BRAZILIAN JOURNAL OF ULTRASONOGRAPHY 2024; 36: 17-21 - DOI - 10.29327/275505.32.36-3

CASE REPORT

CHALLENGES AND STRATEGIES IN THE DIAGNOSIS AND TREATMENT OF CONGENITAL MULTIPLE ARTHROGRYPOSIS: ULTRASOUND, CLINICAL AND MULTIDISCIPLINARY APPROACHES – CASE REPORT

MAYARA PLOCHARSKI[1], ALEXANDRA PIRES GROSSI[1], ADRIANE DE ASSIS FISCHER ASTORI[1], ILANA BARRICHELLO TORRES WENDLER[1], ALEXANDRE BOSSMANN ROMANUS[1], MAURÍCIO SAITO[2]

ABSTRACT

Arthrogryposis multiplex congenital (AMC) is a rare condition characterized by fixed joint contractures present at birth and may present a variety of clinical manifestations. Early diagnosis and multidisciplinary intervention are crucial to improving patients' quality of life. This Case Report is about a pregnant woman with a fetus with AMC, highlighting the clinical findings, diagnoses and treatments adopted. In the first ultrasound, the patient presented with increased nuchal translucency, complicating with a combination of fetal akinesia, abnormal position of the limbs, intrauterine growth retardation and polyhydramnios, in subsequent examinations. After birth, they presented a series of complications, including oropharyngeal dysfunctions, respiratory and neurological problems, as well as joint deformities. Multidisciplinary treatment was essential to minimize sequelae and promote the patients' motor and cognitive development. This discussion emphasizes the importance of early diagnosis, a multidisciplinary approach and comprehensive monitoring of patients with AMC. The various clinical manifestations of the condition, the complementary exams used in the differential diagnosis and the available therapeutic options are explored, including physiotherapy, use of orthoses and corrective surgeries. Therefore, it is noted that AMC is a complex condition that requires an interdisciplinary approach throughout the patient's life. Early diagnosis and appropriate treatment can significantly improve the quality of life and autonomy of affected individuals.

KEYWORDS: ARTHROGRYPOSIS MULTIPLEX CONGENITA, EARLY DIAGNOSIS, MULTIDISCIPLINARY TREATMENT, QUALITY OF LIFE.

INTRODUCTION

Arthrogryposis multiplex congenita (AMC) is a condition characterized by the presence, at birth, of joint contractures in various parts of the body. The term "arthrogryposis" (from the Greek "arthro" for joint and "gryp" for curve) was coined in the last century to describe conditions with multiple congenital contractures. Arthrogryposis multiplex congenita (AMC) was initially described by Otto in 1841 as congenital muscular dystrophy and later named by Stern in 1923.[1]

The condition is more of a combination of signs than a single diagnosis, with most cases being of neurogenic origin, while others are related to connective tissue or mixed mechanisms. The etiology is multifactorial and may include neuromuscular disorders, central nervous system disorders, genetic syndromes, and chromosomal anomalies.[1]

There are more than 400 specific conditions that can present with congenital joint contractures, with the etiopathogenesis of AMC involving genetic factors, environmental factors, and abnormalities during fetal development. Reduced fetal movement, known as fetal hypokinesia/akinesia, is associated with the severity of the contractures.

Arthrogryposis multiplex congenita (AMC) is associated with decreased fetal movement, known as fetal hypokinesia/akinesia. The earlier the onset of this decrease in movement, the more severe the condition is likely to be at birth. The severity of the contractures is directly related to the absence of fetal movement, as the earlier and more prolonged the absence of movement, the more severe the contractures present at birth.

In most cases of arthrogryposis, joint development during embryogenesis is normal. However, decreased fetal movement is associated with several factors that contribute to the contractures present at birth. These include:

1. Increased connective tissue around the joints (collagenosis), further limiting joint movement and increasing contractures.[2]
2. Disuse and muscular atrophy of muscles associated with the joint.
3. Abnormal joint surfaces, such as square edges instead

1. Hospital do Rocio - Campo Largo-PR
2. UNIMEF CONCEPTUS

MAILING ADDRESS:
MAYARA PLOCHARSKI
Rua Dr João motter 69 sob 3
Mossungue-bairro - Curitiba, 81210-260
E-mail: mayaraplocharski@hotmail.com

of rounded, increasing the risk of small fractures of the joint surfaces with efforts to mobilize the joints.

