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Systematic Review

Comprehensive dental and surgical management of patients with congenital insensitivity to pain with anhidrosis: a systematic review of reported cases and management strategies

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ABSTRACT

Congenital insensitivity to pain is a rare condition that is usually detected in late toddlerhood, a time when children are very active and prone to getting hurt without feeling pain. Despite being protected from external dangers, individuals with this condition tend to harm themselves by biting their tongue, lips, and fingers, leading to significant damage. Children who cannot sense pain and have mental challenges are more vulnerable to infections and slow-healing ulcers. The atypical pain is caused by the absence of specific nerves and nerve responses to harmful stimuli. While previous reports have impressed on oral and dental issues related to congenital insensitivity to pain with or without anhidrosis and how they are managed surgically and dentally, there hasn't been a systematic review gathering all oral and dental findings of this condition. Therefore, our current systematic review aims to examine the complete dental and surgical treatment of patients with congenital insensitivity to pain with anhidrosis (CIPA) by discussing documented cases and treatment methods.

Keywords: Congenital insensitivity to pain, Anhidrosis, Dental, Oral, Management

INTRODUCTION

Congenital insensitivity to pain with or without anhidrosis is a rare condition typically identified in late toddlerhood, a stage when children are highly active and susceptible to injury without feeling pain. Despite being shielded from external dangers, individuals with this condition tend to self-harm by chewing on their tongue, lips, and fingers to an extent that causes destruction.[1] This is a rare condition, originating from a mutation in the nerve growth factor (NGF) receptor, leading to the loss of Aδ and C fibers, potentially impacting oral sensation.[2] NTRK1-CIPA, a type of CIPA, is characterized by the absence of pain sensation, the inability to sweat, and intellectual disability. This condition leads to repeated injuries such as self-mutilation, skin bruising and infections, bone fractures, and joint dislocations. Normal touch, vibration, and position senses are retained, while anhidrosis can trigger febrile episodes and hypothermia. Most affected individuals also exhibit varying degrees of intellectual disability, hyperactivity, and emotional lability.[3] Children with the inability to feel pain and mental challenges are more prone to repeated infections and slow-healing ulcers. The unusual pain is linked to the lack of specific nerves and nerve activation by damaging stimuli. NGF helps sustain certain nerve types, and mutations in the NTRK1 gene, responding to NGF, have been identified in mice resembling CIPA symptoms. CIPA patients have also been screened for these mutations, with 37 different known mutations causing CIPA. This syndrome is extremely rare, with only 84 cases reported by 2000, excluding 28 cases from Israeli Bedouins. As there is no

cure, prenatal screening is the sole preventive measure available to avoid transmitting this condition to offspring.[4] Previous reports discussed oral and dental findings of congenital insensitivity to pain with or without anhidrosis and their dental and surgical management. However, there is no systematic review gathering all oral and dental findings of this condition. Thus, our current systematic review aims to assess comprehensive dental and surgical management of patients with CIPA by discussing reported cases and management strategies.

METHODS

Elaboration

This systematic review followed the guidelines of the preferred reporting items for systematic review and meta-analyses protocols (PRISMA 2020). The acronym PICOS was used to investigate this systematic review question, "What are the dental and orofacial manifestations of congenital insensitivity to pain with and without anhidrosis and what are the management strategies of these cases?" PICOS reflects to: population= Patients with congenital insensitivity to pain with and without anhidrosis. Intervention dental and orofacial characteristics and management. Comparison=with and without anhidrosis if applicable. Outcome=outcome of the management strategies. The search strategy was applied to PubMed, Google Scholar, and Web of Science without time restrictions. Figure 1 illustrates the study flow chart.

