

## Arthrogryposis Multiplex Congenita

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### Abstract

Arthrogryposis multiplex congenita is characterized by non-progressive, multiple joint contractures present at birth. The major cause of arthrogryposis is fetal akinesia due to fetal abnormalities like neurogenic, muscle, connective tissue abnormalities or maternal disorders Here we report a rare case of arthrogryposis in infant of mother with multiple congenital anomalies.

**Keywords:** Arthrogryposis; Bilateral CTEV; Multiple Limb Anomalies.

### Introduction

Arthrogryposis multiplex congenita is a rare congenital disorder with multiple joint contractures involving more than one area of the body. It is just a clinical finding rather than a specific diagnosis, associated with different disorders like neurocognitive delay and malformations. It is a nonprogressive disease. It occurs mainly due to fetal akinesia which may be because of multiple factors like neurogenic/myopathic process, a connective disorder, intrauterine compression, a vascular insult / teratogenic exposure. Antenatal ultrasound examination can establish the correct diagnosis. We report the characteristic sonographic feature and pathological correlation of fetus with AMC.

### Case Report

A 7 month female child, First product of non-consanguineous marriage, complains of abnormal joint upper arms and lower limbs since birth.

Lab Investigations:

Hb: 6.8 mg/dl

TLC: 9700

N 72L 20M4B2

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Fig.1: Showing multiple anomalies of hand and skull



Fig.2: Showing bilateral CTEV



## Discussion



Arthrogyrosis multiplex congenita (AMC), or simply arthrogyrosis, describes congenital joint contractures in two or more areas of the body. It derives its name from Greek, literally meaning "curving of joints" (*arthron*, "joint"; *gr3p3sis*, late Latin form of late Greek *gr3p3sis*, "hooking"). Children born with one or more joint contractures have abnormal fibrosis of the muscle tissue causing muscle shortening, and therefore are unable to do passive extension and flexion in the affected joint or joints.<sup>[1]</sup> AMC has been divided into three groups: amyoplasia, distal arthrogyrosis, and syndromic. Amyoplasia is characterized by severe joint contractures and muscle weakness.<sup>[2]</sup> Distal arthrogyrosis mainly involves the hands and feet. Types of arthrogyrosis with a primary neurological or muscle disease belong to the syndromic group.<sup>[3]</sup>

### Epidemiology

Arthrogyrosis is a rare condition. Some authors say the overall prevalence is one in 3000 births.<sup>[4]</sup> Congenital clubfoot is the most common single contracture and its prevalence is one in 500 live births

### Signs and Symptoms

Almost every joint in a patient with arthrogyrosis is affected, because in 84% all limbs are involved, in 11% only the legs and in 4% only the arms are involved. Every joint in the body has typical signs and symptoms like the shoulder (internal rotation), wrist (volar and ulnar), hand (fingers in fixed flexion and

thumb in palm), hip (flexed, abducted and externally rotated, frequently dislocated), elbow (extension and pronation) and foot (clubfoot). The range of motion capability can be different between joints because of the different deviations. Some types of arthrogyrosis like amyoplasia have a symmetrical joint/limb involvement, with normal sensations. The contractures in the joints are sometimes resulting in a reduced walking development in the first 5 years. The intelligence is normal to above normal in children with amyoplasia.<sup>[5]</sup> But it is unknown how many of these children have an above normal intelligent and there is no literature available about the cause of this symptom. There are a few syndromes like the Freeman-Sheldon and Gordon syndrome, which have craniofacial involvement. The amyoplasia form of arthrogyrosis is sometimes accompanied with a midline facial hemangioma. Arthrogyrosis is not a diagnosis but a clinical finding. So this disease is often accompanied with other syndromes or diseases. These other diagnosis can be found in every single organ in a patient. There are a few slightly more common diagnoses such as pulmonary hypoplasia, cryptorchidism, congenital heart defects, tracheoesophageal fistulas, inguinal hernias, cleft palate, and eye abnormalities.

### Causes

Research of arthrogyrosis has shown that anything that inhibits normal joint movement before birth can result in joint contractures. Arthrogyrosis could be caused by genetic and environmental factors. In principle: any factor that entails fetal movement of the fetus can result to congenital contractures. The exact causes of arthrogyrosis are unknown yet.

### Extrinsic factors

The malformations of arthrogyrosis can be secondary to environmental factors such as: decreased intrauterine movement, oligohydramnios (low volume or abnormal distribution of intrauterine fluid), and defects in the fetal blood supply. Other causes could be: hyperthermia, limb immobilization and viral infections. Myasthenia gravis of the mother leads also in rare cases to arthrogyrosis. The major cause in humans is fetal akinesia. However, this is disputed lately.

### Intrinsic Factors

Arthrogyrosis could also be caused by intrinsic factors. Think of molecular, muscle- and connective tissues development disorders or neurological abnormalities.

