'GROWING PAINS': A CLINICAL STUDY OF NON-ARTHRITIC LIMB PAINS IN CHILDREN

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(RECEIVED FOR PUBLICATION JULY 3, 1950)

There is no doubt that children suffer from limb pains more than adults. Since the most obvious difference between the child and the adult is the process of growth, it is hardly surprising that these pains have been dubbed 'growing pains'. An immediate objection is that the pains occur most commonly when growth is far from rapid: the years from 8 to 12, when the pains are most common, form, in fact, one of the 'filling-out' intervals between two of the three periods of rapid general and skeletal growth in childhood. A further criticism is that the commoner sites of pain do not correspond to the sites of maximal growth. Moreover, it appears improbable that pains as intermittent as those described could be related to a process as gradual as that of growth. The idea of any causal relationship between growth and limb pains has, however, never been clearly abandoned, even though many attempts in this direction have been made from time to time.

Fifty years ago childhood limb pains were considered to be a manifestation of the 'rheumatic process', and many otherwise healthy children suffered enforced confinement to bed because of the chance association of limb pains with an innocent cardiac murmur. In the period between the two world wars the pendulum swung the other way; an association between rheumatic carditis and growing pains was discounted, despite some suggested evidence to the contrary (Wilson and Kopel, 1926; Seham and Hilbert, 1933). This reaction, beneficial though it was, possibly accounts for the continued lack of recorded observations of children with limb pains.

A few studies have been made from the clinical aspect but have contributed little to our knowledge of the underlying processes. On the basis of haemoglobin, leucocyte, and sedimentation rate estimations and measurements of anti-streptococcal agglutinins (Seham and Hilbert), it has been postulated that the pains were due to an infective process, but this interpretation rests on evidence which does not appear to be statistically sound.

A newer conception, though one not widely accepted, is that these pains are psychologically determined, possibly as a 'dramatization of persecutions' (Winnicott, 1939), and similar but so-called rheumatic pains in adults have been attributed to psychological causes (Flind and Barber, 1945; Hench, 1948). Sheldon (1946) suggested that growing pains fell into two groups associated respectively with fatigue or with damp weather: this suggestion possesses the merit of attacking the prevalent conception that growing pains represent a single clinical entity.

The primary purpose of the work embodied in this paper was to obtain, by clinical enquiry and examination, basic data on limb pains in a school population. The data obtained were compared with those of a control group of children free from pains. The questions to which an answer was sought were: (1) Are persistent non-arthritis limb pains of childhood all of one type and aetiology? (2) What are the clinical associations of the separate types?

**Limb Pains in a School Population**

Criteria of Selection. At some time in their lives, for one cause or another, a large proportion of the child population suffers from limb pains. To exclude causes such as joint disease, trauma, occult infection, some criteria to warrant the grouping 'growing pains' or 'limb pains' are necessary. They must, to some extent, be arbitrary and personal. Those adopted in the present survey were a history of pains of at least three months' duration, not specifically located in the joints, and of sufficient severity to cause some interruption of normal activities.

Method of Assessment. All children, totalling 721, attending certain school clinics in Bristol for routine school examination were questioned, in a more or less identical manner and without being subjected to strong suggestions, regarding the occurrence of pains. Their mothers were also questioned on similar lines. Those children with a history satisfying the required criteria were examined at the time and
again subsequently and more fully. The selection of school clinics to be visited was made by the school health authorities with a view to giving us a wide geographical area of survey.

The assessment was lengthy and detailed, and was particularly directed to the following points.

**History of Pain.** A history of the duration, frequency, times of occurrence, fluctuations and degree of intensity, exciting and relieving factors was obtained.

**Family and Personal History.** This related to the occupation of the father (as a guide to economic status), family history of rheumatic and allergic disorders, position of the child in the family, and reaction to cold and damp.

**Mentality.** The assessment included school attainments, school and home behaviour. (Individual reports were obtained from the school authorities.)

**Examination.** This included weight and height, build, colouring, activity of sweat glands, limb circulation, posture, and muscle tone. The general physical examination was as complete as possible. The erythrocyte sedimentation rate was estimated (Westergren method) in just over half the cases. In cases where some specific disease process was suspected, a radiograph of the chest was taken, or a blood examination carried out.

**Controls.** Whenever a child with limb pains was selected, the next child due for routine examination was questioned and examined in a similar manner as a control.

**Limb Pains in Children referred to Hospital**

An additional group of 54 children, with limb pains as defined, were patients who had been referred to a hospital clinic by their own doctor, or by the school medical officer, on account of limb pains.

