# Hyperhidrosis in children and review of its current evidence-based management

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**Hyperhidrosis (HH) is excessive sweating that usually interferes with the patient's social life. In more than 80% of the cases, the symptoms start in childhood. Early detection and management can significantly improve the patient's quality of life; however, HH remains widely underdiagnosed and undertreated, particularly among children. Many patients do not realize that they have a treatable condition and reports have shown that only 38% of the patients had discussed their condition with a healthcare professional. The aim of this article was to improve awareness on the significant sequel of HH in children and highlight its effects on their quality of life and various available treatment options.** *Ann Pediatr Surg* **11:169–172 © 2015 Annals of Pediatric Surgery.**

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## Introduction

Hyperhidrosis (HH) is a condition characterized by excessive sweating than that required for normal temperature regulation. It can be very distressing, with significant negative impacts on the patient's social life [1]. In the paediatric population, HH is usually an underrecognized problem [2]. The aim of this article was to highlight the significance of HH in the paediatric population, its effects on their quality of life (QoL) and different available treatment options.

## Types/sites

HH can either be primary (essential) or secondary. Primary HH is defined as 'excessive function of the sudomotor sweat control system, in the absence of a sweating trigger'. However, in secondary HH, the excessive sweating occurs in response to a stimulus such as medication, anxiety and neurological or endocrine disorders [3]. HH can affect the axilla (axillary HH), palms (palmar HH), feet (plantar HH), face (craniofacial HH) or diffuse (generalized HH) [3].

## Epidemiology

The estimated prevalence of HH in the USA is 2.8%, with more than half of these individuals having axillary HH [4]. Although there are few reports of HH in the paediatric population, many adult sufferers admit to an early onset of symptoms. Lin and Fang [5] described surgery for HH in 1360 patients, with 81.5% reporting symptoms since childhood, 15.9% since adolescence, and 2.6% reporting symptoms since adulthood. Authors have reported positive family history in 25–50% of patients with palmar HH, which may suggest autosomal dominance inheritance [3].

## Pathogenesis

Sweating is important for regulating the body temperature by sweat evaporation from the eccrine glands, which are believed to be the source of primary HH. Thermal sweating is controlled by the hypothalamus, and emotional sweating is regulated by the cerebral cortex [2].

## Causes

The aetiology of primary HH is unknown and could be related to abnormal response to emotional stress. In contrast, secondary HH usually has an underlying cause. Examples of causes of secondary HH in children and adolescents are listed in Table 1 [2].

## Diagnosis

The recommended criteria for the diagnosis of primary focal HH are idiopathic excessive focal sweating for a minimum of 6 months. This should be associated with a minimum of two of the following characteristics: (i) bilateral and relatively symmetrical distribution; (ii) interference with daily activities; (iii) onset before 25 years of age; (iv) incidence of at least one episode weekly; (v) positive family history; or (vi) cessation of sweating during sleep [6].

In contrast, generalized sweating can continue during sleep and has an identifiable underlying cause [2]. A detailed history and physical examination should aim at exploring the causes of secondary sweating, listed in Table 1 [2].

## Complications of hyperhidrosis and its effect on quality of life

HH is always accompanied by subjective reduction in QoL for the patient, who will almost inevitably feel uncomfortable in a world where sweating is considered antiaesthetic and may thereby affect socialization. Wolosker *et al.* [7] have observed that, although these patients do not present any risk for death or organ failure, the reduction in QoL can have serious consequences. In some cases, it may not only cause anxiety and distress but can also be incapacitating and even pose high risks for some professionals, such as police officers, who manipulate weapons, and electricians, who handle electric

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**Table 1 Principal causes of secondary hyperhidrosis in children and adolescents 2**

| Physiological causes | Pathological causes | | |
|---|---|---|---|
| | Generalized HH | Regional HH | Focal HH |
| Hot weather | (1) Infectious: tuberculosis, malaria | (1) Compensatory: | (1) Frey syndrome |
| Exercise | (2) Euplastic: lymphoma | spinal cord trauma, | (2) Chorda tympani syndrome |
| Anxiety | (3) Endocrinal: hyperthyroidism, | syringomyelia | (3) Gustatory sweating |
| Ingestion of spicy and citrus food or alcohol | hypoglycaemia, pheochromocytoma | (2) Reflex sympathetic dystrophy | |
| Obesity | (4) Neurological | | |

HH, hyperhidrosis.

material [7]. A national survey by Strutton *et al.* [4], in 2004, in the USA showed that one-sixth of responders reported sweating that was either 'barely tolerable and frequently interfered' or was 'intolerable and always interfered' with their daily activities. In children with HH the symptoms can cause significant social and psychological handicap, which may impair school performance and affect their social lives [1].

