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ENCOURAGEMENT AND APPRECIATION

In this unprecedented moment, science has repeatedly demonstrated that it is the viable and safe way to overcome the challenges imposed on public health worldwide. As long as we do not overcome this obstacle, it is time to maintain common sense and compliance with preventive rules by health authorities, in addition to reinforcing the incentive for scientific research.

SBUS has always done its part in promoting knowledge, holding or supporting the most varied scientific events. Not even the pandemic diverted our focus: SBUS reinvented itself and guaranteed the continuity of scientific programming using the online modality, ensuring the remote sharing of knowledge and experiences in a practical, successful and safe way. RBUS - Brasilian Journal Of Ultrasonography, our Blue Magazine, continues to be a tool that contributes decisively to encourage research with Brazilian ultrasonographers. Therefore, you are also part of these pages that help to value Brazilian ultrasonography even more.

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ORIGINAL ARTICLE

RETROSPECTIVE STUDY OF THE LAST 100 CASES OF ECHO-GUIDED LUMBAR BLOCK FOR MEDICAL FACETS AND BRANCHES IN A REFERENCE CLINIC IN THE CITY OF GOIÂNIA, BRAZIL

JOSE VICTOR LISBOA CARDOSO GOMES[1], MONRES JOSE GOMES[2], HEBE SOLEDAD SIMÕES GOMES DE MOURA[3], DOMINGOS RODRIGUES DE MOURA JÚNIOR[3], LUIS OTAVIO MANTOVANI BATTAGLIN[2], GILLIATT SAEKI SOUZA[4]; MÁRCIO OLIVEIRA GOMES FILHO[5], LORENA CUNHA SILVA[6], DOUGLAS SANTOS SOARES (IN MEMORIAN) [7]

ABSTRACT

OBJECTIVE: This study aims to demonstrate the results of ultrasound-guided blockade of the medial branches and lumbar facets in the treatment for pain relief.

MATERIALS AND METHODS: In this retrospective and comparative study, data analysis of the last 100 cases of lumbar block for medial facets and branches was performed in a reference clinic in the city of Goiânia-GO. The following information was also analyzed: age, sex, laterality, levels of involvement and confirmation of pain improvement using the visual analog scale (VAS). All patients underwent echo-guided puncture for blockade and the following medications were administered according to each case: 2% lidocaine without vasoconstrictor + betamethasone dipropionate (5mg/mL) + betamethasone disodium phosphate (2mg/mL) in medial cephalic and caudal branches of each level; Sodium hyaluronate 10mg/ml, being 0.5ml in each affected facet.

RESULTS: The ultrasound and other imaging tests of these patients contained data on impairment of articular facets at 1, 2 or 3 levels. The mean age of the patients was 61 years old, being the youngest patient at 32 years old and the oldest at 93 years old. As for sex, 40% were male and 60% female. As for laterality, 72 patients were affected bilaterally, which is equivalent to 72%. As for the levels of involvement that were blocked, there was the following arrangement of cases: 13% of the cases were of blocks in only one level, 67% of the cases affecting two levels and 20% of the cases affecting three levels, with the prevalence of occurrence being level of L4-L5.

CONCLUSION: Ultrasound-guided blockade of medial branches and lumbar articular facets at specific levels according to each indication, proved to be effective in the treatment of pain relief in degenerative interfacetary spondyloarthropathy. Two articular levels were the highest frequency of procedures, with the L4-L5 level being the most prevalent. And pain relief was rated between 0 and 3, after procedure.

KEYWORDS: ULTRASOUND-GUIDED BLOCKS, INTERFACETARY SPONDYLOARTHROSIS, LOW BACK PAIN.

INTRODUCTION

Low back pain is considered to be the first cause of visit to an orthopedic doctor's office worldwide. Lumbar facet joints correspond to 15% to 45% of patients with chronic low back pain according to the literature. The medial branches of the dorsal branch of the spinal nerve are responsible for innervating the interapophyseal joints and the deep spinal erector musculature. Over time, radiographic methods such as tomography and fluoroscopy have been and are still used as a guide for facet infiltrations and blockade of the medial branches. Ultrasound-guided nerve blocks have been reported, more recently as an important tool in the management of these cases, freeing patients and doctors from the harmful and cumulative effects of radiation.

This study aims to demonstrate the results of ultrasound-guided blockade of the medial branches and lumbar facets in the treatment for pain relief in the last 100 cases performed at a reference clinic in the city of Goiânia, Brazil.

MATERIAL AND METHODS

A Samsung brand, model HS 50 ultrasound equipment, with linear and convex multifrequency probes was used. A 22Gx3-1/2 spinal needle was used for the punctures.

Data analysis of the last 100 cases of blockade of the medial

1. Pontifícia Universidade Católica de Goiás
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branches and lumbar facets was performed in a reference clinic in the city of Goiânia-GO.

This retrospective and comparative study of the medical record data maintained the patients' privacy and data confidentiality throughout all the research process. This study did not have direct contact with the studied group and all patient identifiers were discarded from the data set at the time of the initial collection, thus obtaining the waiver of informed consent.

The following information was also analyzed: age, sex, laterality, levels of involvement and confirmation of pain improvement using the visual analog scale (VAS). After collecting and computing data via the Epi Info™ | CDC, the tabulated statistical information was obtained using the Microsoft Excel program.

All patients underwent echo-guided puncture for blockade and the following medications were administered according to each case: 2% lidocaine without vasoconstrictor + betamethasone dipropionate (5mg/mL) + betamethasone disodium phosphate (2mg/mL) in the medial cephalic and caudal branches of each level; sodium hyaluronate 10mg/ml, being 0.5ml in each compromised facet.

RESULTS

The last 100 cases of echo-guided procedures for lumbar degenerative facet spondyloarthropathy, performed at the reference musculoskeletal ultrasound clinic in Goiânia-GO, which provided the data for this research, were the basis of this study. The ultrasound and other imaging tests of these patients contained data on impairment of articular facets at 1, 2 or 3 levels.

These patients were submitted to ultrasound-guided puncture to block the medial cephalic and caudal branches of each level and their respective articular facets, with 2% lidocaine without vasoconstrictor + betamethasone dipropionate (5mg/mL) + betamethasone disodium phosphate (2mg/mL) and sodium hyaluronate 10mg/ml, the latter for facet infiltration.

The data are represented by table 1-5 and graphs 1-5.

The average age of the patients was 61 years old, being the youngest patient at 32 years old and the oldest at 93 years old. As for gender, 40% were male and 60% female.

As for laterality, 72 patients were affected bilaterally, which is equivalent to 72%. The left side was affected in 14% of the cases, which is equivalent to 14 patients. The right side was affected by 14% of the patients as well.

As for the levels of involvement that were blocked, there was the following arrangement of cases: 13% of the cases were of blocks in only one level, 67% of the cases affecting two levels and 20% of the cases affecting three levels, with the prevalence of occurrence being the level of L4-L5.

The analogue pain scale (VAS) was applied 30 minutes after the echo-guided procedure and showed that 100% of the patients rated the pain improvement from 0 to 3 in the VAS scale and walked out of the medical clinic. No complications greater than a simple lipothymia in just two cases were observed.

Table 1. Age of patients attended at a clinic in Goiânia, with inferfacetary spondyloarthropathy.

CI (years)	CC	FA	FR(%)	FRA(%)
32 ⊢ 40	36	15	15	15
40 ⊢ 48	44	9	9	24
48 ⊢ 56	52	10	10	34
56 ⊢ 64	60	21	21	55
64 ⊢ 72	68	10	10	65
72 ⊢ 80	76	14	14	79
80 H 93	87	21	21	100
TOTAL		100	100	

CI - Class Interval. CM - Class Mark. FA – Absolute Frequency AF – Relative Cumulative Frequency RCF

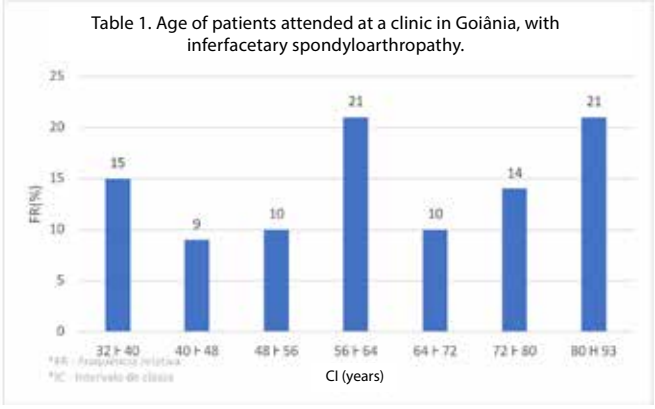


Table 2. Most affected sides of Interfacetary Spondyloarthropathy.

Sides	FA	FR(%)	FRA(%)
Left	14	14	14
Right	14	14	28
Bilateral	72	72	100
TOTAL	100	100	

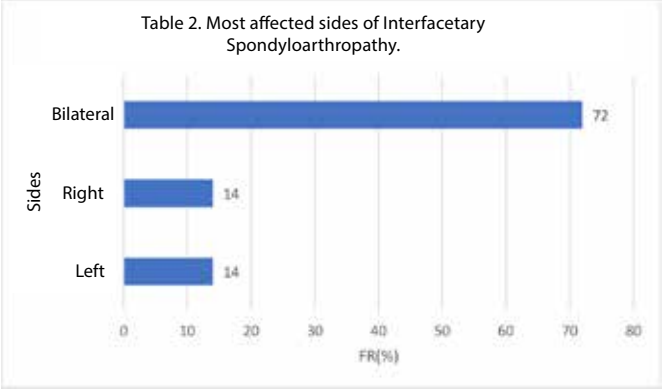


Table 3. Gender Distribution of patients with Interfacetary Spondyloarthropathy.

Sex	FA	FR(%)	FRA(%)
Male	40	40	40
Female	60	60	100
TOTAL	100	100	

Table 3. Gender Distribution of patients with Interfacetary Spondyloarthropathy.

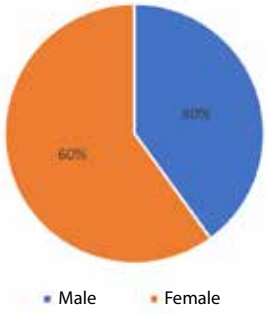


Table 4. Levels of involvement of Interfacetary Spondyloarthropathy.

Levels	FA	FR(%)	FRA(%)
One level	13	13	13
Two levels	67	67	80
Three levels	20	20	100
TOTAL	100	100	

Table 4. Levels of involvement of Interfacetary Spondyloarthropathy.

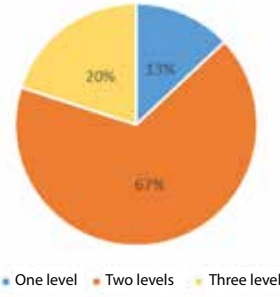
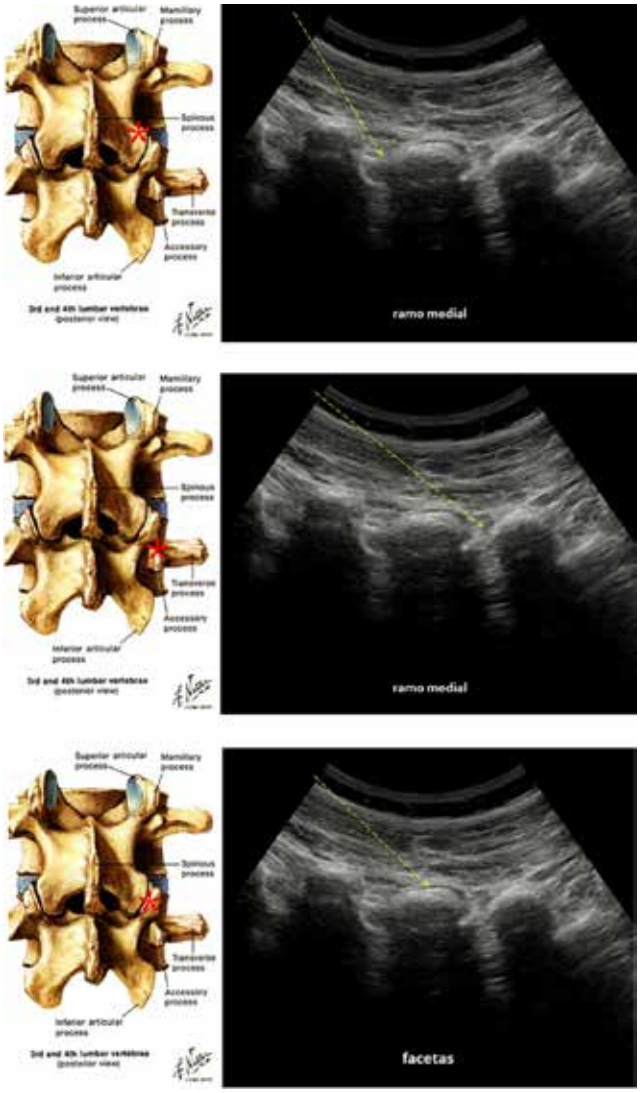


Table 5. VAS of pain after procedure in patients with Spondyloarthropathy Interfacetary

IC (EVA)	CC	FA	FR(%)	FRA(%)
0 ⊢ 3	2	100	100	100
3 ⊢ 6	5	0	0	
6 H 10	8	0	0	
TOTAL		100	100	

The videos of the eco-guided procedures can be viewed according to the QR codes below (bring your camera close to the QR Code):

Video 1: Facet blockade. Video 2: Caudal medial branch block



Figures 1, 2 and 3: Images illustrate with a red asterisk locating the targets in the interapophyseal and facet joints, where the needle is inserted in the path from proximal to distal, longitudinally in the direction of these targets at the level of L4-L5. The dotted arrow indicates the route.

Image 4 illustrates an echographic aspect of L4-L5 interfacet arthrosis comparing it to the image obtained by magnetic resonance imaging.

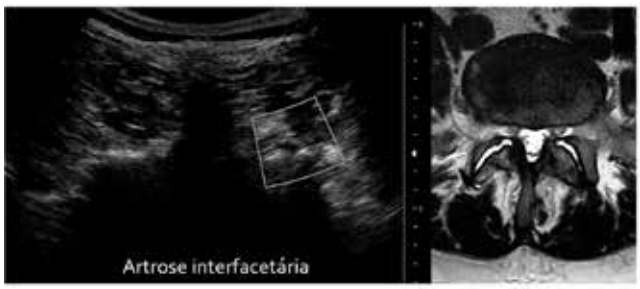


Figure 4: Transverse ultrasound image at the L4-L5 level showing facet arthrosis. Attached magnetic resonance image in the axial plane in T2.

DISCUSSION

The term facet syndrome was first described in 1933 by Ghormley RK[1] as pain induced during torsion or rotation of the lumbosacral region. The medial branches of the dorsal branch of the spinal nerve are responsible for innervating the interapophyseal joints and the deep spinal erector musculature. Over time, radiographic methods such as tomography and fluoroscopy have been and are still used as a guide for facet infiltrations and blockade of the medial branches.

Ultrasound-guided blocks began broadly in 1978 with La Grange et al [2], who drew attention for trying to perform ultrasound-guided brachial plexus block procedures. And from then on, numerous studies were published in this sense, until Greher et al [3] reported a target point for ultrasound-guided facet blockade. Since then, countless authors have been adding knowledge and qualifying the ultrasound method as a reliable guide for the procedures of facet and medial branches blocks.

Galiano et al [4] conducted this study to develop an ultrasound-guided approach for injections into the facet joints of the lumbar spine. Five zygapophyseal joints (L1-S1) on each side of five embalmed corpses were examined by ultrasound of a total of 50 exams. The study was comparative with computed tomography. They concluded that the orientation of the ultrasound can be a useful complement for injections in the facet joints in the lumbar spine[4].

In 2007 Galiano et al [5] in a prospective randomized clinical trial with 40 patients used facet injections guided by ultrasound versus computed tomography in the lumbar spine and concluded that the US approach in the facet joints of the lumbar spine is feasible with minimal risks in most patients and results in a significant reduction in the duration of the procedure and in the radiation dose[5].

Kim et al6 in 2013 observed that ultrasound-guided blocks of the medial branches and facet joints can be performed with 89.5% effectiveness, and advised that these procedures should be performed in outpatient clinics without the concern for radiation exposure [6].

In 2015, in a literature review with a total of 202 adult patients with facet joint pain, Wu et al.[7] evaluated the comparative effectiveness of ultrasound-guided injections (US) versus computed tomography (CT) and/or fluoroscopy. This review suggested that no significant differences in pain and functional improvement were observed between techniques guided by USG and CT/fluoroscopy in facet joint injection. USG injection is feasible and minimizes radiation exposure for patients and professionals in the process of

Ye et al [8] in 2018, studied ultrasound guidance versus low-dose computed tomography for injections in the lumbar facet joints, which showed the same precision and efficiency. 86.5% of the injections in the facet joints were performed correctly under the guidance of the ultrasound in the first attempt. They also concluded that the articular space of the lumbar facet can be accurately demonstrated by US. US-guided facet joint injection in the lumbar spine achieved almost the same satisfactory viability, accuracy, and clinical efficiency compared to low-dose CT. In addition, they concluded that the ultrasound technique can provide real-time monitoring [8].

In 2019 Shi et al [9] conducted a study showing the comparison of measurement between ultrasound and computed tomography for abnormal degenerative facet joints, and demonstrated that the US can clearly show the structure of the facet joints of the lumbar spine. That the method is accurate and viable to evaluate the lumbar spine joints by ultrasound. And that this study has an important significance for the diagnosis of degeneration of the lumbar facet joint.

In our study, the mean age of patients was 61 years and 40% were male and 60% were female. About 72% of the patients were affected bilaterally, with the left and right side with 14% for each side.

As for the levels of involvement that were blocked, there was the following arrangement of cases: 13% of the cases were of blocks in only one level, 67% of the cases affecting two levels and 20% of the cases affecting three levels, with the prevalence of occurrence being level of L4-L5.

The visual analogue pain scale (VAS) was applied in all cases after 30 minutes of the ultrasound-guided procedure and 100% of the patients rated the pain improvement between 0-3 in the VAS of 0-10 and all walked out of the surgery. No complications greater than mild lipothymia were observed in two cases.

CONCLUSION

Ultrasound-guided blockade of medial branches and lumbar articular facets at specific levels according to each indication, proved to be effective in the treatment of pain relief in degenerative interfacetary spondyloarthropathy.

The intrarticular application of hyaluronic acid still requires follow-up studies in the medium and long term.

Two articular levels were the highest frequency of procedures, with the L4-L5 level being the most prevalent. Moreover, pain relief was rated between 0 and 3 in VAS after the procedure.

It was also shown in this study that the majority of cases affected the female gender, the average age was 61 years old and regarding laterality 72% of patients were affected bilaterally.

REFERENCES

1. Ghormley RK. Low back pain: with special reference to the articular facets, with presentation of an operative procedure. 1933; 101:1773-1777.
2. La Grange P, Foster PA, Pretorius LK. Application of the Doppler ultrasound bloodflow detector in supraclavicular brachial plexus block. Ir. J Anaesth. 1978; 50: 965-967.
3. Greher M, Scharbert G, Kamolz LP, Beck H, Gustorff B, Kirchmair L, Kapral S. Ultrasound-guided lumbar facet nerve block: a sonoanatomic study of a new methodologic approach. Anesthesiology 2004; 100: 1242-1248.

4. Galiano K, Obwegeser AA, Bodner G, Freund M, Maurer H, Kamelger FS, Schatzer R, Ploner F. Guidance by ultrasound for injections into facet joints in the lumbar spine: a feasibility study controlled by computed tomography, Anesthesia and Analgesia. 2005; 101(2): 579-583.
5. Galiano K, Obwegeser AA, Walch C, Schatzer R, Ploner F, Gruber H. Ultrasound-guided versus computed tomography-controlled facet joint injections in the lumbar spine: a prospective randomized clinical trial. Reg Anesth Pain Med 2007; 32:317-322.
6. Kim D, Choi D, Kim C, Kim J, Choi Y. Transverse process and needles of medial branch block to facet joint as landmarks for ultrasound-guided selective nerve root block. Clin Orthop Surg. 2013; 5(1): 44-48.
7. Wu T, Zhao WH, Dong Y, Song HX, Li JH. Effectiveness of ultrasound-guided versus fluoroscopy or computed tomography scanning guidance in lumbar facet joint injections in adults with facet joint syndrome: a meta-analysis of controlled trials. Arch Phys Med Rehabil. 2016; 97(9):1558-1563.
8. Ye L, Wen C, Liu H. Ultrasound-guided versus low dose computed tomography scanning guidance for lumbar facet joint injections: same accuracy and efficiency. BMC Anesthesiol. 2018; 18(1):160.
9. Shi W, Tian D, Liu D, Yin J, Huang Y. The comparison of measurement between ultrasound and computed tomography for abnormal degenerative facet joints. Medicine. 2017; 96(31):e7680.

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ORIGINAL ARTICLE

PICTORIAL ESSAY: MAIN RADIOLOGICAL SIGNS IN ULTRASONOGRAPHY AND MAGNETIC RESONANCE OF PLACENTARY ACRETISM

VIVIANE VIEIRA FRANCISCO HABIB[1], VIVIANE LOPES CARDOSO[1], MARCELE MARANHÃO MAIA[1], ROBERTO CARDOSO[1]

ABSTRACT

OBJECTIVE: To describe and demonstrate the main radiological signs on ultrasound (US) and magnetic resonance imaging (MRI) in the diagnosis of placental accretism. CASUISTICS AND METHODS: Retrospective study carried out at Femme Laboratory of some pregnant women referred with clinical suspicion of placental accretism or who underwent routine US referrals from medical offices in greater São Paulo. Gestational age ranged from 24 to 37 weeks. Patients with suspected accretism were followed up through contact with the obstetrician and we identified the outcome that occurred. The examinations were performed using the equipment of US Toshiba and Voluson GE and the MRIs in Aera Siemens, acquired HASTE, TURBO FISP sequences, in the axial, sagittal and coronal planes and Gradiente echo (GE) in the best plane of acquisition of the placenta and the most common cases. Elucidative data were selected. The analysis of the images was performed by experienced doctors in fetal medicine and 1 radiologist with 18 years of experience in the diagnosis of accretism. RESULTS: The main signs found at US were: retroplacental hypoechoic gaps, increased vascularization of the myometrial wall, loss of boundaries between the placenta and the myometrium. MRI included thinning of the myometrial wall, heterogeneity of the placental signal, discontinuity of the myometrial wall, and hyposignal bands on the myometrial wall. FINAL CONSIDERATIONS AND CONCLUSION: US and MRI are useful in identifying placental accretism. It is essential that ultrasonographers and radiologists know and identify the main signs suggestive of accretism, as well as assess its extent for the delivery be safer.

KEYWORD: ULTRASOUND, ACCRETISM, MAGNETIC RESONANCE

INTRODUCTION

Ultrasonography is the first imaging modality in obstetrics as it is a safe and available method. A second method that can be performed without ionizing radiation, with better spatial resolution and multiplanar sections, is Magnetic Resonance Imaging (MRI) [1]. MRI uses electromagnetic radiation and generates detailed images with high tissue contrast.

Magnetic resonance imaging until 2002 was avoided in the first trimester and the use of contrast abolished during pregnancy [1] Today, MRI can be used at any gestational stage according to the maternal-fetal indication and the contrast can be used in pre-selected cases [1, 2, 3].

Placental accretism consists of abnormal placental adherence to the uterine wall. The histopathological basis consists of the absence or disorder of the basal decidua, which is the deepest layer of the endometrium. Abnormal placental adherence including the placenta accreta, increta or percreta is a frequent cause of postnatal hemorrhage [1,2,3,4]. The invasion of the chorionic villus in the myometrium increases the risk of bleeding, increasing the chances of blood transfusions or even hysterectomy, which directly affects the increase in morbidity and mortality[1].

The prevalence of accretism has increased significantly in the last fifty years, being found in recent works from [1]: 250 to 1: 93000 births. The placenta previa is the most frequent cause of placental accretism. The increase in the frequency of accretism correlates with the increase in the number of cesareans, multiparity, myomectomies and embolization of fibroids[1].

The extent of placental invasion is often not known until labor. This is due to the lack of definition in the literature of the best method of prenatal diagnosis of placental accretism, including the radiological signs and definitive maternal blood markers, and the lack of preparation of professionals to research this comorbidity.

Adequate detection of placental accretism and the extent of myometrial invasion would allow adequate planning of the delivery route, operative risk and safety measures under these conditions. This would result in reduced morbidity and a multidisciplinary approach to a potentially dramatic situation.

Ultrasonography (US), Doppler and MRI have been

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used as modalities in the diagnosis of placental accretism, but US is still the most accessible modality [1,2,3].

There are ultrasound criteria established for the diagnosis of placenta accreta and have been used with relative success. There are criteria for MRI, however they are constantly changing and updating [2,4].

There is already evidence in literature that MRI has an important role in helping to detect and complement the assessment of the extent of accretion and placental percretism [4,5].

OBJECTIVE

To describe and demonstrate the main radiological signs on ultrasound (US) and magnetic resonance imaging (MRI) in the diagnosis of placental accretism.

CASUISTICS AND METHODS

Retrospective study carried out at Femme Laboratory of some pregnant women referred with clinical suspicion of placental accretism or who came for routine US referrals from medical offices in greater São Paulo. Gestational age ranged from 24 to 37 weeks. Patients with suspected accretism were followed up through contact with the obstetrician and we identified the outcome that occurred. The examinations were carried out using the equipment of US Toshiba and Voluson GE and the MRIs in Aera Siemens, acquired HASTE, TURBO FISP sequences, in the axial, sagittal and coronal planes and Gradiente echo (GE) in the best plane of acquisition of the placenta. The analysis of the images was performed by experienced doctors in fetal medicine and 1 radiologist with 18 years of experience in the diagnosis of accretism.

RESULTS

THE DIAGNOSIS OF PLACENTARY ACCRETISM:

Placental accretionism is the abnormal adherence of the placenta to the wall of the uterus, being classified as accreta, percrete and increta according to the depth of invasion. Initially, this evaluation is performed by the US, which demonstrates retroplacental vascular gaps, loss of retroplacental hypoechoic pattern of and anomalous vessels exceeding the limit of the placenta. An US with B-mode scale and color doppler analysis presents a sensitivity of about 70% and specificity of about 96% in this assessment in literature [4- 15]. MRI represents an innocuous method in pregnancy and allows an exact assessment of the depth and extent of placental accretism, with a sensitivity of 99% and specificity of 86%, so it has an important impact on the adopted obstetric approach [4,8, 16-18, 20-29].

The main signs highlighted in the literature are: the thin myometrial thickness, the hypersignal of the placental transmural extension in the T2-weighted sequences and the hyposignal bands and exophytic masses [16,17, 19, 20-29].