Before the data from this group could justifiably be compared with that already obtained in the school survey, it was necessary to determine whether the children in the two groups differed in any significant respect. Interrogation and examination were carried out on the lines previously described. Each child was examined by two doctors. It was found that the two groups were comparable: there was no significant difference between them as regards personal and family history or physical and mental attributes. This group was therefore incorporated with the previous group for analysis.

**Follow-up**

Between one and three years after the first examination, a questionary was sent to the parents of all the children examined, and 53 replies were received. Among these, 19 children were stated to have lost their pains; the remainder were examined again.

In the field survey concerning incidence, 30 children were found to be suffering from limb pains as defined; the data from six were insufficient for detailed study, and the following analysis is based on the information obtained from the remaining 24, together with 54 cases obtained from Professor Perry’s clinic. Three cases with associated physical disorders (see later) are excluded from the analysis.

**Results**

**Incidence.** Of 721 children questioned at routine school clinics in the Bristol area 30 were found to be suffering from limb pains as defined. The incidence was therefore 4.2% (S.E. = 0.75). The incidence in boys was 4.0%, and in girls 4.7%; the difference between these two proportions not being significant.

On splitting the sample population into two groups, those examined respectively in the first and second months of the investigation, it was found that the incidence in the two groups was approximately the same, and it is therefore concluded that the method of sampling was sound.

**Age Incidence.** A detailed analysis was not justifiable with the number of cases available, but the maximal incidence was found to fall between eight and 12 years.

**Associated Disorders.** In two cases an active primary tuberculous infection was present, in one of these limb pains preceding the occurrence of erythema nodosum by several months. In one case osteochondritis of the knee was diagnosed.

**Negative Findings.** As the basis for comparison the data derived from the control series previously described provided the standards of assessment, both for negative and positive findings. In the following there was no significant difference between the control group and those with limb pains: developmental progress, frequency of respiratory infections, liability to chilblains, numerical position of child in family, social or financial status, allergic disorders, congenital anomalies, complexion and colour, build, muscle and ligament tone, general nutritional state, limb circulation, degree of sweating, state of lymphatic glands, respiratory infection, joints, general systemic examination.

**Positive Findings.** The positive findings may be assessed under different headings.

**Family History of ‘Rheumatism’.** There was a family history of some rheumatic complaint in a striking number of the children with limb pains as compared with those in the control group.
### Table 1

**Incidence of Family History of Rheumatic Diseases in Children Attending School Clinics**

<table>
<thead>
<tr>
<th>Family History Positive</th>
<th>All Forms of Rheumatism</th>
<th>Acute Rheumatism</th>
<th>No Rheumatism</th>
<th>Total Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>3</td>
<td>1</td>
<td>27</td>
<td>30</td>
</tr>
<tr>
<td>Limb pain children</td>
<td>18</td>
<td>4</td>
<td>6</td>
<td>24</td>
</tr>
</tbody>
</table>

### Table 2

**Types of Family History of Rheumatic Diseases in All Children Studied**

<table>
<thead>
<tr>
<th>Pains predominantly nocturnal</th>
<th>No Relevant Family History</th>
<th>Acute Rheumatism Only</th>
<th>Growing Pains Only</th>
<th>Fibrositis, etc.</th>
<th>Multiple including Growing Pains</th>
<th>Multiple not including Growing Pains</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td>Pains predominantly diurnal</td>
<td>12</td>
<td>8</td>
<td>2</td>
<td>13</td>
<td>5</td>
<td>5</td>
<td>45</td>
</tr>
<tr>
<td>Both or incomplete data</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>12</td>
<td>5</td>
<td>19</td>
<td>12</td>
<td>7</td>
<td>75</td>
</tr>
</tbody>
</table>

### Table 3

**Relation of Occurrence of Pains to Recent Exertion in All Children Studied**

<table>
<thead>
<tr>
<th>Pains predominantly nocturnal</th>
<th>Unrelated</th>
<th>Doubtful</th>
<th>Related</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8</td>
<td>6</td>
<td>5</td>
<td>19</td>
</tr>
<tr>
<td>Pains predominantly diurnal</td>
<td>7</td>
<td>5</td>
<td>33</td>
<td>45</td>
</tr>
<tr>
<td>Both, or incomplete data</td>
<td>1</td>
<td>4</td>
<td>6</td>
<td>11</td>
</tr>
</tbody>
</table>