This condition highlights the importance of embryonic and fetal movement for the normal development of joints. In addition to joint contractures, AMC can present a series of signs and symptoms, such as thin skin, muscular atrophy, slightly shortened limbs, facial asymmetry, among others.

The etiology of AMC is not fully understood, and several factors are associated with its development, such as the use of medications during pregnancy, infections, trauma, among others. The diagnosis is essentially clinical, and there are different classifications for arthrogryposis, which can range from classification based on the pattern of joint involvement to more detailed classifications that consider specific clinical subtypes.[3]

Some authors propose a classification into four basic groups:

1) Generalized arthrogryposis: all four joints between the limbs and trunk are affected.
2) Distal arthrogryposis: mainly affects the feet, hands, and face.
3) Pterygium syndrome: in addition to contractures, there is a band of skin on the neck.
4) Synostosis syndrome: there is a failure in the differentiation or separation of a limb or part of it, altering its normal shape.

Another more detailed classification was proposed by Judith G. Hall4 and colleagues, which includes:

- Amyoplasia types A, B, and C: clinically more severe forms.
- Distal arthrogryposis types I and II: predominance of involvement in hands and feet.
- Arthrogryposis with associated deficiency in known syndromes, such as trismus-pseudocamptodactyly, Freeman-Sheldon, congenital contractural arachnodactyly, adducted thumbs, among others.
- Arthrogryposis due to environmental teratogen exposure.

Amioplasia forms tend to be clinically more severe. Type A amioplasia presents severe involvement of all four limbs, a rounded facial appearance, anteverted nostrils, a high nasal bridge, and micrognathia. In type B, there is severe global involvement of the upper limbs, while in type C, there is severe involvement of the lower limbs. Distal forms predominantly affect the hands and feet, with more discreet deformities in other joints.[4]

The subtypes of distal arthrogryposis type II present distinct clinical characteristics:

- Type II a: short stature and cleft palate.
- Type II b: eyelid ptosis.
- Type II c: cleft palate and cleft lip.
- Type II d: scoliosis.
- Type II e: trismus.

Currently, arthrogryposis multiplex congenita (AMC) can be detected prenatally through ultrasound, but only 25% of cases are diagnosed at this time because fetal movement is not routinely investigated in obstetric ultrasound. It is important to value the maternal perception of fetal movement absence, correlating it with possible alterations present in the ultrasound.[5]

As new diagnostic techniques have been incorporated both prenatally and postnatally, the prevalence of congenital birth defects has increased. The diagnosis of AMC can be made prenatally through ultrasound and fetoscopy.[6]

The use of magnetic resonance imaging (MRI) has been reported for AMC and other muscular dysfunctions. It is a non-invasive technique that allows for the identification and quantification of changes in isolated muscles.[7,8] Some studies suggest that MRI may be useful in children with arthrogryposis, providing information about the underlying pathological process and/or aiding in the search for genes and proteins responsible for the alterations. Computed tomography (CT) is also useful for evaluating both central nervous system involvement and muscle mass impairment.[9]

Other diagnostic methods include muscle biopsy, skin biopsy for fibroblast culture and chromosomal analysis, electromyography, nerve conduction testing, and chromosomal studies.[10]

The differential diagnosis should be made with bilateral brachial plexus paralysis and bony ankylosis. Most patients are diagnosed after birth, and clinical findings in the neonatal period, as well as responses to possible treatments, can contribute to the investigation of the etiology of AMC.

AMC does not have a definitive treatment. The therapeutic goal is to improve the patient's quality of life and autonomy, even though physical limitations remain. Follow-up is done by a multidisciplinary team, and the indication for physical therapy and/or orthopedic surgeries should be individualized. Early rehabilitation and active participation of parents in conducting exercises are fundamental for a favorable evolution of the case.

