ORIGINAL PAPER

Effectiveness of sulphur spa therapy with politzer in the treatment of rhinogenic deafness

Efficacia del politzer crenoterapico sulfureo nel trattamento della sordità rinogena

M. COSTANTINO[1 2], E. LAMPA[1], G. NAPPI[3]
[1] Department of Experimental Medicine, Section of Pharmacology "L. Donatelli", School of Medical Hydrology, Faculty of Medicine and Surgery, Second University of Naples, Naples; [2] ce.Ri.S.T. (Center of Spa Research and Studies Srl), Bacoli (Naples); [3] School of Medical Hydrology, University of Milan, Milan, Italy

Key words

Sulphur mineral water • Politzer • Inhalation • Rhinogenic deafness

Parole chiave

Acqua minerale sulfurea • Politzer • Inalazione • Sordità rinogena

Summary

Several studies have focused on the usefulness of sulphur, radioactive and bromo-iodine mineral waters in the treatment of chronic inflammatory lower and upper respiratory processes. The purpose of this study was to evaluate the tolerability, effectiveness and impact on quality of life of sulphur spa therapy with Politzer in subjects with chronic inflammatory processes responsible for the onset or persistence of rhinogenic deafness. The study was performed on 27 subjects (mean age 62 ± 2.2 years, range: 28-88) with chronic *catarrhalis otitis,* chronic rhino-sinusitis and pharyngeal inflammation. These patients underwent 12 sessions of humid-hot inhalation, with vapour jet 20 cm from the face, at 38 °C for 10 min, followed by Politzer with sulphur sodium chloride bicarbonate alkaline mineral water from "Rosapepe" Spa, in Contursi (Salerno, Italy). Middle ear function and possible social recovery (based on Giaccai and Gardenghi guidelines) of the patients were assessed, at the beginning and end of the spa therapy. Results, at the end of this treatment, showed a significant ($p < 0.05$) increase in audiometric curves corresponding to the normal ventilation of the tympanic box (incidence of 24% before therapy and 33% thereafter) and a decrease in pathological curves. Moreover, a significant ($p < 0.05$) reduction in the percentage of auditory loss was recorded (N = 41; 19.7% ± 2.5 → 13.9% ± 1.9) and improved hearing, at the frequencies required for daily activities: 500-1000 and 2000 Hz (31.1 dB ± 1.7 → 26.8 dB ± 1.5). No adverse effects to the spa therapy were observed during the study. In conclusion, the results of this study are in agreement with data in the literature, demonstrating that associated spa therapy with Politzer and inhalation have a positive impact on the therapeutic strategy of chronic inflammatory processes, responsible for the onset or persistence of rhinogenic deafness, in order to enhance and combine with the already consolidated pharmacological approaches.

Riassunto

Dati di letteratura hanno evidenziato che varie patologie croniche di pertinenza respiratoria ed ORL possono trarre beneficio dall'uso di acque minerali sulfuree, radioattive e salso-bromoiodiche. Pertanto scopo della nostra ricerca è stato quello di valutare la tollerabilità, l'efficacia terapeutica e l'impatto sulla qualità di vita del Politzer crenoterapico sulfureo in soggetti affetti da processi infiammatori cronici spesso responsabili dell'insorgenza o persistenza della sordità rinogena. Lo studio è stato condotto su un campione di 27 soggetti, di età compresa tra i 28 e gli 88 anni con età media pari a 62 ± 2,2 anni, i quali, poiché affetti da patologie flogistiche croniche o comunque recidivanti delle vie aeree superiori e dell'orecchio medio, si sottoponevano a 12 sedute di crenoterapia inalatoria con acqua minerale sulfurea salso-bicarbonata alcalino-terrosa delle Terme "Rosapepe" in Contursi (SA) erogata mediante inalazione a getto di vapore alla T di 38 °C a 20 cm dal viso con durata di 10 min seguita da Politzer. All'inizio e a fine ciclo curativo termale è stata valutata la funzionalità dell'orecchio medio ed il possibile recupero sociale (mediante la tabella di Giaccai e Gardenghi). I dati rilevati hanno mostrato a fine ciclo curativo crenoterapico sulfureo un significativo ($p < 0,05$) miglioramento della funzionalità dell'orecchio medio evidenziato da un aumento delle curve audiometriche normoacusiche (dal 24% → 33%) e da una riduzione di quelle patologiche. Si è anche evidenziato, a fine cura termale, un significativo ($p < 0,05$) recupero sociale dei soggetti del campione esaminato, dimostrato sia dal miglioramento del valore percentuale della perdita uditiva di ciascun orecchio ipoacusico (N = 41; 19,7% ± 2,5 → 13,9% ± 1,9) sia dal miglioramento della capacità uditiva sulle frequenze più importanti ai fini della vita di relazione cioè 500-1000 e 2000 Hz (31,1 dB ± 1,7 → 26,8 dB ± 1,5). In conclusione, i risultati di tale ricerca sembrano dimostrare che la crenoterapia inalatoria sulfurea, comprendente l'associazione di inalazione a getto diretto e Politzer, può apportare notevole beneficio nei processi flogistici cronici o recidivanti delle vie aeree superiori e dell'orecchio medio responsabili dell'insorgenza o persistenza della sordità rinogena con un'ottima tollerabilità locale e sistemica ed una positiva ricaduta sulla qualità di vita dei soggetti.