### Table 4

**Postural Abnormalities in All Children Studied with Diurnal and Nocturnal Pains**

<table>
<thead>
<tr>
<th>Pains predominately nocturnal</th>
<th>No Abnormalities</th>
<th>Doubtful</th>
<th>Abnormalities Present</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>16</td>
<td>1</td>
<td>2</td>
<td>19</td>
</tr>
<tr>
<td>Pains predominantly diurnal</td>
<td>19</td>
<td>3</td>
<td>23</td>
<td>45</td>
</tr>
<tr>
<td>Both, or incomplete data</td>
<td>5</td>
<td>2</td>
<td>4</td>
<td>11</td>
</tr>
</tbody>
</table>
Rheumatic disorders were taken to include rheumatic fever, arthritis, and so-called muscular rheumatism or fibrositis. Enquiry was made as to the experience of parents, grandparents, and siblings (Table 1).

In some instances several members of the family had suffered from such pains in childhood and from 'muscular rheumatism' in later life. There was, however, in most cases a distinction: those children with pains occurring mainly at night usually had relatives with a similar type of nocturnal pain, while those with pains occurring mainly by day gave a strong family history of diurnal 'muscular rheumatism'. An attempt has been made to separate these groups, and to clarify the type of 'rheumatism' on the evidence available (Table 2).

Effects of Exertion and Fatigue. In a fairly large number of children the pains were aggravated or brought on by exertion, or when the child felt tired. This occurred mainly among those complaining of pains in the daytime (Table 3).

Postural defects such as lordosis, pes planus, and scoliosis, were fairly common in these children (Table 4).

Emotional Abnormalities. In a few children there was an evident over-reaction to all forms of pain. Frequently this was accompanied by emotional instability, and the mother's emotional reactions were also excessive.

Other emotional disturbances were commoner in children with growing pains than in controls. Our assessment was made from three aspects. First, on the child's behaviour during interrogation and examination, and the mother-child relationship; second, on the mother's testimony as regards behaviour, including a comparison with other members of the family; third, on a school report obtained specially for the purposes of the investigation. The mother was asked about the occurrence of enuresis, nightmares, irritability and timidity, and the child questioned about his interests, hobbies, and opinions. The school authorities were asked to report on the child's intellectual attainments, position in class, regularity of attendance, and relations with other children. Usually all three were in agreement, but in a small proportion of cases the child was almost too well-behaved at school and seemed to 'have his fling' when he was at home.

Where subjective phenomena are being considered, and where evidence is collated about past events, often at secondhand, it would be unsound to attempt a detailed analysis based on the results, nor do the conclusions lend themselves to statistical treatment. Nevertheless, certain impressions were obtained which assist in a broad classification of the cases. Minor nervous troubles were commoner in children with limb pains than in the controls. The children were frequently irritable, nervous, afraid of the dark; not uncommonly they suffered

### Table 5

<table>
<thead>
<tr>
<th>Emotionally Stable</th>
<th>Doubtful</th>
<th>Emotionally Unstable</th>
<th>Total Analysed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>24</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>Limb pain children</td>
<td>12</td>
<td>6</td>
<td>24</td>
</tr>
</tbody>
</table>

### Table 6

<table>
<thead>
<tr>
<th></th>
<th>Emotionally Stable</th>
<th>Doubtful</th>
<th>Emotionally Unstable</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pains predominantly nocturnal</td>
<td>11</td>
<td>4</td>
<td>4</td>
<td>19</td>
</tr>
<tr>
<td>Pains predominantly diurnal</td>
<td>16</td>
<td>10</td>
<td>19</td>
<td>45</td>
</tr>
<tr>
<td>Both, or incomplete data</td>
<td>6</td>
<td>4</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Totals</td>
<td>33</td>
<td>18</td>
<td>24</td>
<td>75</td>
</tr>
<tr>
<td>(including 4 backward children)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td>24</td>
<td>2</td>
<td>4</td>
<td>30</td>
</tr>
</tbody>
</table>
from bad dreams, nightmares, nocturnal enuresis, or tics. We have not attempted a classification of psychological disturbances, though this theme was so frequently apparent, but a broad separation of those children considered emotionally stable or unstable shows a predominance of disturbances in those with limb pains (Table 5).

The separation of children with pains either predominantly diurnal or nocturnal gives the impression that emotional disturbances are more commonly associated with diurnal pains (Table 6).

