

Growing Pains: Practitioners' Dilemma

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Need and Purpose of Review: Though cases of 'growing pains' are quite common in pediatric practice, very little attention has been given to it, even in the standard text books. The resultant confusion among practitioners regarding diagnosis and management of this condition needs to be addressed.

Methods used for locating, selecting, extracting and synthesizing data: PubMed search was performed using "growing pains" [All Fields] AND (("child"[MeSH Terms] OR "child"[All Fields] OR "children"[All Fields]) AND ("pediatrics"[MeSH Terms] OR "pediatrics"[All Fields] OR "pediatric"[All Fields])). Types of articles included are Review articles, Systemic Reviews, Randomized Controlled Trials, Practice guidelines and Observational studies. Google Scholar was also searched using the term "Growing pains in children". Relevant articles not included in the PubMed results were selected. Reference lists of selected studies were also screened to identify additional studies.

Main conclusions: A fairly accurate diagnosis of 'growing pains' can be made clinically, if the widely accepted diagnostic criteria are followed. A systematic approach, with due consideration of both inclusion as well as exclusion criteria, can avoid unnecessary (sometimes potentially harmful) investigations and medications. Reassurance remains the main stay in the management of 'growing pains'.

Keywords: *Diagnosis, Growing pains, Musculoskeletal pain, Management, Recurrent limb pains in childhood.*

Most pediatricians and general practitioners – in their day-to-day office practice – often come across children complaining of pain in their legs. These pains may sometimes point to serious underlying conditions such as malignancies, infections or injuries. However, majority of the cases may be due to 'growing pains', that have a benign and self-limiting course [1].

Growing pains, though considered benign, can cause considerable anxiety in the parents. Sometimes, the child wakes up in the middle of night with extreme agony, complaining of severe pain in the legs. There are no symptoms in the morning and pediatrician finds no abnormality on physical examination [2]. The pediatrician may be in a dilemma; should parents be simply reassured or the child has to be investigated thoroughly?

This article reviews the current knowledge regarding the diagnosis, etio-pathogenesis and management of this fairly common but perturbing condition.

DIAGNOSIS

Growing pains are typically intermittent, nocturnal and poorly localized, usually occurring once or twice per week - though there is never a regular pattern. Children suffering from 'growing pains' are characteristically well without any physical problems, despite severe pain

experienced in the night. Night awakenings are common but not an essential feature. The usual age group is 4-14 years with equal gender preponderance [1-3]. The diagnostic criteria given by Naish and Apley [4] are: intermittent lower limb pains for at least 3 months duration, not specifically located in the joints, and of sufficient severity to interrupt sleep. The definition provided by Peterson [5] guides clinicians better, and has several inclusion as well as exclusion criteria (**Table I**). Growing pains is essentially a clinical diagnosis and laboratory investigations or X-rays are unnecessary [2,6,7].

DIFFERENTIAL DIAGNOSIS

Though diagnosis of growing pain seems easy; there may be a danger of over-diagnosis, if leg pains due to other conditions are not kept in mind [5,7,8]. Entities mimicking growing pains may be grouped under five broad headings (**Box I**) as follows:

Injury related leg pains: History is obvious, if there is any trauma, and usually the pain is localized. However, history may not be that obvious in cases of non-accidental trauma or Battered child syndrome; presence of injuries of different ages and their inappropriate explanation may be the clue. Osgood-Schlatter disease is characterized by pain over the tibial tubercle, usually in athletes and more common in boys between ages 10-15 years.

TABLE I DIAGNOSTIC CRITERIA FOR GROWING PAINS

<i>Characteristics of pain</i>	<i>Inclusion criteria</i>	<i>Exclusion criteria</i>
Frequency and duration	Intermittent pains once or twice per week, rarely daily, totally pain free in between the episodes; individual episodes lasting for 30 min to 2 hours	Pain, that is persisting or increasing in severity with time
Site	Usually in the muscles of calf, sometimes anterior thigh muscles, shins and popliteal fossa and affects both limbs	a) Pain involving joints b) Pain occurring only in one limb
Time	In the evening and nights	Daytime pain and Nocturnal pain that persists till next morning
Physical examination	Normal	Signs of Inflammation

Chondromalacia Patella or idiopathic adolescent anterior knee pain syndrome (also known as Runner's knee), on the other hand, commonly affects adolescent girl athletes doing a lots of running [8].