Introduction

Clinical and experimental studies have demonstrated that patients with chronic upper or lower respiratory diseases and middle ear disorders benefit from treatment with mineral waters [1-5].
Thermal therapy (or spa therapy) in such diseases has anti-inflammatory, mucolytic and trophic effects. It also enhances the immune system (by synergy with the production of secretive IgA in the upper and lower respiratory tract) [6-8].
The chemical, physical and chemico-physical properties as, indeed, also the curative properties of mineral waters with sulphur and bromo-iodine are well recognized [9-13].
Many Authors differentiate the use of these mineral waters, indicating sulphur mineral water for purulent disturbances and bromo-iodine mineral water prevalently for atrophic disorders [4 5]. For example, of the various treatments for otitis media, spa therapy with sulphur mineral water is indicated for its fluidifying and anti-inflammatory effects.
On the basis of these considerations, the aim of our study was to evaluate the effectiveness and impact on quality of life (QoL) of spa inhalatory therapy using humid-hot vapour jet inhalations + Politzer with sulphur sodium chloride bicarbonate alkaline mineral water in adults with chronic inflammatory processes that could lead to rhinogenic deafness.
Furthermore, investigations were carried out to establish whether this spa inhalatory therapy could induce adverse reactions.

Materials and methods

The study was performed on 27 patients (63% female, 37% male) mean age 62 ± 2.2 years (range: 28-88; median: 62) with chronic inflammatory upper respiratory tract and middle ear disturbances responsible for onset or persistence of the rhinogenic deafness (such as pharyngitis, rhinitis, laryngitis, chronic *catarrhalis otitis* and chronic *rhino-sinusalis* inflammation).
After clinical examination and obtaining written informed consent, all patients were submitted to a cycle of spa inhalatory treatment with sulphur sodium chloride bicarbonate alkaline mineral water from "Rosapepe" Spa in Contursi (Salerno) Italy (Table I) which included individual humid-hot vapour inhalation at 38 °C, 20 cm from the face for 10 min. followed by thermal Politzer.
Thermal Politzer exploits the beginning of deglutition to closed nostrils when increased pressure in the rhinopharyngeal cavity is created and, furthermore, allows ventilation of the Eustachian tube with a dry gaseous mixture, until continuous flow is created, in an indirect manner, unlike direct endotympanic inflation.
During the first few days of treatment, the patients had 6-8 deglutitions per session until reaching 25-30 deglutitions on day 12 of treatment, 13-15 for each nostril.

Table I. Chemical, physical and chemico-physical characteristics of mineral water from "Rosapepe" Spa.

