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Case Report (Pages: 17314-17322)

Swan Neck Deformity in a Neonate with Perinatal Asphyxia

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Abstract

Background: Fingers' swan neck deformity is an uncommon sign in neonates. This deformity has much pathology in adults such as prolonged rheumatoid diseases, tearing or weakness of ligaments or increased spasticity of muscles. In this article we report on a neonate case of swan neck deformity and discuss the possible disorders which have possibly caused this deformity. Our infant is a known case of asphyxia so we are also going to discuss that swan necks may be a complication or a comorbidity of asphyxia.

Case report: Our infant is a two month-old male preterm newborn, hospitalized due to seizures. The infant has a history of intrauterine growth retardation and perinatal asphyxia. On physical examination the patient was hypotonic and reflexes were decreased and there was a deformity on the hands which is very similar to swan neck deformity seen in adults. We requested different paraclinical modalities such as electroencephalogram, electromyography and nerve conduction velocity, computed tomography to rule out different possible diagnoses for the deformity (e.g., Ehlers Danlos syndrome, leukocyte adhesion deficiency). According to the results of the investigations, no reason was found for this deformity in the infant, and it seems that this deformity is one of the complications of asphyxia or has occurred in association with it.

Conclusion: Swan neck deformity is a very rare finding on neonates. It was observed in a newborn with perinatal asphyxia, and different commonly known causes of this deformity were ruled out in this newborn. Therefore, in our opinion, this deformity can possibly be one of the late manifestations of asphyxia in a newborn.

Key Words: Asphyxia, Ehlers Danlos syndrome, Leukocyte adhesion deficiency, Neonate, Swan neck deformity.

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1- INTRODUCTION

Perinatal Asphyxia is caused by an ischemic or hypoxic insult that occurs prenatally or within a close proximity to labor (peripartum). Its incidence is 5-8 cases per 1000 live births over the study period of time from 2004 to 2012 (1). Diagnostic signs of asphyxia in newborns include low Apgar score (less than 5) at 5 minutes and 10 minutes, fetal umbilical Ph less than7 or base deficit more than 12 mmol/L or both, presence of symptoms of organ failures especially hypoxic ischemic encephalopathy (HIE), brain damage seen on MRI (magnetic resonance imaging) or MR spectroscopy.

Clinical manifestations of perinatal asphyxia are direct effect of hypoxia on multisystemic organs including brain (which is the major organ of concern in this insult because of the risk of HIE and seizure) (2) , kidney (oliguria as a result of renal dysfunction), liver (elevation of liver enzymes), gastrointestinal tract (reduced tolerance of enteral feeding) and also respiratory system (apnea, meconium aspiration and hypoventilation and PPHN) (3, 4), cardiovascular system (reduced cardiac output and hypotension due to impaired myocardial contraction as a result of ischemic insult on myocardium) (5, 6), and some hematologic effects including thrombocytopenia and impaired coagulation or DIC (disseminated intravascular coagulation) (7-10). Neurologic signs of HIE on muscle tonicity of neonates were shown in studies which vary from hypotonia to extensor hypertonus. The patients are usually hypotonic at birth but as they develop one of the following three outcomes happens:

1) The patients are hypotonic for several days but then they regain their ton and have normal reflexes,

2) Extensor phase develops after 12 hours,

3) The patients enter a severe hypotonic phase (11).

Swan neck deformity is a deformed position of fingers seen as hyperextension of PIP (proximal interphalangeal) joints and hyperflexion of DIP (distal interphalangeal) joints and also reciprocal flexion of MCP (metacarpophalangeal) joints. Pathophysiology of this deformity is related to ligament weakness (due to rheumatoid diseases), tearing (caused by trauma) or spasticity caused by brain injury (12-14).

2- CASE REPORT

2-1. The parents blood relatives

The infant is a 2-month old male preterm (36 w) newborn of a 37-year-old mother without parents' blood relatives and was born with C-section. The infant had a history of IUGR (intrauterine growth restriction) at birth with an APGAR score of 3 (had undergone cardiopulmonary resuscitation) and signs of respiratory distress (he was under positive pressure ventilation) with umbilical cord PH being 7; these signs indicate that our patient had suffered perinatal asphyxia. On the 15^{th} day after birth, the infant had several episodes of tonic seizure while blood sugar and serum electrolytes and LP were all at normal ranges (HIE being the most probable diagnosis). Upon physical examinations, the patient was hypotonic and had reduced reflex activities and DTR (deep tendon reflexes), while there were no signs of respiratory distress like grunting, cyanosis or pathologic retractions. The infant had swan neck deformity on both hands (**Fig. 1**). And delay in umbilical cord separation was also observed.

