Growing Pains: A Study of 30 Cases and a Review of the Literature

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Background: Data from the literature regarding the clinical profile of growing pains are limited. The purpose of this study was to define the clinical features, familial history, laboratory findings, and therapeutic outcome of growing pains in children.
Methods: Thirty children (18 male and 12 female; 3 to 14 y of age) who presented with growing pains between January 2006 and December 2007 were enrolled and prospectively followed up for 1 year. The inclusion criterion was lower extremity pain, which was recurrent and lasted for > 3 months. The exclusion criteria were any abnormal systemic or local symptoms and signs, joint involvement, and limp or limitation of activity. Laboratory tests, including complete blood count, erythrocyte sedimentation rate, and serum calcium and phosphorus levels, were performed in all children.
Results: The study group had pain during the night and afternoon in 43.3% and 56.7% of cases, respectively. Both lower limbs were involved in 80% of cases, causing awakening and crying episodes in 40% and 37% of cases, respectively. The frequency of pain was as follows: daily, 5%; weekly, 45%; monthly, 35%; and every 3 months, 15%. The pains were relieved by massaging the affected site in 95% of cases and by analgesics in 5% of children. A family history of growing pains was positive in 20% of patients. All patients had laboratory tests within normal values.
Conclusion: Growing pain is a frequent noninflammatory syndrome consisting of intermittent, often annoying, pains that affect the lower extremities of children. Clinical diagnosis is easy if precise inclusion and exclusion criteria in the history and physical examinations are strictly followed. Patients and family reassurance is mandatory.
Level of Evidence: This is a Level I prospective study.

Key Words: pain, lower limbs, non inflammatory pain syndrome, cramping muscle

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Growing pains (GPs) first appeared as a described entity in the medical literature in 1823 after the observations by the French physician, Marcel Duchamp.[1] Although they have been the topic of many reports since that time,[1–28] and despite being a frequent pediatric clinical presentation, GPs remain largely misunderstood, and as a result are poorly managed.

Studies on the prevalence of GP have yielded a wide range of estimates (6% to 49.4%).[6,29] Poor sampling, disparate age ranges, and undefined, variable criteria account for much of the latitude.[18] A relevant study established the prevalence of GPs in children 4 to 6 years of age as 37%.[8]

The etiology of GP remains uncertain, with the following 3 different theories purported: fatigue, anatomic, and psychological.[11] None of these theories have been proven.

The aim of this study was to gain a better understanding of the characteristics of GP in children by describing the clinical features, familial history, laboratory findings, spectrum, and therapeutic outcome of 30 patients with GP seen and followed in our institution.

METHODS

All consecutive children who presented with GP between January 2006 and December 2007 to the Department of Orthopaedics of the University of Catania (Italy) were prospectively enrolled. GP was diagnosed in the presence of lower extremity pains, which were recurrent, but intermittent and lasted for > 3 months. The exclusion criteria were the presence of the following: (a) any abnormal systemic or local symptoms and signs, including fever and malaise; (b) localizing signs, including tenderness, swelling, erythema, and warmth; (c) joint involvement, including swelling, pain, erythema, and warmth; and (d) limp or limitation of activity. Clinical data were obtained through personal interviews with parents and/or patients and physical examination. All children underwent a full laboratory examination, including complete blood count, erythrocyte sedimentation rate, creatine kinase, serum calcium and phosphorus levels, alkaline phosphatase activity, rheumatoid factor titer, and when necessary, x-rays. All children were reevaluated after 1 year of follow-up.

RESULTS

Overall, the study group consisted of 30 children (18 male and 12 female; age range, 3 to 14 y; mean age, 8 y).

The mean duration of the pain was 10 to 30 minutes. The frequency of pain was as follows: daily, 5%;

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weekly, 45%; monthly, 35%; and every 3 months, 15%. Thirteen patients (43.3%) had pain at night, whereas 17 patients (56.7%) had pain in the afternoon.

The sites of involvement were the shins and thighs in 75% of cases, undefined in 20%, and calves in 5%; the sites of involvement were unilateral in 15% of cases, bilateral in 80%, and undefined in the remaining 5%. The GPs caused awakening and crying episodes in 40% and 37% of cases, respectively. The GPs were associated with physical activity in 20% of cases.