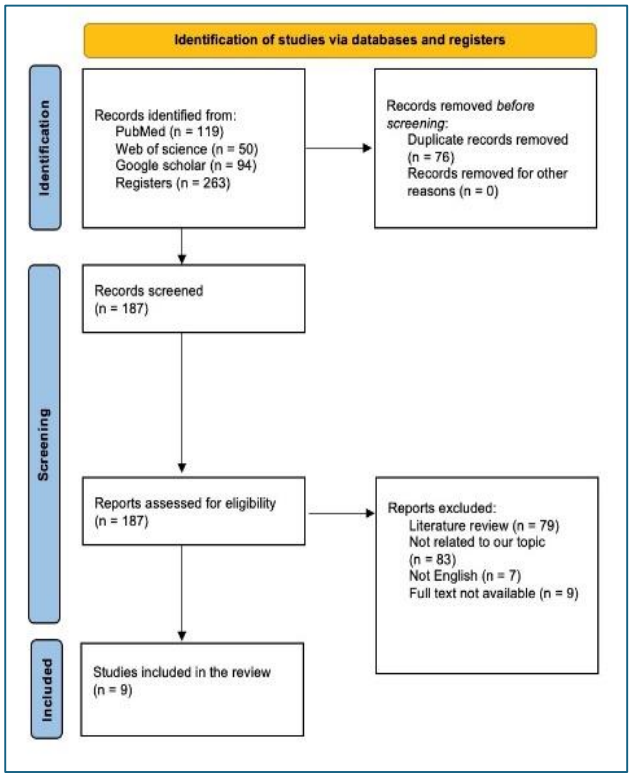

Figure 1: Study flowchart.

Eligibility criteria and selection process

For the selection process of the articles, we included in this systematic review all reports that discussed the dental and surgical management of patients with congenital insensitivity to pain with and without anhidrosis and were defined as inclusion criteria. The exclusion criteria were as follows: (1) Non-case reports, (2) Out-of-scope reports, (3) Did not discuss congenital insensitivity to pain with and without anhidrosis, (4) Articles with no full text available, and (5) Non-English-language articles. This systematic review did not include other systematic reviews, prospective studies, clinical trials, lab studies, or retrospective studies. Articles underwent a two-stage selection process. Initially, two reviewers assessed titles and abstracts based on eligibility criteria to choose articles for full reading. Subsequently, the selected articles were independently evaluated against the eligibility criteria. We performed an extensive online search and literature review to assess the dental and surgical management of patients with congenital insensitivity to pain with and without anhidrosis. PubMed, Google Scholar, and Web of Science databases were searched for articles published up to April 2024. CIPA, congenital insensitivity to pain without anhidrosis, dental, orofacial, manifestations, and management were included in the search. There was no timeframe specific for the papers, and the acquired papers were screened carefully using the PRISMA 2020 guidelines and flow diagram. Electronic files were organized using the Mendeley reference management tool.

Data extraction

Mendeley was used to organize references and gather all papers from the literature search. Studies were evaluated following PRISMA 2020 guidelines. Duplicate articles were removed. Abstracts were checked for relevance by a minimum of two reviewers. Full-text articles were then comprehensively reviewed by four reviewers, focusing on research methods and findings. Referenced studies were examined, and any disagreements were settled through discussion. Articles were included if all reviewers reached a unanimous decision on meeting the criteria. Data from selected articles were gathered and organized in an Excel spreadsheet according to the following criteria: (a) Author, (b) Year of publication, (c) Case description, (d) Symptoms, and (e) management

RESULTS

The majority of case reports were published after the year 2000 which discussed all oral and dental findings of congenital insensitivity to pain with or without anhidrosis from diverse populations across multiple countries. These reports focused on comprehensive dental and surgical management of patients with CIPA by discussing reported cases and management strategies, with two papers detailing multiple cases. They explored oral and