Primary disorders of connective tissue were suspected. They included EDS (Ehlers Danlos syndrome) and skeletal disorders for his hand deformity and HIE and myopathies for hypotonia and seizure, and allergy; and immunology consultant suggested different subtypes of LADs (leukocyte adhesion deficiency) or RAC2

mutation to support the delayed umbilical cord separation.

On laboratory tests several positive CRPs were detected (a 4+ CRP is the most recent finding) that could mean that the infant has an inflammatory process, the most possible explanation could be a mild to moderate inflammatory or infectious meningitis based on neurologic findings (seizure and hypotonia), so LP operation was requested to evaluate the possibility of meningitis and there were no signs of inflammation or infection. Moreover, leukocytosis was shown on several CBCs (WBC=15900/micro litter being the most recent one) and blood culture was negative (there was no growth of any bacteria).

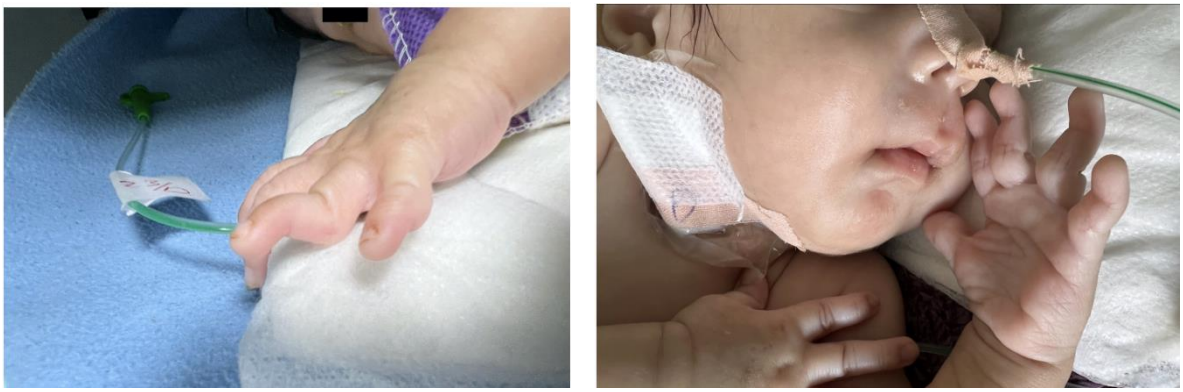

Fig. 1: swan neck deformity on the fingers of a neonate with asphyxia and HIE

There were no findings on the babygram of the infant such as skeletal deformity of fingers and hand (**Fig. 2**) or kyphoscoliosis to rule out EDS which will be discussed below.

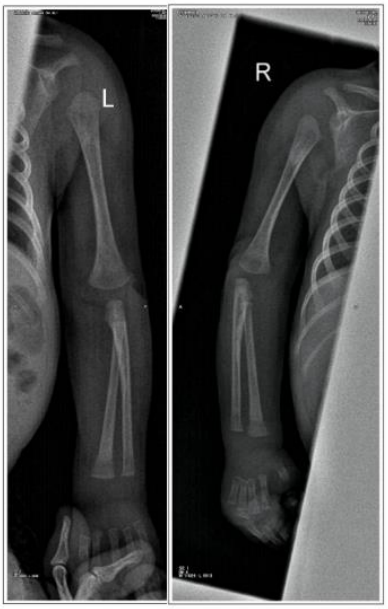

Fig. 2: Babygram (radiography) of the patient which proves that there is no skeletal abnormality in upper limb and fingers to support skeletal abnormality for swan neck deformity seen in our patient

Paraclinical evaluations brain CT (Computed tomography), EEG (electroencephalogram) and brain sonography were requested for this infant for hypotonia and seizure episodes. EEG and brain sonography had no positive findings but brain CT showed evidence of HIE (**Fig 3**).