Massaging the affected site in most of the cases relieved the pains; it was necessary to use an analgesic on occasion in 5% of cases.

A family history of GP was positive in 20% of patients.

All patients had laboratory tests within normal values; it was not necessary to perform imaging studies.

After 1 year of follow-up, all GPs had resolved.

DISCUSSION

The most common cause of childhood musculoskeletal pain is GP, which exemplifies a type of noninflammatory pain syndrome.[27] GPs mainly affect children between 4 and 14 years of age. GPs are usually nonarticular, in 2/3 of children GPs are located in the shins, calves, thighs, or popliteal fossa, and GPs are sometimes bilateral, but often the site is undefined. The pain usually appears late in the day or at night, often awakening the child. The duration of GP ranges from minutes to hours. The intensity of GP can be mild or very severe. By morning, the child is almost always pain free. There are no objective signs of inflammation on physical examination. GP is episodic, with pain-free intervals from days to months. In severe cases, the pain can occur daily.[27] No clear mechanism has been identified that explains GPs, but there is an increasing body of evidence indicating that several factors, individually or in combination, might be responsible for this phenomenon, including mechanical factors, such as joint hypermobility and flat feet, decreased pain thresholds, reduced bone strength, and emotional factors involving the patient's family and other social stressors.[11,18]

In this series of 30 children, GPs presented with a frequency ranging from daily to every 3 months. In all cases, GPs were located in the lower extremities, appeared at night or in the afternoon, and were associated in 20% of cases with physical activity. Indeed, GPs have recently been considered a relative local overuse (stress) syndrome, and may be associated with decreased bone strength and a lower pain threshold.[12] In evaluating this theory, Friedland et al[12] recently measured the bone speed of sound by ultrasound in 39 children with GPs and found that the bone strength density of children with GPs was significantly less than values for population norms of healthy children, especially in the painful tibia region. The same group assessed the pain threshold by dolorimeter in 44 children with GPs and found that children with GPs have a decreased pain threshold compared with age and sex-matched controls.[15] In a subsequent study, the same authors examined the 5-year outcome of these children with GPs and the association with changes in pain threshold, showing that those with continued GPs had significantly lower thresholds than controls and patients with resolved GPs.[28] Thus, GPs may be considered a noninflammatory pain amplification syndrome in early childhood.[25,28] Further, GPs may represent a local lower extremity overuse syndrome with bone fatigue in children with low pain thresholds.[27] However, relative overuse can help explain late day pains, this theory cannot explain all features of GPs, such as the abrupt nocturnal episodes of pain or pain in the upper extremity in some patients. The sudden onset and severity of GPs, and the transience of the attacks, support the hypothesis that GPs have a vascular perfusion component, similar to migraines.[18] Furthermore, a higher prevalence of GPs was found among children with migraine headaches.[27] However, when Hashkes et al[16] evaluated perfusion changes by comparing the ratio of the blood phase of the bone scan to the static phase, they did not find differences between children with GPs and children who underwent bone scans for other reasons.

In addition, anatomic/mechanical factors may be involved in the pathogenesis of GPs.[27] Many clinicians have an impression that many children with GPs are hypermobile. This association, if true, may explain GPs either as a direct consequence of an increased activity as part of the hypermobility syndrome or as a condition of fibromyalgia (associated with hypermobility), thus resulting in pain from a low pain threshold.[13] Other mechanical issues include flexible flat feet with hindfoot valgus. This mechanical instability might be a cause of GPs in some children. In one small, controlled trial, shoe inserts were effective in reducing the frequency and severity of GPs.[7] However, in a recent study, Evans and Scutter[10] compared findings of foot posture and functional health in children and they did not find any correlation, thus not supporting the anatomic theory.

There is no evidence that GPs are actually associated with rapid growth,[18] as originally thought.[22] The mean age of onset of GPs in our series (approximately 8 y) confirms data in the literature, and is usually not part of the child's rapid growing phase.