In this study we will demonstrate the main signs seen in pregnant women monitored at our service.

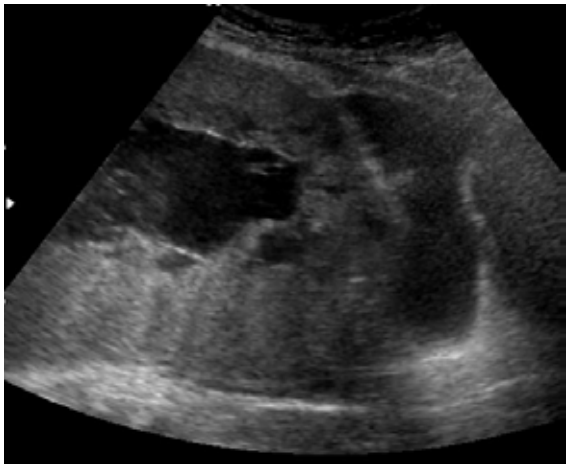

Figure 1: 27-week pregnant woman with low total center placenta insertion and loss of retroplacental hypoechoic myometrium pattern.

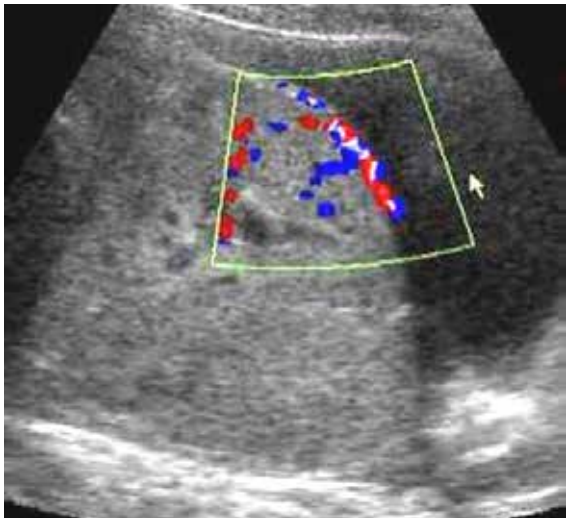

Figure 2: A 31-week pregnant woman with a placenta of low insertion in the total center and tortuous vessels invading the myometrium.

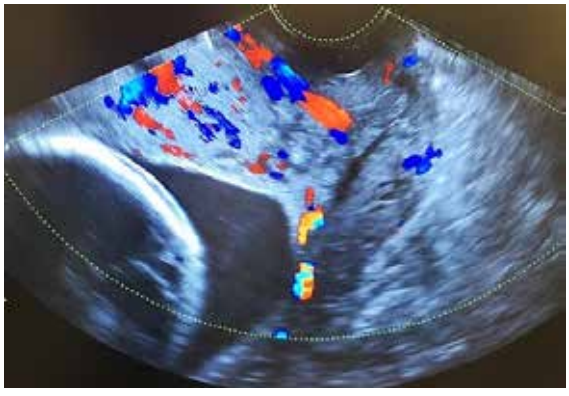

Figure 3: 33-week pregnant woman with low marginal insertion placenta and tortuous vessels invading the myometrium and irregular vascular gaps affecting mainly the cervix and isthmus.

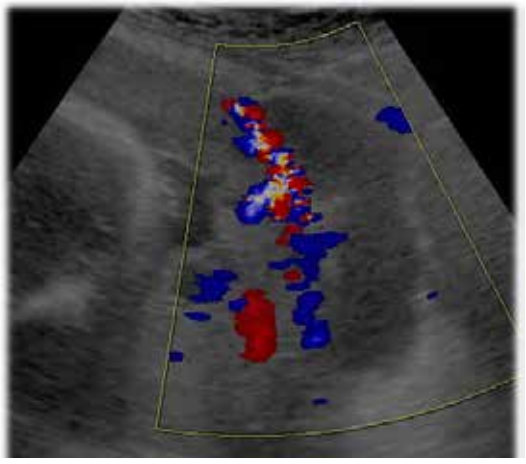

Figure 4: 34-week pregnant woman with low insertion placenta at the center and tortuous vessels invading the myometrium and irregular vascular gaps, mainly affecting the cervix, bladder and isthmus.

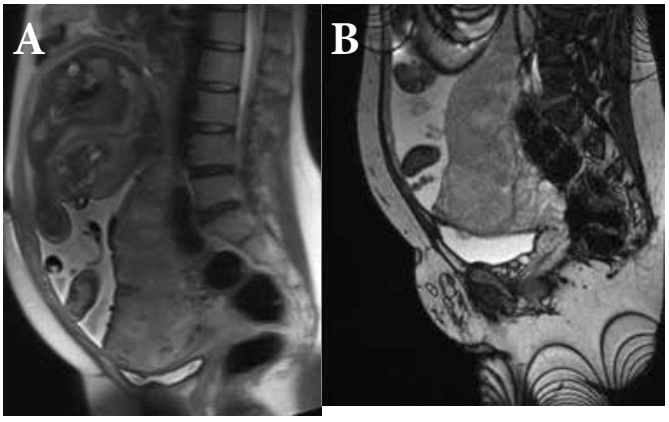

Figure 5: 32-week pregnant woman and diagnosis of percretism, in the sequences HASTE and TURBO FISP (a, b) shows transmural hypersignal of the placenta, thinning of the myometrial wall, focus of exophytic mass on the bladder wall and posterior myometrial wall.

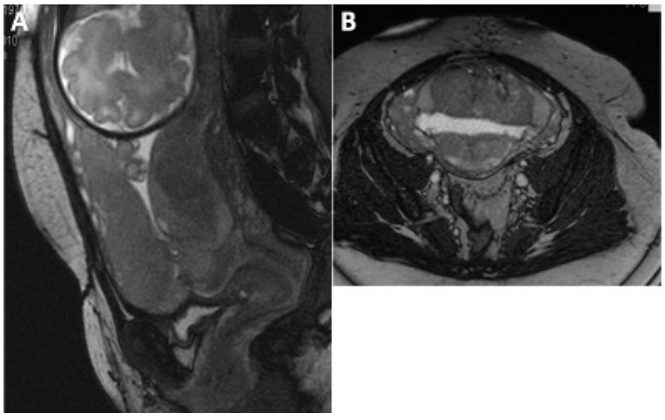

Figure 6: 34-week pregnant woman and diagnosis of accretism in the HASTE and TURBO FISP sequences (a,b) shows transmural hypersignal of the placenta, thinning of the myometrial wall and hyposignal bands in the placenta in the isthmic and cesarean scar region.

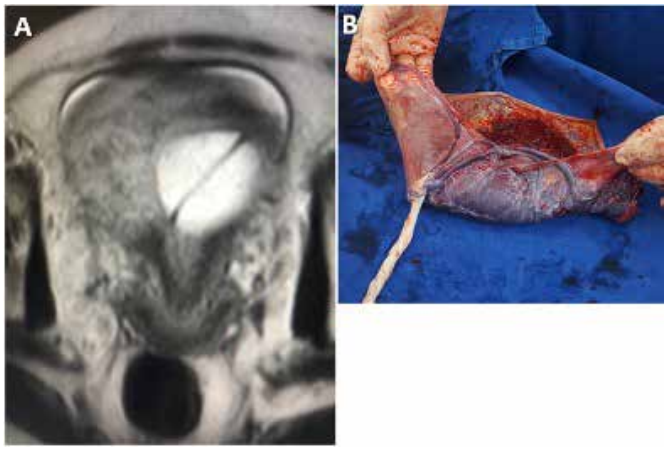

Figure 7: 36-week pregnant woman and diagnosis of vasa previa in the HASTE sequence (a, b) an anomalous vessel adjacent to the internal orifice is evident and the anatomical specimen demonstrates vasa previa.

CONCLUSION

US and MRI are useful in identifying placental accretism. It is essential that ultrasonographers and radiologists know and identify the main signs suggestive of accretism, as well as assess its extent for a safer delivery schedule.

The prenatal diagnosis of the placenta accreta has improved recently, with the combination of diagnostic techniques. This will allow a real benefit for high-risk populations, with the reduction of mortality, since the prevalence of accretism has increased significantly in the last fifty years.

BIBLIOGRAPHY

1- Gielchinsky Y.,Rotajansky N, Faasouliotis S J, Ezra Y Placenta Accreta- Summary Of 10 Years: A Survey Of 310 Cases. Placenta.2002. 23(1):210-4
2- Finberg HJ, JW Williams Placenta accreta: prospective sonographic diagnosis in patients with placenta previa and prior cesarean section. J Ultrasound Med. 1992 117 (1), 333-43.
3- Levine D, Hulka CA Ludmir J, Li W, Edelman, RR Placenta accreta: evaluation with color Doppler US, power Doppler US and MR imaging. Radiology. 1997, 2053 (1), 773-6
4- Lam G, Kuller, J, McMahon, M Use of Magnetic Resonance Imaging and Ultrasound in the Antenatal Diagnosis of Placenta Accreta. J Soc Gynecol Investig 2002; 9 (1):1-3
5- Madjian C , Adam,R, Pelosi M, Pelosi, M III, Rudelli, R D, Maldjian, J. MRI Appearance of Placenta Percreta and Accreta Placenta. Magnetic Resonance Imaging 1999; 17 (7): 965-71
6- Skinner H A. The Origin of medical terms, In: wilhiams &wilhians 2 ed Baltimore, 1961 pg 328
7- Cross C C Placental function in development and disease. Reproduction. Fertility and Development 2005; 18(2) 71,76.
8- Cross J C . The genetics of pré-eclampsia: a feto-placental or maternal problem? Clin. Genet.2003 64,96-103.
9- Adamson S L; Lu Y; Whiteley KJ ; Holmyard, D, M Pfarrer, C, Cross, J C Interactions between trophoblast cells and the maternal e fetal circulation in the mouse placenta. Dev. Biol.2002, 358-373
10- Allen, WR. Maternal recognition of pregnancy and immunological implications of trophoblast endometrium interactions in equids. Ciba Found Symp1978 323-352
11- Anthony, R V Scheaffer, A N Wright CD and Regbault TR Ruminant

models of prenatal growth restriction Reprod Suppl 2003 61, 183-194
12- Adelman DM; Gertsenstein M ; Nagy A; Simon MC; Maltepe, E Placental cells fates are regulates in vivo by HIF- mediated hypoxia responses Genes Dev 2000,14, 3194-3203
13- Francisco V.V., Goldman SM; Faria, J; Szejnfeld J. Valor da ressonância magnética no diagnostico do acretismo placentário. Rev. Bras. Ginecolol. Obstet. 2006; 28:12, 700-7
14- 5- Elsayes, K M; Trout, A.T.; Friedkin; A M; Liu P. S.; Bude; R. O.; Platt J. F. Menias. C.O. Imaging of the placenta: a multimodality Pictorial review- Radiographics 2009; 29: 1371-1391.
15- Torloni, MR, Moron, AF, Camano, LC Placenta prévia: fatores de risco para o acretismo Rev Bras Ginecol Obstet. 2001; 23(7): 417-22
16- Palacios JM, Bruno CH. Magnetic resonance imaging in 300 cases of placenta accreta surgical correlation of new findings. Acta Obstet Gynecol Scand. 2005; 84(6): 716-7
17- Mazouni C; Gorincour G, Juhan V; Bretelle F. Placenta Accreta: A review of current advances in prenatal diagnosis. Placenta 2007 28(7) 599-603.
18- Paublo M M, Bustos Vidal J C, Ramirez H P, Abud, D M, Rojas,G Avilla P. Rev Chil Ultrason. 2000; 3 (3): 80-2
19- Kapernick OS. Postpartum hemorrhage, the anormal pierperium. In: Pernoll ML, editord. Current obstetric and Gynecologic diagnosis & treatment. 7 ed East Norwalk: Appleton & Lange 1984:568-588
20- Pritchard JA, Mac Donald PC, Gant NF. Williams Obstetrics. Norwalk: Appleton-Century-Crofts. página 1985
21- Tabsh KM, Brinkman CR 3d, King W. Ultrasound Diagnosis of placenta increta. J Clin Ultrasound.1983 2 (1): 155-9
22- Chou MM, Ho, ES. Prenatal diagnosis of placenta previa accrete with power amplitude ultrasonic angiography. Am J Obstetric Gynecol. 1997, 177(4): 1523-5
23- Lerner JP, Deane S, Timor-Tritsh IE. Characterization of placenta accreta using transvaginal sonography, and color Doppler imaging. Ultrasound Obstetr Gynecol. 1995; 177(3): 1523-5
24- Thorp JM Jr, Councell RB, Sandridge DA, Wiest HH. Antepartum diagnosis of placenta previa percreta by magnetic resonance imaging Obstet Gynecol. 1992; 80 (5): 506-8
25- Marcos HB, Semelka, RC, Worawattanakul S. Normal placenta gadolinium-enhanced dynamic MR imaging. Radiology. 1997; 205(2):493-6
26- Tanaka YO; Sohda S; Shigemitsu S; Niitsu M; Itai Y. High Tempral resolution dynamic contrast MRI in a High risk group for placenta accrete. Magnetic Resonance Imaging. 2001; 19(5): 635-642
27- Kim JA, Narra, VR. Magnetic resonance imaging with true fast imaging with steady-state precession and half- Fourier acquisition single-shot turbo spin- echo sequences in cases of suspected placenta accreta. Acta Radiol. 2004;45(2):692-8
28- Mauzoni C, Gourincour G, Juhan, V, Bretelle, F. Placenta Accreta: A Review of Current Advances in Prenatal Diagnosis Placenta. 2006 Sep 4: PMID: 16959315 [PubMed – as supplied by plubisher]
29- Priyanka Jha 1, Joseph Rabban 2, Lee-May Chen 3, Ruth B Goldstein 4, Stefanie Weinstein 4, Tara A Morgan 4, Dorothy Shum 4, Nancy Hills 5, Michael A Ohliger 4, Liina Poder 4
Placenta accreta spectrum: value of placental bulge as a sign of myometrial invasion on MR imaging. Abdom Radiol (NY) 2019 Jul;44(7):2572-2581.

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IMPORTANCE OF THE APPLICATION OF THE EXTENDED FOCUSED ASSESSMENT WITH SONOGRAPHY FOR TRAUMA (EFAST) PROTOCOL IN A TRAUMATOLOGY REFERRAL HOSPITAL IN THE SOUTHERN REGION OF RIO DE JANEIRO

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ABSTRACT

INTRODUCTION: To demonstrate the need to apply the EFAST protocol in a regional hospital of high complexity in traumatology in the South of Rio de Janeiro. Analyze the costs involved in the hospitalization and treatment of trauma patients at this hospital.

METHODOS: Epidemiological, observational, and retrospective study, assessing the need for radiological or surgical interventions in the care of traumatized patients in a traumatology referral hospital. The analysis of hospitalization costs, unnecessary exams and non-therapeutic surgeries.

RESULTS: No national EFAST payment table was found. There is an expenditure of 20.9% more with the unnecessary use in exams and when comparing values between the use of ultrasound as the first diagnostic method instead of computed tomography, the hospital could save 79.12% per patient.

DISCUSSION: It is important to prepare your own pay table for EFAST. After data analysis, there are possible financial and therapeutic advantages of applying the EFAST protocol in the emergency department of a referral hospital in the southern region of Rio de Janeiro.

KEYWORDS: EFAST EXAM, COST-BENEFIT, TRAUMA CENTERS, ULTRASONOGRAPHY, INTERVENTIONAL.

INTRODUCTION

Trauma represents a significant public health problem and is among the main causes of mortality in the world with an important human and economic cost.[1] The possibility of non-surgical treatment in polytrauma patients appears to decrease exploratory laparotomies. Studies question the mandatory nature of therapeutic laparotomies in patients suffering from abdominal injuries, demonstrating that in select cases, non-operative treatment can be used satisfactorily. The application of portable devices to detect a serious injury can alter the natural course of the disease and assist in making therapeutic decisions. Except in clinical conditions such as hemodynamic instability, signs of peritonitis or evisceration where laparotomy is indicated, other diagnostic methods such as diagnostic peritoneal lavage (DPL), ultrasound (US), abdominal computed tomography (CT) and videolaparoscopy (VL) can be used in emergency care. Therefore, new ways are sought to manage trauma in a less interventionist, more humanistic and less burdensome way to the health system.[1,2]

Ultrasonography was first used in Europe in trauma patients in the 1970s. However, it was not immediately adopted in the United States, where it was only in the 1990s that it was included in routine trauma assessment, when it became "Focused Assessment with Sonography in Trauma - FAST" and, since then, it has spread throughout the world. As it is a reproducible diagnostic tool, free of ionizing radiation, realizable at the bedside with dynamic images in real time, non-invasive and less costly, [3,4] the largest trauma reference centers in the world have started their use as initial patient screening of the trauma victim.

The use of ultrasound (Focused Assessment with Sonography in Trauma - FAST and EFAST - Extended Focused Assessment with Sonography in Trauma) in the emergency room allows for a quick diagnosis and correct conduct with the pa-

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tient, despite the low precision, also having high accuracy in relation to other diagnostic methods, avoiding expenses with other exams and unnecessary surgeries.[5,6]

The EFAST has been recommended by several international societies and is even included in the secondary evaluation of the Advanced Trauma Life Support (ATLS). The presence of a positive FAST test denotes intracavitary bleeding and, possibly, the need for exploratory laparotomy, if the patient is hemodynamically unstable, or further diagnosis with computed tomography in a hemodynamically stable patient, if available.[7]

The use of ultrasound does not replace other imaging techniques or surgery, when necessary. The objective is to early identify if there is fluid in the cavities - mainly in the pericardial sac, in the pleural space, in the hepatorenal space, in the splenorenal space and in the suprapubic window - and to assist in the therapeutic approach. With that, an algorithm was proposed that is subdivided in: the positive findings, with the diagnostic follow-up in hemodynamically stable patients, needing to complete the evaluation with computed tomography, when it is available; and in those hemodynamically unstable, one should proceed to exploratory laparotomy on an emergency basis. In the negative findings of the FAST exam, when the patient is hemodynamically stable, one can go for complementation with CT and/or clinical observation; and when hemodynamically unstable, it is necessary to investigate another cause of bleeding (extra-abdominal) or intervene through exploratory laparotomy.[3]

EFAST has become widespread as a preferential test over DPL in unstable patients, due to its lower cost, the fact that it is less invasive, faster, decreasing the rate of non-therapeutic laparotomies, the possibility of frequent reevaluations and of concomitant resuscitation. . EFAST can be considered an extension of the abdominal examination in polytrauma patients, being of fundamental importance in the initial evaluation.[7]

In the last ten years, this bedside ultrasound technology also known as "point of care" has started to become a reality in some hospitals in Brazil. Today, with portable, lighter, more accurate equipment and a growing number of radiologists - whether or not interested or having had proper training, this technique has been widely disseminated and used in large hospitals in Rio de Janeiro.[8]

The objective of this research is to demonstrate that the use of the EFAST protocol, in addition to reducing the costs and episodes of non-therapeutic laparotomies, can also reduce the number of more expensive tests, resulting in benefits for both the medical team and patients in hospitals specialized in the urgent and emergency care network, a reference in trauma. In addition, this exam is not restricted to the initial trauma assessment, it can also be used to monitor and assess the evolution of the patient's clinical condition. [9]

Therefore, it is considered important to implement and apply the EFAST protocol at the trauma reference hospital in the southern region of Rio de Janeiro, as there is still no provision for the implementation of this protocol. Although there are many auxiliary methods used in the diagnosis of intra-abdominal injuries in trauma, in most hospitals and in the reference hospital studied, computed tomography is performed as an initial assessment test and/or laparotomy in which the operative finding would not justify the surgical intervention, emphasizing the importance of implementing the EFAST protocol for possible optimization in the use of financial resources in health, reduction of exposure to ionizing radiation and reduction of non-therapeutic exploratory procedures.[7] It should also be noted that this hospital has a boarding program and medical residency in several areas such as general surgery, vascular surgery and other specialties.

METHODS

This is an epidemiological, observational and retrospective study, evaluating the need for radiological or surgical interventions in the care of traumatized patients. The analysis of hospitalization costs, superfluous exams and non-therapeutic surgeries was also carried out.

The hospital covered in this research is a regional reference pole for high complexity in traumatology and has a capacity of 176 beds, of which 25 are beds for the adult emergency sector, 45 for surgical clinic and 13 for intensive and intermediate care units, 10 with average of 2515 attendances performed by general surgery in 2017.[11] It meets the demand of the entire South Fluminense region, in addition to having an internship and medical residency program in several areas such as general surgery, vascular surgery, among other specialties.

An interview was conducted with a person in charge of the billing sector, with the following questions: "is there a specific payment table for the EFAST protocol?", "What transfers does this hospital receive from the Municipal Health Department for: non-therapeutic laparotomy and admission to the surgical clinic / for computed tomography / ultrasonographies performed? ",“ do doctors in the emergency department have as a hiring prerequisite having training in the ATLS and/or EFAST protocol", "does this hospital offer any continuing education program in EFAST and/or ATLS for professionals that have already been hired?".

The studies that support the application of the EFAST protocol were sought in platforms, journals and scientific articles. Data collection was carried out based on documentary research or primary sources, based on the analysis of the accounts in cost and management reports and financial statements, in which information was obtained regarding the costs and the various hospital procedures.

As inclusion criteria, we considered the costs of patients with clinical suspicion, hospitalized or in the emergency ward, regardless of age and sex, who were victims of blunt trauma, including the polytraumatized ones. The patients, regardless of age and sex, victims only of trauma to the brain or upper and/or lower limbs were excluded.

The information was stored in a Microsoft Excel® data-

base and subjected to statistical analysis. The results of quantitative and qualitative variables were described using means, absolute values, percentages, predictive values, sensitivity, specificity, accuracy and likelihood ratios. Fisher's exact test was used to verify the strength of associations, as appropriate.

RESULTS

According to verification in the billing sector, in the most recent data, 15.7% of laparotomies in victims of abdominal trauma were non-therapeutic in the year 2017. It is worth mentioning that this "non-therapeutic" classification is given by the surgeon himself after performing the procedure. There is still an extra expenditure of 20.9% with the superfluous use in exams - such as computed tomography performed on a patient who would have a negative EFAST, that is, there would be no sign of free liquid in the cavity - and even so, the exam would be performed. . Despite studies not showing absolute values, all converge to the same result.[8,9]

In consultation with the billing sector of the reference trauma hospital in the region, the amounts paid for the use of ultrasound in the efast protocol were not found, given that such a procedure has not yet been implemented in the unit. therefore, the billing sector made a search in the national payment table system, in which no table referring to the EFAST protocol was also found.

In view of this, data were collected on the values of tests and procedures, for comparison purposes only, in the billing sector of the reference hospital, chosen for this research, with the following results:

Costs for procedures and examinations provided	
Chest ultrasound (extracardiac)	R$ 24,20
Pelvic ultrasound (gynecological)	R$ 24,20
Total abdomen ultrasound	R$ 37,95
Computed tomography of the chest	R$ 136,41
Computed Tomography of the upper abdomen	R$ 138,63
Computed Tomography of the pelvis	R$ 138,63
Exploratory laparotomy + hospital stay (five days) *	R$ 637,19

* Hospitalization in surgical clinic regarding exploratory laparotomy.

Table 1 - Costs for procedures and exams provided at a public reference hospital in the South Fluminense region.
Source: Billing sector of a public hospital in the South Fluminense region

When comparing values between the use of ultrasound as the first diagnostic method instead of computed tomography, the hospital would save 79.12% per patient, in addition to avoiding displacement of the patient in a serious condition and exposure to ionizing radiation.

In addition, in the absence of the EFAST protocol in a trauma referral hospital, such as the one analyzed in this study, there may be a greater number of non-therapeutic laparotomies, which bring high costs, as mentioned above; and unnecessary occupation of beds for a longer time, reaching, on average, five days of hospitalization. This amount is financed by the Unified Health System (SUS), since the amount consists of the payment of the professional who will perform the procedure (R$ 139.99) and the hospital expenses (R$ 497.20) .[12, 13]

At the hospital covered in this study, training in the internationally recommended EFAST and/or Advanced Trauma Life Support (ATLS) protocol is not a prerequisite for hiring professionals, nor does it have an ATLS/EFAST education program for doctors already hired.

In order to carry out a "point of care" ultrasound course in emergency and ICU, which includes the EFAST protocol, it is essential that the hospital offers training, which would cost, on average, the amount of R$ 3,440.00 per professional. However, this value could change after bidding14. It is worth mentioning that this training would initially be for physicians who assist trauma in the emergency department of the reference hospital studied, thus, it would not be necessary to hire new professionals, ultrasonographers or radiologists to be on call.[7]

DISCUSSION

The analyzed hospital is of great importance in the South Fluminense region, not only because it is a reference center for high complexity in traumatology in the region, with the highest volume of care in the district, but also due to its technical and scientific importance.

Literature searches were carried out. However, consistent financial data on cost and effectiveness in the use of EFAST were not found, both internationally and nationally.

The use of the EFAST protocol would decrease the initial exposure to expendable tomography, which can reduce costs, since, according to the analysis carried out in this study, there is a great expense with the unnecessary use in exams. Given that, although the analyzed literature does not show absolute values, they tend to the same result.[8,9] In addition to computed tomography being a more expensive diagnostic method than ultrasonography, having been demonstrated by our study, it exposes the patient to ionizing radiation, which is another aspect favorable to the use of EFAST, at least as an initial screening method in trauma.

Data found in the survey, referring to the percentage of exploratory laparotomies, corroborate what is found in the bibliography, since the number of non-therapeutic surger-

ies in the analyzed hospital is 15%, while the one found in the study is 14% .[15]

In abdominal trauma, the use of peritoneal lavage was recommended and, with the advent of EFAST, a sensitivity ranging from 28% to 100% and specificity from 94% to 100% was evidenced, leading to a decrease in the use of peritoneal lavage diagnosis by up to 9% .[16] Demonstrating, therefore, its great efficacy in the emergency scenario, including reducing the patient's length of stay in the hospital, demonstrating that the length of hospital stay is long when preventable exams are performed.

According to a prospective study carried out in a hospital in the southern suburb of Paris, which receives 500 trauma patients a year, an average of 7000 euros is saved in the diagnostic cost. Another gain was in relation to the time spent in the emergency ward, because, while a patient who undergoes computed tomography stays on average 30-60 minutes in that location, the one who goes through EFAST remains for an average period of 20-35 minutes, a gain that we cannot measure, since no data were found in the researched hospital.[17]

The average length of stay in the hospital of reference for this study, after non-therapeutic laparotomy, is 4-5 days, as described in the literature, [18] generating a cost, with both exams, procedures and hospitalizations that are not necessary and may aggravate the situation of overcrowding and waste of resources in SUS.