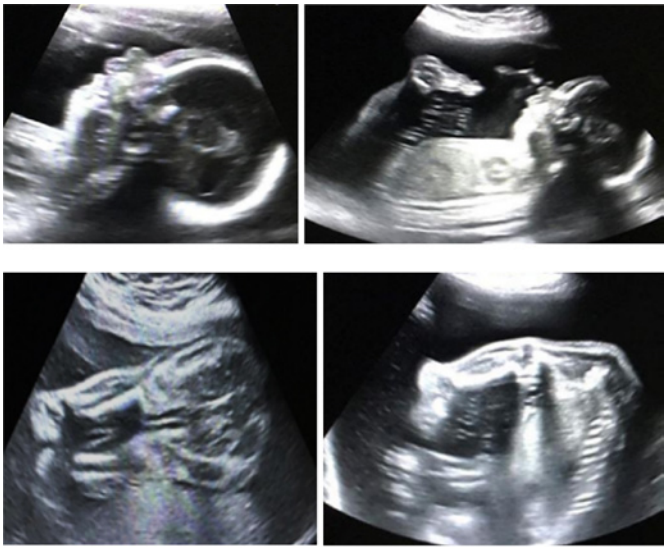
It is worth noting that AMC is a rare condition that requires more studies to elucidate its causal factors and prognostics. Case reports are relevant to assist in understanding the association of AMC with population risk factors. Ultrasonographic examination contributes to the diagnosis of this disease and highlights the importance of visualizing and valuing fetal movement during the examination. Therefore, the radiologist needs to be familiar with the concepts regarding this condition so that a multidisciplinary team is ready to provide adequate follow-up and improve the prognosis of the disease.[9]

The objective of this study is to report the case of a pregnant woman referred to the high-risk service due to a finding of nuchal translucency measurement above the 95th percentile and to discuss the outcome of this case, as well as its clinical evolution.

CASE REPORT

Pregnant woman, 31 years old, currently on her third pregnancy, with two previous cesarean deliveries, and no reported gestational complications. She denies a history of trauma or infectious diseases during pregnancy. She does not consume alcohol, tobacco, or other substances. She has no previous history of diseases, gestational pathologies, uterine alterations, or stillbirth experiences. There is no report of congenital malformations or other diseases in the family. It was observed that the parents have a fourth-degree consanguinity relationship.

Referred to the Fetal Medicine Service at Hospital do Rocio in Campo Largo, Paraná, Brazil, due to a first-trimester ultrasound finding of increased nuchal translucency measurement (5.7 mm). Upon admission at 24 weeks of gestation, fetal hydrops, cystic hygroma, micrognathia, and fetal akinesia were observed. Additionally, moderate micrognathia and the presence of multiple contractures were identified, suggesting a condition compatible with arthrogryposis multiplex congenita (AMC). Ultrasound findings included decreased fetal movement, with a fixed and unusual position of the upper and lower limbs: closed hands, overlapping left fingers, thighs joined, parallel and flexed over the trunk; hyperextension of the knees, as well as polyhydramnios – amniotic fluid index (AFI) = 31cm (Figures 1-4).



Figures 1-4. Illustrates ultrasound images with micrognathia, polyhydramnios, and multiple contractures.

In serial ultrasounds, the changes were confirmed, and worsening of some findings was noted, such as polyhydramnios (AFI 36.7 cm) - figure 5.

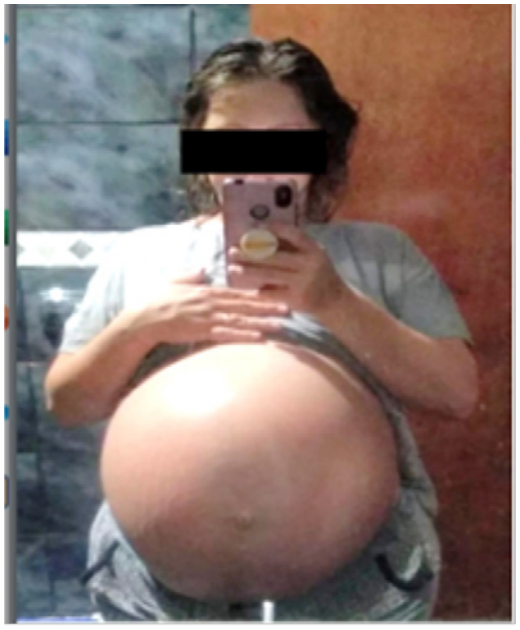


Figure 5. Illustrates maternal abdomen distended by severe polyhydramnios.

