

Efficacy of crenotherapy by Politzer in the treatment of otitis media with effusion in children with down syndrome

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1. Introduction

Down's syndrome (DS) is the most commonly occurring genetic abnormality, involving about 1 in 600 births. ENT disorders hold an important place in DS because of their high incidence and severity. Among these, DS patients present three times higher incidence of chronic ear disease and secondary hearing loss than other children with developmental delays, including an increased incidence of middle ear effusion (OME). OME is defined as the presence of middle ear fluid without symptoms or signs of acute inflammation of the middle ear [1]. OME is the most common cause of acquired conductive hearing loss in childhood with a 10–30% prevalence in the 1–3 year age group [1]. Etiologic factors include upper respiratory tract infections, possibly due to the immaturity of the immune system with a reduction of both T and B lymphocyte cell function [2]. In addition, the anatomical abnormalities of the mid-face in DS subjects, including the nasopharynx hypoplasia, the altered shape of Eustachian tube, which appears more cylindrical and smaller in width, and its abnormal insertion, predisposes to chronic ear disease. The generalized hypotonia seen in DS can also cause a decreased function of the tensor veli palatine muscle, with consequent collapse of the Eustachian tube and obstruction of air flow through the middle ear space.

If chronic middle ear effusion and infections are left untreated atelectasis, atrophic, and adhesive disease of tympanic membrane as well as ossicular damage can occur [2]. The treatment of chronic OME in children aims to improve hearing and to prevent the possible sequelae of long-term hearing loss such as impairment to speech and lan-

guage development. The need for repeated insertion of tympanostomy tube in order to eliminate chronic effusion and to bypass the non-functioning Eustachian tube is common but it remains to be determined whether is also effective [3]. Myringotomy and tympanostomy tubes are less effective treatment for otitis media with effusion in DS patients [3]. Insertion of ventilation tubes is made more difficult or even impossible by the often small size of the external auditory canal and is complicated by a high incidence of persistent otorrhoea and a higher extrusion rate [4]. Through more consistent medical and surgical care, new standard is being established for ENT manifestations in DS [5,6]. Crenotherapy appears suitable for children because well-tolerated, not invasive and repeatable. For these reasons in the present study the authors want to investigate whether, appropriately applied, it could be associated with benefits in DS children with OME. Therapeutic effects of crenotherapy depend essentially on specific characteristics of water and methodology of application. Mineral waters have physical proprieties as temperature, osmolarity, radioactivity and induce chemical and pharmacological responses in human organism [5]. Anti-inflammatory, mucolytic and trophic proprieties of bromo-iodine water are well-recognized, they also enhance the immune system by synergy with the production of secretive IgA in the upper and lower respiratory tract and affect the reactivity of the complete rhino-pharyngeal Eustachian tube ecosystem against intrinsic and extrinsic pathogenic noxae [6]. With regard to the methodology of application, the Politzer's method can restore permeability to the Eustachian tube by using an insufflator made out of a pear-shaped medical device. While the patient swallows, the device, placed into one nostril, with the compression of the other nostril,

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emits a controlled air pressure with consequent indirect ventilation of the Eustachian and without discomfort.

The aim of our study was to evaluate the efficacy of crenotherapy with jet-inhalations and insufflations by Politzer using salt-bromine-iodine mineral water of Agnano spa in Naples, Italy, in children with DS suffering from OME.

2. Material and methods

This study involved 48 subjects, 30 males and 18 females, mean age $6 \pm 2,4$ (range 3–14 years), divided in two groups: 24 children diagnosed as having DS on the basis of the clinical features and chromosomal analysis (group A); 24 age-matched children, who showed neither chromosomal abnormalities nor mental retardation (group B). All the children, suffering from persistent bilateral OME for at least 6 months and resistant to the conservative therapy, were submitted to crenotherapy with jet-inhalations and insufflations by Politzer's method using salt-bromine-iodine water for the treatment of chronic OME. Children treated with drugs in the 2 months before were excluded. Contraindications to crenotherapy were acute disease phases, heart diseases, uncontrolled diabetes, and overt malignancy. All subjects underwent 2 cycles of crenotherapy lasting 12 consecutive days each. Every thermal cycle, performed during the period from March to April the first, and from September to October the second, included one jet-inhalation 10' long, and one Politzer' insufflation 10' long, every day. All subjects underwent the following tests both before and after every treatment: objective ENT examination, tympanometry, and acoustic reflectometry. The tympanograms were classified as type A when static admittance (SA) was ≥ 0.2 mmho and tympanic peak pressure (TPP) was $-200/+100$ daPa, type B when SA was < 0.2 mmho, type C when SA was ≥ 0.2 and TPP < -200 daPa, and positive when SA was ≥ 0.2 mmho and TPP $> +100$ daPa. The A and positive curves were regarded as normal, the B and C curves were regarded as abnormal. The enrolled subjects were followed up for at least 6–8 months after treatment. The Institutional Ethics Committee approved the study protocol. All subjects were accompanied during the study by one or both parents who gave written informed consent for their children's participation in the study.