The literature corroborates what was scored in this research, since there is no table with fixed values for payment of EFAST, being in charge of the service provision to determine such value. However, it should not be seen as an extension of the physical examination, since prior preparation is necessary to exercise the "point of care" technique .[19]

Although the initial cost of training in "point of care" is high, this value can be offset by saving resources by not spending on more expensive initial exams, with the possibility of paying over a specific table for the EFAST protocol for polytrauma patients, as well as the value assigned to the average length of stay for a patient after non-therapeutic laparotomy. Furthermore, it is a continuous education process, and thus, after training the first group, there is a multiplier effect.[18]

Studies also show that EFAST can be used for the testing of pneumothorax, cardiac tamponade and free abdominal fluid in a trauma sector proven by the high specificity and high positivity in each exam performed, corroborating, once again, the importance of its application in a trauma reference hospital. [20,21]

It is also worth mentioning that the ATLS also demonstrates the efficacy in the use of EFAST, being recommended for investigating the presence of bleeding in abdominal trauma, hemothorax, cardiac tamponade, among others. [22] Many professionals are not trained to apply the EFAST protocol, which means that the diagnostic method used may not be the most recommended and/or more expensive at that time.

CONCLUSION

With the implementation of the protocol, there is the possibility of optimizing the use of SUS resources, with the tendency of decreasing hospital stay and more expensive procedures, re-routing the number of vacancies, increasing patient safety.

It is estimated, with this work, the savings of 79.12% per patient in initial exams and 22% for each non-therapeutic laparotomy, which can be shocking in this scenario.

In addition, ATLS is recommended internationally, and when one of the proposed steps is missed, there may be a delay in diagnosis or even worsening of the patient's prognosis, being recommended to follow this protocol, which is the most current evidence in the care of traumatized patients and highlights the importance of applying EFAST in the emergency department.[23]

Therefore, after data analysis, we noticed the need to prepare a specific table for payment for performing EFAST, since it cannot be understood as an extension of the physical examination. Moreover, there are possible financial and therapeutic advantages with the application of the EFAST protocol in the emergency sector of a referral hospital in the South Fluminense region in addition to the immaterial benefit of providing a complete and up-to-date teaching-learning environment for both interns, residents and non-radiologists.[2]

REFERENCES

1. Froehner CD. Avaliação da incidência de laparotomias não terapêuticas nos pacientes vítimas de ferimentos abdominais por arma de fogo ou arma branca no Hospital Florianópolis [monografia]. Santa Catarina: Universidade Federal de Santa Catarina; 2004.
2. Torres OJM, Valadão JA, Salazar RM, Silva AJR, Malafaia O. Negative laparotomy. Risks and benefits. Rev Bras Cir, 1995; 85(1): 13-15
3. Ribas-Filho JM, Malafaia O, Fouani MM, Justen MS, Pedri LE, Silva LMA, Mendes JF. Trauma abdominal: estudo das lesões mais frequentes do sistema digestório e suas causas. Arq Bras Cir Dig 2008;21(4): 170-174.
4. Morgenstern, GA. O FAST na avaliação do trauma abdominal fechado [monografia]. Paraná: Universidade Federal do Paraná; 2011.
5. Richards JR, McGahan JP. Focused Assessment with Sonography in Trauma (FAST) in 2017: What radiologists can learn. Radiology. 2017; 283(1): 30-48
6. Oliveira LGO, Tagliari D, Becker JM, Adame T, Neto JC, Netto FACS. Avaliação de treinamento básico em ultrassom na triagem inicial do trauma abdominal. Rev Col Bras Cir. 2018; 45(1):e155-164
7. Flato UAP, Guimarães HP, Lopes RD, Valiatti JL, Flato EMS, Lorenzo RG. Utilização do FAST-Estendido (EFAST-Extended Focused Assessment with Sonography for Trauma) em terapia intensiva. Rev Bras Ter Intensiva. 2010; 22(3):291-299
8. Serfaty, A. Ultrassonografia à beira do leito: uso em diferentes especialidades. Medscape. 2018, Nov 13. [acesso em: 30 out 2019]. Acesso em: https://portugues.medscape.com/verartigo/6502950
9. Lee BC, Ormsby EL, McGahan JP, Melendres GM, Richards JR. The utility of sonography for the triage of blunt abdominal trauma patients to exploratory laparotomy. AM J Roentgenol. 2007, 188(2): 415-421.
10. Hospital São João Batista [homepage da internet] Estrutura. [acesso

em 30 out 2019]. Disponivel em: http://www.voltaredonda.rj.gov.br/hsjb/13/29
11. Hospital São João Batista [homepage na internet]. Estatística anual AMB 2017. [acesso em 30 out 2019]. Disponível em: http://www.voltaredonda.rj.gov.br/hsjb/images/AMB%20ANUAL.jpg
12. Departamento de Informática do Sistema Único de Saúde do Brasil [homepage na internet]. Tabela de procedimentos, medicamentos e OPM do SUS – Laparotomia exploradora [acesso em 26 out 2018]. Disponível em: http://sigtap.datasus.gov.br/tabela-unificada/app/sec/procedimento/exibir/0407040161/10/2018
13. Departamento de Informática do Sistema Único de Saúde do Brasil [homepage na internet]. Valor médio pago por internação hospitalar no SUS (AIH) [acesso em 26 out 2018]. Disponível em: http://tabnet.datasus.gov.br/cgi/tabcgi.exe?idb2008/e11.def
14. Escola de Educação Permanente. Ultrassonografia "point of care" em emergência e UTI em três etapas: 1. Aulas online; 2. Treinamento em simulador com realidade virtual e 3. Hands-on. [acesso em 18 out 2019]. Disponível em: https://eephcfmusp.org.br/portal/online/curso/ultrassonografia-point-of-care-em-emergencia-e-uti/
15. Kruel NF, Oliveira VL, Oliveria VL, Honorato RD, Pinatti B, Leão FR. Perfil epidemiológico de trauma abdominal submetido à laparotomia exploradora. Arq Bras Cir Dig 2007; 20(2): 106-110.
16. Machado BC, Oliveira CF, Oliveria AC, Freitas R. Uso da ultrassonografia na emergência e protocolo efast. Anais do CREMEDCO [periódicos na internet]. 2018 [acesso em 16 maio 2020]. Disponível em: http://www.periodicos.univag.com.br/index.php/cremed/issue/view/72
17. Hamada SR, Delhaye N, Kerever S, Harrois A, Duranteau J. Integrating eFAST in the initial management of stable trauma patients: the end of plain film radiography. Annals of Intensive Care. 2016; 6:62.
18. Franciozi CES, Tamaoki MJS, Araújo EFA, Dobashi ET, Utumi CE, Pinto JA, Ishida A. Trauma na infância e adolescência: epidemiologia, tratamento e aspectos econômicos em um Hospital Público. Acta Ortop Bras. 2008; 16(5):261-265.
19. Payment for ultrasound services in the emergency department. Ann Emerg Med. 2016;68(3):407-408.
20. Netherton S, Milenkovic V, Taylor M, Davis PJ. Diagnostic accuracy of eFAST in the trauma patient: a systematic review and meta-analysis. CJEM 2019; 21: 727-738.
21. Stengel D, Leisterer J, Ferrada P, Ekkernkamp A, Mutze S, Hoenning S. Point-of-care ultrasonography for diagnosing thoracoabdominal injuries in patients with blunt trauma. Cochrane Database Syst Rev 2018; 12: CD012669.
22. American College Of Surgeons Committee On Trauma. Advanced Trauma Life Suport – ATLS. 10ª ed. Chicago, IL. 2018.
23. Kool DR, Blickman JG. Advanced Trauma Life Support. ABCDE from a radiological point of view. Emerg Radiol 2007 14:135-141.
24. Carneiro RP. Reflexões acerca do processo ensino aprendizagem na perspectiva freireana e biocêntrica. Rev Thema 2012; 09(02): 1-18.

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ORIGINAL ARTICLE

MAIN FINDINGS IN TRANSFONTANELLAR ULTRASOUND IN PREMATURE NEWBORNS

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ABSTRACT

INTRODUCTION: Transfontanellar ultrasonography (TFUS) is an important tool for cranial pathologies of newborns (NBs), which allows the design and evolutionary control of injuries. Knowing the main findings and correlating them with gestational age and birth weight is important to outline the best approaches.

OBJECTIVE: Identify the main lesions found in TFUS of premature newborns in the ICU.

METHODS: Cross-sectional quantitative and retrospective study, developed in an intensive care unit (ICU) in Goiânia-GO.

RESULTS: 150 records of NBs who underwent transfontanellar ultrasonography (TFUS) admitted to the ICU were analyzed, with 36 NBs (24%) showing changes. The maternal profile was of young women, without risk factors, multiparous, with seven prenatal consultations, with vaginal delivery. Urinary tract infection was the most prevalent (41%). For NBs, there is a predominance of males (58%), extremely premature infants with gestational age <27 weeks occurred in 19 fetuses (51%), first-minute Apgar less than 7 (72%) and fifth-minute Apgar greater than 8 (78%). The majority (97%) had adequate weight for gestational age, below 2,500g though. The main alteration found was hemorrhage (91%) and grade II the most prevalent (43%). The average length of stay in the unit was 50 days and the death rate in this group was 11 newborns (31%) and the main TFUS change recorded in the death group was grade III hemorrhage.

CONCLUSION: 150 exams were performed, 76% of which were normal and 24% abnormal, the main alteration found was hemorrhage 91%, with grade II being the most prevalent with 43%. In the group that died, the main change in the TFUS was grade III hemorrhage.

KEYWORDS: LESIONS, TRANSFONTANELAR, ULTRASONOGRAPHY, PRETERM.

INTRODUCTION

In recent years, the survival of premature low birth weight newborns has increased due to the understanding of brain pathologies[1]. Premature birth is the one that occurs before 37 weeks of gestation. A low birth weight newborn is one who weighs less than 2,500 g[2] at birth.

There are some possible tests for the diagnosis of neurological diseases in the neonatal period, such as: transfontanellar ultrasonography (TFUS), computed tomography (CT) and nuclear magnetic resonance (NMR)[3].

It is known that transfontanellar ultrasonography (TFUS) is an important tool for the cranial pathologies of NBs, which allows the design and evolutionary control of injuries. Knowing the main findings and correlating them with gestational age and birth weight are important to outline the best approaches.

TFUS consists of a non-invasive diagnostic method that obtains images by positioning the ultrasound probe on the neonate's anterior fontanelle, thus being able to assess the brain parenchyma, ventricles and vascular structures, in addition to allowing visualization of morphological changes such as intracranial hemorrhages[3]. The main changes in these US findings are: intraventricular hemorrhage (IVH), periventricular leukomalacia (PVL) and ventriculomegaly (VM) being associated with high mortality and adverse results in neurological development[4].

The neurological evaluation associated with neonatal brain ultrasonography, are quite efficient methods for assessment, as they are non-invasive, low cost and fast application methods with high diagnostic predictive value[5].

In addition to being possible to perform it at the bedside using portable devices, maintaining the thermal and hemodynamic balance of critically ill newborns, it does not present harmful effects such as the use of ionizing radiation. It is known that small doses of radiation are potentially harmful to the newborn, particularly when serial examinations are necessary[6].

The ultrasound examination is effective in the diagnosis and serves to refer the newborn to outpatient follow-up with a multidisciplinary team. Therefore, the objective of this work is to identify the main injuries found in TFUS of premature newborns in the ICU.

METHODS

Descriptive cross-sectional quantitative and retrospective study, carried out in the neonatal ICU of Maternidade Dona

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Íris, a reference hospital in Goiânia-GO.

The research was carried out from January to December 2019, including al' newborns that went to the neonatal ICU during this period. The exclusion criterion was incomplete medical record.

For data collection, variables of the newborn and mother were used.

For the Mother: age, number of children, number of prenatal consultations, risk factors and type of delivery.

For the NB: Apgar of the first and the fifth minute of life, gestational age, gender and weight.

For TFUS: type of lesion presented.

The collected items were entered into an electronic spreadsheet (Excel, Microsoft Corporation, USA) and analyzed in gross values and percentages

This research project was based on Resolution N0. 466/2012, and the rights of those involved are ensured, approved by the Ethics Committee indicated by Plataforma Brasil.

RESULTS

Data from January to December 2019 with 306 newborns admitted to the ICU during this period were analyzed, of which 122 were considered term and 184 preterm. Of the 184 preterm infants, 34 records were excluded due to incomplete data, with 150 neonates being evaluated.

TFUS	N	%
Normal	114	76
Altered	36	24

Table 1 - Distribution of the results of TFUS performed in preterm on HMDI, Goiânia (GO), Brazil, 2020.

	Nunber of patients (N=36)	
	N	%
MATERNAL AGE		
≤ 17	2	5
18 – 30	23	64
≥31	11	31
NUMBER OF PREGNANCIES		
1	15	42
2-3	18	50
≥ 4	3	8
PRENATAL CONSULTATIONS		
< 7	30	83
≥ 8	6	17
TYPE OF CHILDBIRTH		
Cesarean	10	28
Normal	26	72
RISK FACTORS		
Yes	17	47
No	19	53
MAIN RISK FACTORS		
SHDP	4	24
Urinary tract infection	7	41
Membrane rupture	2	11
Use of legal and illegal drugs	4	24

Table 2 - Distribution of maternal characteristics of preterm NBs in the NICU who underwent TFUS with anomalies in the HMDI, Goiânia (GO), Brazil, 2020.

	Number of patients (N=36)	
	N	%
GENDER		
Female	15	42
Male	21	58
GESTATIONAL AGE		
23 weeks	2	5
24 weeks	1	4
25 weeks	1	4
26 weeks	9	26
27 weeks	6	18
28 weeks	2	5
29 weeks	2	5
30 weeks	1	4
31 weeks	4	9
32 weeks	1	4
33 weeks	4	9
34 weeks	3	7

APGAR 1ST		
< 7	26	72
≥ 8	10	28
APGAR 5TH		
< 7	8	22
≥ 8	28	78
WEIGHT FOR GESTATIONAL AGE		
AGA	35	97
LGA	0	0
SGA	1	3
WEIGHT RANGE (IN GRAMS)		
<2,500	35	97
≥2,501	1	3

Table 3 - Distribution of the characteristics of preterm NBs in the NICU who underwent TFUS with anomalies in the HMDI, Goiânia (GO), Brazil, 2020.

Anomalies found	N	%
Hemorrhage	33	91
Liquids	1	3
Leukomalacia	1	3
Dandy-Walker syndrome	1	3

Table 4 - Distribution of the main anomalies in the TFUS performed in preterm NBs at HMDI, Goiânia (GO), Brazil, 2020.

Hemorrhage	N	%
Grade I hemorrhage	8	24
Grade II hemorrhage	14	43
Grade III hemorrhage	9	27
Grade IV hemorrhage	2	6

Table 5 - Distribution of TFUS hemorrhages performed in preterm NBs at HMDI, Goiânia (GO), Brazil, 2020.

The average length of stay in the unit was 50 days and the death rate in this group was 11 newborns (31%) and the main TFUS anomaly found in the death group was grade III hemorrhage with seven patients. Extreme preterm infants with a gestational age of <27 weeks occurred in 19 fetuses (51%).

DISCUSSION

Premature newborns are exposed to a wide spectrum of clinically silent brain lesions, supporting a possible role in screening by brain ultrasound[7]. Another finding is that the lower the gestational age, the greater the intrinsic vulnerability of the developing brain, increasing the risk of developing brain damage, particularly when extrinsic factors, such as comorbidities, coexist [8].

150 records of NBs who underwent TFUS admitted to the ICU were analyzed. Among those 114 were within the normal range and 36 with anomalies. The World Health Organization (WHO) defines premature births as those that occur after the 20th and before the 37th week of gestation[2].

The maternal profile is of women between 18-30 years old (64%), with two to three previous pregnancies (50%), who had less than seven prenatal consultations (83%), with vaginal delivery (72%) and who did not have risk factors (53%) and when they had urinary tract infection it was the most prevalent (41%).

The profile of the NBs was male in 58% of cases, extremely premature infants with gestational age of <27 weeks occurred in 19 fetuses (51%), first-minute Apgar less than 7 (72%) and fifth-minute Apgar greater than [8] (78%), although the majority had an adequate weight for gestational age (97%) in 97% of cases the weight was less than 2,500g.

In a subclassification, prematurity can be classified into three categories: mild, when it occurs between 32 and 36 weeks of gestation, moderate (28 and 31 weeks) and severe (below 28 weeks) [2], the study presented found the severe form. Egwu et al[9] studied 99 premature newborns, 36 (36.4%) were between 28 and 31 weeks of gestation, while 63 (63.6%) were between 32 and 36 weeks of gestation. Therefore, investing in preventing premature birth and improving neonatal care interventions is necessary to avoid the risk of bleeding, especially in premature newborns[9].

The main alteration found was hemorrhage (91%) and grade II the most prevalent (43%). Almeida et al[10] evaluated 184 premature newborns in a study where the transfontanelle ultrasound revealed peri-intraventricular hemorrhage in 32 (74.4%) and periventricular leukomalacia in 11 (25.6%) newborns. Grade I hemorrhage was found in 20 (62.5%), grade II in five (15.6%) and grade III in seven (21.8%) newborns, according to Papile's classification. Vaginal delivery ($p = 0.010$), birth weight <1500 g ($p = 0.024$), gestational age at delivery ≤ 32 weeks ($p = 0.018$) and previous history of infection during pregnancy ($p=0.013$) were considered risk factors for intraventricular hemorrhage in premature newborns[10].

Diwakar & Khurana[7] evaluated 100 newborns for anomalies detected on cranial ultrasound of premature newborns, identifying hydrocephalus in 12%, intracranial hemorrhage in 6%, cerebral edema in 6%, periventricular leukomalacia in 2%, choroid plexus cyst in 1%, intraventricular septa in 1% and colpocephaly in 1% [7].

Intraventricular hemorrhage (IVH) is a serious complication among premature newborns, which can result in hydrocephalus, cerebral palsy, behavioral disorders, learning difficulties or death[9]. The incidence of hemorrhage in babies <1000 grams is 50-60% and in babies from 1000 to 1500 grams, the incidence is 10-20%. Approximately 90% of bleeding occurs until the fourth postnatal day, with 50% occurring on the first postnatal day. Approximately 20-40% shows hemorrhage progression for 3-5 days. Babies with hemorrhage are at risk of hydrocephalus and white matter lesion[10].

Hernandez et al[11] found 3% leukomalacia, which is considered a central nervous system injury secondary to a hypoxic-ischemic insult and affects more premature than full-term infants. However, the rates reported in the literature are between 2% and 25% in premature neonates. Accurate identification of white matter lesions in premature newborns is important to advise parents and direct these high-risk newborns to appropriate rehabilitation services[12].

In the Dandy-Walker malformation, which represents [2] to 4% of cases of congenital hydrocephalus, on cerebral ultrasound, it is possible to see a large posterior fossa, a small cerebellar remnant and an exuberant 4th ventricle[13-14].

Stable premature babies with ≥25 weeks of gestation without intervening deterioration may not need repeated screening US after having performed two normal studies with an interval of ≥7 days. Unstable or extremely premature infants with <25 weeks of gestation may be subject to severe late changes and, therefore, need a repeat study before hospital discharge, even if two initial studies with an interval of ≥7 days are norma[l4].

CONCLUSION

150 exams were performed, 72% of which were normal and 28% abnormal, the main alteration found was hemorrhage 91% with grade II being the most prevalent with 43%.

The maternal profile showed that the majority were young patients, with no risk factor and good prenatal care.

The profile of the NBs was male babies with severe prematurity, weight below 2500g with high mortality in cases of grade III hemorrhage.

REFERENCES

1. Santos DSS, Prado MSG. Ocorrência de lesões neurológicas em recém-nascidos diagnosticadas por ultrassonografia transfontanela. Rev enferm UFPE on line. 2017; 11(10): 4081-4088.
2. BRASIL. Ministério da Saúde. Secretaria de Atenção Saúde. Departamento de Ações Programáticas Estratégicas. Atenção humanizada ao recém-nascido de baixo peso: Método Canguru. Brasília: Ministério da Saúde, 2011.
3. Assis, M. C; Machado, H. R. Ecografia transfontanelar com fluxo a cores em recém-nascidos prematuros. Arq. Neuro-Psiquiatr. 2005; 62(1): 68-74.
4. Nwafor-Anene V, Decristofaro J, Baumgart S. Serial head ultrasound studies in preterm infants: how many normal studies does one infant need to exclude significant abnormalities? J Perinatol. 2003; 23(3): 104-110.
5. Farage L, Assis MC. Achados ultra-sonográficos da hemorragia intracraniana em recém-nascidos prematuros. Arq Neuropsiquiatr. 2005; 63(3): 814-816.
6. Maglione AV, Golin MO, Sarni ROS. Triagem neurológica de recém-nascidos pré-termo com hemorragias peri e intraventriculares: estudo transversal observacional. ABCS Health Sci. 2018; 43(1): 3-9.
7. Diwakar RK, Khurana O. Cranial sonography in preterm infants with short review of literature. J Pediatr Neurosci. 2018; 13(2):141-149.
8. Fumagalli M, Ramenghi LA, De Carli A et al. Cranial ultrasound findings in late preterm infants and correlation with perinatal risk factors. Ital J Pediatr. 2015; 41 (65).
9. Egwu CC, Ogala WN, Farouk ZL, Tabari AM, Dambatta AH. Factors associated with intraventricular hemorrhage among preterm neonates in Aminu Kano teaching hospital. Niger J Clin Pract., 2019; 1(22): 298-304.
10. Almeida BA, Rios LT, Araujo Júnior E, Nardozza LM, Moron AF, Martins MG. Antenatal corticosteroid treatment for the prevention of peri-intraventricular haemorrhage in preterm newborns: a retrospective cohort study using transfontanelle ultrasonography. J Ultrason. 2017; 17(69): 91-95.
11. Hernández-Cabrera MA, Flores-Santos R, García-Quintanilla JF, Hernández-Herrera RJ, Alcalá-Galván LG, Castillo-Martínez NE. Periventricular leukomalacia prevalence in premature newborn. Rev Med Inst Mex Seguro Soc. 2009; 47(2): 147-150.
12. Miller SP, Cozzio CC, Goldstein RB, Ferriero DM, Partridge JC, Vigneron DB, Barkovich AJ. Comparing the diagnosis of white matter injury in premature newborns with serial MR imaging and transfontanel ultrasonography findings. AJNR. 2003; 24(8): 1661-1669.
13. Gutierrez FG. Sindrome de Dandy Walker. In: Abasolo SV, Ferreira AZ. Neurocirugia Infantil Latinoamericana. Recife: FLANC; 2006. p. 159-173.
14. Queiroz PT, Margotto JCPR. Caso anátomo-clínico: complexo de Dandy-Walker. Disponível em: http://paulomargotto.com.br/caso-anatomo-clinico-complexo-de-dandy-walker/. Acesso em 12 de fevereiro de 2020.

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ORIGINAL ARTICLE

FETAL ECHOCARDIOGRAPHY: MOST COMMON FINDINGS

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ABSTRACT

INTRODUCTION: Congenital cardiopathies or congenital heart disease (CHD) has a prevalence of about 0.8% of live births, being responsible for about 40% of perinatal deaths. Prenatal diagnosis of CHD can be performed using echocardiography, as this test has a sensitivity of 43% to 85% for visualization of the four cardiac chambers.

OBJECTIVE: To define the most frequent findings of abnormalities among the heart diseases observed on fetal echocardiography, to establish the most frequent maternal age group in fetal echocardiography exams and to establish the frequency of the altered findings.

METHODS: Retrospective, cross-sectional study that evaluated the importance of echocardiography for the early diagnosis of cardiac pathology in fetuses, as well as its prevalence in the results of 1701 reports of electronic medical records of patients who underwent fetal echocardiography at Clínica Fértile, in Goiânia, Goiás, between 01/01/2015 to 12/31/2019. The variables analyzed were the altered findings found, the maternal age and the frequency of each finding.

RESULTS: The age group with the highest incidence of changes was 18 to 34 years old, the frequency of changes found was 8.3% and the most frequent change was interventricular communication and cardiomegaly, both with 16.2%.

CONCLUSION: The frequency of altered findings according to the proposed study was 8.3%, the maternal age group with the largest number of changes on fetal echocardiographic examination was between 18 and 34 years old. The most frequent finding was without abnormalities. As for the most frequent findings of abnormalities, interventricular communication and cardiomegaly, were the most common findings.

KEYWORDS: FETAL ECHOCARDIOGRAPHY, CONGENITAL HEART DISEASE, PRENATAL.

INTRODUCTION

Fetal echocardiography is a method of excellence and high accuracy for the diagnosis of cardiac and circulatory abnormalities in the fetus[1]. This exam has a sensitivity of 43% to 85% for the visualization of the four cardiac chambers[2]. Given the increased risk of morbidity and mortality in babies with congenital heart disease (CHD), an accurate prenatal diagnosis is essential to help plan peripartum management, as it improves survival after surgery and neurological outcomes[3].

According to the American College of Cardiology, the main indications for fetal echocardiography are fetal heart abnormalities or arrhythmia detected by routine prenatal ultrasound, family history of congenital heart disease, maternal diabetes or systemic lupus erythematosus, fetal exposure to a teratogen, altered fetal karyotype and other abnormalities of the fetal system[4]. An additional indication for this procedure is in those fetuses with suspected coronary disease or extracardiac abnormality detected at the time of scanning the fetal anatomy of the second trimester[3]. Despite the recognition of these risk factors, only 15 to 30% of cardiac defects are detected before birth[4].

The prenatal diagnosis of congenital heart disease (CHD) has shown to have a significant effect on prenatal and postnatal management and outcomes. In addition to the potential medical benefits, fetal diagnosis allows valuable advice to parents, which allows families to make informed decisions regarding pregnancy and to prepare emotionally for the birth of the child with significant CHD[5].

Referral to fetal echocardiography typically occurs between 18 and 22 weeks of gestational age. In addition, with the wide availability and practice of nuchal translucency (NT) measures, which generally occur between 11 and 14 weeks of gestational age, the demand for early fetal cardiac images has increased, but it is not a standard practice[5].

The main cardiopathies are: congenital malformations of the cardiac chambers and connections, congenital malformations of cardiac septum, congenital malformations of the lungs and tricuspid valves, congenital malformations of the aorta and mitral valves, congenital malformations of the great arteries, congenital malformations of the great veins[3].

Congenital heart disease occurs in nine out of 1,000 live

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births. Around 25% of cases are severe heart diseases that require intervention in the first year of life. Newborns with congenital heart disease represent a high-risk group due to high mortality and morbidity. Early diagnosis and immediate initiation of treatment minimizes the risk of the child's hemodynamic deterioration, even preventing other organs from being injured, the most important of which being the central nervous system[6].

Therefore, the objective of the present study is to evaluate the most frequent cardiopathies and the importance of fetal echocardiography in the screening of human heart diseases.

