



Acupuncture in Pediatric Diseases

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Abstract

Acupuncture, which is the most commonly used method among traditional and complementary medicine methods, has recently begun to be used also in pediatric cases. In the present review, acupuncture procedures performed by acupuncture needle in pediatric cases were evaluated. Studies have revealed that there are fields in which acupuncture is beneficial and not recommended for pediatric diseases. The use of acupuncture is recommended for the treatment of nocturnal enuresis, pain, nausea-vomiting and allergic diseases in children. Acupuncture and acupressure studies in neonates have also been initiated. Further studies are needed on the applicability of acupuncture in pediatric patients. How important is the benefit brought by acupuncture to children, it is also important who would perform acupuncture and which method would be used.

Keywords

Acupuncture, Pediatric, Children, Diseases, Treatment

Subject Areas: Neuroscience

1. Acupuncture Procedures in Pediatric Diseases

Among complementary medicine methods, acupuncture is a therapeutic method being used for a long time. Acupuncture is known to be effective for the treatment of numerous diseases and has been used in Asia for thousands of years. Acupuncture is the most commonly used method among Traditional Chinese Medicine. The effectiveness of acupuncture is explained in terms of concepts such as *Qi*, *Yin*, and *Yang* in Traditional Chinese Medicine. Acupuncture is performed by stimulating the certain acupuncture points identified on the body surface by needle, laser, heating or pressure. Acupuncture is becoming a more popular method day by day all over the world. While 2 million adults received acupuncture in 2002 in the USA, it reached to 3 million in 2007. It

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has been determined that 4% of the individuals in the USA have acupuncture procedure in anytime of their lives. The use of acupuncture has become widespread with the consensus of the National Institutes of Health (NIH) in 1997, in which effectiveness and usability of acupuncture for postoperative and chemotherapy-related nausea-vomiting and tooth pain are decided unanimously [1].

Acupuncture has recently become a therapeutic method preferred also in pediatric patients. The demand for complementary and alternative medicine for pediatric patients ranges at a rate between 2% and 20% - 30%. It has been observed that parents using any complementary medicine for themselves prefer a complementary medicine technique also for their children. According to a research conducted in 2007, acupuncture has been preferred for 0.2% (150,000) of children in the USA [2]. A questionnaire survey conducted in healthy children and children with chronic diseases in a pediatric hospital in Germany revealed that acupuncture was used at a rate of 5% [3]. Acupuncture was preferred by 11% in children with headache in Italy [4].

In the world, many algology centers have acupuncture units. It has been stated that one third of pediatric pain clinics in the USA have acupuncture units. Among the complementary medicine methods used in the pediatric pain centers in the USA, acupuncture ranks second with a rate of 32% [2] [5].

Along with the use of acupuncture procedures in pediatric patients, safety has been the most emphasized issue. In a study on acupuncture safety conducted in 2009 in 229,230 subjects with a mean age of 46 years, adverse events were reported by 8.6%, the most common adverse events were bleeding (6.1%) and pain (1.7%), and it was suggested that ecchymosis and pain that would occur in children led to more concern than those that would occur in adults [6]. Adams *et al.* [7] conducted a comprehensive review and scrutinized 38 studies containing information on acupuncture and its side effects in pediatric patients. They reported adverse events in 170 (11.4%) of 1487 children under the age of 18 years. Crying, pain, presence of mild bleeding, sensation of numbness, worsening of the complaints, dizziness, and nausea were reported as mild adverse events. Serious adverse events were determined in 25 pediatric cases and included thumb deformity (n = 12), infection (n = 5), cardiac rupture (n = 1), pneumothorax (n = 1), nerve injury (n = 1), subarachnoid hemorrhage (n = 1), intestinal obstruction (n = 1), hemoptysis (n = 1), reversible coma (n = 1), and overnight hospitalization (n = 1). It was stated that these serious adverse events, except for cardiac rupture, could be treated. Adams *et al.* [7] also reported that 83 of the 253 mild adverse events occurred under treatment by physicians certified in acupuncture. Moreover, they attributed the incidence of adverse events being higher as 29.5% in adults to higher number of cases. Jindal *et al.* [8] determined the rate of adverse events due to needle acupuncture performed in children to be low as 8.3% and suggested acupuncture as a safe method also in children. The possibility of serious adverse events due to acupuncture has been reported as one per million [7] [8].

In the literature, there is a limited number of safety studies conducted on acupuncture in pediatric cases. Presence of well-planned application protocols and implementation of these protocols by experienced physicians are important to be protected from serious adverse events [7]. Considering that fine needles are safely used in conventional subcutaneous treatments and in subcutaneous or intramuscular vaccinations, superficial needling for acupuncture is assumed to be safe. As in other treatments, obtaining informed consent form from parents or child him/herself if he/she is over 10 years old is recommended before performing acupuncture [9].