A male newborn, delivered by cesarean section in 2018, with a gestational age of 37 weeks, weighing 3,240g at birth. At birth, the Apgar score was 5/7 due to hypoactivity and apnea. He did not demonstrate sucking and swallowing reflexes. The same anomalies observed on the ultrasound examination were confirmed, with fixed joint contractures and micrognathia (see Figure 6). A small presence of cervical cystic hygroma was observed, which did not require immediate investigation or intervention.

The neonatal hearing screening test revealed abnormal results, leading to the request for Brainstem Auditory Evoked Potential testing, which showed normal bilateral results. The expanded neonatal biological screening did not show any abnormalities, and the karyotype was 46,XY.

In the ocular fundus examination, bilateral and diffuse pre-retinal hemorrhages were observed in the posterior pole, with the presence of a single microhemorrhage in the macular region, which was in the process of reabsorption.

Additionally, a patent foramen ovale, hip dislocation of the hips and knees, and the electroencephalogram showed epileptiform activity in the fronto-centro-temporal regions, consistent with the diagnosis of AMC, treated with clonazepam and phenobarbital, were observed. The neonate was subsequently transferred to the neonatal intensive care unit, where he remained for another 45 days and required mechanical ventilation, nasogastric tube, and later, gastrostomy.

In the computed tomography of the skull, signs of brain volume loss were observed, with areas of hypodensity in the periventricular and semi-oval white matter, with nonspecific characteristics.

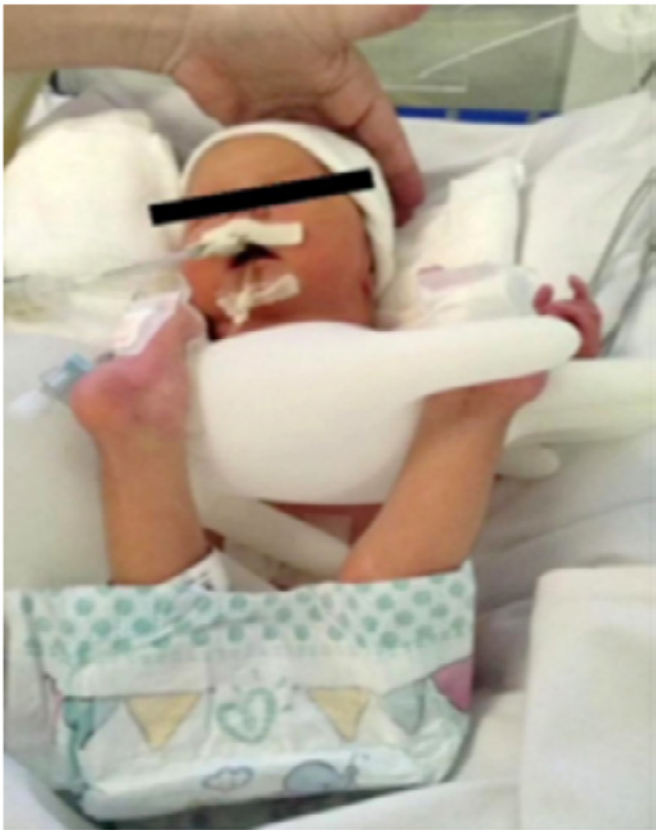


Figure 6. Five-day-old neonate. Joint contracture and hyperextension of the lower limbs are observed.

DISCUSSION

The fetal akinesia or hypomobility, the main etiological characteristic of arthrogryposis, can have various origins, including myogenic factors, fetal environmental conditions, maternal diseases, mechanical, vascular, nutritional, and neurogenic influences. Joint contracture, a symptom common to more than 400 diseases, can arise independently of the underlying pathology that leads to hypomobility.