Statistical analysis was performed with MedCalc software, version 19.0.5. through Wilcoxon/Mann-Whitney test for independent and non-parametric variables, the p value < 0.05 was considered statistically significant. Tympanometry of each group was realized before (t0) and after crenotherapy (t1); data were compared in each group and each other.

3. Results

Before treatment tympanometric results were as follows: (group A) 0 type A, 36 type B, 12 type C; (group B) 0 type A, 30 type B, 12 type C. After therapy tympanometric results were as follows: (group A) 33 normal tympanograms, type A, 4 type B and 11 type C; (group B) 30 normal tympanograms type A, 6 type B and 12 type C (Fig. 1). No adverse effects were recorded in any patients during and after treatment. The follow up confirmed outcomes 6–8 months after treatment. In fact the benefits that were observed immediately after the end of the cycle of endotympanic insufflations remained constant over time even after 6–8 months from the end of the treatment. Therefore, no change in the type of tympanometric pattern was detected.

We compared, through Wilcoxon/Mann-Whitney test, tympanometry of group A and B before treatment ($p = 0,86$ not statistically significant) at baseline the groups were homogeneous. A very statistically significant p value ($p > 0,0001$) was observed in each comparison between tympanometry in A and B group at baseline (t0) and after crenotherapy (t1) (Fig. 2). Comparison, after crenotherapy, of A and B group didn't result statically significant ($p = 0,55$) but in A group 33 patients had a normal tympanometric curve (68,75%) in front of 30 patients (62,50%) in B group with an increased outcome in Down syndrome (group A) of 6,25%.

4. Discussion

DS children had a high prevalence of middle ear problems, 60% are reported to have OME that causes mild to moderate hearing loss which may affect the speech development [6]. Children with Down's syndrome are highly susceptible to OME and present particular problems of assessment and management because of the earlier age of onset, prolonged course, greater risk of complications and potential diagnostic difficulties. A number will also have a co-existing sensorial hearing loss which must be identified. The ENT specialist plays an important role in the medical and surgical care of DS and continued monitoring and treatment is needed [7,8]. Although benefits have been demonstrated for some medications, they are short-term and relatively small in magnitude. Moreover, significant adverse events may occur with all medical therapies [9,10]. On the other hand, surgical management of OME includes insertion of tympanostomy tubes in order to promote drainage of persistent unresolved effusions and to improve hearing [10]. Nevertheless, children with DS continue to have middle ear and Eu-

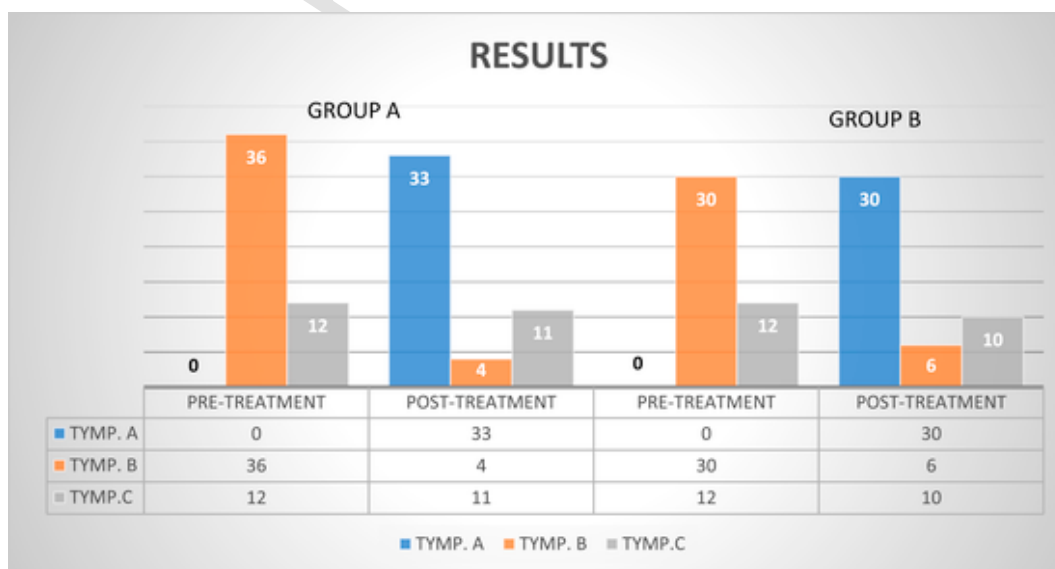


Fig. 1. Results before and after treatment in the Group A and B.