It is more difficult to perform acupuncture in children than in adults. Fear of needle in children definitely enhances this difficulty. Children should be approached with love and a safe environment including objects they would enjoy, such as toys and dolls, should be prepared before the acupuncture procedure. Performing acupressure prior to acupuncture may facilitate compliance in some children [10] [11].

2. How Does Acupuncture Act?

Acupuncture is performed by inserting acupuncture needle into an acupuncture point on the skin. Receptors such as nociceptive receptors, Meissner's corpuscle receptors, Krause's end-bulb receptors and Golgi tendon organ receptors are found intensely in the acupuncture points [12]. Moreover, along with low electrical resistance and high electrical activity, these points have different histological characteristics as compared to their adjacent tissue [13]. There are many theories explaining the effects of acupuncture procedure. Among these theories, neurotransmitter and autonomic system model has become more prominent and accepted. The neurotransmitter model can be explained by stimulation of analgesic system and an increase in endorphin, enkephalin, serotonin, and norepinephrine levels in the central nervous system and in plasma due to acupuncture and electroacupuncture procedures performed in human and experimental animals [14]-[18].

Acupuncture performed on the Back-Shu, Front-Mu and HuaTuo Jiaji points is effective in the treatment of visceral organs. Effect of acupuncture can be explained by viscerocutaneous, cutaneovisceral, and visceromus-

cular reflexes. Localization of Back-Shu, Front-Mu and HuaTuoJiaji points are associated with segmental distribution of sympathetic and parasympathetic systems. Changes in visceral organs due to acupuncture procedure can be explained by sympathetic and parasympathetic system modulation [19]-[21].

3. Acupuncture Applications for Diseases and Symptoms in Children

Acupuncture has been usually performed in children for nocturnal enuresis, diseases with pain, diseases with nausea and vomiting, and gastrointestinal, neurological, and allergic system diseases.

3.1. Nocturnal Enuresis

The rate of monosymptomatic nocturnal enuresis is encountered in 15% - 20% of children aged about 5 years and this rate decreases as the child grows up and is approximately 5% in adulthood. The treatment of monosymptomatic nocturnal enuresis includes drugs, behavioral therapies and some other conventional methods. In a review, in which complementary and alternative medicine methods performed for nocturnal enuresis was scrutinized, it was determined that 1283 of 2334 children with nocturnal enuresis were using one of the complementary medicine methods [10]. Bower *et al.* [22] conducted a review comprising patients below 18 years of age who had complaint of nocturnal enuresis and underwent acupuncture procedure. In that review, body acupuncture was compared with another acupuncture method and body acupuncture considered to be effective in nocturnal enuresis.

Björkström *et al.* [23] performed electroacupuncture in 25 children aged 7 - 16 years, who had monosymptomatic nocturnal enuresis and in whom previous treatments had failed. Number of dry nights per week significantly increased in the patients except for 5 children at the age of 6-7 years. The number of dry nights significantly continued in 78% and 65% of the children after 3 and 6 months of acupuncture, respectively. It was stated that response to acupuncture was poor particularly in the younger age group and in adolescents over the age of 14 years. The parents of 50% of the patients stated that their children could wake up more easily. It was expressed that electroacupuncture showed its activity possibly by increasing vasopressin concentration. It was stated that addition of acupuncture therapy to conventional treatments and to the treatments of patients who were resistant to other therapies would increase the success of treatment. It has been expressed that acupuncture alone is inadequate in the treatment of monosymptomatic nocturnal enuresis and that addition of acupuncture to conventional treatments will be more beneficial [23] [24].

In a recent study, patients with a mean age of 15.7 years who had monosymptomatic nocturnal enuresis were divided into three groups and the first group underwent laser acupuncture alone, the second group received desmopressin alone, and the third group both underwent laser acupuncture and received desmopressin [25]. It was stated that the best outcome was observed in the third group but without any significant difference. Moreover, it was determined that bladder capacity increased in the 1st and 3rd groups undergoing acupuncture procedure.

3.2. Diseases with Pain

Acupuncture is most commonly used in the treatment of pain in adults and mostly its analgesic effect has been investigated. Similar studies have also been conducted in children. In a retrospective study evaluating 47 pediatric and adolescent patients aged 5 - 20 years who had chronic pain and underwent acupuncture procedure, children-reported decrease in pain was 67% and parent-reported decrease in pain was 60% [11]. In another study, significant improvement was determined in chronic pain and chronic fatigue syndrome after acupuncture performed in children and adolescents [26].