The diagnosis of arthrogryposis is challenging and is primarily based on clinical evaluation, given the wide variety of syndromes associated with joint contractures. In approximately 75% of cases, the diagnosis is made late, after birth, possibly due to the lack of investigation of fetal movement during prenatal care, which delays the early initiation of treatment and negatively affects the prognosis. For a comprehensive postnatal evaluation, it is crucial to investigate the gestational history, family history, and perform a detailed physical examination, especially to classify the type of contractures, affected limbs, flexion or extension postures, and identify any muscular and neurological abnormalities.

The list of differential diagnoses for arthrogryposis is extensive, and tests such as X-rays, genetic tests, muscle biopsies, and blood analyses are useful to exclude other causes when the clinical diagnosis is uncertain. Conditions that need to be differentiated include Larsen syndrome, Escobar syndrome, osteogenesis imperfecta, fetal alcohol syndrome, myelomeningocele, Turner syndrome, trisomy 21, among others. AMC should be considered a diagnosis of exclusion in cases of doubt, after the exclusion of other possible causes.

Congenital multiple arthrogryposis can lead to dysphagia and swallowing difficulties in patients with sequelae such as micrognathia. Contraction of the temporomandibular joint is also common. When these oropharyngeal dysfunctions are present, they can prevent safe oral feeding due to the risk of aspiration, requiring, in some cases, the implantation of a gastrostomy to ensure a safe long-term enteral nutrition pathway.

It is crucial, in the follow-up of these patients, to investigate additional problems such as respiratory, aesthetic, and speech issues, which are common in individuals with micrognathia, aiming to improve their quality of life and increase their survival.

Early diagnosis, as exemplified in this case, and treatment coordinated by a multidisciplinary team are extremely important to minimize sequelae and preserve the baby's autonomy. The follow-up and treatment of arthrogryposis should be carried out in a careful and multidisciplinary manner, due to the wide range of disease manifestations and the tendency to recur over time, requiring prolonged follow-up with a multidisciplinary team.

In more severe or advanced cases of AMC, in addition to physiotherapy, orthoses, and immobilization, corrective surgeries may be necessary to correct osteoarticular deformities, aiming to promote independence in socialization and ambulation. In the mentioned case, the use of orthoses and immobilization with plaster casts was necessary.

The patient in question showed improvement in motor skills and neck support after treatment with physiotherapy and speech therapy. Continuous monitoring in a specialized hospital, with a team composed of gastroenterologists, neurologists, orthopedists, and geneticists, has been fundamental to his progress. Despite the limitations, early intrauterine diagnosis has resulted in a significant improvement in the patient's quality of life.

At four years of age, the child shows significant progress, such as independent movements through rolling, the ability to sit without support, hold objects, swallow liquids, and communicate verbally with some words and gestures. Additionally, he demonstrates fine motor skills, such as picking up objects and fitting blocks together (figures 7-12).

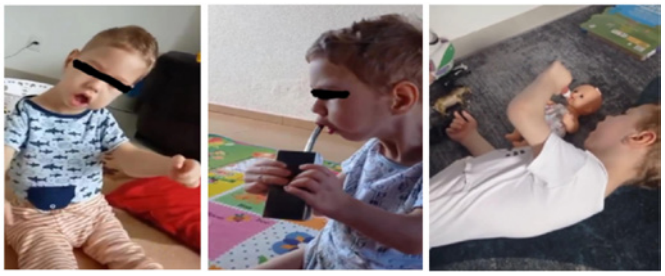


Figure 7. Infant, 45 days old, with legs hyperextended. Also note micrognathia and flexed hands. Figures 8-9. Child at 16 and 20 months, respectively, in physical therapy and orthopedic cast. Photos authorized and provided by the mother.

Figure 10-12. Four-year-old child sitting without support. Able to hold a cup, use a straw, and swallow liquids. Plays and performs some fine motor activities.

CONCLUSION

The diagnosis of arthrogryposis multiplex congenita is predominantly clinical, with an emphasis on investigating fetal movement during prenatal care, facilitated by ultrasound. For a comprehensive approach to the condition, a multidisciplinary team comprising pediatricians, orthopedists, neurologists, geneticists, physiotherapists, psychologists, nutritionists, social workers, and other professionals is essential.