Infections: There are usually systemic features such as fever and toxicity. Localized tenderness, swelling and erythema at the site of pain may be found on examination.

Tumors: Benign tumors, which produce pains in leg, are usually associated with swelling and are well localized. Pain in Osteoid osteoma can cause night awakening, but it

is persistent and gradually increasing in severity as opposed to intermittent painful nights in growing pains [9].

Malignant tumors that can cause leg pain are associated with systemic features such as fever and weight loss. Osteosarcoma can present with deep bone pain with night awakening, but there is usually a palpable mass [8].

Slipped capital femoral epiphysis may present as knee pain due to referred pain along the course of obturator nerve. Usually, patients with this disorder have some limp and have externally rotated lower limb and restriction of movements at hip [9].

Hypermobile joints can produce knee pain, that is worse after activity and relieved by rest. Hypermobile joints have abnormally increased range of motions and may be assessed with the Beighton scale [8].

Legg-Calve-Perthes disease may present as referred pain in knee, but there is usually associated limp and restriction of movements in hip. Osteochondritis dissecans often presents with vague knee pain. However, localized tenderness over medial femoral condyle may be elicited on careful examination. The leg pain in sickle cell anemia is persistent in nature. Other characteristic features of sickle cell anemia will be difficult to miss by careful history and physical examination.

There are two major forms of Amplified Musculoskeletal Pain Syndromes (AMPS); Diffuse AMPS and Localized AMPS [8]. Diffuse AMPS, also known as Juvenile primary fibromyalgia syndrome (JPFS), reveals well defined tender points, and usually affects older child or adolescent with a female preponderance. These children look debilitated; have disturbed personality and daytime symptoms [8]. Localized AMPS, also known as Complex regional pain syndrome (CRPS), is characterized by ongoing burning

BOX I DIFFERENTIAL DIAGNOSIS OF GROWING PAINS
<i>Injury related</i> Inflammation of Soft-tissue or bone due to sports injuries or accidental injuries or battered child syndrome, Osgood-Schlatter disease, Chondromalacia Patella
<i>Infections</i> Osteomyelitis, Septic arthritis, Cellulitis and soft tissue abscess
<i>Tumors</i> <i>Benign:</i> Osteoid osteoma, Unicameral cyst, Fibrous dysplasia, Aneurismal bone cyst, Giant cell tumor, Histiocytosis X and Osteochondroma, <i>Malignant:</i> Osteosarcoma, Ewing's sarcoma, Leukemia and neuroblastoma
<i>Developmental and Congenital</i> Slipped capital femoral epiphysis, Hypermobile joints, Limb deformities such as genu valgum, flat foot, Discoid lateral meniscus, Patellar subluxation
<i>Others</i> Legg-Calve-Perthes disease, Osteochondritis dissecans, Sickle cell crisis, Amplified musculoskeletal pain syndromes, Restless leg syndrome, Juvenile idiopathic arthritis

pain in leg subsequent to an injury or other noxious event. Other characteristic features include allodynia, hyperalgesia and autonomic dysfunction [8].

Restless leg syndrome (RLS) may sometimes be confused with growing pains as both these conditions tend to manifest during the evening hours and are related to discomfort in the legs. However, the uncomfortable feeling in the legs in RLS is associated with an irresistible urge to move the legs, worsened by rest and relieved by movements such as walking or stretching (only as long as motion continues) [10,11]. Juvenile Idiopathic Arthritis may present as leg pains initially, where minimal joint involvement may be missed. The key here is the persistent nature of pain and morning symptoms [9].