METHODS

This is a cross-sectional, descriptive, retrospective study conducted at Clínica Fértile, in the city of Goiânia - GO.

The observed universe consists of patients seen at the clinic for screening fetal ultrasound with a sample for convenience according to the demand, established from January 2015 to December 2019. Inclusion criteria were pregnant women with indication for fetal ultrasound. Exclusion criteria were pregnant women with other ultrasound indications.

For data collection, reports of the conclusion and observation of the fetal echocardiography exams were used, as well as the maternal age, located and saved in the Ultra System 3.8.1 program.

The data were analyzed with the aid of the statistical package SPSS, (26.0). The normality of the data was tested using the Kolmogorov-Smirnov test. The prevalence of heart disease according to the age group and period of the study was performed using absolute frequency (n) and relative frequency (%) using Pearson's chi-square test. The prevalence of the type of heart disease was based on the cumulative relative frequency. Pearson's correlation was used to verify the relationship between the number of heart diseases and the age of the patients. The level of significance adopted was 5% ($p < 0.05$).

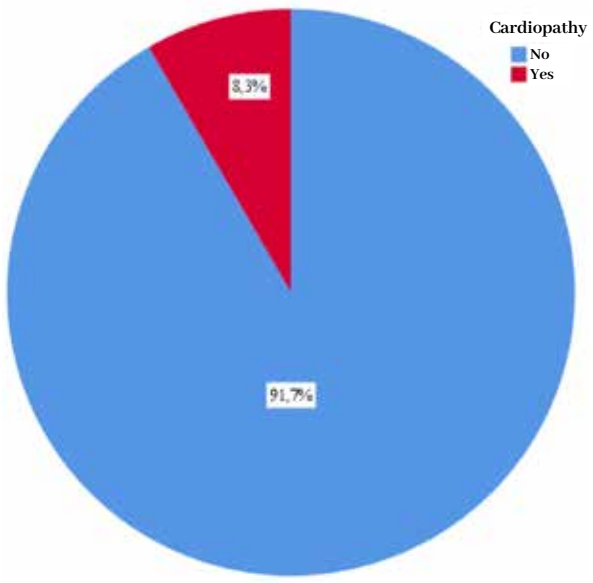
No patient identification was performed and the only variables analyzed were age and echocardiogram report.

Due to the large number of cardiopathies found, it was chosen to categorize "others", exams with a frequency of onset less than four.

As for ethical aspects, it is highlighted that the research will be based on Resolution n. 466/2012, and the rights of those involved are ensured, being approved by the Ethics Committee by the number 4,196,514.

RESULTS

In a period of five years, 1701 fetal echocardiography exams were analyzed in search of the most frequent findings. There was an absence of heart disease in 91.7% of the exams. Heart diseases were found in 8.3% of the exams. Most of the results found were without altered findings (Graph 1).



Graph 1- Relative frequency of the prevalence of fetal heart disease in the population studied.

Among the age groups analyzed, the range with the highest incidence of changes was 18 to 34 years, representing 74.2% of cases. In absolute numbers, the age group that most performed the exam was pregnant women between 18 and 34 years of age. There was no statistical difference in the relationship between the finding of heart disease and age, and with the distribution per year of the exam (Table 2).

	Cardiopathy n (%)		Total	
	No	Yes	142	p*
	1559 (91,7)	(8,3)	n = 1701	
Age Group				
< 18	12 (0,8)	3 (2,1)	15 (0,9)	
18 a 34	1159 (74,3)	104 (73,2)	1263 (74,2)	0,26
≥ 35	389 (24,9)	35 (24,6)	424 (24,9)	
Year				
2015	238 (15,3)	32 (22,5)	270 (15,9)	
2016	306 (19,6)	26 (18,3)	332 (19,5)	
2017	289 (18,5)	33 (23,2)	322 (18,9)	0,06
2018	429 (27,5)	30 (21,1)	459 (27,0)	
2019	297 (19,1)	21 (14,8)	318 (18,7)	

* Pearson's chi-square; n = absolute frequency; % = relative frequency

Table 2. Description of the prevalence of heart disease according to the age group and period of the study.

The average age group in the study was 30.33, with a standard deviation of 5.84 years (Figure 2).

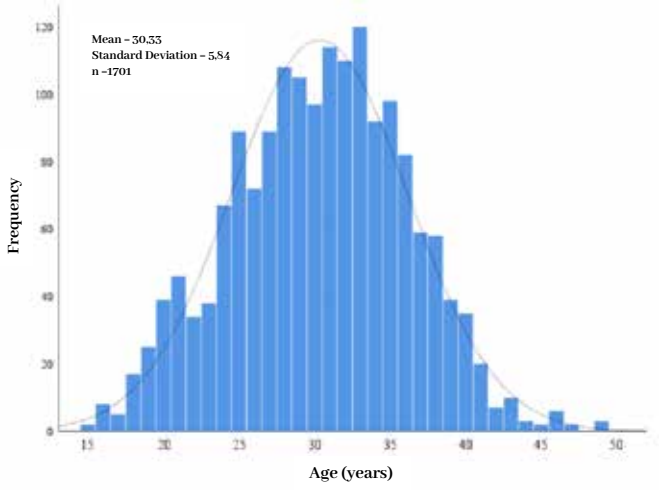


Figure 2. Histogram graph showing the age distribution of the patients

Trend analysis was carried out to assess whether there was a trend in the reduction in the finding of heart diseases over the years. A negative trend was found for the reduction of heart diseases, with p = 0.30. Therefore, it cannot be said that there has been a decrease in the prevalence of heart disease over the years (Figure 3).

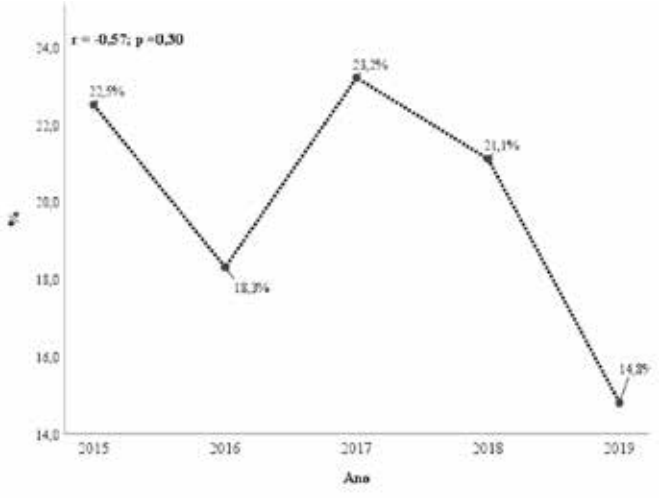


Figure 3. Bar graph showing the prevalence of fetal heart diseases in the period from Jan 2015 to Dec 2020.

In the group of fetuses with anomalies, the most frequent cardiopathies were interventricular communication (16.2%) and cardiomegaly (16.2%), followed by pericardial effusion (10.6%), golf ball (8.5%), hypoplastic left heart syndrome (6.3%), endocardial cushion (6.3%), dilation of the pulmonary trunk (5.6%), congestive heart failure (4.9%), interatrial communication (4.2%) and tetralogy of fallot, transposition of the great vessels and single atrium (2.8%). "Others" were considered cardiac anomalies found at a frequency lower than four exams (Table 3).

Cardiac Anomalies	N	%
Interatrial communication	6	4,2
Interventricular communication	23	16,2
Tetralogy of Fallot	4	2,8
Transposition of the great vessels	4	2,8
Single atrium	4	2,8
Cardiomegaly	23	16,2
Endocardial cushion	9	6,3
Pericardial effusion	15	10,6
Dilatation of the pulmonary trunk	8	5,6
Golf Ball	12	8,5
Hypoplastic left heart syndrome	9	6,3
Congestive heart failure	7	4,9
Others	82	57,7

n = absolute frequency; % = relative frequency

Table 3. Distribution of cases of fetal heart disease according to the type of cardiopathy (n = 142).

Of the women who had heart disease, a positive correlation was observed in the cumulative number of cardiopathies and age. The greater the age, the greater the number of cardiopathies in cumulative terms, with p = 0.02, and r = 0.19 (Figure 4).

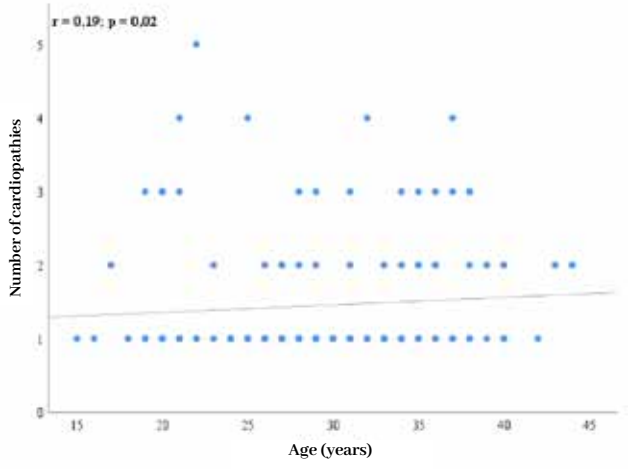


Figure 4. Scatterplot showing Pearson's correlation of age with the number of fetal cardiopathies.

DISCUSSION

Congenital cardiopathies or congenital heart disease (CHD) are among the most common congenital anomalies, with a prevalence of about 0.8% of live births[2]. Satomi et al. also report that since this statistic does not include abortions or stillbirths, it can be inferred that the actual number of fetuses with heart defects is almost five times higher than what has been reported[7].

Due to their poor prognosis, they contribute significantly to infant mortality, becoming responsible for about 10% of infant deaths and half of deaths due to congenital malformation[8].

Such diseases are significantly associated with perinatal morbidity and mortality, accounting for about 40% of perinatal deaths. The intrauterine diagnosis of cardiac alterations allows the doctor to have information related to the characteristics of the disease, its evolution, therapeutic possibilities and prognosis; in addition to recurrence for future pregnancies.

In this study, it was possible to analyze the importance of echocardiography in the diagnosis of congenital heart diseases. The prevalence of heart disease was observed in 8.3% of pregnancies in the tests performed, that is, of the 1701 tests evaluated in the last five years 142 diagnosed some heart disease. Bahtiyar and Copel are emphatic in saying that despite their high prevalence, CHD is not identified as it should be during prenatal care[9]. The early diagnosis of CHD remains low, compared to the diagnosis of other types of congenital structural malformations, since echocardiography is commonly indicated for patients with high-risk pregnancies[10,11].

Fetal echocardiography is traditionally indicated for high-risk pregnant women, but most newborns with heart disease are still born undiagnosed in all parts of the world. This is because many cases of congenital heart disease occur in low-risk groups and are not detected by screening at the time of prenatal ultrasonography[12].

The prenatal diagnosis of CHD can be performed by means of echocardiography, since this exam has a sensitivity of 43% to 85% for the visualization of the four cardiac chambers[2,7,11].

Nayak et al report that fetal echocardiography is an exam that requires time and requires experienced examiners[10]. In this study, all exams were performed by the same examiner, which hides the selection bias. In addition, there was no access to the indication of the exam; they are patients who arrived due to spontaneous demand. However, despite recognizing the importance of this test and that many heart diseases exist in low-risk pregnancies, there is no formal indication in the literature about the same being indicated for all patients, therefore, doctors indicate this test when there is a known risk factor. Therefore, it is believed that the patients in the study had some risk factor for the examination to have been indicated and because of this, they found the rate of heart diseases similar to that of the current literature.

When analyzing maternal age compared to the findings, the maternal indications for performing fetal echocardiography should be highlighted: family history of congenital heart disease, metabolic disorders (diabetes, thyroid disease), exposure to teratogens, exposure to prostaglandin synthase inhibitors (ibuprofen, salicylic acid), rubella infection, autoimmune disease (SLE, Sjogren), family hereditary disorders (Ellisvan Creveld, Marfan) and in vitro fertilization. There are no specific prenatal markers to identify the fetus with congenital heart disease. The increase in nuchal translucency between 10 and 13 weeks of gestation has been associated with an increased risk of congenital heart disease.

Early diagnosis helps both in prenatal and postnatal management and in counseling for parents; as well as decreasing morbidity and mortality rates, since it allows treatments to be implemented early[7].

According to Mogra et al, major cardiac abnormalities are potentially lethal or require surgical treatment in the first year of life and affect about four born between 1000[13]. Holland, Myers and Woods claim that prenatal diagnosis reduced the risk of death before planned cardiac surgery in relation to patients with postnatal diagnosis[14]. Additional studies and efforts to improve the prenatal diagnosis of congenital heart diseases should be considered. For this reason, the importance of this study, because through it, in a five-year study in a selected population, a rate of 8.1% has already been found, probably if this test was indicated for the population in general, the prevalence found would be different. It would increase.

The fetal echocardiography exam is a high-cost exam, which requires an experienced examiner and is not present and accessible to the general population.

Contrary to age logic, which relates more advanced ages to the involvement of congenital disorders (higher prevalence of metabolic disorders, in vitro fertilization, greater exposure to teratogens), the study presents the age group over 35 years with the lowest incidence of changes, 24.9% compared to the age group from 18 to 34 years old with 74.5%. The average age found was 30.33 years, with a standard deviation of 5.84 years. Perhaps this finding occurred due to the greater number of tests performed in this age group, with 1263 tests performed between 18 and 34 years old and 424 over 35 years old. The age group with the lowest prevalence of CHD were those under 18 years old, yet, also with a smaller number of patients, $n = 15$.

In this study, regarding the age group, there was no statistically significant difference in the relationship between maternal age and heart diseases, with $p = 0.26$. However, when comparing maternal age and cumulative heart diseases, an $r = 0.19$ was observed, that is, the higher the maternal age, the greater the prevalence of more than one heart disease in the same fetus, this evaluation being statistically significant with $p = 0,02$.

There was also a tendency of reduction of heart disease in this study, with respect to the last five years, with $r = -0.57$.

However, p = 0.30, showing no statistical significance. This data also differed from the current literature, in which the tendency is to increase the number of cardiopathy findings, due to the improvement of ultrasound devices and greater access to the population to them.

With regard to the types of CHD's and their frequencies in the populations studied, Wei et al show that the five most frequent defects in their study are: single ventricle (15.9%, 31/195), atrioventricular septal defect (12, 3%, 24/195), interventricular communication (IVC) (11.8%, 23/195), tetralogy of Fallot (10.8%, 21/195), and double outlet right ventricle (8.2% , 16/195). They also state that the IVC represented the largest proportion (24.4%, 77/316) of ventricular malformations. The total proportion of obstructive lesions in this group was much higher for the right side than for the left side of the heart (18.4% (58/316) vs 9.5% (30/316), respectively) [15].

In this study, it was observed that the frequency of normal findings was 91.7% and that of altered 8.3%. Of these, interventricular communication and cardiomegaly were responsible for the highest prevalence, both with 16.2%. Followed by pericardial effusion with 10.6%, golf ball with 8.5%, endocardial cushion and hypoplastic left heart syndrome both with 6.3%, congestive heart failure with 4.9%, interatrial communication with 4.2% and tetralogy of Fallot, transposition of the great vessels of the base and a single atrium with 2.8%. Therefore, this study contradicted the findings of previous studies.

Comparing the results obtained by this study with the results presented by Hagemann and Zielinsky, it is possible to notice some considerations to be made: 1) "Golf ball" was not the most frequent alteration, as was observed in this study; 2) Pericardial effusion and chamber hypoplasia are considerable findings[8].

All studies were emphatic in demonstrating that early echocardiography should be implemented as a routine in all prenatal care, even in patients who are not part of the group considered at risk as well as the importance of recognizing such cardiopathies in the prenatal period, so that intrauterine interventions can be performed or delivery in a specialized referral center for better survival and reduction of perinatal mortality.

Therefore, this study contributed to demonstrate that heart diseases are still present at a high rate in our country, and that if the fetal echocardiography exam was inserted universally, the prevalence would probably be higher. And also due to the observation that congenital heart diseases are unrelated to older age, being more prevalent at an average of 30.33 years, the age group with the highest number of pregnancies.

CONCLUSION

The results of this work allow us to conclude that:

- The maternal age group with the largest number of abnormalities on fetal echocardiographic examination was between 18 and 34 years old.
- It can be concluded that the frequency of abnormal findings according to the proposed study was 8.3%.
- As for the most frequent findings of abnormalities, interventricular communication and cardiomegaly were the most frequently found alterations, with 16.2% each, in the examination findings.

REFERENCES

1. Macedo AJ, Ferreira M, Borges A, Sampaio A, Ferraz F, Sampayo F. Ecocardiografia fetal, ume estudo de três anos. Acta Médica Portuguesa 1993; 6:I9-I13
2. Zhang Y, Zeng X, Zhao E, Lu H. Diagnostic value of fetal echocardiography for congenital heart disease. Medicine, 2015; 94 (42).
3. Mone F, Walsh C, Mulcahy C, McMahon CJ, Farrell S, MacTiernan A, Segurado R, Mahony R, Higgins S, Carroll S, McParland P, McAuliffe FM. Prenatal detection of structural cardiac defects and presence of associated anomalies: a retrospective observational study of 1262 fetal echocardiograms. Prenat Diagn. 2015; 35(6) :577-82.
4. Simpson LL. Indications for fetal echocardiography from a tertiary-care obstetric sonography practice. Journal of Clinical Ultrasound, 2004; 32(3):123-128.
5. Pike JI, Krishnan A, Donofrio MT. Early fetal echocardiography: congenital heart disease detection and diagnostic accuracy in the hands of an experienced fetal cardiology program. Prenatal Diagnoses, 2014; 34(8).
6. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Ações Programáticas Estratégicas. Atenção à saúde do recém-nascido: guia para os profissionais de saúde. 2. ed. atual. – Brasília: Ministério da Saúde, 2014.
7. Satomi G. Guidelines for fetal echocardiography. Pediatrics International, 2015; 57:1-21.
8. Hagemann LL, Zielinsky P. Rastreamento populacional de anormalidades cardíacas fetais por ecocardiografia pré-natal em gestações de baixo risco no município de Porto Alegre. Arq. Bras. Cardiol. 2004; 82(4): 313-319.
9. Bahtiyar MO, Copel JA. Screening for congenital heart disease during anatomical survey ultrasonography. Obstet Gynecol Clin North Am, 2015; 42(2): 209-223.
10. Nayak K, Chandra GSN, Shetty R, Narayan PK. Evaluation of fetal echocardiography as a routine antenatal screening tool for detection of congenital heart disease. Cardiovasc Diagn Ther. 2016 ; 6(1): 44-49.
11. Lai YC, Tabima DM, Dube JJ, Hughan KS, Vanderpool RR, Goncharov DA, St Croix CM, Garcia-Ocaña A, Goncharova EA, Tofovic SP, Mora AL, Gladwin MT. SIRT3-AMP-activated protein kinase activation by nitrite and metformin improves hyperglycemia and normalizes pulmonary hypertension associated with heart failure with preserved ejection fraction. Circulation. 2016; 133 (8): 717-731.
12. Pedra SRFF, Zielinsky P, Binotto CN, Martins CN, Fonseca ESVB, Guimarães ICB et al. Diretriz Brasileira de Cardiologia Fetal - 2019. Arq Bras Cardiol. 2019; 112(5): 600-648.
13. Mogra R, Kesby G, Sholler G, Hyett J. Identification and management of fetal isolated right-sided aortic arch in an unselected population. Ultrasound Obstet Gynecol. 2016; 48(6): 739-743.
14. Holland BJ, Myers JA, Woods CR Jr. Prenatal diagnosis of critical congenital heart disease reduces risk of death from cardiovascular compromise prior to planned neonatal cardiac surgery: a meta-analysis. Ultrasound Obstet Gynecol. 2015; 45(6): 631-638.
15. Wei YJ, Liu BM, Zhou YH, Jia XH, Mu SG, Gao XR, Yang ML, Zhang Y. Spectrum and features of congenital heart disease in Xi'an, China as detected using fetal echocardiography. Genetics and Molecular Research, 2014; 13(4): 9412-9420.

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ECOGRAPHIC DIAGNOSIS OF THE SUBCLAVIAN STEAL SYNDROME BY ULTRASONOGRAPHY AND DOPPLER: CASE REPORT

ANTONIO GADELHA DA COSTA [1], PATRICIA SPARA GADELHA [1], MARINA MENDES CAVALCANTI [1]

ABSTRACT

INTRODUCTION: The subclavian steal syndrome refers to a vascular disorder with inversion of the vertebral artery blood flow due to proximal occlusion or stenosis.

CASE REPORT: We report a clinical case of subclavian artery steal, the initial diagnostic hypothesis was labyrinthitis, due to the patient having frequent vertigo. The final diagnosis was made through ultrasound and Doppler, where we observed severe stenosis in the left subclavian artery, with the presence of an aliasing phenomenon. The left vertebral artery spectrogram revealed a partially inverted flow pattern, with medium-systolic deceleration, transmitting a "bunny rabbit" sign image.

KEYWORDS: SUBCLAVIAN STEAL SYNDROME; SUBCLAVIAN ARTERY; DIAGNOSTIC IMAGING; ATHEROSCLEROSIS; DOPPLER ULTRASOUND

INTRODUCTION

The subclavian steal syndrome (SSS) refers to a vascular disorder in which there is an inversion of blood flow in the vertebral artery, resulting from severe occlusion or stenosis proximal to its origin[1], more commonly in the ipsilateral subclavian artery or the brachiocephalic trunk[2].

It is a rare condition, reported in about 6% of asymptomatic patients with cervical murmurs[2]. There is a slight prevalence in males with a mean age of onset close to 60 years [1, 3].

It has a diverse etiology and, in most cases, it is a consequence of atheromatous disease[2]. Vasculitis, such as Takayasu's arteritis and giant cell arteritis, can also be causal factors[4]. There is concomitance with smoking in 78% to 100% of cases, and with coronary artery disease in 27% to 65% [3].

The pathophysiology of the subclavian steal consists of the sequestration of blood from the arterial territories of the basilar, contralateral vertebral and carotid artery to the subclavian ipsilateral to the obstruction, due to the low pressure system[1].

The retrograde flow causes symptoms arising from the ipsilateral upper limb ischemia or vertebrobasilar hypoperfusion and cerebral ischemia, such as dizziness, vertigo, motor deficits and confusion, which are exacerbated with situations of physical exertion[3, 5, 6]. These symptoms usually worsen with the physical exercise of the upper limbs[7].

This report aims to present a case of partial subclavian artery steal syndrome with symptoms of cerebral hypoperfusion.

CASE REPORT

89-year-old female patient with hypothyroidism and hypertension, using levothyroxine and antihypertensive medication. She was referred for Doppler ultrasound examination of the carotid artery due to complaints of persistent vertigo with the diagnostic hypothesis of labyrinthtopathy having been excluded.

Carotid ultrasound and Doppler were performed, with stenosis ≥ 70% in the right carotid bulb/emergence of the internal carotid and 50-69% stenosis in the left external carotid. Moderate atheromatosis was also seen in the left common carotid and in the left carotid bulb, with no significant changes in the systolic velocity peak.

In the left subclavian artery, severe stenosis was seen with aliasing phenomenon (Figure 1). The spectrogram of the left vertebral artery revealed a partially inverted flow pattern, with medium-systolic deceleration, transmitting an image similar to a rabbit ("bunny rabbit" sign) (Figure 2).

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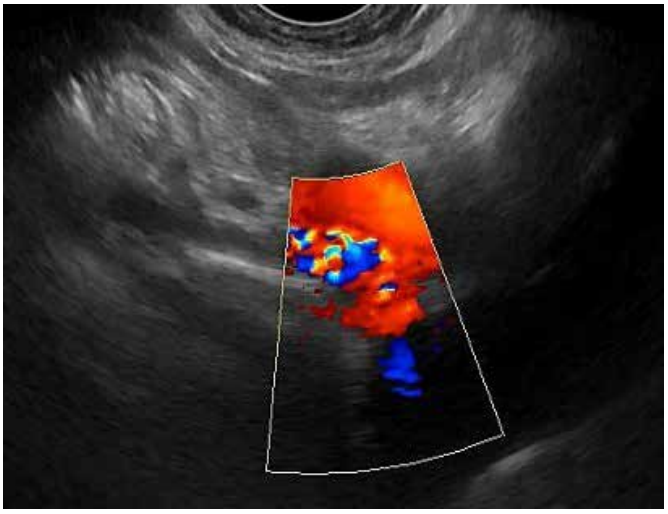

Figure 1: Color Doppler of the left subclavian artery showing the aliasing phenomenon. Image obtained by placing the endovaginal convex transducer in the patient's sternal furcula.

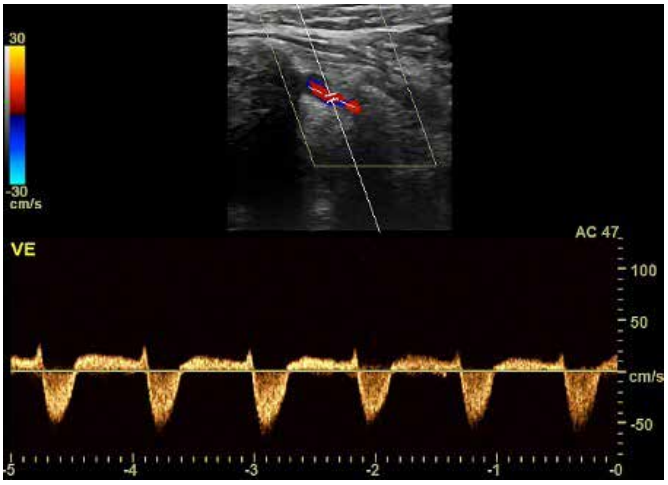

Figure 2: Spectral Doppler of the left vertebral artery showing a partially inverted blood flow pattern, with medium-systolic deceleration, transmitting an image similar to a rabbit ("bunny rabbit" sign).

DISCUSSION

Arterial obstruction of the left subclavian is more often involved than the right subclavian[5, 6]. This occlusive disease can be clinically silent, asymptomatic in most patients, especially when the blood supply of the ipsilateral vertebral artery is compensated by the contralateral or carotid system and Willis polygon[6].

When there is no compensation, patients may present symptoms related to vertebrobasilar insufficiency, such as dizziness, vertigo, ataxia, visual disturbances, motor deficits, focal seizures and confusion[3, 5, 6].

They are common findings of subclavian stenosis, murmurs in the subclavian artery, decreased blood pressure and intermittent claudication of the ipsilateral arm to the affected artery[6].

In our clinical case, the stenosis was more frequent on the left, where we observed plaque in the left subclavian artery with severe stenosis and aliasing.

In the subclavian artery, once obstructed, pressure decreases distally to the ipsilateral vertebral artery, with consequent repercussions on the upper limbs. On the contralateral side of the obstruction, blood normally flows through the vertebral artery to the basilar artery, and, subsequently, blood descends retrogradely through the ipsilateral vertebral artery due to its low pressure[2] (Figure 3). Consequently, the blood supply to the basilar system is then sequestered and it is not fully offered. This sequestration can, therefore, compromise brain perfusion[2].