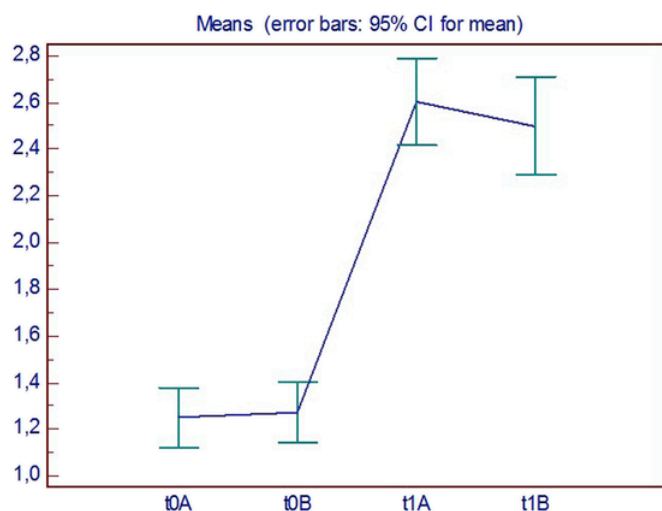


Fig. 2. Statistically significant p value was observed in each comparison between tympanometry in A and B group at baseline (t0) and after crenotherapy (t1).

stachian tube dysfunction far longer than what is seen in non syndromic children, and the need for repeated insertion of tympanostomy tube to eliminate chronic effusion and to bypass the non-functioning Eustachian tube is common but it remains to be determined whether it is also effective [3–11]. Iino reported a low success rate for improvement in hearing, shortly after tympanostomy tube insertion in DS subjects [3]. Still Iino reported that the efficacy of tympanostomy tube insertion was much lower compared to that in age-matched controls. Also insertion of ventilation tubes is made more difficult or even impossible by the often small size of the external auditory canal. DS patients also suffer a risk of permanent perforation following extrusion of the tube, because the tympanic membrane is very thin that lacks a lamina propria, a layer rich in blood vessels and collagen fibers [3].

Adenoidectomy was significantly less efficacious in the treatment of nasal and middle ear disorder in DS group with the exception of symptoms of restless sleep and nasal congestion [12,13,14,15]. For these reasons conservative management should be the approach of first choice and the placement of tympanostomy tube should be limited only when hearing loss due to middle ear effusion is severe and when pathological changes of eardrum, such as adhesion and deep retraction pocket formation, are going to occur [16,17]. Following this point of view other non-surgical therapies should be proposed.

In the present study the authors want to investigate whether appropriately applied, crenotherapy could be associated with benefits in DS children with OME. Crenotherapy is suitable for DS children because well-tolerated, not invasive, repeatable and without adverse effects. Therapeutic outcomes of crenotherapy depend on specific physical properties of water and in particular on methodology of application. The authors have pursued the application of 2 thermal cycles, lasting 12 consecutive days each, included one jet inhalation 10' long, and one Politzer 10' long, every day, using salt-bromine-iodine water. After treatment in A group 68,75% of patients had a normal tympanometric curve in front of 62,50% in B group with an increased outcome in Down syndrome of 6,25%. The crenotherapy shows an improvement in tympanometric data and a reduction in OME duration. This has a favourable for counselling children with DS and their families, as these children are likely to outgrow the condition.

5. Conclusions

The beneficial effects are correlated with the action mechanism of Politzer, which allows opening and closing of the Eustachian tube, favours secretion drainage and endotympanic pressure balance and with the chemical, physical and chemico-physical characteristics of the mineral water used. Our results suggest that crenotherapy with jet-inhalations and insufflations by Politzer might be used as an alternative conservative approach to medical and surgical treatment of OME in DS children.

Declaration of competing interest

None to declare.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijporl.2019.109803>.

Uncited references

[12,13].

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