**Discussion**

**Incidence of Limb Pains.** The age and sex incidence in the present series are in agreement with those recorded by other workers. Two comments are worth making: first, that the maximum incidence falls in a period when growth is relatively slow; and secondly, that similar pains, when they occur in adult life, are then attributed either to 'rheumatism' or to psychological disturbances (Flind and Barber, 1945). For these and other reasons the term 'growing pains' is obviously inaccurate and should be discarded; we prefer the less specific term, 'limb pains'.

The numerical incidence previously found has varied greatly, the highest recorded incidence being 50% (Williams, 1928). The marked discrepancies illustrate to some extent the differences in criteria; our own figure of 4.2% is lower, largely because of the more stringent criteria employed. If all cases with transient, mild, and nondescript pains had been included, the incidence in the present series would have been rather more than twice as high. The difficulty of selection, for example, of a child who had had one or two twinges of mild pain a year previously, appeared insuperable, and indicate that some such criteria as we adopted are essential for any valid study.

Within the limits obtaining at primary schools, economic factors appeared not to play any appreciable part in the pathogenesis of the pains, but it may be that other factors, such as climate, which could not be estimated in a local survey, are of importance.

**Underlying Organic Disease.** The exclusion of cases with demonstrable underlying organic disease is clearly essential in the investigation of children with limb pains. One of the well-recognized causes of vague limb pains is occult infection, and the two cases of active primary tuberculosis in the present series come into this category. The majority of such can be eliminated if a duration of, say, three months, is one of the criteria imposed for the selection of cases. Satisfactory weight progress will also help in elimination, and estimation of the E.S.R. provides further assistance.

In cases without demonstrable organic disease the E.S.R. appears to provide negative evidence. Westergren's method was used to measure the E.S.R. in just over half the children with limb pains. As many estimations were made as were feasible, but no good method of sampling was employed and, consequently, the results are of little value. Of 26 estimations on children with diurnal pains the mean reading was 6.2 mm. ± 1.7 mm.; of eight children with nocturnal pains the mean reading was 8.5 ± 5.5 mm., and of five other children whose pains were not easily classified the mean reading was 5.8 ± 2.3 mm.

In the present series, only three cases with organic disease were found, but other causes of long-standing limb pains which we have encountered on occasion include leukaemia, coarctation of the aorta, auricular septal defect, food sensitivity, and asthma. The much more frequent association with postural defects is better known.

No relationship to rheumatic fever was established in our series. Only one child had a history of rheumatic fever, occurring as an episode during long-continued limb pains. In the Bristol area, from which our cases were drawn, all children with acute rheumatism (or chorea) are referred to Professor Perry's clinic; the fact that no such event occurred among the cases with limb pains, over a period of two to four years, therefore, appears significant. Sheldon (1946) found that of 189 children under observation for four years with 'growing pains' only two developed rheumatic fever. On the other hand, he noted also that of 266 children with rheumatic heart disease 52 gave a history of preceding pains. It may be that in the latter group occult, repeated upper respiratory infection plays a part in the production not only of heart disease but also of the limb pains.

**Special Times of Occurrence.** Limb pains appeared to occur at all times of the year, though more frequently in the winter. As far as could be ascertained, they occurred in holiday time as well as in term time.

**Site of Pains.** In two-thirds of the cases pains occurred only in the lower limbs; in no single instance were they confined to the arms alone. In one-third of the cases they occurred variably in arms, legs, and possibly the trunk. Those pains occurring solely at night were almost exclusively confined to the lower limbs. The pains were located in muscles, and close questioning of the child left no doubt that joints were unaffected.

**Types of Pain.** We have divided the types of pain into three groups.
GROUP 1: ILL-DEFINED PAINS. In a few children there was no clear-cut distinction between diurnal and nocturnal pains, and in these the pains tended to be vaguely distributed in the limbs and the body.

GROUP 2: DIURNAL FATIGUE PAINS. In the largest group, 45 cases (64% of), the pains were predominantly diurnal. They varied in severity and frequency but were most troublesome after heavy exertion; often they brought the child in from play, but sometimes the onset of pain was delayed until late evening. Nearly always they occurred in the legs and feet. Several associations were clearly evident: postural defects were common, emotional disturbances were frequent, and there was usually a strong family history of 'rheumatic' disorders.

In a small and distinct sub-group there was a pronounced over-reaction to all forms of pain.