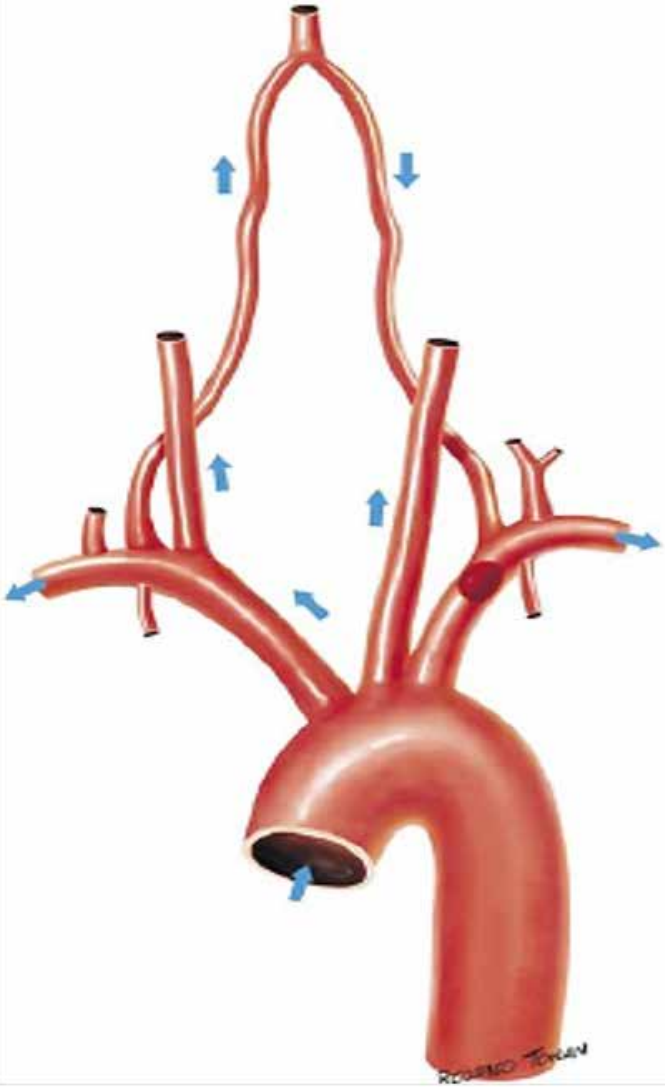

Figure 3: Schematic drawing of the passage of blood from the left vertebral artery to the ipsilateral subclavian[2].

For diagnosis, Doppler ultrasonography offers an alternative technique to contrasted arteriography with an important role in the investigation of these patients[1]. According to Brott et. al., 2011, this imaging method is class I recommendation for the detection of carotid stenosis in patients with focal neurological symptoms and can be considered in patients with non-specific neurological symptoms when cerebral ischemia is a possible cause[7].

The patient, in our clinical case, had vertigo, a non-specific neurological symptom, and was referred to the otorhinolaryngology service for the investigation of labyrinthitis. After ruling out the diagnostic hypothesis of labyrinthitis, ultrasonography and Doppler of the carotid and vertebral arteries were requested, and subclavian steal syndrome was diagnosed.

One of the main objectives of the Doppler examination of the vertebral arteries is the detection of retrograde blood flow, indicating the phenomenon of subclavian steal[8]. This data was observed in our clinical case and was essential for the diagnosis of the subclavian artery steal.

In addition to having high diagnostic accuracy for steal of the subclavian artery, Doppler ultrasonography is a non-invasive method and can be repeated without prejudice to the patient[1].

The ultrasound device to be used must contain a linear probe with frequencies above 7 MHz, color Doppler and pulsed Doppler capable of measuring speeds, in addition to the angulation function in B mode[9].

To perform the exam, Rodríguez et. al., 2018, recommend positioning the patient in the supine position with the neck in hyperextension and 45° rotation to the opposite side to the explored. If there is poor visualization, a posterior approach to the sternocleidomastoid muscle can be considered[9].

Tahmasebpour et. al., 2005, suggest identification of the vertebral artery with color Doppler image locating the common carotid artery in sagittal view and scanning the transducer laterally to the transverse processes of the cervical spine[10].

For the identification of the vertebral artery, we used the linear transducer, with the patient's head positioned in a straight line, and placing the transducer perpendicular to the floor, anterior to the sternocleidomastoid muscle, in accordance with Santos et. al., 2019[11]. The subclavian artery was identified by the placement of the convex, endovaginal transducer in the patient's sternal furcula.

In normal patients, the vertebral artery has a flow in the cranial direction and a low resistance pattern[9]. Thus, based on the hemodynamic changes of the vertebral artery by the spectral Doppler study, three types of subclavian steal can be identified, occult, partial and complete, the most advanced stage[2]. Although the complete inversion of blood flow throughout the cardiac cycle is the most advanced stage of abnormality, precursor changes can occur in the spectral waveforms of the vertebral arteries, even when the flow direction is completely anterograde[8].

The basic characteristic of waveforms in subclavian steal is the abrupt decline in blood flow velocity after the initial systolic impulse, comparing the Doppler tracing with the synchronized electrocardiogram (ECG) tracing. In this way, two peaks of velocity appear inside the systole, the first sharp and the second rounded. The types of subclavian steal and its waveform are defined, therefore, by the depth of the mid-systolic notch[8].

In the steal of the hidden subclavian artery, there is minimal hemodynamic change[10]. Anterograde flow is observed throughout the cardiac cycle with a transient acute decline in velocity in the middle of the systole, producing a notch in the tracing, whose nadir is greater than the velocity at the end of diastole[8].

In partial subclavian artery steal, the gap in the Doppler wave is more pronounced and deep. There are two evident systolic peaks, and the nadir velocity is equal to or less than the end of diastole or below the baseline, with recovery of the anterograde flow before diastole[8].

The spectral Doppler image, in both the hidden and partial subclavian steal, may resemble the image of a rabbit profile ("bunny rabbit" sign) [10]; with the ears representing the systolic peak, the neck as the middle systolic notch and the body as the diastole[4].

Our clinical case was the steal of the partial subclavian artery, where we observed the left vertebral artery revealing a partially inverted blood flow pattern, with medium-systolic deceleration, transmitting an image similar to a rabbit ("bunny rabbit" sign).

In the case of total subclavian artery steal, spectral Doppler of the vertebral artery shows complete inversion of blood flow8, which may be associated with ischemic symptoms in the ipsilateral arm[10].

We reported a clinical case of subclavian artery steal, whose clinical complaint was vertigo, with a diagnosis concluded by means of Doppler ultrasonography, where severe stenosis of the left subclavian artery and partial inversion of the flow velocity in the ipsilateral vertebral artery were observed.

REFERENCES

1. Delaney CP, Couse NF, Mehigan D, Keaveny TV. Investigation and management of subclavian steal syndrome. Br J Surg. 1994; 81(8):1093-5.
2. de Deus Passos, M, Alves, LM, de Jesus, PC, Jr, LFJ, Vasconcelos, DF. An Update on Doppler Ultrasound of Vertebral Arteries: Subclavian Steal Syndrome. 2016.
3. Lacey KO. Subclavian steal syndrome: a review. J Vasc Nurs 1996; 14(1):1-7.
4. Han, J., Xiang, H., Ridley, W. E., & Ridley, L. J. (2018). Bunny waveform: Early feature of subclavian steal syndrome. Journal of medical imaging and radiation oncology, 62, 22-22.
5. Pollard H, Rigby S, Moritz G, Lau C. Subclavian steal syndrome: a review. Australas Chiropr Osteopathy 1998; 7(1):20-8.
6. Fregni, F, Castelo-Branco, LEC, Conforto, AB, Yamamoto, FI, Campos, CR, Puglia Jr, P, et. al. Treatment of subclavian steal syndrome with percutaneous transluminal angioplasty and stenting: case re-

port. Arquivos de Neuro-psiquiatria 2003; 61(1), 95-99.
7. Brott, TG, Halperin, JL, Abbara, S, Bacharach, JM, Barr, JD, Bush, RL, et. al. 2011 ASA/ACCF/AHA/AANN/AANS/ACR/ASNR/CNS/SAIP/SCAI/SIR/SNIS/SVM/SVS guideline on the management of patients with extracranial carotid and vertebral artery disease: A report of the American college of cardiology foundation/American heart association task force on practice guidelines, and the American stroke association, American association of neuroscience nurses, American association of neurological surgeons, American college of radiology, American society of neuroradiology, congress of neurological .... Journal of the American College of Cardiology 2011; 57(8), e16-e94.
8. Kliewer MA, Hertzberg BS, Kim DH, Bowie JD, Courneya DL, Carroll BA. Vertebral artery Doppler waveform changes indicating subclavian steal physiology. AJR Am J Roentgenol 2000; 174(3): 815-9.
9. Rodríguez, BM, García, NR, Mayor, OVG, Calero, CL, Machan, K, & Puertas, AV. Ecografía Doppler de troncos supraaórticos: Guia prático para residentes. Seram. 2018
10. Tahmasebpour HR, Buckley AR, Cooperberg PL, Fix CH. Sonographic examination of the carotid arteries. Radiographics 2005; 25(6):1561-75.
11. Santos, SND, Alcantara, MLD, Freire, CMV, Cantisano, AL, Teodoro, JAR, Porto, CLL et. al. Posicionamento de Ultrassonografia Vascular do Departamento de Imagem Cardiovascular da Sociedade Brasileira de Cardiologia-2019. Arquivos Brasileiros de Cardiologia 2019; 112(6), 809-849.

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MESENTERIC CYST IN CHILD: THE CAREFUL LOOK OF THE ULTRASONOGRAPHIST

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ABSTRACT

INTRODUCTION: The mesenteric cyst is one of the rarest abdominal tumors, with approximately 820 cases reported since 1507. The lack of clinical features and characteristic radiological signs can present major diagnostic difficulties.

OBJECTIVE: describe the clinical manifestations in a patient with a mesenteric cyst and the route to diagnosis.

CASE REPORT: Two-year-old female patient, with no comorbidities complaining of abdominal pain, mainly in iliac fossae, associated with intense vomiting and sporadic fever spikes for about three months. Globose and painless abdomen without visceromegaly or masses. Abdominal ultrasound showed a collection of thin walls and anechoic content with minimal debris in suspension in the supravesical and hypogastric region. Laboratory tests with leukocytosis. As the symptoms intensified a tomography of the total abdomen was prescribed, which showed a voluminous, well-defined contoured cystic lesion, measuring approximately 12 x 6 cm of intraperitoneal location, occupying the lower half of the abdomen. The lesion presented septations in its anterosuperior aspect, left with a mass effect on the adjacent structures, with displacement of intestinal loops, but apparently with cleavage planes and with small free liquid in the peritoneal sac bottom, without retroperitoneal or pelvic lymph node enlargement and presence of massive ascites. The patient underwent diagnostic exploratory laparotomy, which showed a giant mesenteric cyst at the root of the mesocolon, which was excised.

CONCLUSION: The mesentery cyst is the main clinical manifestation of abdominal pain associated with vomiting. Its diagnosis is difficult to conclude and may require special attention from ultrasound. If the doubt persists, tests of greater accuracy should be indicated. The role of the ultrasonographer goes far beyond the application of systematics in conducting exams. He needs to correlate radiological images with the association of possible clinical diagnoses and leverage all possible hypotheses to elucidate and facilitate the final diagnosis.

KEYWORDS: MESENTERIC CYST, DIAGNOSIS, ULTRASOUND.

INTRODUCTION

A recent systematic study has classified the mesentery as an organ and it must therefore be subjected to the same focus of investigation applied to other organs and systems.

The main mesenteropathies are volvulus with malrotation, thrombosis in the superior mesenteric artery, sclerosing mesenteritis (of which there are several subtypes) and mesenteric cysts[1].

The mesenteric cyst is one of the rarest abdominal tumors, with approximately 820 cases reported since 1507. The lack of clinical features and characteristic radiological signs can present great diagnostic difficulties[2].

The incidence is 1 per 100,000 to 1 per 250,000 hospitalizations[3].

The exact etiology of the mesenteric cyst has not yet been determined, but the failure of the lymph nodes to communicate with the lymphatic or venous systems or the blockage of the lymphatics because of trauma, infection and neoplasia are contributing factors.

The accepted theory, proposed by Gross, is the benign proliferation of ectopic lymphatics in the mesentery that lack communication with the rest of the lymphatic system[4].

Precise preoperative diagnosis is possible with current ultrasound imaging techniques. Complete cyst resection is the procedure of choice and it presents excellent results[5].

It is known that clinical characteristics are variable and it is not always possible to view them on ultrasound images, especially in children due to gas distension and agitation at the time of the examination, so being aware of subtle characteristics is essential for early diagnosis. The aim of this study is to describe the clinical manifestations in a patient with a mesenteric cyst and the route to diagnosis.

CASE REPORT

This is a descriptive case report. The techniques used to obtain information in this study stand out through data from medical records, physical examination, laboratory and images. This research project was based on Resolution N^0. 466/2012, and the rights of those involved are ensured by the Ethics Committee appointed by Plataforma Brasil.

Patient born by cesarean delivery, at term, with adequate weight for gestational age, complete vaccination for age, living in an urban area with basic sanitation. Female, two years old, with no comorbidities, complaining of abdominal pain mainly in the iliac fossae, associated with intense vomiting and sporadic fever spikes for three months. Good general

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condition, hydrated, normal, eupneic, anicteric. Cardiopulmonary auscultation with murmur. Globose and painless abdomen without visceromegaly or masses. Well-perfused extremities, without edema or cyanosis.

An abdominal ultrasonography was performed with a normal-sized, slightly heterogeneous liver, a patent portal system, with normal flow. Free peritoneal fluid occupying the bottom of the pouch of Douglas and bottom of the uterine vesicle with distention of intestinal loops (figure 1).

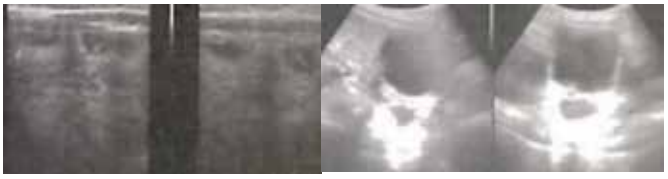

Figure 1. Abdominal ultrasound

Laboratory tests with borderline leukocytosis and 15.90 uL and EAS leukocytes increased by 24.0000/mL.

The main suspicion of food allergies was ruled out since the specific allergens were negative. The patient was referred to the cardiologist who detected an innocent murmur without major repercussions for the clinical picture.

Ultrasound of the urinary tract was normal with observation of collection of thin walls and anechoic content with minimal debris suspended in the hypogastric, supravesical, partially assessed (figure 2).

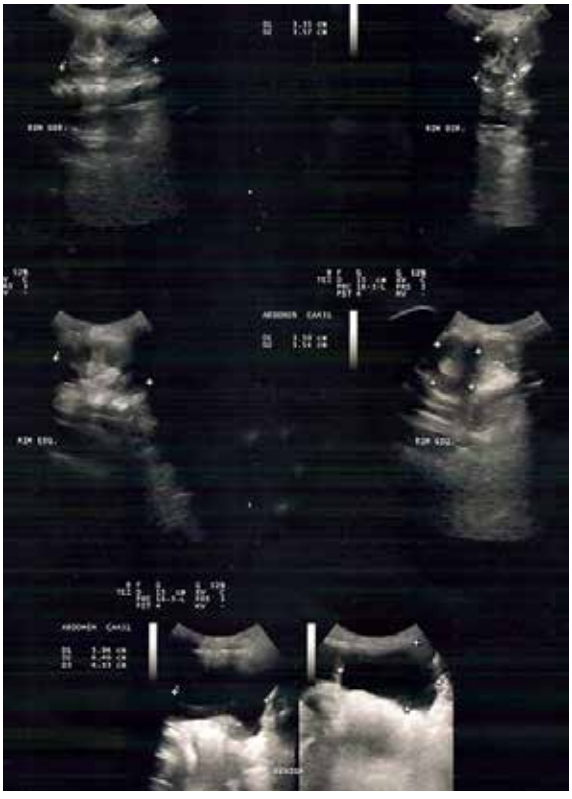

Figure 2. Ultrasound of the urinary tract.

The patient sought medical attention several times with hospitalizations at different periods. Referred for reflux assessment.

Tomography of the total abdomen was performed after the symptoms intensified, which showed a large, well-defined contoured cystic lesion, measuring approximately 12 x 6 cm of intraperitoneal location, occupying the lower half of the abdomen. The lesion had septations in its anterosuperior left aspect, with a mass effect on the adjacent structures, with displacement of intestinal loops, but apparently with cleavage planes and with small free liquid in the bottom of the peritoneal sac, without retroperitoneal or pelvic lymph node enlargement (figures 3 and 4), which confirmed voluminous ascites, with fine septations, displacing the intestinal loops to the left and absence of thrombi in hepatic veins. Bulky expansive intraperitoneal cystic lesion, with gross septations in its intraperitoneal aspect occupying the lower half of the abdomen with gross septations in the left anterolateral aspect.

Figure 3. Computed tomography of the abdomen and pelvis.

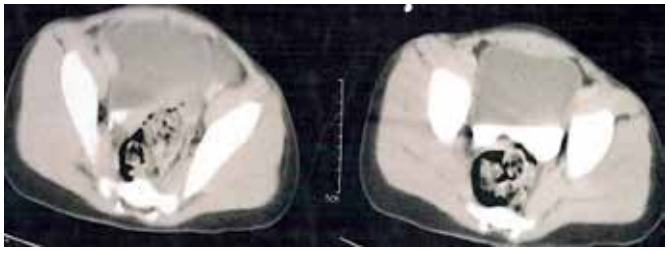

Figure 4. Computed tomography of the abdomen and pelvis.

The patient underwent a diagnostic exploratory laparotomy, which showed a giant mesenteric cyst at the root of the mesocolon, which was completely excised during the procedure.

Histopathological examination revealed cystic formation in the mesentery without atypia and the immunohistochemical study found mesenteric cystic lymphangioma.

The patient evolved asymptomatic in the postoperative period, without pain and with a flat abdomen, without healing changes and no new complaints.

DISCUSSION

The first case of mesenteric cyst reported in the literature was by Benevieni in 1507[6].

Benign intra-abdominal cystic masses in childhood are quite uncommon and their etiopathogenesis, histology and clinical presentation differ significantly[7].

The cysts are probably of congenital and lymphatic origin. Trauma, infection, bleeding or volvulus can manifest a silent cyst[8]

Mesenteric cysts are rare intra-abdominal injuries and account for only one in 100,000 acute admissions of adults. There is a wide spectrum of symptoms and patients have nonspecific complaints of abdominal pain, bloating or abdominal mass[9].

The diagnosis of the present case took 13 months between the first episode of pain and the diagnosis.

Dawar & Madsen[10] reported a case of a 10-year-old boy with known episodes of moderate abdominal pain for 18 months that evolved to severe abdominal pain and only on tomography was it possible to see a 25 × 15 cm cystic view. It should be stated that mesenteric cysts are rare, but they should be considered a source of abdominal pain in children, especially after excluding the most common diagnoses[10].

The child's age in the report was two years. In a retrospective analysis in the period 2002-2012 in Spain[11] seven patients were found, with an average age of 5.3 years (range $^{3-11}$). However, in these cases, abdominal ultrasound was the diagnostic tool in all cases, except one, diagnosed during laparotomy. All had abdominal pain, five (71.4%) vomiting, four (57%) gross abdominal distension, three (42.8%) fever and none had complete abdominal obstruction, although two patients (28.6%) had mild subocclusion symptoms[11].

Ghritlaharey & More[13] presented an eight-year-old boy who revealed a cystic mass in the peritoneal cavity with dilated bowel loops in an ultrasound of the abdomen and, in the case presented, this was the only finding on the initial ultrasound. In exploration of the abdomen, he revealed a solitary cyst of the terminal ileum mesentery measuring 10 x 8 cm. A study of 18 patients using ultrasound of the abdomen, performed in all patients, was not conclusive in half of the cases[14].

Belhassen et al.[15] analyzed two boys and a girl with an average age: 6.3 years. The abdominal ultrasound examination showed a cystic mass in all cases. However, the cystic nature of the mass, its margins and its extension were better described in the tomographic images.

Mesenteric cysts vary in presentation. Lymphangiomas predominate in male children, can cause acute abdominal pain and often require resection of adjacent structures[16].

In the case presented, the patient was female, which was at odds with the researched literature.

As for the location, the cyst presented itself in the mesentery of the small intestine. In an evaluation from 1970 to 1990, [15] children were diagnosed and treated for mesenteric cysts at the Hospital Ste Justine, in Montreal[15]. Ten patients had preoperative ultrasounds that diagnosed cystic mass in all of them. The second most frequent preoperative diagnosis was appendicitis. The cysts were located in the mesentery of the small intestine in five cases, the base of the mesentery with retroperitoneal extension in four cases, the transverse mesocolon in four cases and the gastrocolic ligament in two cases. The operative procedures performed included complete excision of the cyst in nine patients, complete excision with intestinal resection in five patients and in one patient only drainage of the cyst was performed[5].

Another study with 10 children with histological examination showed a mesenteric cyst and recurrence was not observed[12]. Early diagnosis and treatment produce excellent results[17].

Abdominal tumors usually present themselves as an asymptomatic abdominal mass, often discovered in routine consultations or by the parents themselves[18].

Despite the rarity of these injuries, benign cystic abdominal masses in children are not so uncommon and should be considered as causes of acute abdominal pain in the presence of intestinal loop distension. If the ultrasound examination does not reveal an abdominal lesion even with intestinal preparation, a CT scan should be performed[7].

CONCLUSION

Mesentery cyst is the main clinical manifestation of abdominal pain associated with vomiting. Its diagnosis is difficult to conclude and may require special attention in the ultrasound.

Therefore, it is necessary for the ultrasound doctor to be attentive and when in doubt, tests of greater accuracy, such as abdominal tomography, should be performed.

The role of the ultrasonographer goes far beyond the application of systematics in conducting exams. He needs to correlate radiological images with the association of possible clinical diagnoses and leverage all possible hypotheses to elucidate and facilitate the final diagnosis.

REFERENCES

1. Coffey JC, O'Leary DP. The mesentery: structure, function, and role in disease. The Lancet Gastroenterology & Hepatology. 2016; 1(3): 238-247.
2. Liew SC, Glenn DC, Storey DW. Mesenteric cyst. Aust N Z J Surg. 1994; 64(11):741-4.
3. Vijayabaskaran S, Raghul M, Rajamani G. Abdominal cystic disease of the neonate - a systematic review. Journal of Dental and Medical Sciences. 2018; 17(7):07-12.
4. Pithawa AK, Bansal AS, Kochar SP. Mesenteric cyst: A rare intra-abdominal tumour. Med J Armed Forces India. 2014; 70(1):79-82.
5. Chung MA, Brandt ML, St-Vil D, Yazbeck S. Mesenteric cysts in children. J Pediatr Surg. 1991; 26(11):1306-8.
6. Swartley WB. Mesenteric cysts. Ann Surg. 1927; 85(6):886-896.
7. Ferrero L, Guanà R, Carbonaro G et al. Cystic intra-abdominal masses in children. Pediatr Rep., 2017; 9(3):7284.
8. Estourgie RJ, Van Beek MW. Mesenteric cysts. Z Kinderchir. 1981; 32 (3) :223-230.

9. Nam SH. The surgical experience for retroperitoneal, mesenteric and omental cyst in children. J Korean Surg Soc. 2012; 83(2):102-106.
10. Dawar M, Mmadsen MR. Mesenteric cyst is a rare origin for abdominal pain in children. Ugeskr Laeger. 2015; 177(8): V10140538.
11. Ibieta MF, Ticona JR, Castaño IM et al. Mesenteric cysts in children. An Pediatr. 2015; 82(1):e48-51.
12. Ghritlaharey RK. Management of mesenteric cysts in children: review of ten cases. management of mesenteric cysts in children: review of ten cases. Journal of Clinical and Diagnostic Research. 2018; 12(7): PC05-PC09.
13. Ghritlaharey RK; More S. Chylolymphatic cyst of mesentery of terminal ileum: a case report in 8-year-old boy. J Clin Diagn Res. 2014; 8(11): ND05-7.
14. Santana WB. Mesenteric cyst--clinical and pathological aspects. Rev Col Bras Cir. 2010; 37(4): 260-264.
15. Belhassen S, Meriem B, Rachida L et al. Mesenteric cyst in infancy: presentation and management. Pan Afr Med J. 2017; 26(1):191.
16. Perrot M, Bründler M, Tötsch M, Mentha G, Morel P. Mesenteric cysts. Toward less confusion? Dig Surg. 2000; 17(4):323-328.
17. Prakash A, Agrawal A, Gupta RK et al. Early management of mesenteric cyst prevents catastrophes: A single centre analysis of 17 cases. Afr J Paediatr Surg. 2010; 7(1):140-3.
18. Souza NE, Botrel LN, Neves KS. Diagnóstico diferencial de massas abdominais na infância: revisão de literatura. Revista de Saúde, 2015; 6(2): 11-14.

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CASE REPORT

MARKED HYPERTHROPHIC PILORIOUS STENOSIS DIAGNOSED THROUGH ULTRASONOGRAPHY - CASE REPORT

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ABSTRACT

Hypertrophic pyloric stenosis is the main surgical cause of non-bilious vomiting in infants. Ultrasound is the diagnostic imaging method of choice because it can evaluate the pyloric canal morphologically and functionally. Thus, the objective of the present study is to report a case of marked pyloric stenosis with severe difficulty in gastric emptying diagnosed by ultrasound.

KEYWORDS: PYLORIC STENOSIS, INFANT, GASTRIC OBSTRUCTION, ULTRASOUND, PEDIATRICS.

INTRODUCTION

Hypertrophic pyloric stenosis is a common cause of obstruction of gastric emptying in infants. The incidence is approximately two to five cases per 1,000 live births per year in most white populations, although variations are described in relation to the geographic region of the studies and the period in which they were performed [1-3]. Studies describe a higher prevalence in males, with a ratio of approximately four cases of males to each case of females [2,4]. There is also a family predisposition. In addition, pyloric stenosis occurs more frequently in the white race compared to populations of black and Asian races[2,5].

The disease is characterized by thickening of the muscular layer of the pylorus, which begins to present difficulty in relaxation, with consequent obstruction of the passage of gastric contents through the pylorus. Usually, the clinical picture starts with the infant presenting with non-bilious vomiting between the second and eighth weeks of life3. The main differential diagnosis is gastroesophageal reflux, which is why clinical history and physical examination may not be sufficient for the definitive diagnosis[5].