## Treatment

Many patients do not realize that they have a treatable condition. According to Strutton *et al.* [4], only 38% of patients had discussed their condition with a healthcare professional. Early detection and management can significantly improve a patient's QoL; nonetheless, HH remains widely underdiagnosed and undertreated, particularly among paediatric patients [8].

Benefits, limitations and complications of different treatment options are outlined below.

### Topical therapy

Topical therapy can be used in the treatment of axillary HH. 'Aluminium salts are the most common active ingredient in antiperspirants. Aluminium chloride is the form used in over-the-counter antiperspirants, whereas aluminium chloride hexahydrate is the more effective compound found in prescription preparations [8]'. Different concentrations of aluminium chloride are used. Higher concentrations usually cause intolerable dermatitis, whereas lower concentrations are more tolerable but less effective. The mechanism of action is blockage of the eccrine sweat glands, thus leading to degeneration of the sweat glands [8]. The use of topical therapy for palmar and plantar HH is usually less effective [2].

Most of the practitioners use topical therapy as first-line treatment in children because of its noninvasive nature, despite lack of reports evaluating its efficacy and safety in children [8]. Side effects of topical therapy include skin irritation, messy and time-consuming application and failure or inadequate response [8].

### Anticholinergics

Anticholinergics decrease sweat secretion by competitive inhibition of acetylcholine at the muscarinic receptor [9]. Oxybutynin has been used in the treatment of axillary HH among adults, with satisfactory results in around 70% of the cases [10]. Known side effects of anticholinergics include dry mouth, headache and urinary retention [8,10]. Although oral anticholinergics are commonly used in children with urinary symptoms, its use in children with HH has not been adequately evaluated. Oral glycopyrrolate is an anticholinergic used in children with excessive salivation [11]. Its use in children with HH has been retrospectively evaluated and the authors concluded that a mean of 2 mg/day of oral glycopyrrolate improved HH in 90% of 31 treated children. Median age at the time of prescription was 14.9 years. Dry mouth was noted in 26% of patients and one patient had palpitations requiring cessation of treatment. Patients were still taking the medicine for up to 10 years and all patients experienced recurrence within a day or two when the treatment was discontinued, and families reported 'recurrence of sweating to baseline when administration of the medication was inadvertently forgotten' [11]. Patients who were tired of taking the medication for 7 years eventually underwent thoracoscopic sympathectomy (TS) as a more definite treatment for HH [11]. Another oral anticholinergic is glycopyrronium bromide, which has been reported in adults with HH, and side effects have limited the treatment in one-third of the patients [12]. Its use in the paediatric population has not been evaluated.

### Gabapentin

In a case report by Adams *et al.* [13], the anticonvulsant gabapentin was used orally to treat HH secondary to spinal cord injury in a 12-year-old girl. This provided improvement in her sweating, but the dose had to be increased with time and combined with propantheline bromide to eventually control her symptoms. The mechanism of action of gabapentin in HH is unknown, and the authors stated that 'it may affect some as yet unidentified receptor site that is present both centrally and peripherally, or it may affect a second messenger system that is intimately involved in neuronal function'. They recommended that it 'may be a worthwhile alternative for patients who do not respond to other medications, or who cannot tolerate the side of effects of these drugs' [13].

### Iontophoresis

Iontophoresis, which involves 'introduction of ions into the tissues using electric current', has been used for the treatment of HH since the 1930s [8]. Its mechanism of action is thought to involve plugging of the eccrine ducts by hyperkeratinization [14]. Recurrence is common after stopping the treatment [15]. There are no studies that examined its use in the paediatric population.

