EARLY PREDICTION OF NEUROPATHIC WRIST ARTHROPATHY IN EGYPTIAN LEPROTIC PATIENTS

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ABSTRACT

**Hypothesis:** Leprosy is a chronic dermatologic and neurologic condition caused by the organism, an obligate intracellular acid fast bacillus with a predilection for dermal and neural cells (John, 2006).

**Objective:** We investigated the early prediction of the neuropathic wrist arthropathy in Egyptian leprotic patients.

**Methodology:** Thirty six leprotic patients (26 males & 10 females) their ages ranged from 15-60 years with mean (44.83±16.75) and the disease duration ranged from 1-35 years with mean (15.70±4.70) in addition to thirty control subjects(22 males & 8 females) their age ranged from 12-58 years with mean (32.03±11.99) were included in the study.

Careful history examination with a special attention to family history, Neurological examination and Rheumatological & Radiological examination of both wrists joints, ESR, CBC, RF, urine & stool analysis and kidney & liver functions.

**Results:** the wrist joints are highly significantly involved in the patients group than in the control group with a higher predilection to the sensory impaired patients than the motor impaired patients.

**Conclusion:** We can conclude that the radio carpal joints may be affected by neuropathic arthropathy in leprotic patients with sensory impairment.
INTRODUCTION

Leprosy, also known as Hansen's disease, is a chronic infectious disease that primarily affects the skin, the peripheral nerves, the upper respiratory tract, and the eyes (Sasaki, et al., 2001).

The causative agent is an acid-fast bacterium, Mycobacterium leprae, first identified in 1873 by the Norwegian physician, Gerhard Henrik Armauer Hansen. The organism Mycobacterium leprae binds laminin-2 to alpha-dystroglycan on Schwann cells (these binding proteins are not found in CNS). M leprae proliferates best at 86° F (30° C). The incubation period can range from 2 months to 10 years between infection and clinical manifestations. The bacillus is spread via respiratory droplets and active skin lesion contact (Haimanot & Melaku 2000).

Road (1991), stated that, even countries with developed health services, leprosy often diagnosed only in an advanced stages due to:

1. In most societies, leprosy is not endemic and occurs only as an imported disease of minor public health importance.
2. Little attention is being paid to teaching leprosy in medical schools. Moreover, chapters of leprosy in general textbooks are not always update.
3. Traditional fear is still common, the patients are often reluctant to expose themselves, as leprotic patients because the fear of restrictive measures.

Reports of joint involvement in leprosy have been published since the 1960s (Karat et al., 1967 and Lele et al., 1965), but the main aspect of interest in this work was to study the neuropathic joint involvement in leprosy patients not in reaction since the arthritis in lepra reaction type II is well known (Chakrabarty & Dastidar 2002).

PATIENTS AND METHODS

Thirty six leprotic patients in addition to thirty control subjects were included in the study. All of the patients were selected from Abou-Zaabal, Al-Safieh, Masoud Villages, and Al-Kalyobia Governorate.

The patients were 26 males - 10 females, their ages range from 15-60 years with mean (44.83±16.75) and the disease duration ranged from 1-35 years with mean (15.70±4.70). The control subjects were 22 males - 8 females, their age ranged from 12-58 years with mean (32.03±11.99) with
no family history of leprosy and with no known exposure to leprosy and with no history of wrist or carpal injury or trauma.

All of patients in addition to the control group were subjected to the following:

1. Careful family history
2. Rheumatological examination.

Both wrists joints were examined from all aspect according to spread-severity (S-S index) \( (Walker & Griffith, 1986) \).

\[ G_0 = \text{Normal} \]
\[ G_I = \text{Tender} \]
\[ G_{II} = \text{Swollen} \]
\[ G_{III} = \text{Tender and swollen} \]
\[ G_{IV} = \text{Deformities} \]

Ritchie index \( (Ritchie \text{ et al.}, 1968) \) was used for assessment of joint tenderness as follow: \( G_0 = \) No tenderness.
\[ G_I = \text{Tender} \]
\[ G_{II} = \text{Tender and winced} \]
\[ G_{III} = \text{Tender, winced and withdraws} \]

3. Routine laboratory investigations (ESR, CBC, RF, urine and stool analysis, kidney and liver functions).

4. Neurological examination all had a full neurological examination as follow, sensory impairment was evaluated by the two point discrimination in a digit; where 4mm was considered normal, while >4 mm was considered abnormal \( (Tubiana, 1994) \).

The degree of motor dysfunction was also assessed as follow: The presence of intrinsic minus finger (which was defined as hyperextension of MCP joints and flexion of PIP & DIP joints of little and ring finger) indicated motor involvement of ulnar nerve, while the presence of thenar paralysis with loss of opposition of thumb indicated motor involvement of median nerve \( (Brunel \text{ et al.}, 1988) \).

According to the above neurological examination, the patients were divided into three subgroup, \( (I_a) \) was 20 patients with sensory impairment only, \( (I_b) \) was 6 patients with sensory and motor impairment, and \( (I_c) \) was 10 patients with neither sensory nor motor involvement.