General organological characteristics
1) Appearance = clear
2) Favour = sulphureous
3) Taste = slightly saline

Microbiological test: bacteriologically pure

Chemico-physical characteristics
1) Temperature of water at well = + 37.6 °C;
2) Temperature of outside air = + 4 °C;
3) Electric conducibility = 4.37 m/S;
4) Thickness = 1.002;
5) pH = 6.62

Chemical characteristics
1) Fixed residue at 110 °C = 2999 mg/l;
2) Fixed residue at + 180 °C = 2957 mg/l;
3) Total alkalinity (in HCl N/10/l) = 362 ml;
4) Total hardness in French degrees = 178.8;
5) Ammonia = traces;
6) Nitrites = traces;
7) Nitrates = present

Gas dissolved in 1 lt of water
1) Carbonic anhydride at well = 1408.0 mg/l
2) Sulphydric degree = 15.25 mg/l

Analysis of residue in mg/l

Sodium	420
Potassium	65
Calcium	525.32
Magnesium	115.57
Lithium	1.00
Chlorine	567.25
Iron	0.04
Manganese	0.13
Fluorine	0.18
Barium	absent
Hydrogen carbonate	2208.20
Sulfites	243
Silica	12.6
Bromine	traces
Iodine	traces

Classification: Hyper-thermal alkaline sulphur sodium-chloride bicarbonate mineral water

The spa inhalatory therapy included 12 sessions, with a rest day after the first 6 sittings, to avoid *thermal shock*.
The patients presented with a specific diagnosis, confirmed by physicians at the Spa.
All patients were submitted to clinical investigations before, during and after the spa inhalatory treatment. At the beginning and end of the treatment cycle, middle ear function and social recovery (based on the guidelines of Giaccai and Gardenghi) were assessed.
Middle ear function of the patients was evaluated by means of an audiometric test for a total of 54 examinations (27 patients x 2 ears = 54 audiometric tests). The *pure tone audiometry classification* was used to quantify data [14 15], where levels of deafness are evaluated at the conversational frequencies of 0.1-1.2 KHz and the auditory damage, expressed in decibels (dB), is derived from the midrange loss of these frequencies. Based on this classification, patients were subdivided into: normoacoustics < 20 dB, with light hearing loss ≥ 20-40 dB, with middle hearing loss ≥ 40-70 dB, with severe hearing loss ≥ 70-90 dB, with deep hearing loss ≥ 90 dB.
Social recovery of patients with hypoacusis was assessed by determining the percentage of hearing loss per non normoacoustic ear (N = 41) at 250-500-1000-2000 Hz, based on the guidelines of Giaccai and Gardenghi [14 15], and by evaluating midrange values obtained for the frequencies used in everyday life (500-1000-2000 Hz) and frequency important for background noise (4000 Hz).
Statistical analysis of the data was performed by determining the mean ± SEM and results were compared with the Student t test for paired data. A p value < 0.05 was considered significant [16].

Results

Adverse effects

No adverse effects were recorded, in any patient, during the course of the spa inhalation therapy (inhalation of vapour + Politzer) for rhinogenic deafness.

Middle ear function

At the end of spa inhalation therapy, the results were significant ($p < 0.05$) showing increased audiometric normoacoustic curves (from 24% to 33%) and decreased pathologic curves (from 76% to 67%) (Fig. 1).
Audiometric curves, assessed before the curative spa inhalation cycle, revealed mild transmitted deafness in 56% of the cases and less mild transmitted deafness in 20% (Fig. 2). Cases of severe perceptive hearing loss did not respond to therapy since they involved diseases beyond the scope of spa inhalation.
Finally, in the spa inhalation cycle, 9% of the audiometric disorder curves, with mild transmitted deaf-