Ultrasound is the method of choice for diagnosis. It allows the anatomical study of the pylorus and the functional assessment of gastric emptying after feedings, without the need for sedation, ionizing radiation or contrast medium [4,5].

The objective of this work is to present an ultrasound study of a case of hypertrophic stenosis of the pylorus with marked narrowing of the pyloric channel, causing great difficulty in gastric emptying.

CASE REPORT

LSMC, one month old, male, referred by the pediatrician with a history of frequent projectile vomiting showing low weight gain. Upon ultrasound examination, the pylorus had increased dimensions in both length and width, due to the hypertrophy of the muscle layer. Stomach peristalsis was observed without relaxation of the pylorus musculature, with the passage of gastric contents to the duodenum greatly reduced. The stomach was distended and its volume was 175 ml after three hours and thirty minutes of the last feeding. The intestinal loops were empty and without gaseous content. The pylorus measurements were 21.0 mm long (reference <18.0 mm), 17.0 mm wide (reference up to 12.0 mm) and the thickness of the muscle varied from 4.5 to 4.9 (Reference : <3.0 mm) - figure 1-3.

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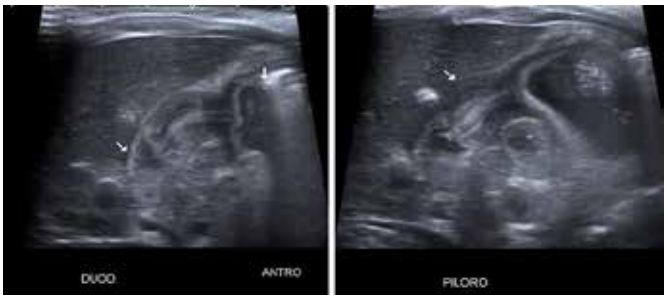

Figure 1: Ultrasound of the abdomen: pylorus with enlarged dimensions.

Figure 2: Enlarged image of the muscular layer of the pylorus, which has a significantly increased length and thickness.

Figure 3: Ultrasound of the abdomen: distended stomach and small intestine loops completely empty.

DISCUSSION

The diagnostic imaging method of choice in the suspicion of hypertrophic pyloric stenosis is ultrasound. However, the ultrasound examination of the infant has particularities that are worth reinforcing and that, certainly, greatly improve the sensitivity of the method. The baby needs to feel comfortable, protected and stay close to the parents throughout the exam. The test should be performed in a quiet environment, using a heated gel close to body temperature and after breastfeeding[4]. The transducer must be of high frequency and of adequate size for the baby's biotype.

The morphological criteria for the ultrasonographic diagnosis of pyloric stenosis are the thickness of the muscular layer, which must not exceed 3mm in thickness, and the length of the pyloric canal, usually less than 12mm in length[2,6]. An additional finding that reinforces the diagnosis is mucosal hypertrophy, which can present itself as a double inner layer of thick and redundant mucosa, making protrusion into the gastric antrum.

Functional assessment of pylorus is essential for the diagnostic conclusion in cases of pyloric stenosis, especially in cases where the measurements are borderline and the baby is premature[4]. The functional study of the pyloric canal includes the observation of gastric peristalsis and the verification of the opening of the pylorus, since in these cases, the pylorus remains thickened and elongated throughout the evaluation and there is no relaxation of the musculature, which occurs in cases of pylorospasm.

Therefore, the ultrasound study of the pylorus is a morphological and functional investigation, which must be carried out systematically, with great attention to the peculiarities of the age group and the possibilities of differential diagnosis, especially in borderline cases and in premature infants. Undoubtedly, ultrasound is the exam of choice in the suspicion of hypertrophic pyloric stenosis. The thickness of the muscular layer from 3 to 4 mm and the length of the pyloric channel from 15 to 18 mm have a sensitivity of 100% and specificity of 97% to 99% [2,4,7-13].

It is a well-tolerated examination by infants, non-invasive, without ionizing radiation and does not require sedation.

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REFERENCES

1. Galea R, Said E. Infantile hypertrophic pyloric stenosis: an epidemiological review. Neonatal Network. 2018; 37(4): 197–204.
2. Schulman MH. Infantile hypertrophic pyloric stenosis. Radiology 2003; 227(2): 319–31.
3. Panteli C. New insights into the pathogenesis of infantile pyloric stenosis. Pediatric Surgery International. 2009; 25(12): 1043-1052.
4. Costa Dias S, Swinson S, Torrão H, Gonçalves L, Kurochka S, Vaz CP, et al. Hypertrophic pyloric stenosis: Tips and tricks for ultrasound diagnosis. Insights into Imaging. 2012; 3(3): 247-250.
5. Khan AA, Yousaf MA, Ashraf M. Role of ultrasonography in early diagnosis of infantile hypertrophic pyloric stenosis. JAMC. 2014; 26(3): 316-319.
6. Reed AA, Michael K. Hypertrophic pyloric stenosis. J Diagn Medical Sonography. 2010; 26(3): 157-160.
7. Haider N, Spicer R, Grier D. Ultrasound diagnosis of infantile hypertrophic pyloric stenosis: Determinants of pyloric length and the effect of prematurity. Clinical Radiology. 2002; 57(2): 136-139.
8. Hiorns MP. Gastrointestinal tract imaging in children: Current techniques. Pediatric Radiology. 2011; 41(1): 42-54.
9. Iqbal CW, Rivard DC, Mortellaro VE, Sharp SW, St. Peter SD. Evaluation of ultrasonographic parameters in the diagnosis of pyloric stenosis relative to patient age and size. J Pediat Surgery. 2012; 47(8): 1542-1547.
10. Cohen HL, Blumer SL, Zucconi WB. The sonographic double-track sign. J Ultrasound Med. 2004; 23(5): 641-646.
11. Leaphart CL, Borland K, Kane TD, Hackam DJ. Hypertrophic pyloric stenosis in newborns younger than 21 days: remodeling the path of surgical intervention. J Pediat Surgery. 2008; 43(6): 998-1001.
12. Otjen JP, Iyer RS, Phillips GS, Parisi MT. Usual and unusual causes of pediatric gastric outlet obstruction. Pediat Radiology. 2012; 42(6): 728-737.
13. Gale HI, Gee MS, Westra SJ, Nimkin K. Abdominal ultrasonography of the pediatric gastrointestinal tract. World Journal of Radiology. 2016; 8(7): 656.

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CASE REPORT

RIGHT UTERINE TUBE TORSION: CASE REPORT

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ABSTRACT

Although adnexal torsion is a condition with low incidence, this emergency is considered of great gynecological importance, either due to the difficulty of early diagnosis, or to the potentially serious complications. Thus, the present report aims to present a case of cyst with uterine tube torsion.

KEYWORDS: UTERINE TUBE, FALLOPIAN TUBES, TORSION, DIAGNOSIS, ULTRASONOGRAPHY, COMPUTERIZED TOMOGRAPHY, MAGNETIC RESONANCE, LAPAROSCOPY.

INTRODUCTION

Adnexal torsion is a gynecological emergency caused by torsion of the ovary and/or uterine tube, and may be partial or total[1]. Although isolated torsion of the uterine tube has a low incidence - it is estimated to occur in 1 in 1.5 million of women, making it a very unusual condition[2]. If not relieved, persistent vascular occlusion can lead to infarction and necrosis of the adnexal structures, causing even more serious complications such as peritonitis and infertility.

Thus, the early recognition of this condition is extremely important, even though its diagnosis is often hampered by the absence of specific clinical signs, manifestations or biomarkers[1].

CASE REPORT

GALC, female, 25 years old, with no history of previous pregnancies. The patient underwent laparoscopy, under general sedation, after burning pain in the left hypochondrium that radiated later to severe pain in the right flank and right iliac fossa one week before the procedure. Magnetic resonance imaging shows a cystic mass in the region of the right iliac fossa (figure 1). During surgery, an 8 cm tumor was noted in the right uterine tube with terminal torsion. At the time, the biopsy of the finding and its resection with tube distortion were also performed (figure 2).

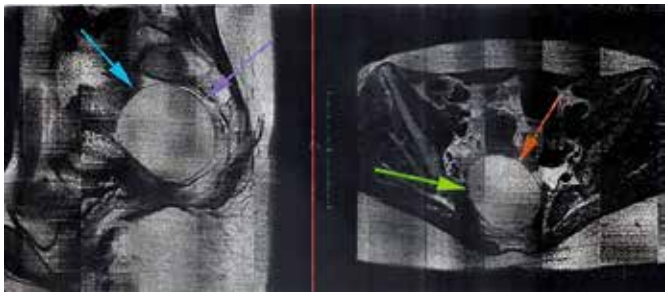

Figure. 1- Magnetic resonance imaging shows an image with hyposignal suggestive of a cyst in the right iliac region.

Figure 2. Images from videolaparoscopy surgery.

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The result of the anatomopathological analysis of the material showed a brownish elastic irregular hemorrhagic paratubal cyst, measuring 8.0 x 3.0 x 1.5 cm in its largest dimensions. Microscopically, there was also a cystic structure of delicate fibrous walls, covered by flattened cells, without atypia, accompanied by areas of necrosis and absence of signs of malignancy. Thus, a histopathological picture compatible with a serous cyst with foci of infarction was concluded.

Finally, the onco-parasitic cytology did not show atypical cells in the 15ml sample of hemorrhagic fluid from the right paratubal cyst, containing only an amorphous background, hair cells and leukocytes in the smears analyzed.

DISCUSSION

Uterine tube torsion is a rare condition whose possible risk factors include abnormalities of the uterine tubes, such as neoplasia, ectopic pregnancy, hydrosalpinx, tubal ligation device, congenital anomaly and paratubal cyst. In addition to the previous intrinsic factors, abnormalities in organs close to the attachments, such as endometriosis, adhesions, infections and ovarian mass can also influence[2].

As described in a series of cases, torsion of the right uterine tube is more commonly diagnosed compared to the left, and the possible explanations may be related to the fixation of the left tube in the left hemipelvis by the sigmoid colon and mesentery or to the more frequent right pelvis image evaluations due to the diagnostic hypothesis of appendicitis[3].

The clinical presentation of a torsion of the uterine tube can be somewhat nonspecific, being, therefore, a challenge for the physician to recognize and differentiate it from other etiologies. It is worth remembering that acute pain in the lower abdomen is an ever-present sign, which may be accompanied by nausea, vomiting and, more rarely, fever. Laboratory findings are generally nonspecific[4].

Ultrasonography (US) is the primary imaging technique most often used in women with acute pelvic pain and suspected adnexal torsion, due not only to its low cost-effectiveness, but also to the absence of radiation exposure and its non-invasive character. However, low rates of detection of the test still make it difficult to distinguish torsion from other diseases, such as hemorrhagic cysts, endometriosis, ovarian tumors or pelvic inflammatory disease[1,3].

Therefore, computed tomography (CT) may be useful if the adnexal torsion is doubtful at US or the lesion is not well represented on ultrasonography, in addition to being an important exam for the exclusion of appendicitis. Typical CT image findings in cases of torsion of the uterine tube include an enlarged fluid-filled structure and thick wall enhancement[1-3].

Magnetic resonance imaging (MRI), in turn, is used, in some cases, for the preoperative diagnosis of acute conditions in young or pregnant patients, as in the case of the reported patient. This is due to the excellent contrast of soft tissues and the absence of radiation exposure[3].

Finally, laparoscopy is considered the gold standard for establishing diagnosis and therapy for patients, since it is minimally invasive, with rapid recovery and low morbidity rate. Thus, in addition to confirming the diagnostic hypothesis through visualization of the twisted segment, the procedure assesses the involvement of the affected tube, the possibility of surgical treatment with resection of the mass found and simple reverse rotation of the twisted pedicle, preserving, whenever possible, the uterine tube[3].

FINAL CONSIDERATIONS

Tubal torsion has nonspecific clinical signs, making the diagnosis even more challenging. Ultrasonography and computed tomography can demonstrate alterations that strongly suggest tubal torsion. However, a definitive diagnosis with appropriate treatment, require exploration surgery, with laparoscopy as the best option. Thus, the importance of clinical suspicion and early intervention is emphasized as a means of preserving the integrity of the uterine tube, and, consequently, female fertility.

REFERENCES

1. Jung SI, Park HS, Yim Y, Jeon HJ, Yu MH, Kim YJ, Jeong K. Added value of using a CT coronal reformation to diagnose adnexal torsion. Korean Journal of Radiology 2015, 16 (4): 835-845.
2. Jokić R, Lovrenski J, Lovrenski A, Trajković V. Isolated Fallopian Tube Torsion - A challenge for the timely diagnosis and treatment. Srp Arh Celok Lek. 2015; 143 (7-8): 471-5.
3. Kolovos GN, Meytap E, Samartzis N, Kalaitzopoulos DR. Isolated torsion of the fallopian tube in a 16-year-old girl: A case report and review of the literature. Case Reports in Women's Health. 2019;23:e00132.
4. Modotti WP, Dias R, Bueno PR, Mussi M, Bergamasco J, Moitim SZ. Torção isolada da trompa relato de caso. Revista Brasileira de Videocirurgia. 2003;4.

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REVIEW ARTICLE

PULMONARY ULTRASONOGRAPHY AT COVID-19: A WINDOW OF OPPORTUNITY FOR ITS APPLICATION AND DISSEMINATION

LEONARDO DE SOUZA PIBER[1], ADILSON CUNHA FERREIRA[2]

ABSTRACT

COVID-19 manifests itself predominantly as a pulmonary infection that can be diagnosed and controlled through ultrasound. This procedure, in a hospital environment, can be performed at the bedside, including in intensive care units, decreasing the locomotion of patients and the exposure of other patients and health professionals. This study aims to review the technique and pulmonary ultrasound findings related to COVID-19. To this end, it performed a narrative review of articles that address pulmonary ultrasound, as well as literature on COVID-19, in national and international databases. Articles were selected that highlighted the quality of the images and didactically prepared text, so that the examination technique and the most frequent findings related to pulmonary infection of this etiology were addressed. According to the literature, ultrasonography allows for the screening of clinically stable symptomatic patients, especially in view of possible limitations to hospital access and computed tomography, standing out as a complementary diagnostic method when coping with the pandemic of COVID-19.

KEYWORDS: COVID-19; ULTRASOUND; LUNG; PULMONARY ASSESSMENT; VIRAL PNEUMONIA.

INTRODUCTION

COVID-19, a disease caused by the new coronavirus (Sars-Cov-2), started in December 2019 in Wuhan, China. Since then, it has taken on a pandemic proportion, spreading across the world[1].

The most common symptoms are fever and cough, associated with sore throat, nasal congestion, headache, malaise, body pain, with an average incubation period of 4-5 days, which may progress with dyspnea[1,2]. Other symptoms have been described, such as nausea or vomiting, diarrhea, disorders of smell and taste, such as anosmia and dysgeusia, asthenia, anorexia[2].

Special attention is given to symptomatic patients with comorbidities (heart disease, lung disease, diabetes, people with low immunity, neoplasms) and/or higher risk groups (children under two years of age, pregnant women, adults aged 60 or over) , due to the greater possibility of worsening[2].

The initial flu state evolves to a type of pneumonia, whose imaging finding on chest computed tomography (CT) is, more often, ground-glass opacity1. Computed tomography is the gold standard for the diagnosis of lung injuries. However, ultrasonography stands out for the possibility of diagnosis, control and monitoring of pulmonary changes in adults and children, regardless of the severity of the cases and the complexity of the hospitalization site. It also includes the possibility of follow-up after hospital discharge at home. Ultrasonography is not a substitute for computed tomography.

The recovery of patients can vary from two weeks, for mild cases, up to three to six weeks for severe illnesses[2].

In view of the worrying virulence, transmissibility, morbidity and mortality, with admissions in intensive care units and the extremely high demand for care due to them, there is an urgent need for the instruction and training of sonographers.

This study aims to review the technique and pulmonary ultrasound findings related to COVID-19.

METHODS

We performed a narrative review of articles addressing pulmonary ultrasound, as well as literature on COVID-19, information from the Brazilian Society of Infectious Diseases, guidelines from the Health Surveillance Agency, and, to specifically address the pulmonary ultrasound findings of COVID-19, we used search strategy (ultrasound OR ultrasonography and COVID and Lung) in the PubMed database. Articles that were in agreement with the objective of this study were selected, including good quality images and didactically elaborated texts.

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RESULTS AND DISCUSSION

It was initially thought that ultrasound could not be used to assess the chest. The main organs of the chest contain air, which does not adequately transmit the ultrasound, associated with the fact that the ribs block it.

Ultrasonography has become a very valuable resource in the evaluation of the abnormal chest. Its role in the evaluation of various respiratory conditions has been widely documented for a long time, but it is only recently, due to the improvement of equipment and specifically the low cost of high frequency transducers, that the method has been gaining coverage in several situations[1,3], providing results similar to computed tomography scan of the chest and superior to standard chest radiography to assess pneumonia and/or adult respiratory distress syndrome[4].

A recognized limitation of pulmonary ultrasound is that it cannot detect lesions deep within the lung, as the aerated lung blocks the transmission of ultrasound, that is, the abnormality must extend to the pleural surface to be visible on ultrasound examination. Chest CT is necessary to detect pneumonia that does not extend to the pleural surface1[4].

Ultrasonography and chest X-ray have known sensitivity and specificity, according to Tables 1 and 2.

	Sensitivity (%)	Specificity (%)
Ultrasound		
Pleural effusion (7)	94	97
Alveolar consolidation (11)	90	98
Interstitial syndrome (18)	93	93
Pneumothorax (23)	95	94
Complete pneumothorax (20)	100	96
Hidden pneumothorax (24)	79	100

Translated from Lichtenstein, 2009[5]

Table 1. Performance of ultrasound compared to computed tomography

	Sensitivity (%)	Specificity (%)
X-ray		
Pleural effusion (7)	39	85
Alveolar consolidation (11)	68	95
Interstitial syndrome (18)	60	100

Translated from Lichtenstein, 2009[5]

Table 2. Performance of radiography in critically ill adults

Standardized imaging criteria for assessing pulmonary pathology in adults with ultrasonography also apply to neonates, potentially providing an alternative to bedside X-ray, with a reduction in associated radiation[5].

Among the advantages of performing ultrasound at bedside, we highlight the reduction in the number of professionals exposed to contamination and the possibility of imaging control every 12 or 24 hours[1]. Pulmonary ultrasonography is very useful in the treatment of COVID-19 with respiratory impairment due to its safety, reproducibility, absence of radiation, low cost and use at the service location; chest CT can be reserved for cases in which pulmonary ultrasound is not sufficient to answer the clinical question[4]. The removal of patients to the radiology service is often not possible due to clinical conditions, in addition to the potential exposure of other patients and professionals[1].

Examination technique and systematization

Soldati et al 6 published a standardization of areas of the chest to be examined. The ultrasound scans can be identified with progressive numbering from the right posterior basal region (Figure 1), for the patient capable of maintaining the sitting position[6]. There are fourteen areas (three posterior, two lateral and two anterior) namely (Figure 1):

1. Right basal in the paravertebral line;
2. Right middle third on the paravertebral line at the lower angle of the scapula;
3. Upper right on the paravertebral line;
4. Left basal in the paravertebral line;
5. Middle third on the paravertebral line at the lower angle of the scapula;
6. Upper left on the paravertebral line;
7. Right basal in the middle axillary line;
8. Upper right in the middle axillary line above the intermammary line;
9. Left basal in the middle axillary line;
10. Upper left in the middle axillary line above the intermammary line;
11. Right basal in the middle clavicular line below the intermammary line;
12. Upper right on the middle clavicular line above the intermammary line;
13. Left basal in the middle clavicular line below the intermammary line;
14. Upper left in the middle clavicular line above the intermammary line.

Performing ultrasound in intensive care settings (such as patients on mechanical ventilation) and for patients who are unable to maintain a sitting position, it may be difficult to assess the posterior areas. In such cases, the operator should try to have a partial view of the posterior basal areas; despite the importance of assessing these areas for COVID-19, ultrasound assessment can be started from reference point number 7 [6].

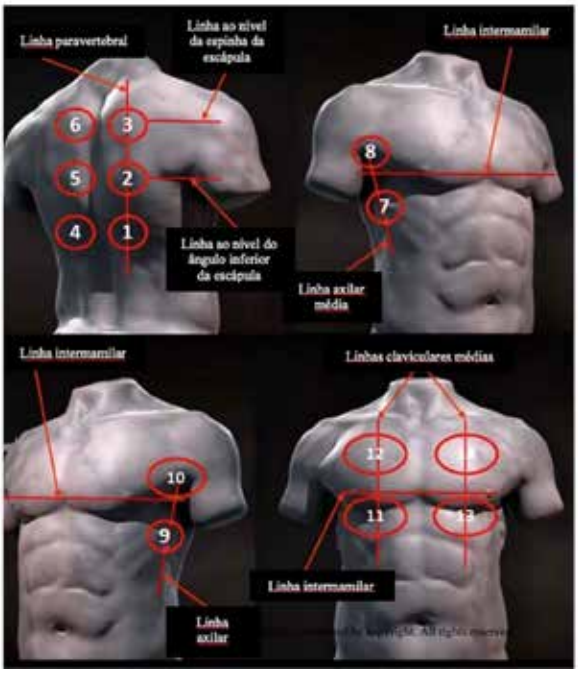

Figure 1 - Fourteen areas suggested by Soldati et al [6].

Proposal for the following systematization for extracardiac thoracic ultrasonography:

1. Start the examination with a convex or sectorial transducer (these provide the assessment of a larger area with an initially adequate depth);
2. Longitudinal scan of each hemithorax on the anterior, lateral and posterior sides;
3. In a suspicious region, the transducer is rotated approximately 90 degrees, so that the acoustic beam reaches the intercostal space;
4. Additional evaluation is indicated with a linear transducer (due to the increased frequency inherent in this transducer, the superficial planes, such as pleural line and subpleural space, are adequately examined).

Ultrasound findings at covid-19

The patterns observed on ultrasound occur progressively, from a mild alveolar interstitial pattern to a severe bilateral interstitial pattern and pulmonary consolidation[4].

The characteristic ultrasound findings related to covid-19 are[4]:

1. Thickening of the pleural line with irregularity;
2. B lines in a variety of patterns, including focal, multifocal and confluent;
3. Consolidations in a variety of patterns, including small multifocal, non-translobar and translobar, with occasional mobile air bronchograms;
4. Appearance of A lines during the recovery phase;
5. Pleural effusions are uncommon.

Figures 2 and 3 show the normal pattern on ultrasound.

Figure 2 - Normal examination. Pleural line (yellow arrow); A lines (white arrows); ribs (white stars) [7].

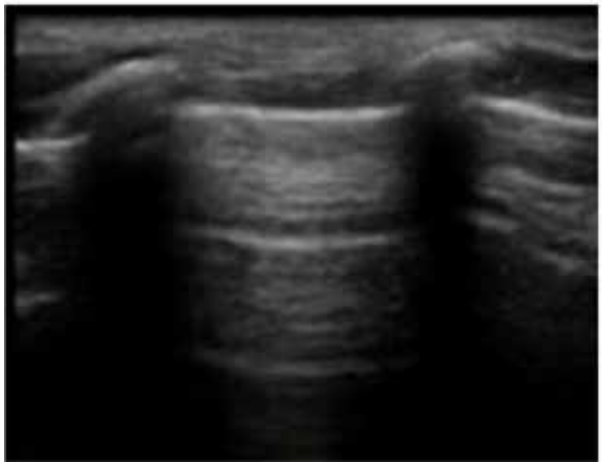

Figure 3 - Normal examination, showing regular pleural line and sporadic B lines[7].

Figures 4 to 7 show pathological ultrasound findings that may be related to COVID-19.

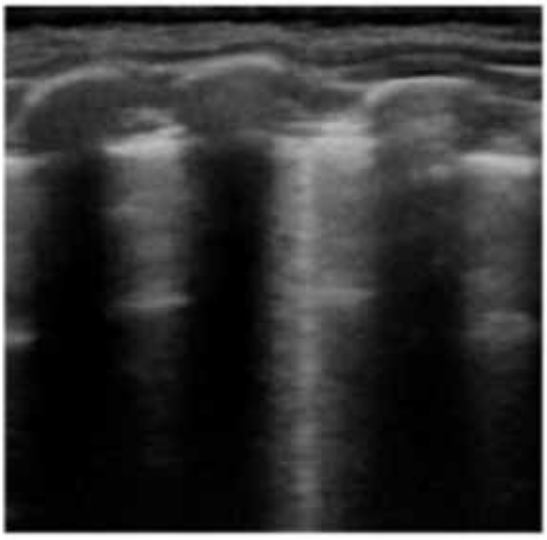

Figure 4 - Irregular pleural line and sporadic B lines[7].

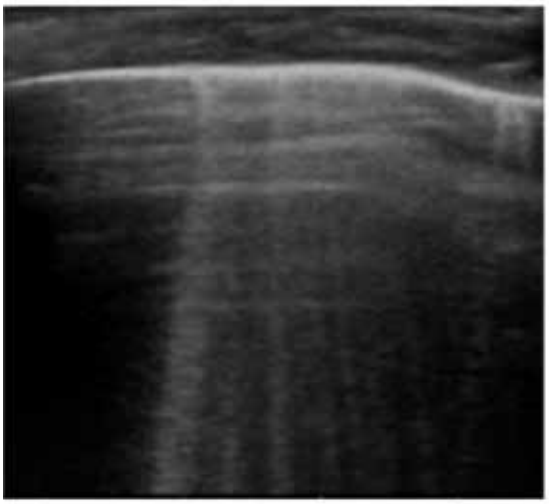

Figure 5 - Irregular pleural line and multiple B lines [7].

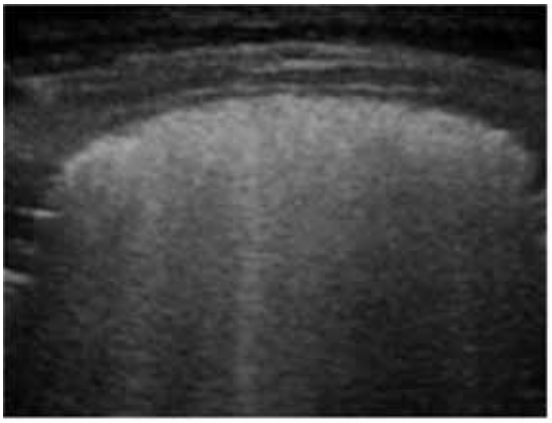

Figure 6 - Irregular pleural line and pulmonary parenchyma with increased echogenicity, making it impossible to characterize the A lines[7].