5. Radiological examination: A standard postero-anterior radiograph of both wrists and the following measurements were made in neutral position:

1. The carpal glenoid sector: which is the arc formed by the articulating surface of distal radius and ulna with the first row of carpal bones (arc AC).
2. The radial physeal widening index: which is the ratio of that proportion of the circumference representing the radius of the previous measurement (arc AB/arc ACX100).

3. The carpal index: This is the ratio of carpal high to the distance from the distal articulating surface of the radius to the head of middle metacarpal (ab/ac).

4. The carpal ulnar distance: This is the distance from the extension of the ulnar axis to the axis of rotation of the carpus (d-d).

5. The distal radioulnar discrepancy: This is the distance from the lower distal articulating surface of both radius and ulna.

6. The covered length of lunate: This is the percentage of the os lunatum lying beneath the radius (Youm et al. 1978 and Gelberman et al. 1975).

**RESULTS**

The results of this work will be summarized in the following tables and figures:

Table (1): Shows the radiological measurements for both groups.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Patients</th>
<th>Control</th>
<th>p. value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carnal glenoid sector</td>
<td>65.70 ± 13.20</td>
<td>93.08 ± 15.20</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Radial physeal widening</td>
<td>80.67 ± 6.63</td>
<td>74.81 ± 5.48</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Carpal index</td>
<td>0.78 ± 0.40</td>
<td>0.51 ± 0.04</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Carpal ulnar distance</td>
<td>20.01 ± 3.34</td>
<td>16.85 ± 3.73</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Distal radio-ulnar discrepancy</td>
<td>2.45 ± 1.53</td>
<td>0.78 ± 1.40</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Covered length of lunate</td>
<td>94.65 ± 4.51</td>
<td>83.67 ± 16.41</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

There were a highly significant differences between them as regards the whole measurements (p<0.01).
Fig. (1): Shows the radiological measurements for both groups.

Table (2): Shows the radiological measurement in the subgroups Ia, Ib, Ic.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Group Ia n = 20</th>
<th>Group Ib n = 6</th>
<th>Group Ic n = 10</th>
<th>p. Value</th>
<th>la / lb</th>
<th>la / lc</th>
<th>lb / lc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carpal Glenoid sector</td>
<td>64.3 ± 11.81</td>
<td>66.7 ± 10.70</td>
<td>90.8 ± 10.30</td>
<td>&gt;0.05</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Radial physeal widening</td>
<td>85.1 ± 4.51</td>
<td>80.3 ± 5.73</td>
<td>76.1 ± 2.82</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&gt;0.05</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Carpal index</td>
<td>0.75 ± 0.04</td>
<td>0.51 ± 0.06</td>
<td>0.54 ± 0.05</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Carpal ulnar distance</td>
<td>21.82 ± 1.73</td>
<td>17.71 ± 4.23</td>
<td>16.93 ± 2.85</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&gt;0.05</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Distal radio-ulnar discrepancy</td>
<td>3.23 ± 1.74</td>
<td>1.73 ± 1.56</td>
<td>0.73 ± 0.52</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&gt;0.05</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Covered length of lunate</td>
<td>97.9 ± 4.85</td>
<td>91.6 ± 14.72</td>
<td>90 ± 13.43</td>
<td>&gt;0.05</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

There were a highly significant difference between subgroup Ia & Ic for all measurement (p<0.01). Also, a highly significant differences were, seen between subgroup Ia and Ib for all measurements except the carpal
glenoid sector and the covered length of lunate where (p>0.05). A regards the subgroups Ib & Ic, the significant differences were only found in the carpal glenoid sector, carpal index and covered length of lunate (p<0.01).

Fig. (2): Shows the radiological measurement in the subgroups Ia, Ib, Ic.

Table (3): Shows both wrist involvement in both of the studied groups according to S-S index (Walker and Griffith 1986) and (Larsen et al., 1977).

<table>
<thead>
<tr>
<th>Joint affected</th>
<th>Grade of involvement</th>
<th>Patients</th>
<th>Control</th>
<th>p. value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrist</td>
<td>No</td>
<td>No</td>
<td>p &lt;0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>10 27.8</td>
<td>30 100</td>
<td>p &lt;0.001</td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>12 33.3</td>
<td>0</td>
<td>p &lt;0.001</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>2 5.6</td>
<td>0</td>
<td>p &lt;0.001</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>4 11.1</td>
<td>0</td>
<td>p &lt;0.001</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>8 22.2</td>
<td>0</td>
<td>p &lt;0.001</td>
</tr>
</tbody>
</table>

The wrist joints were more involved among group (I) than group (II) with highly significant diff (<0.001).
**DISCUSSION**

*Jea-Martin & Charcot (1868)* was the first to describe an apparent cause and effect relationship between primary lesions of the central nervous system and subsequent arthropathy in patients with tabes dorsalis. So, this arthropathy commonly called a Charcot's joint, which is more correctly termed neuropathic arthropathy. This term implies that neurologic disease leads to basic bone abnormality and subsequent manifestations of obvious joint involvement (*Solbrig et al., 2000*).