dental findings of congenital insensitivity to pain with or without anhidrosis in both healthy and unhealthy individuals. Neves et al reported a case involving a 2-year-old girl who had severe self-inflicted injuries on her tongue, hands, lips, and oral tissues from biting.[5] She had extensive ulceration under her tongue with a necrotic look. Despite having a full set of primary teeth, she lost her upper central incisors due to trauma. The girl's mother observed a decrease in tongue lesions after the incisor loss. Once all offended teeth were removed, the mouth ulcers and scarred hands and fingers were able to heal.[5] Romero et al documented a case involving a 22-month-old toddler who was treated with a dental appliance designed to prevent tongue injuries.[6] The appliance, composed of two interconnected acrylic splints, induced an anterior open bite to facilitate mouth breathing. Although the patient's lesions showed improvement with the appliance, the patient died of medical complications.[6] Abdullah et al presented a case concerning a 4-year-old boy brought by his parents to seek the replacement of missing front teeth.[1] The child had congenital insensitivity to pain without anhidrosis, contributing to severe self-harm resulting in teeth loss, tongue amputation, fingertip damage, and infections in the lower limbs. Dental and orthopedic intervention focuses on treating oral injuries on-site and averting further oral and finger harm through dental splints, and finger sleeve splints, ensuring consistent foot protection with shoes, and utilizing behavioral medical therapy.[1] In a study by Bodner et al young children with CIPA underwent an orofacial examination to assess soft tissue disorders in the tongue, lips, and buccal mucosa, along with noting any missing or displaced teeth.[7] Twenty-four patients showed notable self-mutilation tendencies, with all patients displaying oral self-injury such as biting injuries and scarring of soft tissues (tongue, lip, and buccal mucosa). Fingertip biting was common among most patients, and infants predominantly exhibited decubital ulcers on the tongue as part of their self-harm behaviors.[7] Butler et al documented a case of a 9-month-old boy who engaged in self-harming behavior by biting his tongue, fingers, wrists, and feet once his teeth erupted.[8] The patient exhibited self-inflicted injuries on his hands and mouth due to biting, prompting the sequential removal of his primary teeth after eruption to alleviate symptoms and promote recovery.[8] Hutton et al presented a case study of a female patient with congenital insensitivity to pain up to age six.[9] The treatment aimed to prevent orofacial trauma and self-inflicted injuries. Primary teeth were removed upon eruption, and ongoing care for permanent teeth involves using soft occlusal guards and behavioral strategies, including education.[9] Amano et al studied 18 individuals with hereditary sensory and autonomic neuropathy type IV (HSAN-IV), aged between 1 year and 22 years 3 months, who underwent oral examinations for various issues like tooth abnormalities, malocclusions, soft tissue disorders, tongue papilla atrophy, and hand/finger abnormalities.[10] The majority of these patients showed insensitivity to pain since birth and a lack of sweating. They demonstrated self-harming behaviors, such as pulling out their teeth and causing serious injuries to their fingers and mouth.[10] Gao et al discussed a Chinese patient with autosomal-recessive CIPA, who exhibited compound heterozygosity in the NTRK1 gene.[11] The patient had a multisystem disorder characterized by the absence of pain response, self-harming behavior, inability to sweat leading to body temperature regulation issues, and mental disabilities. The patient also presented with oral and facial manifestations such as missing teeth, nasal abnormalities, cleft palate, severe mouth injuries, tooth decay, and misalignment.[11] Xue et al presented a case study of a 7-year-old Chinese boy with CIPA who had 2 new mutations in the NTRK1 gene, unveiling a newly identified feature of the condition.[12] The child exhibited typical symptoms including insensitivity to pain, lack of sweating, and cognitive impairment. Additionally, he suffered from recurrent fractures, osteoporosis, and a range of oral and facial problems like drooping eyelids, numerous missing teeth, extensive tooth damage, severe mouth injuries, and dental decay.[12] All reported cases are demonstrated in Table 1.

Table 1: Demonstration of reported cases.

Authors	Year of publication	Case description	Symptoms and findings	Management
Abdullah et al[1]	2015	A 4-year-old boy was brought by his parents to request replacement of several missing front teeth.	The patient had congenital insensitivity to pain without anhidrosis, which resulted in severe self-mutilation leading to loss of teeth, tongue tip amputation, finger tips destruction, and infections in lower limbs.	Dental and orthopedic treatment involves managing oral wounds locally and preventing additional oral and finger injuries using dental splints, finger sleeve splints, ensuring constant foot coverage with shoes, and utilizing behavioral medical therapy.
Neves et al[5]	2009	A 2-year-old girl with extensive self-inflicted wounds on her tongue, hands, lips, and oral tissues resulting from biting.	The underside of her tongue displayed extensive ulceration with necrotic appearance. Patient had a full set of primary teeth, except for upper central incisors lost due to trauma. Her mother noted a reduction in tongue lesions following incisor loss.	Following the extraction of all offending teeth, the mouth ulcers and scarred hands and fingers were able to heal.

Continued.

