ARTERIAL INSUFFICIENCY IN CONGENITAL CLUB FOOT

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Abstract

Background: Idiopathic club foot (Talipes equina varus) (TEV) is a common congenital deformity, but its etiology and pathophysiology remains uncertain, a congenital vascular abnormalities or malformation is one of the hypotheses behind the etiology of the pathogenesis of (TEV).

Patient and methods: Doppler ultrasonography examination has been done to fifteen child with twenty five club feet, their age was ranging from two weeks to fourteen year, two children subjected for M.R Arteriography of the affected feet. Nineteen normal feet as a control group undergone Doppler ultrasonography for comparison.

Results: the posterior tibial and peroneal arteries were present in all cases while the anterior tibial artery was present in all cases but severely reduced in ten (40%). Dorsalis pedis artery (DP) was normal in six feet (24%), severely reduced in eight (32%) and absent in eleven feet (44%).

MRA of the two feet confirmed the absence of (DP) in one foot, reduced in the other one.

Conclusion: the consistent finding is the high incidence of absence of DP artery or it is severely reduced, which might be an important etiopathological factor in the pathogenesis of idiopathic (TEV).

Evaluation of the vascular state in the pretreatment stage in patient with club foot might decides what mode of therapeutic approach to be undertaken.

Keywords: Talipes equina varus, arterial insufficiency in (TEV).

Introduction:

Idiopathic club foot (TEV) is a common congenital deformity, recent genetic research supports the Hypothesis of multifactorial pattern of inheritance in which the genetics plays a central role(1), but environmental and intrauterine mechanical factors, as well as neuromuscular (Sarsam(2)), or neurogenic, defects (Obaydi)(3), may modulate the genetic expression, Recently a trial of drawing a map of the Vascular tree of a foot with (TEV) been conducted by many authors had disclosed a vascular abnormalities or arterial malformation in particular in the form of total agenesis (absence) or blockage of one or mor arterial branches, at the level of sinus tarsi during early fetal life, a pattern(4) similar to that found in one stage of fetal angiogenesis before three months of gestation, the persistence of this fetal pattern might be due to(5) injury, infection at that stage, or due to arrest in the development(5). The abnormal arteriography associated with club foot (TEV) as had been studied by Hootnick(6) and Edelson(7) and in two of our cases had confirmed this hypothesis of vascular etiopathology.(6)

This study try to evaluate the role of vascular insuffinency (arterial) behind the etiology of (TEV).
Patients & Methods
Arterial pulses at the ankle and foot were investigated in 16 child (25 feet) seen at the out-patient orthopedic clinic of Medical City Teaching Hospital, Baghdad, with typical (TEV) deformity using Doppler ultrasound technique during the period from January 2007 to April 2008.

Patients age ranged from 2 weeks -14 year, 11 male, and 5 female, 18 child were below 3 years and 7 above 3 years of age.

Nine cases were with Bilateral deformities and 7 cases with unilateral deformity. Flexible type in 8 feet (32%), and resistant type in 17 feet (68%), 15 feet with right side and 10 with the left.

Full physical examination of the child and recording the findings, ruling out neurogenic or syndromic cause of the deformity, hip radiograph and the foot taken, When necessary.

Doppler blood flow detector (Samsung model 1999)*, with bi-directional probe with two channels chart recorder had been used in the arterial Pulses examination by an expert radiologist Doppler examination carried out for posterior tibial artery (PTA) one cm posterior to the medial malleolus, anterior tibial artery (ATA) at and above the ankle joint line anteriorly, dorsales pedis (DP) art. pulse at mid tarsal level at the anteromedial aspect, peroneal vessel at 1-3 cm proximal to the lateral malleolus posteriorly. for the (ATA) and (PTA), a blood flow was considered to be normal if the flow was more than 12 cm/sec. Severely reduced between 6-11 cm/sec, meanwhile. Doppler blood flow detector performed too on 13 patent (19 feet), 7 feet were normal of a unilateral deformity and 6 of bilateral normal feet patients as a control group.

Results:
Doppler ultrasonography examination of all the feet with (TEV) revealed that the post. tibial. and peroneal arteries are present in all of the feet. The ant. tibial art. was normal in 16 feet (64%), severely reduced in (9 feet) (36%). DP art. absent in one of the feet of the flexible type, severely reduced in 2, and present (normal) in 5 (62%). In the resistant type the DP art. absent in 10, Severely reduced in 4 and normal in 3. (17.6%)

Children below 3 years of age (18 feet), the DP art. was absent in 6, reduced in 5, and normal in 7 feet.

Children above 3 year of age (all resistant type) DP art. absent in 5 feet, severely reduced in one foot and normal in one.

The control group: 13 patient (19 feet) the DP art. absent in one foot, lateral displacement (a normal variation) in one foot, magnetic resonance arteriography (MRA) of the two feet showed absent DP in one foot, attenuated in the other one.