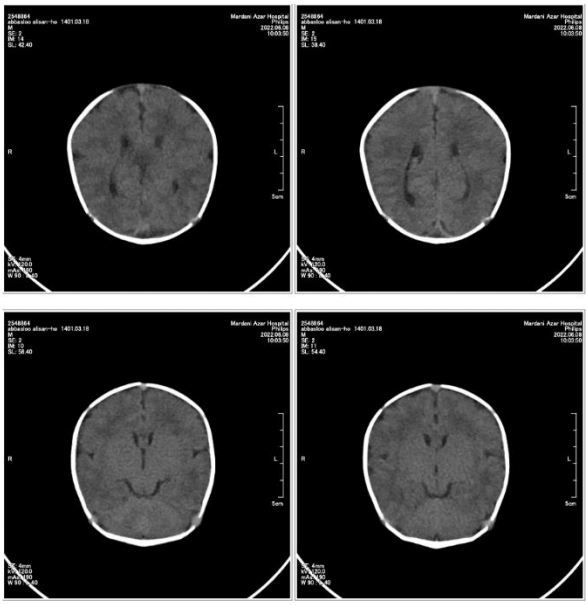

Fig. 3: brain CT of our patient which shows evidence of HIE.

Echocardiography of our infant had no signs of cardiac abnormality. Also, EMG-MCV (electromyography and nerve conduction velocity) showed no evidence of myopathies.

Flow Cytometry was requested in this case for CD11, CD15and CD18 levels to evaluate immunologic disorders and they were all reported in normal range.

3- DISCUSSION

Swan neck deformity in neonates has not been reported in cases of asphyxia or HIE following asphyxia. Diseases causing this deformity in neonates could be congenital collagen deficiency disorders like EDS or cerebral palsy. To our knowledge, the association of this deformity with asphyxia has not been yet studied.

Hypotonia and extensor hypertonus has been reported with asphyxia and our infant happens to be hypotonic with hypotonic posture (the upper limbs are abducted and extended at the side of the head) which is shown in pictures. Sometimes asphyxia patients with hypotonia develop hypertonus state within 12 hours after birth, signs of which are appearing of extensor tone, asymmetric tonic neck reflexes and trunk incurvation reflexes (11). Extensor hypertonus phase could cause hyperextension of fingers and maybe swan neck deformity; but none of the signs of this state were evident in this infant and the patient was apathetic and had weak reflexes.

In this infant, different subtypes of EDS were suspected; however, considering that both parents had no such disorders, the autosomal dominant subtypes such as classic, arthrochalasia, vascular and hypermobile EDS that are mainly inherited as autosomal dominant, are less likely (15-18). other autosomal recessive subtypes which are more likely in this case include

dermatochalasis EDS but there are no signs of skin involvement (skin fragility, sagging redundant skin and large hernias) (19, 20); Moreover, cardiac valvular deficit was not observed on echocardiography and there were no signs of progressive kyphoscoliosis on babygram, so the diagnosis of kyphoscoliosis EDS and cardiac valvular EDS were rejected (21, 22). Classic like EDS is also a recessive type of EDS which is caused by tenascin-X deficiency and has manifestants of hyper elastic skin, hypermobile joints, easy bruising without atrophic scarring (23, 24). Also, our infant had no signs of skin hyperextension or easy bruising. Furthermore, the EDS diseases do not demonstrate signs of seizure, while in this infant several episodes of seizure had been detected (25).

The kyphoscoliotic type EDS (EDS VIA) is a rare type of disease with the incidence of 1 out of 100,000 live births. This disease causes severe muscular hypotonia and early onset of progressive kyphoscoliosis, excessive skin fragility, and mobility of the joints without tendency to fracture at the time of birth. Manifestations such as scoliosis are not seen at birth, but appear progressively during childhood. This disease is diagnosed as a neuromuscular disease in neonatal period and its diagnosis is usually delayed during neonatal period due to severe hypotonia and gross motor developmental delay.

Cerebral palsy can also have signs of swan neck fingers (because of the hypertonic state) and seizure but considering that our patient was hypotonic this option was also rejected (in cerebral palsy we expected the patient to be hypertonic and spastic) (26).