Presence of following Red flag signs in a child with leg pain should alert a clinician for further investigations [8,9]: (i) involvement of joints, (ii) systemic involvement, (iii) persistent pain or daytime pain or pain that is localized, and (iv) limping.

PREVALENCE AND NATURAL HISTORY

It is believed that growing pains affect about 10-20% of children [1]. Estimated prevalence ranges from 2.6% to 36.9%. This is mainly due to different and unspecified sample sizes, different age ranges in the literature, and lack of objective diagnostic criteria adopted in different studies [4,12,13].

Abu-Arafah and Russell determined the prevalence rate to be 2.6%, among school children aged 5-15 years [14]. Evans, *et al.* [12] estimated the prevalence of growing pains among children aged 4-6 years to be 36.9%, in a well-designed sample using a validated questionnaire. A relatively recent study by Kaspiris and Zafiropoulou [15] reported a prevalence of 24.5% among 532 children of age 4-12 years.

Growing pains is the most common cause of recurrent musculoskeletal pain in children [1]. Two recent studies reported that most of cases of unexplained recurrent limb pains in children could be classified as growing pains [16,17].

Usually, there is a gradual decline in the frequency of pain episodes over a period of 1 to 2 years and most cases of growing pains resolve by adolescence [18]. Uziel, *et al.* [19] reported persistence of growing pains in 18 out of 35 cases in 5-year follow up, though the episodes became less frequent and milder. However, more recently, Pavone, *et al.* [20] reported resolution of all pain episodes of growing pains after 1 year, in all 30 cases.

THE TERMINOLOGY

The terminology growing pains is being used since 1823,

since the condition was first described in medical literature by French physician Marcel Duchamp as *Maladies de la Croissance* (pains of growth) [21]. Many authors have raised objections and questioned the validity and rationale of the term [5]. Clearly, these pains cannot be attributed to growth. Peak age for growing pains (4-8 years) corresponds to the relatively slower growth period of childhood. Moreover, the sites of pain (diaphyses) do not match the site of maximal growth (epiphyses) [4]. Besides, no difference of rate is seen between the children with and without growing pains [13]. Thus the term growing pains appears to be a misnomer; there is no evidence that growth *per se* can cause pain. Alternative terms such as 'paroxysmal nocturnal pains' [4] and 'recurrent limb pains in childhood' [14] have been suggested. However these terms are non-specific and describe the disorder incompletely. The terminology *Benign idiopathic paroxysmal nocturnal limb pains of childhood* [9] perhaps describes the condition properly, but sounds too long and inconvenient for general use. On the other hand, the term growing pains has the advantage of emphasizing the benign nature of the disease and indicates that the pain occurs in the growing children, and not after growth is complete [5]. Thus, despite the controversy, the term growing pains enjoys wide acceptance and popularity [22].

ETIO-PATHOGENESIS

In the 19th century, at the time when the term Growing pain was coined, growth was considered to be the causative agent of nearly all pains during the childhood [7]. By early 20th century, medical community believed that growing pains were actually a sub-acute form of rheumatic fever, [7,23]. Studies of Sheldon in 1936 and thereafter Hawksley in 1939 proved that growing pains are not associated with rheumatic fever [24,25].

The exact mechanisms, by which these pains occur, are still poorly understood. Some of the theories, put forward to explain the etiology of 'growing pains', are summarized below [2,3]:

Anatomical/mechanical theory: Hawksley observed that growing pains were often associated with postural or orthopedic defects such as flat foot, knock-knee, scoliosis or bad stance [25]. Mechanical instability such as flexible flat feet with hind foot valgus had been suggested as a cause of growing pains [20]. A small controlled study reported that shoe inserts were effective in reducing the frequency and severity of growing pains [26]. However, subsequent study by the same author did not find any association between foot posture and growing pains [27]. A cross sectional study [28] reported a statistically significant association between joint hyper-mobility and

growing pains. Some cases of growing pains occurring after increased activity may be explained by hypermobile joints. However, due to absence of universally reliable and valid assessment tool for hyper-mobility in children, the notion of hyper-mobility causing growing pains remains largely unproved [3].