### *Molecular basis*

Research has shown that there are more than 35 specific genetic disorders associated with arthrogryposis. Most of those mutations are missense, which means the mutation results in a different amino acid. Other mutations that could cause arthrogryposis are: single gene defects (X-linked recessive, autosomal recessive and autosomal dominant), mitochondrial defects and chromosomal disorders (for example: trisomy 18). This is mostly seen in distal arthrogryposis. Mutations in at least five genes (TNN12, TNNT3, TPM2, MYH3 and MYH8) could cause distal arthrogryposis. There could be also connective tissue-, neurological or muscle development disorders.<sup>[6]</sup>

### *Muscle and connective tissue development disorders*

Loss of muscle mass with an imbalance of muscle power at the joint can lead to connective tissue abnormality. This leads to joint fixation and reduced fetal movement.<sup>[2]</sup> Also muscle abnormalities could lead to reduce of fetal movement. Those could be: dystrophy, myopathy and mitochondrial disorders. This is mostly the result of abnormal function of the dystrophin-glycoprotein-associated complex in the sarcolemma of skeletal muscles.

### *Neurological abnormalities*

In 70-80% of the cases of arthrogryposis are caused by neurological abnormalities. Most of these are underlying of a genetic syndrome or the result of environmental factors.

The underlying etiology and pathogenesis of congenital contractures, particularly arthrogryposis and the mechanism of the mutations remains an active area of investigation. Because identifying these factors could help to develop treatment and congenital finding of arthrogryposis.

## **Diagnosis**

There is currently a lot of research on prenatal diagnosis. The diagnosis can be made prenatally in approximately 50% of fetuses presenting arthrogryposis. It could be found during routine ultrasound scanning showing a lack of mobility and abnormal position of the fetus. Nowadays there are more options for visualization of details and structures can be seen well, like the use of 4D ultrasound.<sup>[7]</sup> In clinic a child can be diagnosed with

arthrogryposis with physical examination, confirmed by ultrasound, MRI, or muscle biopsy.

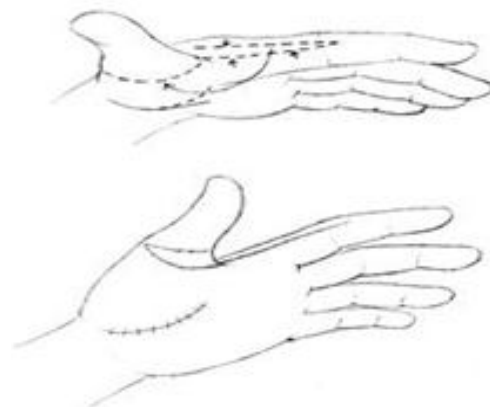
## **Treatment**

The treatment of arthrogryposis includes occupational therapy, splinting and surgery. The primary long-term goals of these treatments are increasing joint mobility, muscle strength and the development of adaptive use patterns that allow for walking and independence with activities of daily living. Since arthrogryposis includes many different types, the treatment varies between patients depending on the symptoms.<sup>[8]</sup> Only a few good articles exist in which a surgical technique that is used to treat arthrogryposis is described. These surgeries are explained below.

### *Wrist surgery in Arthrogryposis*

Children with the amyoplasia type of arthrogryposis usually have flexed and ulnarly deviated wrists.<sup>[9]</sup> Dorsal carpal wedge osteotomy is indicated for wrists with excessive flexion contracture deformity when non-surgical interventions such as occupational therapy and splinting have failed to improve function. On the dorsal side, at the level of the mid carpus, a wedge osteotomy is made. Sufficient bone is resected to at least be able to put the wrist in a neutral position. If the wrist is also ulnarly deviated, more bone can be taken from the radial side to correct this abnormality. This position is held into place with two cross K-wires. In addition, a tendon transfer of the extensor carpi ulnaris to the extensor carpi radialis brevis may be performed to correct ulnar deviation or wrist extension weakness, or both. This tendon transfer is only used if the extensor carpi ulnaris appears to be functional enough.

### *Thumb surgery in Arthrogryposis*



### Index rotation flap

The soft tissue envelope in congenital contractual conditions such as clasped or arthrogryptic thumbs is often deficient in two planes, the thumb-index web and the flexor aspect of the thumb. There is often an appearance of increased skin at the base of the index finger that is part of the deformity. This tissue can be used to resurface the thumb-index web after a comprehensive release of all the tight structures to allow for a larger range of motion of the thumb. This technique is called the index rotation flap.<sup>[10]</sup> The flap is taken from the radial side of the index finger. It is proximally based at the distal edge of the thumb-index web. The flap is made as wide as possible, but still small enough to close with the excessive skin on the palmar side of the index finger. The flap is rotated around the tightest part of the thumb to the metacarpophalangeal joint of the thumb, allowing for a larger range of motion.

### Other surgeries

Many other surgeries are also able to improve function in joints of arthrogryposis patients. These surgeries usually exist out of tendon transfers and skin flap movements, adjusted to the individual.

### Prognosis

There is still little literature available about the prognosis of patient with arthrogryposis. The search for a prognostic factor is difficult, because of the small number of patients. But there are a few factors that seem to have an influence on the prognosis like the progressive muscle activity improvement. Results of a study showed an increase in strength during growth after the recovery of a passive range of motion in a useful arc.<sup>[11]</sup> Other positive prognostic factors for independent walking were active hips and knees, hip flexion contractures of less than 20 degrees and knee flexion contractures less than 15 degrees without severe scoliosis.

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