### Botulinum toxin A

The botulinum toxin is produced by Gram positive anaerobic bacteria known as *Clostridium botulinum*. It acts within the nerve endings to block the cholinergic transmission at the neuromuscular junction of sweat glands by antagonizing the action of $Ca^{++}$ [16]. It has been used

in children with spastic cerebral palsy, strabismus and spasmodic torticollis [16]. There have been only two case reports describing the successful use of botulinum toxin in children, one in a 13-year-old with palmar HH [17] and the other was in a 14-year-old with axillary HH [16]. The main side effect from the botulinum toxin injection is its short-lived efficacy for around 6 months requiring retreatment, which can result in atrophy of the underlying muscles [2].

### Surgery

#### *Overview*

Surgery represents a safe, effective and long-lasting treatment for HH in both children and adults [1]. The current recommended surgical treatment by many authors is TS [1]. Local procedures such as curettage or liposuction have been used in axillary HH by some authors who believe that it can provide long-term relief from the excessive sweating while avoiding the compensatory sweating (CS) that is commonly seen with TS. However, the main risks of these local procedures are scarring, contractures and infections [8].

#### *Sympathectomy, different techniques and results*

Sympathectomy means destruction of the sympathetic ganglia and chain, whereas sympathectomy refers to the division of the sympathetic chain [18]. However, most authors use the term sympathectomy for any sort of interruption to the sympathetic chain [18].

In the past, sympathectomy was performed through cervical or transaxillary open approach. In recent times, minimally invasive approaches have been widely used for the treatment of HH in both children and adults. Various techniques have been described to interrupt the sympathetic chain for treatment of HH, including diathermy [19], chemical ablation [20], ultrasonic coagulation [21], radiofrequency [22], transaction [23] or thoracoscopic excision of the sympathetic chain [1].

TS is classically reserved for severe cases, after failure of the conservative measures [3], although some authors have recommended it as the first-line treatment for the severe forms of palmar HH [1,22]. This usually involves division, coagulation or excision of the second (T2) and/or the third (T3) thoracic ganglia in palmar HH and the addition of the fourth thoracic ganglia (T4) in axillary HH [1].

It has been suggested that more 'aggressive' approaches for treating HH yield better results [1]. This is supported by reports demonstrating higher satisfaction rates when T2 and T3 were resected, in comparison with isolated T2 resection [24]. Authors have demonstrated higher recurrence rates following sympathectomy when compared with sympathectomy, and higher recurrence following one-ganglion resection in comparison with two-ganglion resections [24]. Separation of the ends of the interrupted sympathetic trunk was considered important to decrease the risk for nerve regeneration following TS [5].

#### *Compensatory sweating and quality of life after thoracoscopic sympathectomy*

CS is a common side effect following TS occurring between 60 and 90% of the cases [1]. It usually appears after 6 to 12 months, with the female population being more susceptible to it, yet not related to the extension of the sympathectomy [25].

In a report of 1360 patients following TS, CS was noted in 84% of them. The most common affected sites were the back (82%) and the leg (78%). Only 3.5% of the patients were more embarrassed by the CS when compared with their original HH, and an overall 95% of the patients were considered to have satisfactory results [5]. This is similar to our experience in which CS was noted in two-thirds of the patients following TS, yet none of them considered it as a complication and all of the patients reported significant improvement in their QoL. Overall, patients considered CS as a minor inconvenience when compared with their original sweating problem [1,21]. This is different from that reported by Yano *et al.* [24], in which CS was noted in almost all of their patients and was considered severe in 76% of them; moreover, the intensity of CS did not change in the majority of the cases and was related to hot weather and stress.

An assessment of the QoL before and after TS has demonstrated that less than 10% of the patients were dissatisfied and only 4% regretted the procedure [26]. Another report that evaluated the QoL at 30 days and 5 years after TS reported better QoL in more than 90% of the patients, with around 1.5% reporting worse QoL secondary to severe CS [7].

## Conclusion

HH in children is a relatively common yet under-reported problem that can cause a significant impact on the QoL. Clinicians should be aware of this condition and have a low threshold for referral for specialist treatment, which has a high success rate.

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### Conflicts of interest

There are no conflicts of interest.

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