Fatigue theory: It was observed that bone strength (based on speed of ultrasound in tibia), in children with growing pains, was significantly lesser than in controls [2]. Often episodes of growing pains are reported on days of increased activity and during the latter part of a day. These observations probably signify that growing pains represent, a *local overuse syndrome* leading to bone fatigue [7].

Psychological theory: John Apley (1951) found emotional disturbance and family stress to be associated with ‘growing pains’ [4]. His famous saying “*physical growth is not painful, but emotional growth can hurt like hell*” often gets quoted [29]. Oster (1972) also showed that psychogenic abdominal pains and nervous headaches are more often found in children with growing pains than in otherwise healthy children [13].

Lower pain threshold: Haskes, *et al.* [30] have recently shown that children with growing pain have decreased pain threshold when compared with the age- and sex-matched controls. They suggested that ‘growing pains’ may represent a form of non-inflammatory pain amplification syndrome. This was further supported by the findings of Uziel, *et al.* [19] in a 5-year follow-up study of growing pains. They found a correlation between persistence of symptoms and lower pain threshold. Pathirana, *et al.* [31] also demonstrated a lower threshold of pain response to cold, vibration and deep pressure in cases of growing pains than in controls.

Other associations: A positive family history associated in some cases of growing pains suggests that there may be a genetic component playing role in the pathogenesis [3]. Some cases of growing pain may be actually having childhood onset *e.g.*, Restless leg syndrome [11]. Children with growing pains may also represent a parasomnia such as sleep walking and sleep terrors [32]. A study found hair of children with growing pain contained increased levels of lead and zinc and decreased levels of copper and magnesium [33]. However, the usefulness of the analysis in the pathogenesis is not validated [3]. In a recent study – Golding, *et al.* [34] could not find any role of dietary omega-3 fatty acids in the development of growing pains [34].

Thus growing pains may be caused by lower extremity overuse, in children having lower pain

threshold or decreased bone strength [2,20]. The negative psychosocial environment may also be a contributing factor.

MANAGEMENT

The most important component of management is proper explanation regarding the benign nature of growing pains. The family may be reassured that these pains will be resolved in time and will not progress to any serious organic disease [35]. The parents may be advised to use analgesics as well as non-pharmacologic measures to relieve pain such as leg massages, rubbing, and hot fomentation. But it remains unclear whether these interventions actually help to resolve the attack, as the pain episodes are self-limiting. Considering the intermittent nature of pain, use of analgesics on regular or long-term basis can be harmful, and should not be advised [8].

In this era of evidence-based medicine, treatment modalities proven with randomized controlled trials are the gold standards for management. A randomized controlled trial [36] involving treatment of growing pains described efficacy of a muscle stretching program (involving the quadriceps, hamstrings, and gastrosoleus muscle groups) in faster decline of pain episodes. These exercises may be taught to the parents and done at home twice-a-day for 10 minutes in the morning and at night. This treatment modality has further advantage of providing an extra attention of the parent, fulfilling the psychological needs of the children [22].

Evans [26] reported use of in-shoe devices such as tri-plane wedges and orthoses was effective in children with pronated foot posture. However, the study involved single-case experimental design, which is much lower in evidence hierarchy [26]. These in-shoe devices may be helpful in selected cases with postural defect.

Widespread vitamin D deficiency is being reported among population at large, and vitamin D may affect body’s endocrine system, immune system, cardiovascular system, neuro-psychological functioning and neuromuscular performance [37]. Thus, it is interesting to know whether vitamin D has any role in management of growing pains. A recent study reported insufficient vitamin D levels in majority of cases with growing pains [38]. However, the study does not mention, if the children without growing pains had different vitamin D levels. Efficacy of vitamin D supplementation in growing pains has not been studied. Currently, there is insufficient evidence to use vitamin D for the management of growing pains. Use of vitamin C, calcium or magnesium etc have no scientific basis and should not be advocated.

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