and in 0.48% of cases between 16 and 23 weeks. In singleton live births, the prevalence is approximately 0.5% to 1%, while in twins, it ranges from 5% to 8%. SUA occurs in about 2% of spontaneous abortions and can be present in up to 7% of therapeutic abortions when a fetal structural anomaly is detected. Furthermore, SUA is identified in roughly 3.9% of perinatal autopsies. [1,11,12].

This condition is more commonly found in pregnant women with diabetes, individuals of the white race, those with epilepsy, smokers, and women experiencing their first pregnancy, particularly if they are young or elderly multiparous women. It is also more prevalent in cases of twin gestation and assisted reproduction. Additionally, alterations in biochemical screening have been noted. Research indicates that male fetuses are more frequently affected and are more likely to present additional malformations compared to female fetuses. [1,5,7,9,]. In this case, the patient has been a smoker since she was 15 years old and continued to smoke during her first pregnancy. She is at an increased risk due to her maternal age. The newborn is male, and as noted, she has several risk factors for Single Umbilical Artery (SUA).

The exact cause of SUA is not well understood, but there are three possible explanations: primary agenesis, thrombotic atrophy of an umbilical artery, and the persistence of the original allantoic artery within the body stalk. The likely etiology of SUA can be categorized into four types. [11].

- **Type 1:** The umbilical cord contains two functional blood vessels: one artery, which originates from the allantois, and one vein, which is derived from the left umbilical vein. This specific type of subumbilical atrophy has been associated with genitourinary abnormalities. It is the most common form of subumbilical atrophy, accounting for 98% of all cases.
- **Type 2:** The umbilical cord contains two functional blood vessels: an artery of vitelline origin that arises from the superior mesenteric artery and a vein that originates from the left umbilical vein. Abnormalities in the umbilical cord have been linked to severe fetal conditions, the most common being caudal regression syndrome and sirenomelia, along with type 2 adrenal muscular atrophy.
- **Type 3:** The umbilical cord contains three functional blood vessels: one artery of allantoic origin and two veins. The veins come from the left umbilical vein and a persistent abnormal right umbilical vein. This form of subacute umbilical atrophy has been linked to severe congenital abnormalities and a poor fetal prognosis. However, it is a rare condition.
- **Type 4:** The umbilical cord consists of two vessels: an artery of vitelline or allantoic origin and a vein derived from the right umbilical vein. This type may experience greater embryonic loss, although such occurrences are extremely rare.

Atrophy of a normal umbilical artery is regarded as the most likely cause of SUA in humans. Studies show that 40% of umbilical cords with SUA, when examined microscopically, contain muscle remnants. This evidence supports the theory of atrophy as a contributing mechanism in these cases. [1].

The patient in our case did not receive adequate prenatal care, which led to the diagnosis of ISUA during the second trimester following a structural ultrasound. It is most likely classified as type 1 due to subumbilical atrophy, as this is the most common type and is present in nearly all cases.

Differential diagnoses for fetuses with SUA include the presence of fused arteries at the placental insertion site. In this scenario, the umbilical arteries may fuse along a short segment (less than 3 cm) of the cord. It is essential to visualize the vessels on both sides of the bladder to rule out SUA. Another possible diagnosis is the hypoplasia of one umbilical artery. This condition occurs when both arteries are present, but there is a significant size difference between them. While it can occasionally be identified through ultrasound before birth, diagnosing it after birth is challenging due to the natural constriction of the umbilical vessels. [11].

In our patient, fused arteries at the placental insertion site have been ruled out as a differential diagnosis. This conclusion is based on a thorough ultrasound examination conducted upon admission to our clinic, which included assessments of the abdominal insertion, intra-abdominal portion, and placental insertion. Regarding hypoplasia of an umbilical artery, it is challenging to identify this condition

due to the normal anatomical changes in the umbilical vessels that occur after birth.

Many clinics today are equipped with high-resolution ultrasounds, allowing for the diagnosis of abnormalities associated with SUA. However, up to 7% of cases may remain undiagnosed until birth.