This multidisciplinary approach ensures comprehensive care for AMC patients at all stages of life, providing education and awareness to parents about the nature of the disease. The integrity of care is crucial to ensure comprehensive follow-up, addressing health promotion, treatment, and rehabilitation, and ensuring access to all levels of care through service integration.

REFERENCES

1. Hall JG. 2012. Arthrogryposes (multiple congenital contractures). In: DL Rimoin, RE Pyeritz, BR Korf, editors. Emery and Rimoin's principle and practice of medical genetics, 6th edition. New York, NY: Churchill Livingstone.
2.Swinyard CA. Concepts of multiple congenital contractures (arthrogryposis) in man and animals. Teratology, 1982; 25: 247-258.
3. Murray PDF, Drachman DB. The role of movement in the development of joints and related structures: the head and neck in the chick embryo. J Embryol Exp Morphol 1969; 22:349-371.
4. .Sucuoglu H, Ornek NI, Caglar C. Arthrogryposis multiplex congenita: multiple congenital joint contractures. Case Rep Med. 2015; 2015: 379730.
5. van der Linden V, Filho EL, Lins OG, van der Linden A, Aragão Mde F, Brainer-Lima AM, Cruz DD, Rocha MA, Sobral da Silva PF, Carvalho MD, do Amaral FJ, Gomes JA, Ribeiro de Medeiros IC, Ventura CV, Ramos RC. Congenital Zika syndrome with arthrogryposis: retrospective case series study. BMJ. 2016; 354: i3899.
6. Hall JG. Arthrogryposis (multiple congenital contractures): diagnostic approach to etiology, classification, genetics, and general principles. Eur J Med Genet. 2014; 57(8): 464-472.
7. Masiero D, Pinto JA, Lourenço AF. Artrogripose. In: Hebert S. et al. Ortopedia e Traumatologia: princípios e prática. 2ed. São Paulo: Artmed, 1998. cap. 27, p.427-434.
8. Bamshad M, Van Heest AE, Pleasure D. Arthrogryposis: a review and update. J Bone Joint Surg Am. 2009; 91(4):40-46.
9. Lal MK, Windle ML, Descartes M, Chen H, Bowman J. Arthrogryposis. Disponível em: < https://emedicine.medscape.com/article/941917-overview?form=fpf> Acesso em: 28 Março de 2024.
10. Fleckenstein JL, Weatherall PT, Bertocci LA, Ezaki M, Haller RG, Greenlee R, Bryan WW, Peshock RM. Locomotor system assessment by muscle magnetic resonance imaging. Magn Reson Q. 1991; 7(2): 79-103.
11. Shepherd RB. Fisioterapia em Pediatria. 3ed. São Paulo: Santos, 1998. cap.14, p.235-237.
12. Uchida T, Nonaka I, Yokochi K, Kodama K. Arthrogryposis multiplex congenita: histochemical study of biopsied muscles. Pediatr Neurol. 1985; 1(3): 169-173.

MAYARA PLOCHARSKI
http://lattes.cnpq.br/6978561059315414
https://orcid.org/0009-0003-2972-1741

ALEXANDRA PIRES GROSSI
http://lattes.cnpq.br/9588564785176771
https://orcid.org/0000-0000-0003-1231-9708

ADRIANE DE ASSIS FISCHER ASTORI
http://lattes.cnpq.br/6760470101892175
https://orcid.org/0009-0003-9359-9760

ILANA BARRICHELLO TORRES WENDLER
http://lattes.cnpq.br/3245503317499373
https://orcid.org/0000-0002-3737-8395

ALEXANDRE BOSSMANN ROMANUS
http://lattes.cnpq.br/6302107052192602
https://orcid.org/0009-0007-5396-3379

MAURÍCIO SAITO
http://lattes.cnpq.br/1567133008383114
https://orcid.org/0009-0004-5323-7586

Scientific Editor - Heverton Pettersen
Spelling Check: Dario Alvares
Received: 03/21/2024. Accepted: 02/04/2024. Published: 04/12/2024