LADs work up was suggested for this infant because of the Delayed separation of the umbilical cord. Four major types of LADs have been discovered by now, type 1, 2, 3 have defects in neutrophil adhesion and migration and type 4 has defects in monocyte migration (27). Genetic studies of the pathogenesis of LADs show that LAD-1 is an autosomal recessive genetic disease that has mutation in ITGB2 (integrin beta2 gene) encoding CD18 subtypes (27, 28); LAD-2 is due to defects in fucosylation of carbohydrate ligands (27, 29) and LAD-3 is caused by defects in activation of integrins (27).

LADs syndrome is a disorder in which leukocytes (particularly neutrophils in LADs type 1,2,3 and monocytes in LADs type 4) cannot leave the vasculature to migrate normally into tissues; as a result there is leukocytosis in CBC but leukocyte counts are low at the site of infection (one of the signs of LAD type 1 is complete devoid of neutrophils in biopsies of the infected tissue). Because of leukopenia (mostly neutropenia), non-healing ulcers and absence of pus formations in site of infections (which the latter is said to be the hallmark of LADs) is frequently seen in these patients. Reports suggest that the umbilical cord separation delay is most frequently seen in type 1 and 3, and has not been detected in type 2 yet. Many studies suggest that evaluation for LAD type 3 should be performed in patients with these three signs: bleeding complications from birth (thrombocytopenia), severe infections, delayed umbilical cord separation (27).

Severe infections, leukocytosis, unseparated umbilical cord with omphalitis and impaired wound healing are signs of type 1. In the case of our patient, no major bleeding or severe infection was seen and the only important findings were delayed umbilical cord separation and a minor leukocytosis, while the CD markers (CD11a, b, c, CD15 and CD18) were evaluated to be on normal ranges (**Table 1**).

Table-1: CD markers of the patient to evaluate the possibility of immunologic disorders

Cd markers	Values
CD22	Lymphocyte 20.9
CD45RO	Lymphocyte 12.7%
CD45RA	Lymphocyte 72%
CD19	Lymphocyte 4%
CD3	Lymphocyte 53%
CD16	Lymphocyte 13%
CD4	Lymphocyte 39%
CD8	Lymphocyte 13%
CD56	Lymphocyte 7%
CD11a	Lymphocyte 66.7% Neutrophile 96.4%
CD11b	Lymphocyte 8.7% Neutrophile 96.5%
CD11c	Lymphocyte 4.7% Neutrophil 94.2%
CD18	Lymphocyte 90% Neutrophil 99.7%

Note: As it seems, all requested markers are normal.

Table-2- CBC test items

CBC	Values
WBC	15.9*103
RBC	4.04 * 106
Hb	12 mg/dl
Plt	288 *103
Neutrophil	31% (5*103)
Lymphocyte	52% (8*103)

CBC (complete blood count), WBC (white blood cell), RBC (red blood cells), Plt (platelets), Hb (hemoglobin). These results show slight leukopenia.

RAC2 mutation is an extremely rare primary immune deficiency disorder. Delayed umbilical cord separation reported in these patients and recent studies showed that the adaptive (mainly the B cell compartment) immunity was also impaired leading to combined immunodeficiency. (30-32)

RAC2 is expressed only in hematopoietic cells and regulates actin cytoskeletal changes.

Dynamic reorganization of the actin cytoskeleton is necessary for several biological processes including rapid and directional actin remodeling required for leukocyte migration (30, 33).

Deformity of the fingers can be seen in a variety of disorders including JIA, CACP syndrome, or Systemic lupus erythematosus. The skeletal disorder of this infant (swan neck deformity) might be an unknown sign of RAC2 deficiency because of weak ligaments due to alteration in actin production.

Accordingly, we would like to say that none of the disorders discussed above are proven to be the cause of swan neck deformity in this infant. In this infant, the only diagnosis that we are sure about is asphyxia, and the deformity may be a complication of it or just a comorbidity.

3-1. Limitations of the study

One of the important limitations of this report was that it was not possible to perform the WES (Whole Exome Sequencing) test (Due to financial constraints). The goal of this test is to identify genetic variants and congenital genetic disorders such as EDS.

4- ACKNOWLEDGEMENTS

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