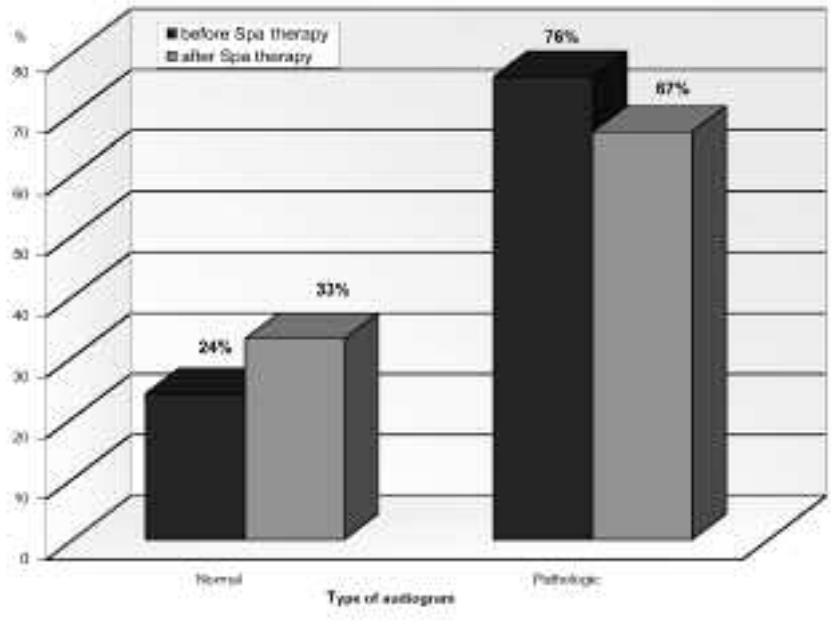
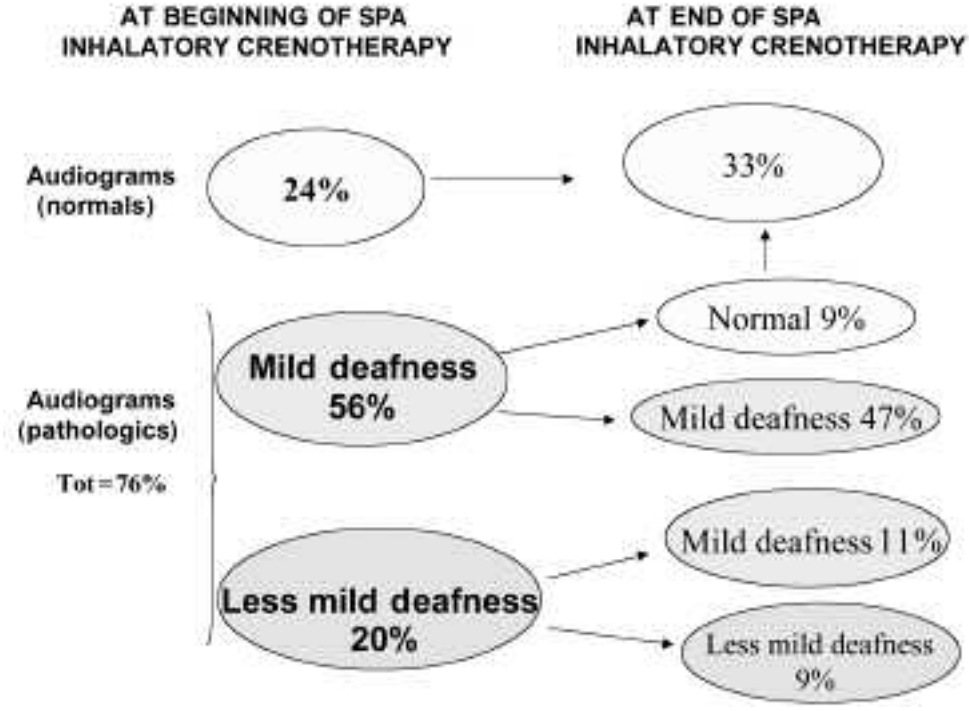


Fig. 1. Percentage of normal and pathological audiometric curves observed, at beginning and end of spa inhalatory therapy (inhalation humid-hot vapour + Politzer) with sulphur mineral water, in 27 subjects (54 ears).

ness, evolved toward normoacoustic curves (33%); 11% of the audiometric disorder curves, with less mild transmitted deafness, evolved towards a mild transmitted deafness (Fig. 2).
Moreover, a significant ($p < 0.05$) reduction in the percentage of the auditory loss was also recorded in ears of all patients with deafness (N = 41, 19.7% ± 2.5 → 13.9% ± 1.9) (Fig. 3).
The same situation was found in the groups with mild deafness (N = 30, 12% ± 1.3 → 8.7% ± 1.2) and in less mild deafness (N = 11, 42% ± 3.5 → 28% ± 3.7) (Fig. 3).
Analysis of mean values obtained in 41 audiometric disorder curves for the more important frequencies of daily situations (500-1000-2000 Hz) and important frequencies to perceive sounds and background noises (4000 Hz) shows that at the end of a spa inhalation cycle, there is a significant ($p < 0.05$) improvement in 500-1000-2000 Hz frequencies (31.1dB ± 1.7 → 26.8dB ± 1.5) (Table II), while a significant improvement was not achieved ($p > 0.05$) only at a frequency of 4000 Hz (45dB ± 3.0 → 40dB ± 3) (Table II).