Authors	Year of publication	Case description	Symptoms and findings	Management
Romero et al[6]	2008	A 22-month-old infant, who received treatment with a dental appliance to prevent tongue injury. The appliance, made of two connected acrylic splints, created an anterior open bite, enabling mouth breathing. While the patient's lesions saw improvement with the device, unfortunately, the patient passed away due to medical issues.	Episodes of fever, varying degrees of cognitive impairment, recurring fevers due to lack of sweating, minimal perspiration, and congenital insensitivity to pain.	The device, made of two connected acrylic splints at the back, created an anterior open bite, enabling the infant to breathe through the mouth. The patient's lesions showed improvement following device use.
Bodner et al[7]	2002	Young children with CIPA were evaluated through an orofacial examination, where the tongue, lips, and buccal mucosa were inspected for soft tissue disorders, and any missing or displaced teeth were noted.	Twenty-four patients exhibited significant self-mutilation behavior. Instances of oral self-injury, including biting injuries and scarring of soft tissues (tongue, lip, and buccal mucosa), were present in all patients. Fingertip biting was also common among the majority of patients. Infants predominantly displayed decubital ulcers on the tongue as part of their self-mutilation patterns.	No management were reported
Butler et al[8]	2005	Since three months of age, a nine-month-old boy has a history of self-mutilation, involving biting his tongue leading to bleeding, as well as biting his fingers, wrists, and the feet since his teeth erupted	Presented with self-inflicted injuries on the hands and oral tissues resulting from biting.	The severe form of the injuries required that his primary teeth be sequentially removed shortly after they erupted , resulting in symptoms regression.
Hutton et al[9]	2010	A female with congenital insensitivity to pain until the age of six. The goal of treatment was to avoid instances of oro-facial trauma and self-inflicted injuries.	Oro-facial trauma and self-mutilation injuries.	The primary teeth were extracted when they erupted, and ongoing care for the permanent teeth has included utilizing soft occlusal guards along with behavior management strategies, including education.
Amano et al[10]	1998	Eighteen individuals diagnosed with HSAN-IV, ranging in age from one year to twenty-two years three months, underwent oral assessment for signs of tooth abnormalities, malocclusions, soft tissue disorders, tongue papilla atrophy, and morphologic hand and finger abnormalities.	Most of the 18 patients displayed a lack of sensitivity to pain and inability to sweat from birth. They also exhibited oral self-harm behaviors like extracting their own teeth and causing severe injuries to their fingers and oral tissues.	No management reported

Continued.

Authors	Year of publication	Case description	Symptoms and findings	Management
Gao et al[11]	2013	A Chinese patient with autosomal-recessive CIPA was found to have compound heterozygosity in the NTRK1 gene.	The patient was affected by a multisystem disorder shows no response to pain, engages in self-harm, cannot sweat properly which affects body temperature regulation, and has mental disabilities. His oral and facial features include numerous missing teeth, nasal issues, cleft palate, severe mouth injuries, tooth decay, and misalignment.	No management reported
Xue et al[12]	2018	A 7-year-old Chinese boy with CIPA was found to have 2 new mutations in the NTRK1 gene, revealing a newly recognized characteristic of the condition.	The individual displayed common symptoms such as lack of pain sensitivity, inability to sweat, and cognitive impairment. He also experienced repeated fractures, osteoporosis, and various oral and facial issues like droopy eyelids, many missing teeth, significant tooth wear, severe mouth injuries, and dental caries.	No management reported

DISCUSSION

CIPA or HSAN-IV is an autosomal recessive disorder characterized by recurrent episodic fevers, inability to sweat, lack of response to painful stimuli, self-injurious behavior, and intellectual disability. The unusual pain and temperature sensations in CIPA result from the absence of nerves responding to tissue damage and lack of nerve supply to sweat glands. NGF supports the survival of specific neurons and mutations in the TRKA gene linked to CIPA affect NGF signal transduction, leading to neuron loss. CIPA provides insight into NGF-dependent neuron development and maintenance in humans.[13] Mostafa et al reported a 5-year-old girl with a family history of a sibling with similar issues, initially diagnosed with Papillon-Lefèvre syndrome due to early tooth loss and palmoplantar hyperkeratosis. However, a more thorough examination revealed the correct diagnosis of CIPA, which can sometimes be mistaken for Papillon-Lefèvre syndrome.[14] Chen et al documented a case of an infant with CIPA. The primary symptoms included lack of pain sensation, absence of sweating, and recurrent fevers. The author also highlighted the usefulness of genetic molecular analysis in diagnosing and identifying new gene mutations.[15] Theodorou et al detailed in their research that characteristics for diagnosis include complete insensitivity to pain, lack of sweating or reduced sweating, early-onset high fevers, self-harm incidents, impaired or absent tear production, and intellectual disability. Additionally, issues related to orthopedics, facial structures, skin and eyes are frequently observed.[16] Elsana et al showed that children born with congenital insensitivity to pain are at risk of developing corneal scarring. Individuals with CIP typically experience more severe eye surface problems compared to those with CIPA, likely because of a higher occurrence of the reduced corneal sensitivity.[17] The Rosemberg et al documented a situation involving a 4-year-old girl with CIPA and highlighted in their study that around 20% of patients experience fatal hyperpyrexia within the initial three years of life.[18] Varma et al detailed a scenario involving a 2-year-old girl previously diagnosed with CIPA who presented with gradual onset bilateral upper limb weakness. An MRI scan identified a mass putting pressure on her cervical spine as the root cause, with further investigation indicating potential immune system dysfunction.[19] Shorer et al documented four patients with CIPA who shared a common mutation in the TRK-A gene. They underwent nerve and skeletal muscle biopsies. While their sensory and motor conduction studies were normal, they lacked sympathetic skin responses. The muscle biopsies of two patients showed different histological features, leading the authors to believe that these variations are not linked to their genetic mutation.[20] Masri et al reported seven Jordanian patients diagnosed with CIPA. Commonly observed were global developmental delay, microcephaly, and poor weight gain. Their study noted a high occurrence of early death in this group. The newly identified variant in their research may result in a milder reduction in pain sensation, though the neurological and orthopedic symptoms align with those documented in existing literature.[21] Soussou et al discussed a case involving an 18-month-old child diagnosed with CIPA, following multiple visits to the emergency department for significant tongue and finger injuries.[22] Indo et al highlighted the importance of discovering that individuals with CIPA have a deficiency in NGF-sensitive neurons, such as interoceptive polymodal receptors and sympathetic postganglionic neurons, which may extend to various brain neuron types. These patients display distinct emotional behaviors or difficulties. The NGF-TrkA system is vital for creating a neural circuit for internal perception and balance, possibly contributing to intuition.