The emotional or psychological theory was introduced in 1951 and has been further cited and addressed as a possible causative factor by many investigators since that time. Naish and Apley[21] assumed that emotional disturbances are more common in children with GPs, and that recurrent abdominal pain, headaches, and extremity pains are a group of pain syndromes expressing a reactive pattern to familial emotional disturbances. In a study by Oberklaid et al[23] children with musculoskeletal pains (without the homogenous criteria of GPs) were often rated by their parents as having different temperamental and behavioral profiles than healthy controls, suggesting a psychosocial contribution to their pain, similar to that seen with other pain syndromes, such as recurrent abdominal pain. In others studies, the family environment

and psychological distress were also found to contribute to the development of musculoskeletal pain syndromes.[24]

GPs are real and can be very distressing. In this study, GPs were so severe that they made the children cry in 37% of cases. Uziel et al[28] evaluated the quality of life, depression, and anxiety levels in parents of children with GPs and found that the level of depression of the parents was similar to other noninflammatory pain syndromes, with mothers having an increased level of depression. Parents of children with GPs and children without pain had similar quality of life scores, which is not surprising considering the episodic nature of GPs.[28]

In our series, a positive family history of GPs was recorded in 20% of cases, which was less frequent compared with data reported in the literature, with affected children having either a parent or sibling with GPs in nearly 70% of cases.[9]

Increased levels of lead, zinc, and decreased levels of copper and magnesium have been detected in the hair of children with GPs, but the usefulness of the analysis of elements in hair remains controversial and has yet to be validated.[17]

In our series, laboratory tests were within normal values in all children. There is no single diagnostic test for GPs, and as a result, GPs continue to be diagnosed on the basis of both inclusion and exclusion criteria.[4,25] Misdiagnoses of children with less common, but potentially more serious conditions, including rheumatoid arthritis (articular pain) or bone tumors (unlikely to be bilateral occurring at night) are unlikely if these criteria are adhered to and can be investigated further with blood analyses and imaging, if suspected. A common condition, which often is misinterpreted as GP is muscle cramping, although the absence of palpable/visible hardening of muscle usually seen with cramps, the different sites and duration of pain may help in the differential diagnosis. A recent, matched case control study concluded that GP remains a clinical diagnosis and if precise inclusion and exclusion criteria are considered, there is no need for laboratory tests to establish a diagnosis.[4] It is important to emphasize that GP is a diagnosis of exclusion and all other causes of such painful episodes should be considered and ruled out.

In this study, GPs were relieved by massaging the affected site in most of the cases, and by analgesic in 5% of children, less frequently than that reported in the literature (ie, 52%).[15] The literature is replete with many unfounded treatments of GP including, vitamins C and D, magnesium, calcium, and reassurance.[18] Clearly, the first line treatment for GPs should be that supported by evidence in the form of a muscle stretching program for the quadricep, hamstring, and tricep surae groups.[18] Some children need to chronically use medications, especially acetaminophen and nonsteroidal anti-inflammatory drugs.[15] Occasionally, nighttime use of a long-acting analgesic, such as naproxen, may prevent episodes and can be used on days when parents predict an episode may occur or daily in children with frequent awakenings.[18] Other interventions shown to be effective in small, controlled studies include in-shoe inserts, such as triplane wedges or orthotics, especially in children with pronated foot posture, and a muscle stretching exercise program.[7] In our experience, no child was submitted to any prophylactic treatment, and all GPs remitted after 1 year of follow-up.

The natural history is benign with disappearance of most attacks of pain by adolescence.[11,18] In the recent study by Uziel et al,[28] the 5-year follow-up of children with GPs showed that GPs resolved in slightly $> 50\%$ of the patients and improved in nearly all of the other patients, with less frequent episodes, less use of analgesics, and fewer school absences related to pain. However, it is not clear whether some of these children develop symptoms of other noninflammatory pain syndromes. It would be important to progressively follow the pain thresholds of children with GPs and to correlate the findings with the symptoms. In our opinion, almost all of children with GPs have a benign course and do not need any pharmacologic, behavioral, or mechanical prophylactic therapy.

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