Discussion

Rhinogenic deafness is a transmission deafness with varying degrees of involvement. It is caused primar-



Type of audiogram	N. audiograms observed at beginning of spa inhalatory therapy (%)	N. audiograms observed at end of spa inhalatory therapy (%)
Normoacoustic	13 (24%)	18 (33%)
Mild hearing loss	30 (56%)	31 (58%)
Less mild hearing loss	11 (20%)	5 (9%)
Severe hearing loss	0 (0%)	0 (0%)
Total hearing loss	0 (0%)	0 (0%)

Fig. 2. Type of audiogram observed in 27 patients considered (54 ears) at beginning and end of spa inhalatory therapy (inhalation of humid-hot vapour + Politzer) with sulphur mineral water. For classification, a mean value to frequencies of 125-250-500-1000 Hz was used.

Table II. Pure tone audiometry: analysis of audiogram disorders (N = 41) observed at beginning and end of spa inhalatory therapy (inhalation of humid-hot vapour jet + Politzer) with sulphur mineral water.

Mean (Hz) frequency	Mean (dB) basal ± SEM	Mean (dB) final ± SEM	Difference	Improvement %	"t" test
500-1000-2000	31.1 ± 1.7	26.8 ± 1.5*	4.3	14	< 0.05
4000	45.0 ± 3.0	40.0 ± 3	5.0	11	> 0.05

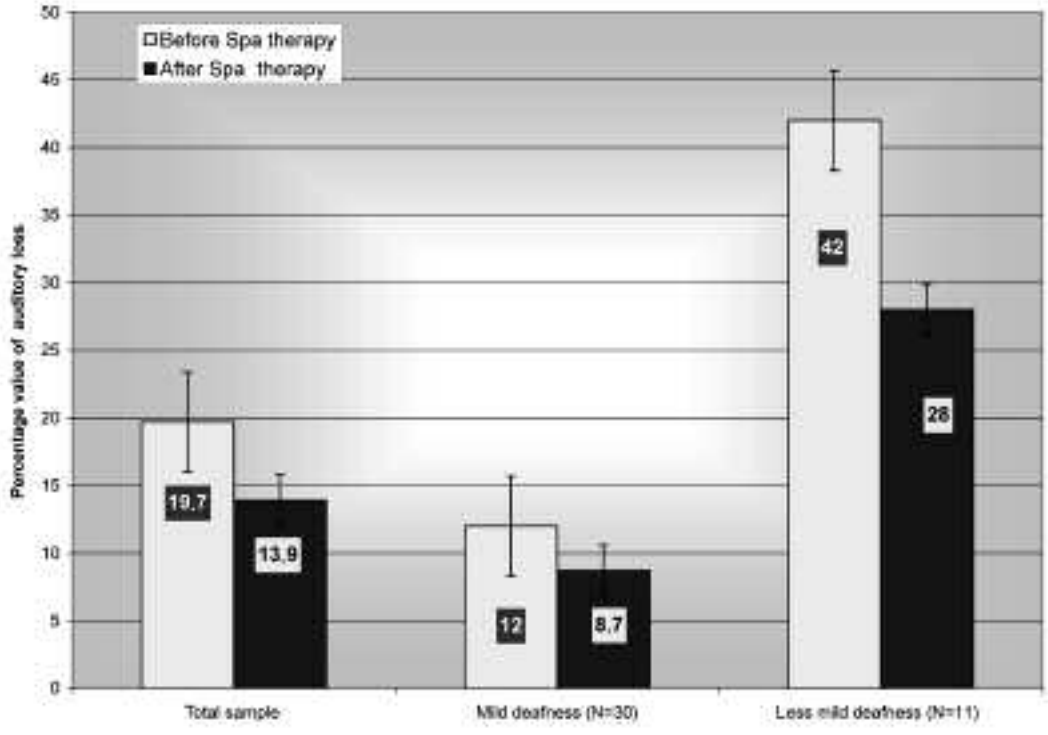


Fig. 3. Evaluation of social recovery in 27 subjects considered by means of determination of the percentage value of hearing loss of each non normoacoustic ear (N = 41) at 250-500-1000 and 2000 Hz at beginning and end of spa inhalatory therapy (inhalation humid-hot at vapour jet + Politzer) with sulphur mineral water.

ily by a nasal clog associated with dysfunction of the Eustachian tube, the integrity of which is essential for middle ear function [14 15].