Therefore, NGF-dependent neurons are key in shaping emotional responses and decision-making abilities.[23] Iijima et al assessed the function of peripheral sensory nerves in CIPA patients through a basic clinical neurological exam, focusing on touch, vibration, joint position, and two-point discrimination. The study found that CIPA patients experience broader sensory disruptions than previously thought, indicating impairment that may affect more than just specific types of sensations conducted by certain peripheral sensory fibers.[24] Jiang and colleagues documented a scenario involving a child with CIPA who had open-heart surgery and examined the anesthesia considerations. The authors determined that CIPA patients undergoing this procedure need opioids, must be cautious with muscle relaxants and volatile anesthetics, and should give special attention to airway management and temperature regulation.[25] Destegul et al outlined an anesthetic approach for two siblings, aged 17 and 14, who had CIPA syndrome, including insensitivity to pain, lack of sweating, intellectual disability, and septic arthritis. They successfully achieved surgical comfort using midazolam sedation without adverse effects on the patients' hemodynamics.[26]

CONCLUSION

This current systematic review illustrates that congenital insensitivity to pain with or without anhidrosis has multiple facial and dental manifestations, including tongue ulceration, loss of teeth, droopy eyelids, tooth wear, dental caries, cleft palate, teeth misalignment, and tongue tip amputation. Management of these oro-facial manifestations ranged between extraction of primary teeth, occlusal guards, behavioral management techniques, and finger sleeve splints. Future studies should be aimed at the utilization of new methods and strategies for the management of facial and dental manifestations associated with this condition.