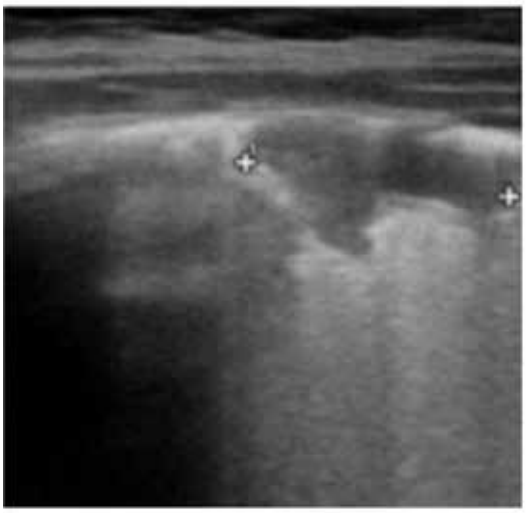

Figure 7 - Irregular pleural line and subpleural consolidation[7].

Below are pulmonary images with the respective findings and scores proposed by Soldati et al [6]. Note the characteristics of the images captured with convex and linear transducers (Figures 8, 9, 10 and 11).

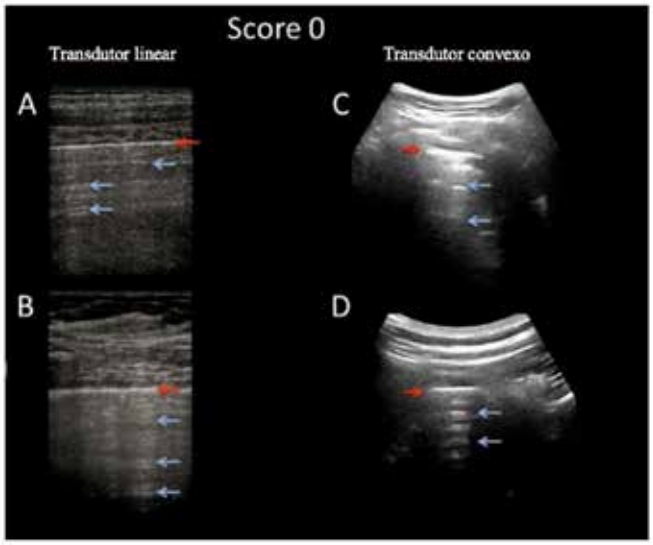

Figure 8 - Pulmonary ultrasound images obtained with a linear (A-B) and convex (C-D) probe. The pleura line (indicated by the red arrows) is continuous. Below, horizontal artifacts, or A lines (indicated by blue arrows) may be visible. This standard is classified as Score 0[1].

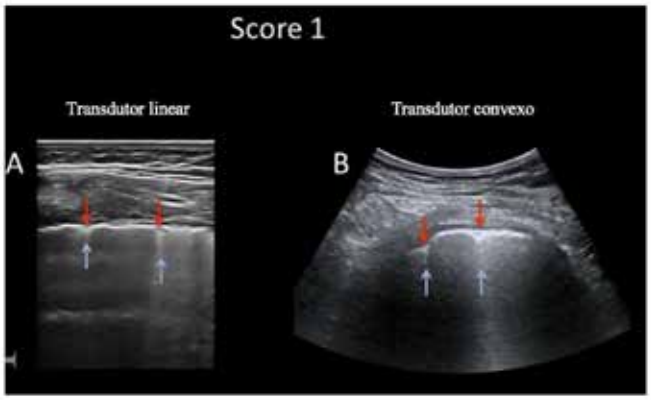

Figure 9 - Pulmonary ultrasound images obtained with a linear (A) and convex (B) probe. The pleura line is not continuous. Below the point of discontinuity (indicated by the red arrows), vertical white areas are visible, or B lines (indicated by the blue arrows). This standard is classified as Score 1[6].

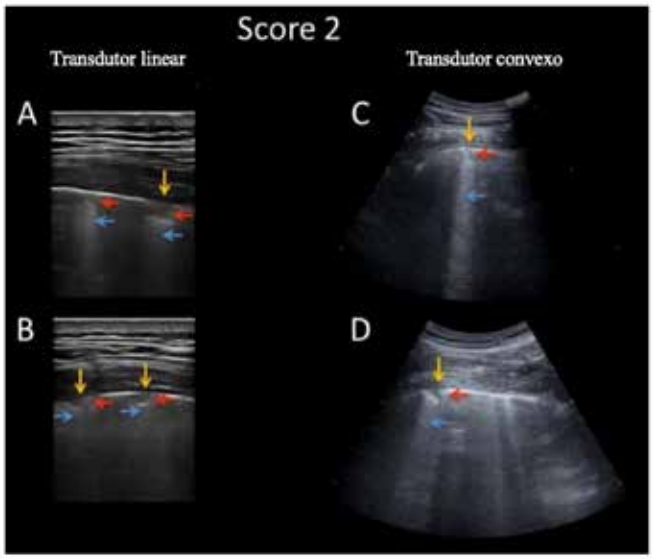

Figure 10 - Pulmonary ultrasound images obtained with a linear (A-B) and convex (C-D) probe. The pleura line is severely broken. Below the point of discontinuity (indicated by the orange arrows), small consolidated areas (darker areas indicated by the red arrows) appear with associated white areas (indicated by the blue arrows) in correspondence with the consolidations. This standard is classified as Score 2[6].

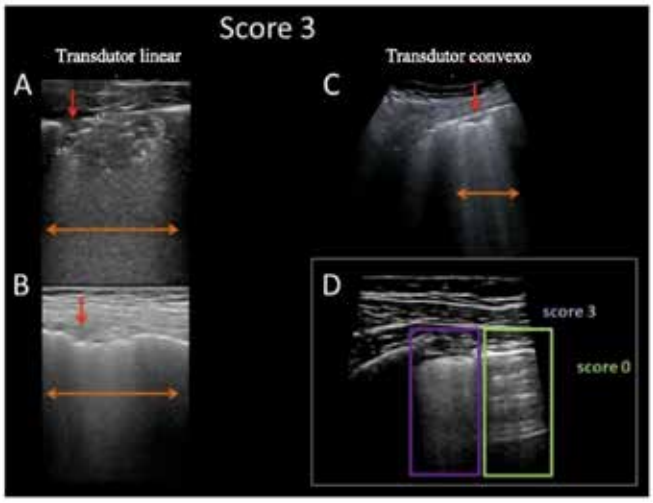

Figure 11 - Pulmonary ultrasound images obtained with a linear (A-B) and convex (C) probe. The pleura line is severely broken. Below the point of discontinuity, large areas of consolidation (more hypoechogenic areas indicated by red arrows). Hyperechogenic images between consolidation are suggestive of aerobronchograms. The "white" lung pattern, with increased echogenicity is indicated by orange arrows. This pattern is classified as Score 3. In the box at the bottom right (D), a lung image is shown where the boundary between a pattern of Score 0 (green box) and Score 3 (purple box) is clearly visible[6].

FINAL CONSIDERATIONS

Ultrasonography allows screening of clinically stable symptomatic patients, especially in view of possible limitations to hospital access and computed tomography1.

Once a pulmonary ultrasound evaluation is requested, all precautionary contact measures, for droplets and aerosols, guided by the World Health Organization and the National Health Surveillance Agency, must be respected, using the appropriate personal protective equipment[8].

There was no intention to exhaust such a large amount of information in recent publications. Given the above, it is understood that it is, above all, a time of need for unity and sharing of secure information.

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Gratitude to all who motivate our studies.

REFERENCES

1. Buonsenso D, Piano A, Raffaelli F, Bonadia N, de Gaetano Donati K, Franceschi F. Point-of-care lung ultrasound findings in novel coronavirus disease-19 pnemoniae: a case report and potential applications during COVID-19 outbreak. Eur Rev Med Pharmacol Sci. 2020; 24(5):2776-2780.
2. Dias VM de CH, Carneiro M, de Lacerda Vidal CF, Corradi M de FD Ben, Brandão D, da Cunha CA, et al. Orientações sobre diagnóstico, tratamento e isolamento de pacientes com COVID-19. J Infect Control. 2020; 9(2):1-20.
3. Ferreira AC, Mauad Filho F, Braga T, Fanstone GD, Chodraui ICB, Onari N. Papel da ultra-sonografia na avaliação da efusão pleural. Radiol Bras. 2006; 39(2):145-150.
4. Peng QY, Wang XT, Zhang LN. Findings of lung ultrasonography of novel corona virus pneumonia during the 2019–2020 epidemic. Intensive Care Medicine. 2020;46: 849-850.
5. Lichtenstein DA. Ultrasound examination of the lungs in the intensive care unit. Pediatr Crit Care Med. 2009; 10(6): 693-698.
6. Soldati G, Smargiassi A, Inchingolo R, Buonsenso D, Perrone T, Briganti DF, et al. Proposal for international standardization of the use of lung ultrasound for patients with COVID-19: A simple, quantitative, reproducible method. J Ultrasound Med. 2020; 39(7):1413-1419.
7. Moro F, Buonsenso D, Moruzzi MC, Inchingolo R, Smargiassi A, Demi L, et al. How to perform lung ultrasound in pregnant women with suspected COVID19. Ultrasound Obstet Gynecol. 2020; 55(5): 593-598.
8. Agência Nacional de Vigilância Sanitária. Nota técnica GVIMS/GGTES/ANVISA No 04/2020-Orientações para serviços de saúde: medidas de prevenção e controle que devem ser adotadas durante a assistência aos casos suspeitos ou confirmados de infecção pelo novo coronavírus (SARS-CoV-2). ANVISA Brasília (DF); 2020. p. 1–92.

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REVIEW ARTICLE

CRITERIA FOR PERFORMING ULTRASONOGRAPHY IN THE SECOND TRIMESTER OF PREGNANCY BASED ON INTERNATIONAL SOCIETY OF ULTRASONOGRAPHY IN OBSTETRICS AND GYNECOLOGY (ISUOG) GUIDELINES

ANTONIO GADELHA DA COSTA[1] , PATRICIA SPARA GADELHA[1], MARINA MENDES CAVALCANTI[1]

ABSTRACT

Second trimester routine ultrasound, whose main indication is the study of fetal morphology, is performed between 18 and 22 weeks of gestation, an ideal period to detect growth abnormalities and congenital anomalies. At this stage, gestational age can also be evaluated, until the 22nd week as well as the fetal growth by ultrasonography and Doppler velocimetry. The recommendations of the guideline of the International Society for Ultrasonography in Obstetrics and Gynecology (ISUOG) represent an international reference for the performance of fetal ultrasound, and are intended to reflect about the most appropriate methodology. Thus, the aim of this review was to analyze the criteria and indications for performing ultrasound in the second trimester of pregnancy. This paper was developed on ISUOG's practical guidelines for the routine performance of fetal ultrasound in the second trimester of pregnancy, using the updated literature. The knowledge of fetal development throughout pregnancy and the use of an appropriate ultrasound methodology in the second trimester are, therefore, essential to obtain accurate results.

KEY-WORDS: ULTRASONOGRAPHY, GESTATION, SECOND TRIMESTER, PRENATAL, DIAGNOSTIC IMAGING.

INTRODUCTION

Ultrasonography is a well-established imaging method and widely used in prenatal assessment of fetal growth and anatomy[1-3], as well as in monitoring multiple pregnancies[2,3].

Routine ultrasonography in the second trimester is primarily used to study fetal morphology. It is preferably performed between 18 and 22 weeks of gestation, an ideal period to detect growth abnormalities and congenital anomalies[3-5].

The use of this imaging method as a screening for fetal anomalies in the second trimester of pregnancy can diagnose more than half of the fetal structural anomalies[3,6]. This early diagnosis corroborates with a relevant reduction in perinatal morbidity and mortality due to morphostructural factors[6].

Although part of the malformations can be identified in the first trimester of pregnancy, it is recognized that some fetal malformations have their diagnosis postponed, in view of their later development in pregnancy, being better diagnosed in the second trimester of pregnancy[6-7].

The main indications for ultrasonography in the second trimester of pregnancy are the study of fetal morphology, the diagnosis of fetal growth restriction by ultrasound and Doppler velocimetry, as well as the calculation of gestational age if it has not been performed in the first trimester of pregnancy[2].

The guidelines recommendations represent an international reference for their realization, and are intended to reflect on the practices, considered more appropriate by the International Society of Ultrasonography in Obstetrics and Gynecology (ISUOG), when they were developed[8].

However, the circumstances and medical practices of each service must be considered, and it is advisable to document the cases in which it is impossible to carry out the examination in full according to these recommendations[2]. In this scenario, it is recommended to refer to a tertiary service to complement the exam, in order to minimize the delay in the diagnosis of potential congenital abnormalities and growth disorders using this method.

The adequate performance of fetal ultrasound in the second trimester of pregnancy is of fundamental importance to obtain accurate results that optimize prenatal care and potential necessary conduct[2]. Therefore, it should be offered to all patients at this gestational age so that the most reliable goals in detecting fetal anomalies and complications during pregnancy can be achieved[7].

Thus, the present study aims to analyze the criteria and

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indications for performing ultrasonography in the second trimester of pregnancy.

ULTRASONOGRAPHIC METHODOLOGY IN THE SECOND TRIMESTER OF PREGNANCY

The work was developed in the form of a bibliographic review carried out based on ISUOG's practical guidelines for the performance of the routine of fetal ultrasound in the second trimester.

In the ISUOG guidelines, recommendations are described, ranging from the equipment that must be used to how to evaluate the fetus from a morphostructural point of view.

The ultrasound equipment to be used for the adequate performance of routine ultrasound in the second trimester of pregnancy must acquire images in real time and gray scale[2]. In addition, they must contain transabdominal ultrasound transducers, in the 3–5 MHz band; adjustable acoustic power output controls and output pattern display; freeze frame capabilities, "freeze" mode; electronic cursors and the ability to print and store images[2]. There should be regular maintenance and repair of the equipment[2].

In order to obtain ideal results, it is suggested that routine ultrasounds should be performed by professionals trained in the use of diagnostic ultrasound, who perform fetal ultrasound examinations regularly, respecting quality assurance and control measures and based on standards appropriate reference points for suspicious or abnormal findings[9].

After the examination, a documented report must be made, to be printed and stored, and, in accordance with local practices, made available to the pregnant woman and the health service provider who referred the patient. This document must contain information about the patient's general data; date of the exam and performing professional; relevant clinical indication and information; if there was adequacy or technical limitation; chorionicity in cases of twin pregnancies; appearance of the placenta and its location in relation to the internal cervical orifice (ICO); as well as amniotic fluid and fetal movements as to their normality or abnormality[2]. In the second trimester ultrasound examination, it is also recommended to produce and store images of visualization patterns, as well as movement videos for the documentation of fetal cardiac activity[2].

In addition, fetal biometric measurements, such as biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC) and length of the femur (FL), and their respective percentiles[2], must be documented.

Regarding the effects of ultrasound on the fetus, the use of this method in its static and real-time modes, B and M respectively, is safe for all stages of pregnancy, since the output acoustic energy is not high enough to produce deleterious effects[10-11].

The calculation of gestational age by ultrasound can be performed in the second trimester until the 22nd week, with a standard deviation of one week, if the crown rump length measurement (CRL), the gold standard for calculating the GA, has not been performed previously[12].

In the period between 18 and 22 weeks, the ultrasound parameters for estimating gestational age and for assessing fetal size are BPD, HC, AC and FL [12-15].

For the measurement of BPD and HC, the symmetrical axial plane of the fetus head should be considered, in which the third ventricle should be visible, in a central position; interhemispheric fissure; choroid plexus and midline structures, such as the thalamus and cavum septum pellucidum (CSP) [2,16-17] (Figure 1). There should be no distortion of the fetal head by adjacent structures or by the pressure exerted by the transducer[8].

The HC can be obtained directly by the ellipse measurement too[11,17], as well as it can be calculated through the measurements of BPD and occipitofrontal diameter (OFD), by the equation HC = (BPD + OFD) x 1,62 [2] (Figure 1). For this, the position of the cursors must follow the technique used to produce the selected nomogram[18 19].

For the BPD, the cursors should be positioned in the largest diameter transversal to the external-external or external-internal interhemispheric fissure in relation to the parietal limits of the skullcap[18-20], being, for some authors, the external-external diameter of choice for the calculation of the HC [20]. For OFD measurements, in the same symmetrical axial plane in which BPD is measured, the cursors are positioned anteroposteriorly in the external-external diameter of the occipital and frontal poles [8-17,21]. Considering the methodological variability in the positioning of the calipers to measure the biparietal diameter, it is advisable that the same methodology be used in all gestational ages.

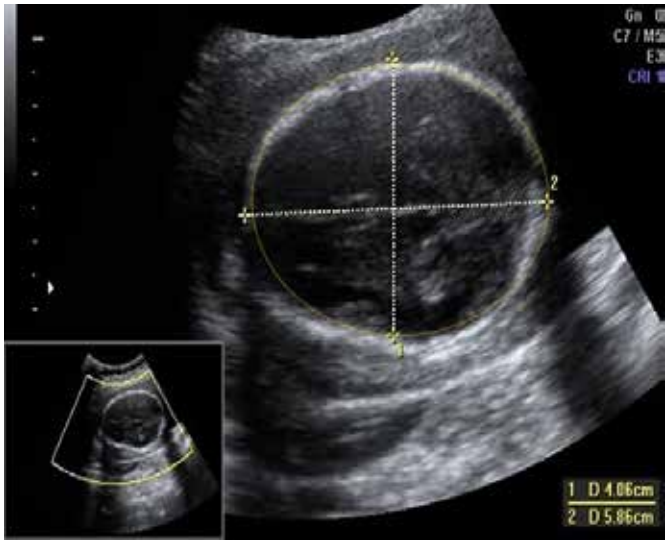

Figure 1: View of the symmetrical axial plane of the fetal head. Cursors positioned to measure BPD (external-internal) and OFD (external-external) and HC.

The shape of the fetal head, characterized by the cephalic index (biparietal diameter / occipitofrontal diameter x 100), may be abnormal, as in brachycephaly and dolichocephaly. Such variations adversely affect the accuracy of BPD in predicting gestational age, and, in these cases, the measurement of the HC is of no value in comparative studies with AC in assessments of fetal growth restriction[13,22].

For the calculation of gestational age, it is advisable to use the combination of measures HC, AC and FL. This approach improves accuracy in calculating gestational age[13,22].

The AC is measured in the transverse plane of the fetal abdomen, showing the stomach and venous sinus, either directly using the ellipse measurement tool or calculated from linear measurements perpendicular to each other, the abdominal anteroposterior diameter (APD) and the transverse abdominal diameter (TAD) [2] (Figure 2). To measure the APD, the cursors are placed on the outer edges of the abdominal contour, from the back to the spine to the anterior abdomen wall. To measure TAD, the cursors are placed on the outer edges of the widest laterolateral diameter of the abdomen. The AC is then calculated using the formula: AC = (APD + TAD) x 1.57 [2].

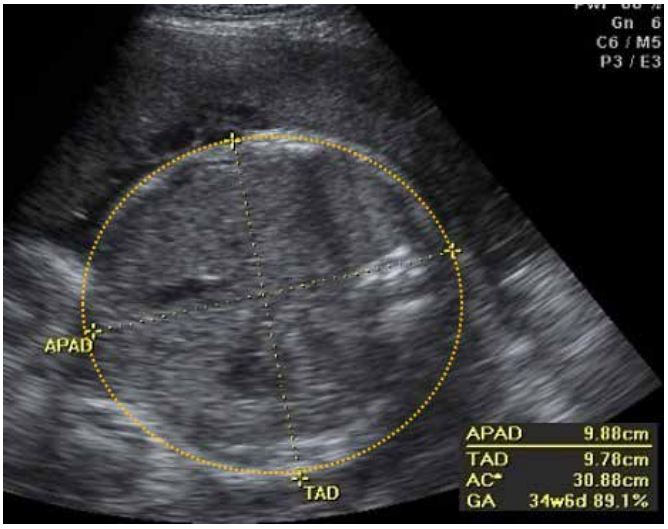

Figure 2: Measurement of abdominal circumference (AC) in the transverse plane of the fetal abdomen. The AC measurement was obtained by the equation AC = (APD + TAD) x 1.57.

The FL is measured on the longest axis of the femoral diaphysis[23]. The measurement should include both visible ends of the bone, and the femur should be positioned at an angle <45° to the horizontal, occupying more than half of the total image of the ultrasound device[1] (Figure 3).

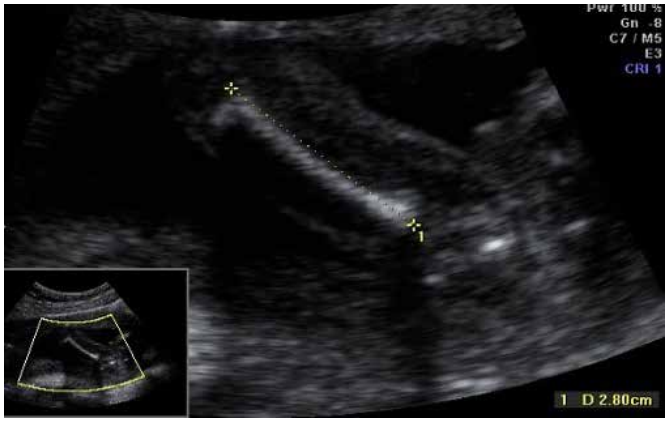

Figure 3: Measurement of the length of the femur (FL) on the longest axis of the femoral diaphysis.

CHARACTERIZATION OF THE ECOGRAPHIC EXAMINATION IN THE SECOND TRIMESTER OF PREGNANCY

Estimated fetal growth and weight

Second trimester ultrasound measurements can also be used to identify size abnormalities[2] as well as to estimate weight as a baseline parameter to monitor fetal growth and track intrauterine growth problems[2,24]. In addition, in term fetuses, the estimated fetal weight provides a good estimate of the actual birth weight[24].

Fetal weight is estimated throughout pregnancy based on measurements of healthy fetuses[24]. The most accurate estimates are based on at least three fetal measurements: BPD or HC, as an index of the size of the head; AC, as an index of body circumference and FL, as an index of the vertical length of the fetus[25]. The estimated fetal weight is calculated using the formula [log10EFW = 1.326 + 0.0107 x HC + 0.0438 x AC + 0.158 x FL - 0.00326 x AC × FL5] [24]. However, it should be considered that population differences or differences subtle in imaging and measurement techniques can change the shape of the optimal equation or the values of its coefficients[25].

Assessment of amniotic fluid (AF)

Another important parameter in the prenatal assessment of the second trimester is the identification of abnormal amounts of AF. The abnormality of the volume, both the decrease and the increase, are associated, among other factors, with congenital anomalies and increased perinatal morbidity and mortality[26]. Patients with deviation from normality should have a more detailed anatomical evaluation and clinical follow-up[2].

Current ultrasound techniques to estimate the volume of the AF include the amniotic fluid index (AFI) or Phelan test and the measurement of the largest vertical pock-

et27,28. The Phelan test is based on anatomical shields, so that, using the umbilical scar as a reference point, the uterus is transversely divided into two parts, upper and lower and the black line is the reference that divides the uterus into left portions and right27,28 (Figure 4). With the transducer perpendicular to the ground, the largest vertical pocket in each quadrant is then measured and the sum of the values of the four pockets is the AFI28 measurement (Figure 5).

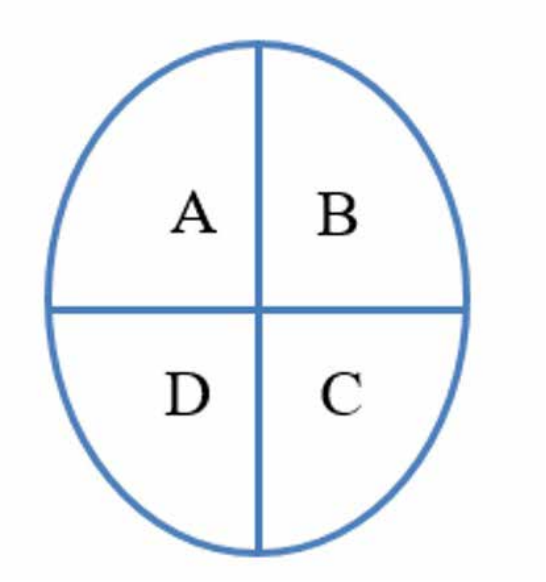

Figure 4: Representative illustration of the imaginary division of the maternal abdomen into four quadrants (A, B, C, D) to perform the Phelan test[28].

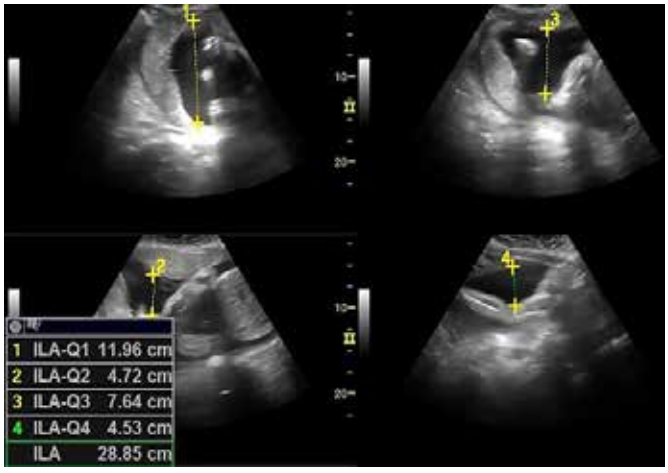

Figure 5: Measurement of the amniotic fluid index using the Phelan method[28].

The largest vertical pocket is also measured in a location that does not contain umbilical cord or fetal extremities. However, unlike the Phelan test, only one measurement should be considered, the largest one[29] (Figure 6).

Figure 6: Measurement of the largest vertical pocket

According to a systematic review of the literature, published in the Cochrane Library in 2008, there is no evidence of superiority between the AFI methods and measurement of the largest pocket in preventing negative pregnancy outcomes, including admission to a neonatal intensive care unit and a 5th minute Apgar lower than [7]. However, it was observed that the use of the AFI method was related to a significant increase in cases of oligohydramnios, as well as to the induction rates of labor and cesarean sections, being, therefore, the measurement of the largest pocket in the evaluation of the volume of amniotic fluid during fetal surveillance is currently the best choice[30].

Fetal Movement

Normal fetuses generally adopt a relaxed position and show regular movements, with no specific movement patterns in the second trimester of pregnancy[2].

Motor ultrasound assessment is limited to detecting the presence of any motility[31]. However, the presence of motility does not exclude anomalies[31], and the temporary absence or reduction in fetal movements should not be considered as a risk factor[2].

In cases where the movements are performed with the participation of all parts of the body and with variable speed and amplitude, this excludes many high-risk situations[31]. Unusual restriction of movement of all parts of the fetal body or persistent abnormal positioning may suggest abnormal fetal conditions, such as multiple congenital contractures. The lack of normal fetal movement should therefore lead to detailed motor ultrasound examination, as well as careful analysis of the joints[31,32].

Doppler ultrasound

Doppler ultrasonography of uterine arteries at 24 weeks can be a useful screening test for pre-eclampsia, placental abruption or delivery of a baby small for gestational age[3].