Although there are many studies on acupuncture procedure for the treatment of headache and migraine in adult patients, this subject has not been studied adequately in children.

In their review, Gold *et al.* [26] encountered only one pediatric study on migraine. In that pediatric study with a randomized controlled design, 22 migraine patients aged 7 - 15 years underwent acupuncture and placebo acupuncture. A significant decrease was determined in the frequency and intensity of migraine in the acupuncture group as compared to the placebo group. In a two-center study from Germany, 48 patients aged 17 years and having headache or migraine were assigned half to receive laser acupuncture and half to receive placebo acupuncture [28]. A significant decrease was determined in the frequency, duration, and intensity of headache in the acupuncture than in the placebo group.

In a study, acupuncture and hypnosis were performed in the same session in 33 children aged 6 - 18 years and having chronic pain. It was stated that there was a significant decrease in anxiety symptoms and complaint of pain after treatment [29]. In a study conducted in a pediatric pain clinic in America, 15% of 129 patients (aged 8 - 18 years) who presented with chronic pain received acupuncture. Acupuncture preferred fourth after bio-feedback method, yoga and hypnosis [30].

In a study, acupuncture was performed two times for 10 - 15 minutes with 24-hour interval in children aged between 7 months and 18 years, who were postoperatively hospitalized at a tertiary referral pediatric intensive care unit [31]; it was reported that the procedure, during which no adverse event was observed, was well-tolerated by the patients and parents and 70% of the parents stated that acupuncture was a beneficial method in reducing pain. Although it was concluded that acupuncture was an acceptable and beneficial procedure in children with intensive postoperative pain, the requirement of randomized controlled studies was also emphasized [31].

3.3. Diseases with Nausea and Vomiting

The efficacy of acupuncture in adult and pediatric patients was studied mostly on nausea. Many studies have demonstrated that the use of acupuncture point PC6 decreases nausea and vomiting. This efficacy has also mentioned in classical textbooks. Bolton *et al.* [32] conducted a review and scrutinized the studies on acupuncture and drugs used for nausea after tonsillectomy. They reported the most effective drugs after tonsillectomy as dexamethasone, serotonergic antagonists (ondansetron etc.), and metoclopramide. Efficacy of acupuncture was compared with the above-mentioned drugs and found not to be as effective as the drugs.

Butkovic *et al.* [33] divided 120 patients, who received anesthesia for surgery due to various reasons, into three groups; the first group underwent laser acupuncture, the second group received metoclopramide, and the third group underwent sham acupuncture. Acupuncture was performed on the P6 point 15 min before the anesthesia. The patients were evaluated on the 2nd, 6th, and 24th hours in terms of retching and vomiting. The incidence of vomiting was found to be significantly more common in the first two hours in the control group than in the drug and acupuncture groups; however, no significant difference was determined between the methods at the 6th and 24th hours. Moreover, laser acupuncture was found as effective as the drug [33]. In 90 pediatric patients undergoing general anesthesia for maxillary surgery, the frequency and intensity of nausea was found to be lower in drug and acupuncture groups than in the control group. Moreover, no difference was determined between the drug and acupuncture groups in terms of efficacy [34].

In a study performed to reduce the adverse events of chemotherapy in adult patients with cancer, a significant improvement was observed in nausea and vomiting [35]. In a study in which real or sham acupressure was performed in 10 pediatric cancer patients receiving standard therapy alone, a decrease was observed in nausea and vomiting; however, no difference was determined between the real and sham acupressure methods in terms of efficacy [36]. Further studies that will be conducted in larger patient groups are needed on the efficacy of acupuncture in pediatric cases receiving chemotherapy.

It has been expressed that in addition to anesthesia-related nausea and vomiting, complementary medicine might also be effective in reducing anxiety of children [37] [38].

3.4. Gastrointestinal System Diseases

Constipation is a common condition also in children. Behavioral therapy and massage techniques are used in the treatment of constipation in children. Despite numerous acupuncture points that might be effective on the gastrointestinal system, the relation between acupuncture and constipation has not been studied enough in pediatric patients. In China, a success rate of 81% was achieved with acupuncture in the treatment of adult patients with constipation. In a study, LI11 point was stimulated for three successive days without giving laxatives in 10 patients having hospital-induced constipation and spontaneous defecation was observed 2 hours after treatment [39] [40].

3.5. Neurological System Diseases

Acupuncture has been tried as a therapeutic option for the treatment also for pediatric cases with refractory seizure. In a study from China, in which acupuncture + Chinese herbal medicine or Chinese herbal medicine alone or carbamazepine alone was given to 64 boys (1 - 17 years of age) with seizures, decreases in the number of seizures were reported in all groups without statistically significant difference among the three groups in terms

of success of the therapeutic method [41].