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REFERENCES

1. Abdullah N, Kausar SF. Congenital Insensitivity to Pain without Anhidrosis: Orodental Problems and Management. Case Rep Dentist. 2015;179892:1-4.
2. Tsuchihashi N, Naoko U, Zenzo M, Naomi Y, Kumiko S. Perception of pungent, gustatory and olfactory stimuli in patients with congenital insensitivity to pain with anhidrosis. J Oral Sci. 2020;63(1):104-6.
3. Indo Y. NTRK1 Congenital Insensitivity to Pain with Anhidrosis. GeneReviews®, edited by Adam MP, University of Washington, Seattle. 2008.
4. Schwarzkopf R, Vered P, Yaron W, Dan A, Yair G. Clinical and genetic aspects of congenital insensitivity to pain with anhidrosis. Harefuah. 2005;144(6):433-7.
5. Neves BG, Rosemere TR, Gloria FC. Traumatic lesions from congenital insensitivity to pain with anhidrosis in a pediatric patient: dental management. Dental Traumatol. 2009;25(5):545-9.
6. Romero M, Rogelio S, Jose IGR, Ana R. Dental management of oral self-mutilation in neurological patients: a case of congenital insensitivity to pain with anhidrosis. Medicina Pral, Patologia Oral Cirugia Bucal. 2008;13(10):E644-7.
7. Bodner L, Yitzhak W, Vered P, Jacov L. Orofacial manifestations of congenital insensitivity to pain with anhidrosis: a report of 24 cases. ASDC J Dentistry Children. 2002;69(3):293-6.
8. Butler J, Padraig F, David W. Congenital insensitivity to pain--review and report of a case with dental implications. Oral Surg Oral Med Oral Pathol Oral Radiol Endodontics. 2006;101(1):58-62.
9. Hutton A, Sarah McK. The dental management of a child with congenital insensitivity to pain. Dental Update. 2010;37(3):180-2.
10. Amano A, Akiyama S, Ikeda M, Morisaki I. Oral manifestations of hereditary sensory and autonomic neuropathy type IV. Congenital insensitivity to pain with anhidrosis. Oral Surg Oral Med Oral Pathol Oral Radiol Endodont. 1998;86(4):425-31.
11. Gao L, Hao G, Nan Y, Yudi B, Xin L, Ping Y, et al. Oral and craniofacial manifestations and two novel missense mutations of the NTRK1 gene identified in the patient with congenital insensitivity to pain with anhidrosis. PloS One. 2013;8(6):e66863.
12. Xue X-M, Yan-Qing L, Pai P, Chang-Fu S. Congenital Loss of Permanent Teeth in a Patient with Congenital Insensitivity to Pain With Anhidrosis due to 2 Novel Mutations in the NTRK1 Gene. J Oral Maxillofacial Surg. 2018;76(12):2582.e1-9.
13. Indo Y. Genetics of congenital insensitivity to pain with anhidrosis (CIPA) or hereditary sensory and autonomic neuropathy type IV. Clinical, biological and molecular aspects of mutations in TRKA(NTRK1) gene encoding the receptor tyrosine kinase for nerve growth factor. Clin Autonomic Res. 2002;12(1):I20-32.
14. Mostafa MI, Maha RA, Manal MT, Ghada YEK. Could Congenital Insensitivity to Pain with Anhidrosis Be Misdiagnosed as Papillon-Lefèvre Syndrome? J Pediatr Genet. 2017;6(4):238-40.
15. Chen Y, Caixia L, Lan L. Congenital insensitivity to pain with anhidrosis: A case report and literature review. Zhong Nan Da Xue Xue Bao. Yi Xue Ban. 2019;44(10:1203-8.
16. Theodorou SD, Klimentopoulou AE, Papalouka E. Congenital insensitivity to pain with anhidrosis. Report of a case and review of the literature. Acta Orthop Belgica. 2000;66(2):137-45.
17. Elsana B, Libe G, Ahed I, Ronit Y, Chiya B, Galina L, et al. Ocular manifestations of congenital insensitivity to pain: a long-term follow-up. Brit J Ophthalmol. 2022;106(9):1217-21.
18. Rosemberg S, Marie SK, Kliemann S. Congenital insensitivity to pain with anhidrosis (hereditary

sensory and autonomic neuropathy type IV). Pediatr Neurol. 1994;11(1):50-6.
19. Varma AV, Lori McB, Michael M, Ann T. Congenital insensitivity to pain and anhidrosis: Case report and review of findings along neuro-immune axis in the disorder. J Neurological Sci. 2016;370:201-10.
20. Shorer Z, Ruth S-L, Vered P, Leonid K, Jacov L. Variation of muscular structure in congenital insensitivity to pain and anhidrosis." Pediatr Neurol. 2013;48(4):311-3.
21. Masri A, Mohammad S, Aisha K, Rama J, Asma AL, Nathalie EB, et al. Congenital insensitivity to pain with anhidrosis syndrome: A series from Jordan. Clin Neurol Neurosurg. 2020;189:105636.
22. Soussou R, Wa SC, Karen MC. Congenital Insensitivity to Pain with Anhidrosis: A Case with Self-Inflicted Oral Ulcerations. J Dentistr Children (Chicago, Ill.). 2019;86(2):109-12.
23. Indo Y. Nerve growth factor, interoception, and sympathetic neuron: lesson from congenital insensitivity to pain with anhidrosis. Autonomic Neurosci. 12009;47(1-2):3-8.
24. Iijima M, Nobuhiko H. Evaluation of nonnociceptive sensation in patients with congenital insensitivity to pain with anhidrosis. Child's Nervous System. 2010;26(8):1085-9.
25. Jiang J. A case report: Anesthetic management for open-heart surgery in a child with congenital insensitivity to pain with anhidrosis. Paediatr Anaesthesia. 2022;32(9):1070-2.
26. Destegul D, Fazilet K, Ahmet SS. Anesthetic management of two siblings with congenital insensitivity to pain with anhidrosis syndrome. J Turk Society Algol. 2019;31(4):202-5.

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