However, the application of Doppler ultrasound techniques of the umbilical artery or the combination of Doppler ultrasound of the umbilical artery and uterine in low-risk pregnancies is currently not recommended as part of the routine examination in the second trimester. This is due to the fact that the exam does not change the outcomes and prenatal, obstetric and neonatal interventions[33].

It should be emphasized that the prediction of preeclampsia by means of uterine Doppler velocimetry of the uterine arteries is better indicated in the first trimester of pregnancy, being restricted, in the second trimester, to patients who did not perform this exam at the best indicated gestational age[33].

Nevertheless, Doppler studies of the umbilical artery should be incorporated into fetal monitoring protocols in high-risk pregnancies, such as women with hypertensive disorders and small fetuses for gestational age, due to the risk of placental insufficiency[34]. In this regard, the work on the evaluation of growth restriction is emphasized, using Doppler velocimetry of the umbilical and cerebral fetal middle arteries[35].

Multiple pregnancies

The visualization of the insertion of the placental cord, as well as the distinguishing characteristics between the fetuses (gender and position in the uterus) are additional elements that should be included in the ultrasound of the second trimester in the evaluation of multiple pregnancies[2].

The determination of chorionicity must be made before 13 + 6 weeks of gestation using the thickness of the membrane at the insertion site of the amniotic membrane in the placenta, identifying the "T" sign for the diamniotic monochorionics, the "λ" (lambda) sign for the dichorionic and the number of placental masses [36,37] (Figures 7-8). For pregnant women who present themselves for the first time after 14 weeks of gestation, chorionicity must be determined by the same ultrasound signals and by the discrepancy of fetal sex [2,37].

Figures 7 and 8. (7): Lambda sign evidenced in transabdominal ultrasonography of dichorionic diamniotic pregnancy37. (8): Slender interamniotic junction forming the "T" sign at transabdominal ultrasonography of monochorionic diamniotic pregnancy 37.

Abnormalities of the insertion of the umbilical cord into the placenta, such as the velamentous cord insertion, are more common in multiple pregnancies[2] and may be associated with various complications of pregnancy, such as IUGR, vasa previa, abnormal patterns of fetal heart rate, low Apgar scores in 1st and 5th minutes and also fetal exsanguination during labor [2,38]. The marginal insertion of the cord may also be associated with a slight reduction in birth weight and premature labor[39].

Despite being effectively seen in just over half of the cases in clinical practice, it is recommended to try to visualize the cord insertion, as part of the routine of obstetric ultrasound, since the identification of marginal and velamentous insertion can change the obstetric management in childbirth and, consequently, improve the fetal result[39].

BASIC STUDY OF FETAL MORPHOLOGY

Head

In the morphological study of the fetal head, skull and brain are examined paying attention to the main structures.

For the assessment of the anatomical integrity of the brain, the structures to be evaluated are the lateral ventricles, including choroidal plexuses, cavum septum pellucidum, midline fissure, thalamus, cerebellum and cisterna magna (Figure 9). Two axial planes allow the visualization of these relevant brain structures, the transventricular and the transtalamic plane. A third axial transcerebellar plane can be added to assess the posterior fossa[2].

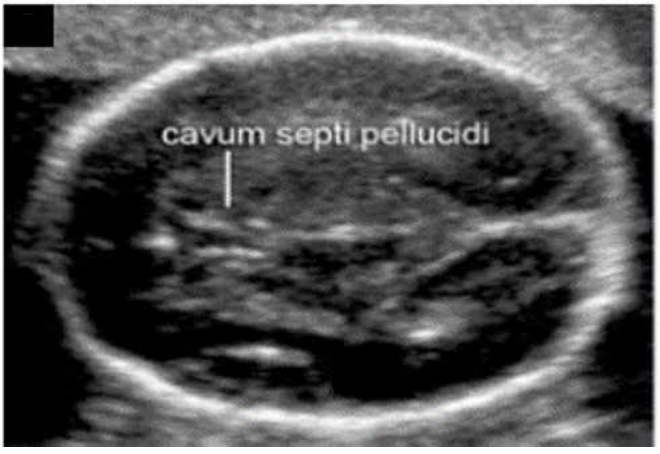

Figure 9: View of the transverse plane of the fetal head showing the transventricular plane and the cavum septum pellucidum[2].

Prenatal ultrasound diagnosis of major structural abnormalities can have a substantial impact on perinatal care due to the relatively high incidence of brain malformations and uniformly poor prognosis. At week 22, some significant abnormalities are prone to prenatal diagnosis, including agen-

esis of the corpus callosum, ventriculomegaly, and some abnormalities of the posterior fossa, such as cerebellar abnormalities and the size of the cisterna magna[40].

Regarding the study of the fetal skull, four areas should be routinely evaluated: size, shape, integrity and bone density (Table 1), which can be viewed at the time of head measurements and when the brain is assessed for anatomical integrity[2].

Fetal Skull	
Size	Measurements made according to biometric study
Format	Oval, without focal protrusion. Anomalies must be documented and investigated.
Integrity	No bone defects should be present. Rarely, brain tissue can extrude through defects in the frontal or occipital bones
Density	Hyperechogenic structure remains interrupted only by narrow echolucent sutures. Skull easily depressed by manual pressure with the transducer and loss of echogenicity raise suspicion of poor bone mineralization.

Table 1: Routine evaluation of the fetal skull[2].

Face

The fetal facial examination with ultrasound is done mainly in the routine screening for the presence of facial anomalies and in the analysis of facial features to accurately delineate the anomaly[41].

The minimal evaluation of the fetal face must include visualization of the upper lip to describe a possible cleft lip abnormality[2] (Figure 10). The facial cleft, the most common facial congenital anomaly, can concurrently affect the lip and palate, although the other half is equally divided between isolated lip and palate abnormalities[42].

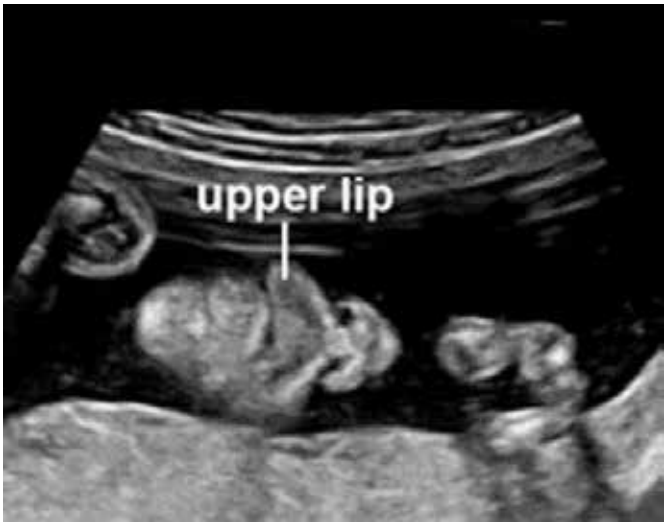

Figure 10: Ultrasound image of the fetal face in which it is evaluated, in the coronal section, mouth, lips and fetal nose[2].

In a screening scenario, the examination protocol must compromise between high sensitivity and reasonable examination time, so that a systematic examination of at least two views, the middle sagittal plane and the anterior coronal plane[41], is performed. If technically feasible, other facial features that can be assessed include the median facial profile, orbits, nose and nostrils[2].

In each of the ultrasound study planes of the fetal face, specific analyzes are possible (Table 2).

Medium sagittal plane	Dysmorphology research of the facial profile and measurement of biometric parameters, such as facial angles and nasal bone length
Anterior Coronal Plane	Essential for research of rupture in the lip continuity, deformation of the nostril curvature and defective alignment of the alveolar crest
Axial plane	Analysis of eyes, lips, maxilla, tongue and mandible

Table 2: Purpose of certain ultrasound planes for studying the fetal face[39].

Nape

The study of the fetal neck usually demonstrates a cylindrical structure without bulges, masses or fluid collections. Obvious cervical masses, such as cystic hygromas or teratomas, should be documented[2].

In addition to teratomas, cystic hygroma has differential diagnoses of cervical meningocele, cephalocele and, even, suspicion of increased nuchal translucency, associated with chromosomal abnormalities such as Turner (45,X) and Down syndromes.[42]

Chest

In the study of the chest, the shape must be regular with a smooth transition to the abdomen[2]. The ribs, whose ossification begins at the end of the first trimester, should have normal curvature without deformities[2, 43].

Both lungs must appear homogeneous, with echogenicity that is clearer than the liver and without evidence of displacement or mediastinal masses[2,43]. Normal lung size data are important for assessing lung development and the presence of a cystic mass in the fetal thorax should alert the sonographer to consider, in the differential diagnosis, congenital thoracic abnormalities, such as diaphragmatic hernia, macrocystic adenomatoid malformation of the lung, or more rare conditions, such as esophageal duplication or neurenteric cyst[43-44].

The diaphragmatic interface can often be viewed as a thin, hypoechoic and arched dividing line between the thoracic and abdominal contents, which usually shows a dome on each side and becomes detectable approximately from the 10th to the 11th week of gestation[2,43].

Heart

The fetal cardiac examination is ideally performed between 18th and 22nd weeks of gestation. Heart rate and

regular rhythm should be confirmed at a normal rate of 120 to 160 beats per minute. Mild bradycardia and tachycardia can be temporarily observed in normal fetuses in the second trimester[45].

The fetal heart must be located in the left thorax, on the same side of the stomach, deviated by about 45 ° ± 20 ° with the apex pointing to the left of the fetus, and it is generally no larger than one third of the chest area[43,45].

The basic cardiac screening exam is based on the visualization of the four fetal cardiac chambers, whose elements of study are, in addition to the cardiac situs, the atria and ventricles, interatrial and interventricular septum, margins of the foramen ovale and atrioventricular valves (Figure 11). Some views may reveal a small hypoechogenic border around the fetal heart that should not be confused with pericardial effusion[45].

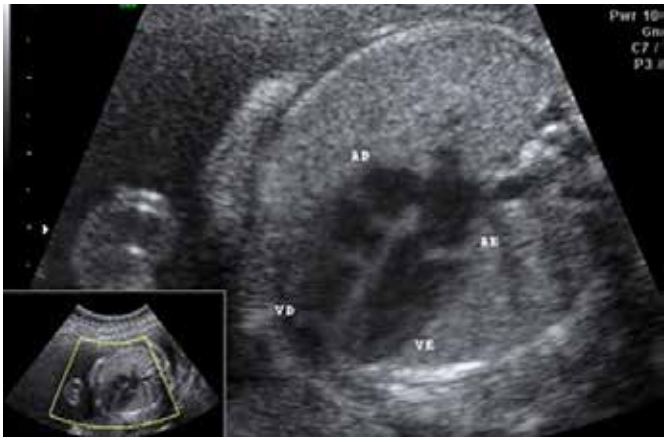

Figure 11: Image of the four cardiac chambers with both ventricles and atria.

If technically feasible, routine visualization of the aortic and pulmonary outflow tract should be attempted as part of extended basic cardiac assessment, which requires, at a minimum, that the large normal vessels are approximately the same size and that they intersect at angles straight after leaving their respective ventricular chambers[46]. These additional views are more likely to identify conotruncal anomalies, such as tetralogy of Fallot, transposition of the great arteries, double-outlet right ventricle and truncus arteriosus[5, 45].

Suspected cardiac abnormalities will require a more comprehensive assessment using fetal echocardiography[5,45].

Abdomen

Under normal conditions, the stomach should be identified to the left of the spine[2]. The gallbladder, a fluid-filled structure, should also be assessed for its position, which is opposite the stomach, in the upper right abdomen[43] (Figure 12). Any other cystic structures seen in the abdomen should request referral for a more detailed examination[2].

Figure 12: Ultrasound evaluation of the fetal abdomen in which the fetal stomach and venous sinus are visualized.

Abnormal relationship between abdominal and thoracic organs is a useful indicator for the diagnosis of situs inversus, whose primary indicators are the stomach located contralateral to the apex of the heart and the gallbladder located to the left of the umbilical vein[46].

The intestine, a less echogenic and uniform structure than the liver, must be contained in the abdomen and the umbilical cord must be inserted into the intact abdominal wall[2,43] (Figure 13). Abnormal collections of intestinal fluids, such as enteric cysts and intestinal dilation, as well as defects in the insertion of the umbilical cord, such as omphalocele and gastroschisis, must be documented[2].

Figure 13: Ultrasound evaluation of the fetal abdomen in which the umbilical cord insertion site can be seen2.

Kidneys and bladder

The fetal bladder and both kidneys must be identified (Figure 14). Measurement must be documented in cases of possible expansion[2].

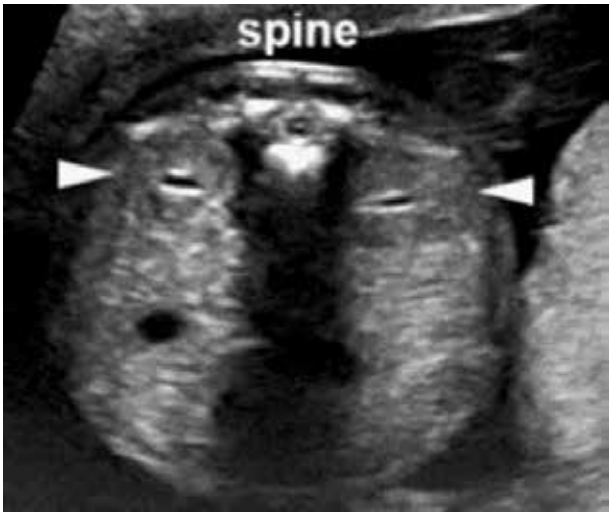

Figure 14: Ultrasound evaluation of fetal kidneys2.

Spine

Detailed spinal assessment is an important component of fetal morphological examination that requires precision (Figure 15). The transverse plane is, in general, the most sensitive to detect a defect of the vertebral column and allows the examination of each segment of the spine. However, the complete and detailed evaluation of the fetal spine in each projection is not part of the basic examination[4,47].

In addition, skin that covers the intact spine in transverse or longitudinal sections should be demonstrated[4,47]. One should look for discontinuities, which are related to spina bifida, in addition to searching for sacral agenesis and caudal regression syndrome [2,47] (Figure 15).

Figure 15: Ultrasound evaluation of the fetal spine.

Limbs

The presence of arms and hands, legs and feet must be reported. Finger counting is not part of the routine of the second trimester exam[2].

Once a malformation of the limb is suspected, the precise diagnosis will influence the management and genetic counseling and the prognosis will depend on whether it is isolated or part of a known syndrome[48].

Placenta

Determining the placental location and its relationship to the internal cervical orifice (ICO), is one of the main objectives of routine second trimester transabdominal ultrasonography[49] (Figure 16). Placental grade should be reported, possible placental masses, chorioangiomas, hemorrhages and cysts should be reported, as well as myometrial invasion or placental accretism should be investigated.

Figure 16: Ultrasound image of the placental location and its relationship to the internal cervical orifice (ICO) [2].

Placenta previa, which reach or occlude the ICO, should be followed up until the third trimester, as they are among the main causes of vaginal bleeding in this period and are associated with an increased risk of maternal, fetal and perinatal morbidity and mortality[2,49-50].

The rates of placenta previa and placenta accreta are related to advanced maternal age and the number of previous cesarean deliveries[49,51]. In these cases, the placenta should be examined for findings that confirm these diagnoses, the most sensitive for placenta accreta being the presence of multiple linear and irregular placental gaps that show arterial or mixed flow[51].

In the basic ultrasound study of the second trimester, it is also necessary to document uterine fibroids and adnexal masses that may interfere with the pregnancy outcome. The

characterization of fetal sex is not mandatory[2].

CONCLUSION

We conclude, therefore, that knowledge of fetal development throughout pregnancy and the use of appropriate ultrasound methodology, in the second trimester, are essential in detecting fetal changes and obtaining accurate results.

REFERENCES

1. Salomon LJ, Alfirevic Z, Da Silva Costa F, Deter RL, Figueras F, Ghi T, et al. A. ISUOG Practice Guidelines: ultrasound assessment of fetal biometry and growth. Ultrasound Obstet Gynecol. 2019; 53(6): 715-723.
2. Salomon LJ, Alfirevic Z, Berghella V, Bilardo C, Hernandez-Andrade E, Johnsen SL et al. Practice guidelines for performance of the routine mid-trimester fetal ultrasound scan. Ultrasound in Obstet Gynecol, 2011; 37(1): 116-126.
3. Schwarzler P, Senat MV, Holden D, Bernard JP, Masroor T, Ville Y. Feasibility of the second-trimester fetal ultrasound examination in an unselected population at 18, 20 or 22 weeks of pregnancy: a randomized trial. Ultrasound Obstet Gynecol 1999; 14:92-97.
4. Goldberg JD. Routine screening for fetal anomalies: expectations. Obstet Gynecol Clin North Am 2004; 31:35-50.
5. Tegnander E, Williams W, Johansen OJ, Blaas HG, Eik- Nes SH. Prenatal detection of heart defects in a non-selected population of 30149 fetuses – detection rates and outcome. Ultrasound Obstet Gynecol 2006; 27: 252-265.
6. Grandjean H, Larroque D, Levi S. The performance of routine ultrasonographic screening of pregnancies in the Eurofetus Study. Am J Obstet Gynecol 1999; 181: 446-454.
7. Reddy UM, Filly RA, Copel JA. Prenatal imaging: ultrasonography and magnetic resonance imaging. Obstet Gynecol 2008; 112: 145-157.
8. Salomon LJ., Alfirevic Z, Bilardo CM, Chalouhi GE, Ghi T, Kagan KO. ISUOG practice guidelines: performance of first-trimester fetal ultrasound scan. Ultrasound Obstet Gynecol. 2013; 41(1): 102.
9. Ville Y. 'Ceci n'est pas une echographie': a plea for quality assessment in prenatal ultrasound. Ultrasound Obstet Gynecol 2008; 31:1-5.
10. Abramowicz JS, Kossoff G, Marsal K, Ter Haar G. Safety Statement, 2000 (reconfirmed 2003). International Society of Ultrasound in Obstetrics and Gynecology (ISUOG). Ultrasound Obstet Gynecol. 2003; 21(1): 100.
11. Torloni MR, Vedmedovska N, Merialdi M, Betran AP, Allen T, Gonzalez R, et al. Safety of ultrasonography in pregnancy: WHO systematic review of the literature and meta-analysis. Ultrasound Obstet Gynecol; 2009; 33(5): 599-608.
12. Altman DG, Chitty LS. New charts for ultrasound dating of pregnancy. Ultrasound Obstet Gynecol 1997; 10: 174-191.
13. Salomon LJ, Bernard M, Amarsy R, Bernard JP, Ville Y. The impact of crown–rump length measurement error on combined Down syndrome screening: a simulation study. Ultrasound Obstet Gynecol. 2009; 33: 506-511.
14. Ioannou C, Sarris I, Hoch L, Salomon, L, Papageorghiou AT. International Fetal and Newborn Growth Consortium for the 21st Century (INTERGROWTH-21st). Standardisation of crown-rump length measurement. BJOG 2013; 120 (2): 38-41.
15. Degani S. Fetal biometry: clinical, pathological, and technical considerations. Obstet Gynecol Surv 2001; 56: 159-167.
16. Salomon LJ, Bernard JP, Duyme M, Dorion A, Ville Y. Revisiting first-trimester fetal biometry. Ultrasound Obstet Gynecol. 2003; 22(1): 63-66.
17. Loughna P, Chitty L, Evans T, Chudleigh T. Fetal size and dating: charts recommended for clinical obstetric practice. Ultrasound. 2009; 17: 161-167.
18. Salomon LJ, Bernard JP, Duyme M, Doris B, Mas N, Ville Y. Feasibility and reproducibility of an image scoring method for quality control of fetal biometry in the second trimester. Ultrasound Obstet Gynecol 2006; 27: 34-40
19. Salomon LJ, Bernard JP, Duyme M, Buvat I, Ville Y. The impact of choice of reference charts and equations on the assessment of fetal biometry. Ultrasound Obstet Gynecol 2005; 25: 559-565.
20. International Society of Ultrasound in Obstetrics and Gynecology (ISUOG). ISUOG Basic training: biometria fetal - determinação da idade gestacional, medidas e peso fetal. Disponível em: https://www.isuog.org/uploads/assets/uploaded/78d7756b-dc18-4807-a2200a74204c46e9.pdf, acessado dia 20 Março de 2021.
21. Hadlock FP, Deter RL, Carpenter RJ, Park SK. Estimating fetal age: effect of head shape on BPD. Am J Roentgenol 1981; 137(1): 83-85.
22. Lessoway VA, Schulzer M, Wittmann BK. Sonographic measurement of the fetal femur: factors affecting accuracy. J Clin Ultrasound 1990; 18: 471-476.
24. Salomon LJ, Bernard JP, Ville Y. Estimation of fetal weight: reference range at 20–36 weeks' gestation and comparison with actual birthweight reference range. Ultrasound Obstet Gynecol 2007; 29: 550-555.
25. Hadlock FP, Harrist RB, Sharman RS, Deter RL, Park SK. Estimation of fetal weight with the use of head, body, and femur measurements – a prospective study. Am J Obstet Gynecol 1985; 151: 333-337.
26. Magann EF, Perry KG Jr, Chauhan SP, Anfanger PJ, Whitworth NS, Morrison JC. The accuracy of ultrasound evaluation of amniotic fluid volume in singleton pregnancies: the effect of operator experience and ultrasound interpretative technique J Clin Ultrasound 1997; 25: 249-253.
27. Magann EF, Chauhan SP, Whitworth NS, Isler C, Wiggs C, Morrison JC. Subjective versus objective evaluation of amniotic fluid volume of pregnancies of less than 24 weeks' gestation: how can we be accurate? J Ultrasound Med 2001; 20: 191-195.
28. Phelan J, Martin G. Polyhydramnios: fetal and neonatal implications. Clin Perinatol 1989; 16:987-994.
29. Chamberlain P, Manning F, Morrison I et al. Ultrasound evaluation of amniotic fluid volume. II. The relationship of increased amniotic fluid volume to perinatal outcome. Am J Obstet Gynecol 1984; 150:250-254.
30. Nabhan A, Abdelmoula Y. Amniotic fluid index versus single deepest vertical pocket as a screening test for preventing adverse pregnancy outcome. Cochrane Database Syst Rev 2008; (3):CD006593.
31. de Vries JI, Fong BF. Normal fetal motility: an overview. Ultrasound Obstet Gynecol 2006; 27: 701-711.
32. Bonilla-Musoles F, Machado LE, Osborne NG. Multiple congenital contractures (congenital multiple arthrogryposis).J PerinatMed 2002; 30: 99-104.
33. Alfirevic, Z, Stampalija, T, Medley, N. Fetal and umbilical Doppler ultrasound in normal pregnancy. Cochrane Database Syst Rev 2015; (4).
34. Alfirevic Z, Stampalija T, Gyte GM. Fetal and umbilical Doppler ultrasound in high-risk pregnancies. Cochrane Database Syst Rev. 2010; CD007529.
35. Figueras, F, Gratacos, E. An integrated approach to fetal growth restriction. Best Practice & Research Clinical Obstetrics & Gynaecology 2017; 38: 48-58.
36. Fong KW, Toi A, Salem S, Hornberger LK, Chitayat D, Keating SJ, McAuliffe F, Johnson JA. Detection of fetal structural abnormalities with US during early pregnancy. Radiographics. 2004; 24: 157–174.
37. Khalil A, Rodgers M, Baschat A, Bhide A, Gratacos E, Hecher K, Kilby MD, Lewi L, Nicolaides KH, Oepkes D, Raine-Fenning N, Reed K, Salomon LJ, Sotiriadis A, Thilaganathan B, Ville Y. ISUOG Practice Guidelines: role of ultrasound in twin pregnancy. Ultrasound Obstet Gynecol. 2016; 7(2): 247-63.
38. Heinonen S, Ryyn¨anen M, Kirkinen P, Saarikoski S. Perinatal diagnostic evaluation of velamentous umbilical cord insertion: clinical, Doppler, and ultrasonic findings. Obstet Gynecol 1996; 87: 112-117.
39. Pretorius DH, Chau C, Poeltler DM, Mendoza A, Catanzarite VA, Hollenbach KA. Placental cord insertion visualization with prenatal ultrasonography. J Ultrasound Med 1996; 15: 585-593.
40. Aubry MC, Aubry JP, Dommergues M. Sonographic prenatal diagnosis of central nervous system abnormalities. Childs Nerv Syst 2003; 19: 391-402.

41. Rotten D, Levaillant JM. Two- and three- dimensional sonographic assessment of the fetal face. 1. A systematic analysis of the normal face. Ultrasound Obstet Gynecol 2004; 23: 224-231.
42. Dar P, Gross SJ. Craniofacial and neck anomalies. Clin Perinatol 2000; 27: 813-837.
43. Blaas HG, Eik-Nes SH. Sonographic development of the normal foetal thorax and abdomen across gestation. Prenat Diagn 2008; 28: 568-580.
44. Ruano R, Benachi A, Aubry MC, Bernard JP, Hameury F, Nihoul-Fekete C, Dumez Y. Prenatal sonographic diagnosis of congenital hiatal hernia. Prenat Diagn 2004; 24:26-30.
45. International Society of Ultrasound in Obstetrics and Gynecology. Cardiac screening examination of the fetus: guidelines for performing the 'basic' and 'extended basic' cardiac scan. Ultrasound Obstet Gynecol 2006; 27: 107-113.
46. Bronshtein M, Gover A, Zimmer EZ. Sonographic definition of the fetal situs. Obstet Gynecol 2002; 99: 1129-1130.
47. International Society of Ultrasound in Obstetrics and Gynecology. Sonographic examination of the fetal central nervous system: guidelines for performing the 'basic examination' and the 'fetal neurosonogram'. Ultrasound Obstet Gynecol 2007; 29:109-116.
48. Holder-Espinasse M, Devisme L, Thomas D, Boute O, Vaast P, Fron D, Herbaux B, Puech F, Manouvrier-Hanu S. Pre- and postnatal diagnosis of limb anomalies: a series of 107 cases. Am J Med Genet A 2004; 124A: 417-422.
49. Mustafa SA, Brizot ML, Carvalho MHB, Watanabe L, Kahhale S, Zugaib M. Transvaginal ultrasonography in predicting placenta previa at delivery: a longitudinal study. Ultrasound Obstet Gynecol. 2002; 20: 356-359.
50. Royal College of Obstetricians and Gynaecologists. Guideline No. 27. Placenta praevia and placenta praevia accreta diagnosis and management. RCOG: London, October, 2005
51. Comstock CH, Love JJ Jr, Bronsteen RA, Lee W, Vettraino IM, Huang RR, Lorenz RP. Sonographic detection of placenta accreta in the second and third trimesters of pregnancy. Am J Obstet Gynecol 2004; 190: 1135-1140.

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