Since SUA is considered a soft ultrasound marker, a thorough anatomical study of the fetus is essential. This examination should focus on the structures that are most associated with congenital anomalies. The most frequent malformations, in order of prevalence, are genitourinary abnormalities at 6.48%, cardiovascular issues at 6.25%, and musculoskeletal disorders at 5.44%. [6,10]

The presence of a SUA can be detected in the first trimester; however, the sensitivity and specificity of this detection are significantly higher in the second and third trimesters. Specifically, the sensitivity increases from 57.1% in the first trimester to 86.6% in the later trimesters, while the specificity improves from 98.9% to 99.9%. This enhancement in detection is due to the fact that umbilical vessels are small during the first trimester, making them more challenging to observe. In contrast, by the second and third trimesters, the umbilical vessels can be easily visualized in cross-sectional images of the cord using two-dimensional ultrasound. An absent umbilical artery appears on the ultrasound like a "soda can tab" and can be confirmed by the lack of its intra-abdominal portion. [6,11]. During the patient's admission to our clinic, an ultrasound was performed. The cross-sectional imaging of the fetal bladder confirmed the diagnosis of SUA, as it occurred in the third trimester and the blood vessels were clearly visible.

In cases ISUA with normal fetal growth, routine fetal testing is typically not recommended. However, some authors suggest performing ultrasounds at 28 and 35 weeks to check for fetal growth restriction, as there is an increased risk of this complication when there is a single umbilical artery. [6,11]. Upon the admission of our patient, an obstetric ultrasound was performed, which estimated the fetal weight to be 2,980 grams, placing it in the 33rd percentile. This result rules out the possibility of fetal growth restriction or that the fetus is small for gestational age. It is important to note that the patient did not undergo first trimester screening for this condition.

The diameter of the artery increases because all fetoplacental circulation is transported through a single vessel, resulting in a compensatory increase in arterial diameter. The diameter of the artery increases because all fetoplacental circulation is transported through a single vessel, resulting in a compensatory increase in arterial diameter. [1]. As can be seen in figures 1 and 3 of our case.

Color Doppler is helpful in situations where it is challenging to view the umbilical vessels, such as in cases of oligohydramnios, early gestational age, maternal obesity, or a coiled umbilical cord. Additionally, it is common to observe a loss of the normal spiral formation of the cord in these instances. [1]. During the color Doppler ultrasound of our patient, we confirmed the diagnosis in the intra-abdominal portion and noted a loss of spiralization that had been observed at birth. The use of color Doppler was particularly helpful, given that the patient has WHO grade I obesity.

The presence of a single artery in the umbilical cord, without other congenital anomalies, is not a reason to perform a karyotype analysis due to the low incidence of chromosomal abnormalities. [9]. It is advisable to consider requesting either invasive or non-invasive genetic studies for patients with this condition, depending on the clinical context. However, in this case, the patient did not receive adequate prenatal care and this was her first visit to our clinic. As a result, we were unable to evaluate the need for these studies. Additionally, our clinic, as a secondary care facility, does not offer these types of studies.

The mode of delivery is determined by factors such as prenatal risks, the mother's obstetric history, and her personal preferences. [7]. Our patient was in the latent phase of labor, presenting with dystocia. Considering the history of ISUA, it was decided to terminate the pregnancy via cesarean section due to the high risk of dystocic delivery and fetal distress.

A renal and urinary tract ultrasound in recommended for al neonates, since genitourinary malformations occur more frequently. It is important to mention the so-called silent renal anomalies with ISUA and it is found that up to 4.5% of these infants may have vesicoureteral reflux, which supports the need for a renal ultrasound for all newborns diagnosed with ISUA. In addition to this ultrasound, a thorough physical examination and cystourethrography should be performed based on the clinical context. [1,7]. The newborn in our clinical case underwent a thorough physical examination and a renal and urinary tract ultrasound, which showed no structural alterations. As our clinic is a second level of care, we do not have access to cystourethrography.

CONCLUSION

The case presented highlights the occurrence of a single isolated umbilical artery, which was confirmed at birth and found to be free of any structural or chromosomal malformations.