<table>
<thead>
<tr>
<th>Type of club foot</th>
<th>Normal DP flow</th>
<th>%</th>
<th>Severely Reduced flow</th>
<th>%</th>
<th>Absence flow</th>
<th>%</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible type</td>
<td>5</td>
<td>62.5</td>
<td>2</td>
<td>25</td>
<td>1</td>
<td>12.5</td>
<td>8</td>
<td>32</td>
</tr>
<tr>
<td>Resistant type</td>
<td>3</td>
<td>17.6</td>
<td>4</td>
<td>23.5</td>
<td>10</td>
<td>58.8</td>
<td>17</td>
<td>68</td>
</tr>
</tbody>
</table>

* No commercial benefit.
Table 1: DP artery variations in relation to the type of club foot deformity.

<table>
<thead>
<tr>
<th>Artery</th>
<th>Normal DP flow</th>
<th>%</th>
<th>Severely Reduced flow</th>
<th>%</th>
<th>Absence flow</th>
<th>%</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pos. tib. art.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>Pern. art.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>Ant. tib. art.</td>
<td>19</td>
<td>76</td>
<td>6</td>
<td>24</td>
<td>-</td>
<td>-</td>
<td>25</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2: Other arterial changes associated with the deformity.

<table>
<thead>
<tr>
<th>Age</th>
<th>No. flexible type</th>
<th>%</th>
<th>normal DP</th>
<th>%</th>
<th>Severely reduced DP</th>
<th>%</th>
<th>Absent DP</th>
<th>%</th>
<th>No. resistant Type</th>
<th>%</th>
<th>Normal DP</th>
<th>%</th>
<th>reduced DP</th>
<th>%</th>
<th>Absent DP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 3 year</td>
<td>8</td>
<td>44</td>
<td>5</td>
<td>62.5</td>
<td>2</td>
<td>25</td>
<td>1</td>
<td>12.5</td>
<td>10</td>
<td>56</td>
<td>2</td>
<td>20</td>
<td>3</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>Above 3 year</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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Table 3: Age of the patients and related changes.

Discussion
The consistent major vascular variation found in the patients of this study is the deficiency of the distal portion of ant. tib. art. and its derivatives; namely the dorsalis. Pedes (DP), the ant. tibial art. originate from the pars distalis of the embryonic artery. Which is developed from proximal to distal in the embryonic limb, with proximal portion appearing before 22m stage (35-36 days of gestation)(8) for unknown etiology there might be an arrest or agenesis of that portion. (infection, trauma) aminiocenthesies) etc. (9) are probable causative factors which ultimately lead to agenesis (absence) of the distal part i.e DP art. Whoever, in the normal feet the DP art is absent in only 2.2% (Tredwel), and 3.7% Gomoz(10) Anderson found that it is absent in one of every six normal limbs.

In the present study it is not present in (5.2%) of our normal limbs of the control group Studies of the Vascular state of feet with club deformity revealed that the great majority (85%) of patients with sever untreated club foot have no DP artery (feldbrin)(12).Edelson(7) showed that the DP artery was absent in (38.9%) of sever, neglected club foot deformity, in this study the DP artery is absent in (44%), severely reduced in (24%), and normal in (32%), of cases. Ippolito, Herzenberg, and other(12) researchers have believed that the vascular abnormality is a secondary changes to walking, which may be similar to that found with the luminal closure of the medial circumflex artery of the hip due to its gradual stretching in cases of high-riding and neglected developmental dysplasia of the hip (DDH). Hootnick(6) et al found that the DP is absent in his patients during both the preambulatory and at the ambulatory age and he proved that this abnormality is not an adaptive changes to walking as suggested by others(7). The finding in his study is correlate with that of Hootnick in the sense that the vascular difiency is a primary and foot deformity is secondary, the possible
mechanism firstly is that the imbalance of blood flow may cause an over growth of the lateral side of the foot while an ischemic fibrosis may develop in the medial aspect of the foot, secondly; the only structure which is consistently shown to be abnormal is the talus, its head in particular and this part of the bone receive its blood supply mainly via the DP artery, reduction could cause hypoplasia of the talar head. The talar neck will suffer insufficiency too, because it receives its blood supply form the lateral tarsal artery a branch of DP, This will consequently cause whole talus growth abnormality.DP is absent in the present study in (58.8%) of the resistant type, these findings are correlate with those of (Meanachem)\(^{13}\) who disclosed the fact that the more the severity of the deformity, the more the incidence of absences of DP artery, this incidence goes down to (23%) in severely reduced, and in the flexible type it arrives to (12.5%).Absence of pulse in the DP was (50%) in patients below than 3 years of age, and it raises up to (71.4%) in those patients above the age of 3 years. 

M.R.A is recommended for further evaluation in order to draw a relation between the recurrence rate and the arterial abnormalities in club foot.

\section*{Conclusion}
Vascular insufficiency in the form of agenesis or malformation of the anterior . tibia. artery or its termination mainly the dorsalis pedis artery is important etiological factor behind the congenital (TEV). Pre knowledge of the vascular map of the foot with this deformity is mandatory before embarking on any mode of treatment.

\section*{References}