Almost all studies on neurogenic arthropathy have been concerned with the weight-bearing joints which usually develop over a long period and called the hypertrophic type (*Midroni et al., 1995*). Non-weight bearing joints may be affected by neurogenic arthropathies with a less degree of involvement particularly the shoulder, wrist and elbow (*Nagano et al., 1989, Tatkow 1966 and Parker et al., 1986*).

The presentation of Hansen disease can be variable and the disease should be considered in any patient from an endemic country presenting
with a non-healing skin lesion. Lesions characteristically develop on the elbows, knees, or ears, where bacilli tend to live. Anesthetic lesions or enlarged nerves should heighten the suspicion for the diagnosis (Jacobson & Krahenbuhl 1999).

The radial physeal widening of distal radius, increased carpal index and the relative lengthening of the ulna with respect to the radius are considered secondary to the pressure exerted by the carpus on radius when gripping in a joint with impaired proprioceptive sensibility. This explains the observed differences observed between patients presenting with only sensory impairment and those with motor dysfunction, since the later cannot close the fist normally.

This agree with that reported by (Ranney, 1973) who stated that, in patients with impaired sensation the grip is tightened more than normal to insure that objects do not fall from the hand leading to greater pressure on the corpus. These changes were not seen in leprotic patients without neurological impairment (Ic). Suggesting that they are secondary to the sensory changes rather than the disease itself.

The decrease in the carpal glenoid sector and the increase in the carpal-ulnar distance and the covered length of lunate, are secondary to the widening and collapse of distal radius leading to displacement of the entire carpus towards the radial side.

As regards the elbow joint, the patients were presented with painful, warm and swollen joint suggestive of early infection as observed by (Jones et al., 2000). Who directed attention to the difficulty in separating the radiologic features of neuroarthropathy from that of local infection and they found infection in the contiguous soft tissues in most of their patients and postulated that Osteomyelitis contributed to the radiologic picture of neuropathic joint disease.

In contrast to the present study, Cole et al. (2001) found a non inflammatory transparent lemon-colored fluid containing blood or markedly xanthochromic also the culture and sensitivity was negative for
The radiologic picture of our patients was agreed with that observed by Schreuder (1998) who emphasized that, the bony margins produced by osseous fragmentation in neuropathic joint disease are well defined and sharp, in contrast to the "Fuzzy" bony contours that suggests the presence of infection or other inflammatory processes.

The radiologic appearance may be the first clue to the presence of neuroarthropathy. Subluxation, Para-articular debris and bony fragmentation which were observed in x-ray of our patient's elbow joint strongly suggest the diagnosis of neuropathic joint disease as reported by Ridley & Job (1985).

**Conclusion:**

We can conclude that the radio carpal joints may be affected by neuropathic arthropathy in leprotic patients with sensory impairment, allowing continued use of the joint which unable to sense. The clinical and radiological manifestations, however, may be less marked than in joints subjected to greater mechanical stress. These patients may benefit from the use of adaptive aids fitted to common items of daily use, thus preventing the overload on a joint with impaired sensibility.

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الكشف المبكر للإصابة المفصلية لمفصل الرسغ المتاثر عصبياً في
مرضى الجزام المصريين

هشام صلاح حمود، أشرف إسماعيل مصطفى، جمال عطية، شعبان صالح، وجمال الخشن

الجزام، هذا المرض الجلدي والعصبي المزمن يسبب هذا المكروب العصوي السريع
الحمضي الخلوي الملزم بميل إتجاه الخلايا الجلدية والعصبية.

أهداف البحث: تحرير التنبؤ المبكر لإصابة العصبية المفصلية للرسغ في مرضى
الجزام المصريين.

المريض: احتوت هذه الدراسة على 36 مريضاً بالجزام (26 ذكوراً و10 أنثى)
أعمارهم تتراوح من 15-60 عاماً بمتوسط (44.83±16.75) وحفر المريض تتراوح من 1-35
عاماً بمتوسط (15.70±4.70) بالإضافة إلى 30 شخص ضابط (22 ذكوراً و8 أنثى) أعمارهم
من 12-58 عاماً بمتوسط (32.03±11.99).

طريق البحث: أخذ التاريخ المرضي بعناية مع اتباع خاصٍ إلى التاريخ العائلي،فحص
عصبي وفحص رومانيزمي وفحص إشعاعي من كلتا مفاصل الرسغ، سرعة ترسيب، صورة دم
كاملة، عامل رومانوف، تحليل المعد والبول ووظائف الكبد والكلي.

النتائج: إن مفاصل الرسغ تشتترك إصابة في مجموعة المرضى إلى حد كبير بشكل
ملحوظ من المجموعة القياسية مع ميل أعلى إلى مرضى الضعف الحسي عن مرضى الضعف
الحركي.

الخاتمة: نحن نَميِّن أن نستنتج بأن المفاصل الرسغية الكعبري قد تؤثر عليها من قبل
الإصابة المفصلية العصبية في مرضى الجزام المصابين بالضعف الحسي.