GROUP 3: PAROXYSMAL NOCTURNAL PAINS. In 19 children (27% of) the pains were predominantly nocturnal. On the uncommon occasions when pain occurred in the daytime it was rapid in onset and severe, but lasted only a short time. At night the child would awaken with pains in the shins, calves, and thighs, and attacks might occur on several successive nights. The pain tended to be severe for a few minutes, then faded slowly, and after an hour or so the child would fall asleep again. Rubbing the legs was comforting, but gave no real relief. During the next day the limbs were sometimes said to be heavy. Most mothers and children agreed that the pains were commoner in wet or cold weather, but occasionally they occurred during the warm summer months. The only other common association was a history of 'growing pains' in other members of the family. There was no apparent relation to exertion and fatigue or faulty posture; emotional disturbances were distinctly less common than in groups 1 or 2, though probably commoner than in the control group.

We are indebted to a medical colleague for a graphic description of the pain. It first developed when she was 9 years old, and woke her up about two hours after she had gone to sleep. The pain was excruciating and was located chiefly in the thighs and shins. The pain lasted in severe form for somewhat over ten minutes, and was not really eased by rubbing although she found this a comforting procedure. She was sufficiently free of pain after an hour to go to sleep again, but next morning her limbs felt tired and heavy. Bouts of pain only occurred in the winter, and even then there would be intervals of freedom lasting a month or so. At the worst, the pains would occur about once every other night. The attacks of pain gradually became less frequent, and ceased after the age of 12 which, incidentally, was the time when she first began to grow rapidly.

Aetiology. Flind and Barber (1945) have discussed the psychogenic basis of some so-called rheumatic pains in adults, in whom symptoms may date from childhood. The small number of children in our group 1 appear to fall into this category. In the remaining cases there appeared, as a recurring theme, a suggestion of emotional disturbances, but so different were the relative incidence and the associated factors that a purely psychogenic causation appears untenable. Sheldon (1946) has separated growing pains into two groups, associated respectively with fatigue and damp; his two classes show a rough correspondence with our groups 2 and 3, but the additional features which became apparent during the course of our investigation appear of prime importance.

In the group of diurnal pains the trigger effect of exertion, possibly superimposed on faulty posture, should be correlated with the high incidence both of emotional disturbance in the child and of 'rheumatic' disorders in the family. It is speculative but tempting to suggest that the family history of rheumatism is merely another facet of a familial tendency to emotional disorders, but we have no evidence to support this. It does, however, appear possible that with a background of emotional disturbance or familial predisposition, whether inherited or not, a degree of exertion or faulty posture, which in the normal child would produce no untoward effects, may result in limb pains.

The characteristics of the nocturnal pains appear quite distinct from those already described. Again, in this group the incidence of emotional disturbances was slightly higher than in the controls, but in this group the difference was not statistically significant. The associations with 'growing pains' in other members of the family on the one hand, and with cold and damp on the other, might be due to an abnormal familial response to atmospheric conditions, but positive evidence on this score is lacking. It is believed that cramp runs in families, and the characters of the nocturnal paroxysmal pains described are reminiscent of such occurrences.

The evidence from these studies suggests that limb pains, even when manifest organic disease has been excluded, comprise more than one single clinical entity. That an important part is played by psychological factors is clear, but it is only one facet of the problem. Investigations confined to the child alone are unlikely to be productive of further information; parallel data are required regarding familial responses to atmospheric changes, and the familial relationship, if any, between pain and psychological aberrations.
By sampling, the incidence of persistent non-arthritic limb pains in the Bristol school population was found to be 4·2%. It was approximately equal in boys and girls, and the maximum incidence lay between 8 and 12 years of age.

By comparison with controls, a family history of rheumatic disorders was found to be significantly commoner in children with such pains. Minor emotional disturbances also appeared to be common, especially in certain groups.

The majority of children with limb pains fell into one of two groups. 'Diurnal fatigue pains' occurred in children in association with exertion, fatigue, and postural defects. In this group emotional disturbances were very common, and there was a strong family history of rheumatic disorders. 'Paroxysmal nocturnal pains' occurred in children who were more stable emotionally but who came from families in whom similar pains were common. A small group of children had pains apparently of psychological origin without other associations.

Only in rare instances was any underlying organic disease present.

The term 'growing pains' should be discarded since the pains have no demonstrable connexion with growth.

We are very grateful to Professor R. H. Parry, the Medical Officer of Health for Bristol and to Dr. A. L. Smallwood for making the school investigation possible; to Drs. J. Benn, H. R. E. Wallis, and J. A. Cosh for their generous help on many occasions; and to Professor C. Bruce Perry for allowing us to study the 54 clinic children with limb pains.

REFERENCES