Ultrasound is a readily accessible, cost-effective, and highly beneficial tool for detecting and monitoring both umbilical cord malformations and structural defects.

It is essential for all physicians involved in the care of pregnant women and newborns to be knowledgeable about this condition. An ultrasound evaluation of the umbilical cord should be conducted starting in the first trimester to rule out any associated congenital defects. If any abnormalities are identified, it allows healthcare providers to offer the patient closer monitoring and comprehensive fetal care.

ACKNOWLEDGMENT

To “Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado (ISSSTE)” and the “Facultad de Medicina de la Universidad Autónoma de Yucatán (UADY)”.

REFERENCES

I. LázaroJ,Cid MJ, Repollés M. Actualizacion en el diagnóstico prenatal de arteria umbilical única. Clin Invest Ginecol Obstet [Internet]. 20204;31 (3):93-102. http://dx.doi.org/10.1016/s0210-573x (04)77310-4
II. García-Rabasco AE, Subiabre-Ferrer D, Alegre-de-Miquel V. Patología del área umbilical. Medicina Clínica Práctica [Internet]. 2019;2(6):105–8. Disponible en: http://dx.doi.org/10.1016/j.mcpsp.2019.08.002
III. Mottet N, Chaussy Y, Arbez-Gindre F, Riethmuller D. Fisiología y patologías del cordón umbilical. EMC - Ginecol-Obstet [Internet]. 2017;53(4):1–12. Disponible en: http://dx.doi.org/10.1016/s1283-081x(17)86887-9
IV. Debra LP, Mary LB. Care of the umbilicus and management of umbilical disorders, In: UptoDate, [Internet]. (Accessed on Jan 2024) https://www.uptodate.com/contents/care-of-the-umbilicus-and-management-of-umbilical-disorders-in-children
V. Sakar MN, Oğlak SC, Saridas Demir S, Gültekin H, Demir B. Isolated single umbilical artery: Implications for pregnancy. East J Med [Internet]. 2020;25(3):444–9. Disponible en: http://dx.doi.org/10.5505/ejm.2020.13540
VI. Yu J Wu Q, Kong F, Ning y. Diagnosis of single umbilical artery and risk of foetal congenital malformations by prenatal ultrasound: a retrospective study. BMC PregnancyChildbirth [Internet]2024;24(1):192 http://dx.doi.org/10.1186/s12884-024-06375-5
VII. McCully B, Dodampahala SH, Menon AS, D’Sa N, Day E, Ahmed M. The clinical implications of single umbilical artery: A case report and multifaceted review. Sri Lanka J Obstet Gynaecol [Internet]. 2024;46(1):1–10. Disponible en: http://dx.doi.org/10.4038/sljog.v46i1.8130
VIII. Karimi Rouzbahani A, Zarrinkoub N, Mahmoudvand G, Yari F. Single umbilical artery leading to intrauterine growth restriction: A case report. J Obstet Gynecol Cancer Res [Internet]. 2024;9(1):110–3. Disponible en: http://dx.doi.org/10.30699/jogcr.9.1.110
IX. Medina -Gaona LA, Neira – Magey E. Recién nacido sano con arteria única y nudo verdadero de cordón umbilical. Rev Mex Pediatr [Internet]. 2022;89(4):158-61. http: //dx.doi.org/10.35366/109591
X. Murphy-Kaulbeck L, Dodds L, Joseph KS, Van den Hof M. Single umbilical artery risk factors and pregnancy outcomes. Obstet Gynecol [Internet]. 2010;116(4):843–50.Disponible en: http://dx.doi.org/10.1097/aog.0b013e3181f0bc08
XI. Martin LG, Eva TR, Waldos S. Single umbilical artery, in UptoDate, [Internet](Accessed on may 2017) https:// www.uptodate.com/contents/single-umbilical-artery
XII. Saller DN Jr, Neiger R. Cytogenetic abnormalities among perinatal deaths demonstrating a single umbilical artery. Diagn 1994;14:13-6