In China, acupuncture is performed in many children with neurological sequelae. In a study, tongue acupuncture was performed for more than 30 days in 10 patients with drooling problems and it was reported that the method was beneficial [42]. In another study, tongue acupuncture and sham acupuncture were compared in pediatric cases and significant improvement was observed in motor functions and self-care of the patients in the acupuncture group [43].

In the 2008 Cochrane review [44], it was reported that there was no adequate and reliable study on the use of acupuncture procedure for the treatment of epilepsy in pediatric cases and accordingly acupuncture was not recommended. Studies have been conducted on the use of acupuncture in refractory epilepsy; however, acupuncture is not recommended to be used in children with refractory epilepsy as the majority of studies are not randomized controlled studies or the results are not significant [44].

Cerebral imaging studies have been conducted by performing acupuncture in children with cerebral palsy and in normal children. Differences have been determined between the images obtained during acupuncture therapy. It has been emphasized that studies on the use of acupuncture for the treatment of cerebral palsy should continue [45]. In a study, acupuncture was performed for 3 months in 200 children with cerebral palsy and it was stated that acupuncture significantly and favorably affected mental and motor development in the treatment group than in the control group, which underwent physical rehabilitation alone [46]. There are studies suggesting that acupuncture may be beneficial in mental retardation, attention deficit and in enhancing school success [47] [48].

3.6. Allergic System Diseases

In a randomized controlled study published in 2013, acupuncture was performed in half of 56 preschool children with asthma and the other half was included as the control group [49]. They reported decreases in the use of inhaled steroids and in the need for beta-mimetic drugs and a reduction in subjective asthma symptoms after acupuncture therapy.

In Egypt, laser acupuncture was performed 3 sessions per week in 50 children followed for asthma and it was stated that an improvement in respiratory function tests were observed, beta-mimetic drugs were discontinued, and the dose of inhaled corticosteroids was reduced after the 1-month treatment period [50].

In a randomized controlled study conducted in Hong Kong in 72 children aged 6 - 20 years, who had allergic rhinitis and underwent acupuncture procedure, a significant reduction was reported in the symptoms of allergic rhinitis at the end of 3 months [51]. In a meta-analysis, it was also expressed that acupuncture was safe and valid for the treatment of allergic rhinitis [52].

4. Acupuncture Procedures in Neonates

In a survey conducted by Landgren [53], 23 acupuncturists performing acupuncture for infantile colic from 5 European countries and 4 non-European countries were questioned about their experiences. In the light of their experiences, acupuncture was found to be beneficial in reducing the symptoms of infantile colic. In a randomized, blinded, controlled study by Landgren *et al.* [54], the effect of acupuncture on the number and quality of feeding and defecation and sleep routine of the infants was investigated in the infants aged 2 - 8 weeks. The infants received a single point acupuncture for 2 seconds twice weekly for 3 weeks. They determined that minimal acupuncture had no significant favorable effect on the feeding, defecation, and sleep routine of the infants and that no significant improvement was observed in the symptoms of colic. On the other hand two studies suggested that acupuncture was beneficial in reducing the symptoms of infantile colic [55] [56].

Ecevit *et al.* [57] demonstrated analgesic and anxiolytic effects of acupuncture in 10 premature infants. In a review on the efficacy and safety of acupuncture in preterm and term infants, acupuncture was found to be beneficial and safe in pain management in the neonates; however, it was stated that there was no adequate data on its long-term effects [58].

Benefit and efficacy of acupuncture in the treatment of hypoxic-ischemic encephalopathy, which is an important problem in neonates, were investigated; however, no noteworthy study could be found [59]. However, an electroacupuncture study conducted in the neonate rat model of hypoxic-ischemic encephalopathy demonstrated neuroprotective effect of acupuncture [60].

Raith *et al.* [61] investigated cerebral effect of laser acupuncture in premature and mature neonates for the first time. After performing single point laser acupuncture for 5 minutes, no change was observed in the heart-

beat and peripheral oxygen saturation of the neonate, whereas regional cerebral oxygen saturation was decreased and cerebral fractional tissue oxygenation was increased. Although peripheral oxygen saturation was not changed, different measurements detected in the brain were attributed to the effect of acupuncture on regional cerebral blood flow and oxygen supply.

5. Conclusion

There is a need for randomized controlled studies on the pediatric use of acupuncture, which is a widespread complementary method of treatment. It is obvious that acupuncture, which is associated with has low rates of serious adverse events when performed by experienced acupuncturist physicians, and would contribute to healing in pediatric diseases. We are in the opinion that development of guidelines for acupuncture procedures in pediatric patients will be beneficial for acupuncture to be performed safely in children.

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