Besides allowing drainage of exudates from the tympanic box, the middle ear is also responsible for pressure balance between inner and outer surfaces of the eardrum. Chronic *catarrhalis otitis*, responsible for rhinogenic deafness occurs in adults due to chronic inflammatory processes such as rhino-pharyngitis, rhinitis, sinusitis, nasal stenosis, laryngitis, rhino-sinusitis, pharyngitis. In the treatment of factors promoting inflammatory processes responsible for the onset or persistence of rhinogenic deafness, spa inhalation therapy with sulphur mineral water is indicated, at any age, since it has a beneficial effect upon the degree of inflammation and biochemical characteristics of the nasal mucus. As a consequence, it also affects the reactivity of the complete rhino-pharyngeal Eustachian tube ecosystem versus the intrinsic and extrinsic pathogenic noxae [6 17-19]. In the chronic inflammatory processes characterized by mucus of the upper respiratory tract, spa therapy with sulphur mineral water induced numerous beneficial effects both on tissues and secretions. The curative action induces immune, anti-inflammatory and mucus-regulatory mechanisms [5 10 17 18]. Spa therapy of rhinogenic deafness and the chronic inflammatory processes responsible for its onset or persistence is based on sul-

phur, radioactive and bromo-iodine mineral waters. The most used method is by means of direct vapour inhalation. This may be either endotympanic ventilation, with direct sulphur vapour in the Eustachian tube, or in Politzer therapy with indirect ventilation of the Eustachian tube [4 5]. Several studies have demonstrated the effectiveness of endotympanic ventilation, while results of the Politzer method are controversial.

On the basis of these considerations, the aim of our study was to further confirm, in adults with chronic inflammatory processes, responsible for the onset or persistence of rhinogenic deafness, the *tolerability*, *effectiveness* and *impact on the QoL* of sulphur spa therapy using humid-hot vapour + Politzer.

Our findings are in agreement with reports in the literature [4 5 10 18], suggesting that spa inhalatory therapy with humid-hot vapour + thermal Politzer inhalation, improves not only most symptoms but also middle ear function.

In fact, at the end of spa inhalation therapy, the study shows an increase in the audiometric normoacoustic curves and a reduction in those disorders (audiometric curves with mild transmission deafness returned to normoaudiometric curves; audiometric curves with less mild transmission deafness became mild transmission deafness).

Significant social recovery of the patients was achieved at the end of the spa inhalation therapy, namely a percent recovery of auditory loss in each ear and improved hearing at frequencies required for routine situations (500-1000 and 2000 Hz). The beneficial effects are correlated with the action mechanism of Politzer. This allows opening and closing of the Eustachian tube, favours secretion drainage and endotympanic pressure balance. This is based on the chemical, physical and chemico-physical characteristics of the mineral water used, in our case sulphur sodium-chloride bicarbonate alkaline [12 17 20].

Thanks to these characteristics, this mineral water has an anti-inflammatory effect and increases defences by enhancing the endothelial reticulocyte system in synergism with the production of S-IgA by nasal respiratory tissues. This water increases trophic and mucus-ciliary activity (by undergoing vascular changes the respiratory mucous membrane receives eutrophic impulses that act on the secretion and vibrating cilia, with marked improvement in "*mucus-ciliary clearance*", and thus on the function that commonly prevents organic, inorganic, bacterial or viral particles from entering the organism); anti-oedema action (in fact, vapour penetration in the respiratory tissues determines a marked osmotic action that allows the water to cleanse the mucous epithelium and allows serum from transudation to escape from the capillary and lymphatic beds); mucolytic action and fluidifying secretions by its osmotic effect linked to hypertonia and for breaking disulphide bonds of the mucin.

In conclusion, considering the multifactorial aetiology of rhinogenic deafness [15 16 21 22], it is important to characterize and remove the causes. Spa inhalatory therapy, using sulphur mineral water, offers this possibility, with its beneficial effects, good local and systemic tolerability and its positive contribution to social recovery by improving the quality of life.

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■ Address for correspondence: Prof.ssa M. Costantino, Dipartimento di Medicina Sperimentale, Sezione di Farmacologia "L. Donatelli", Seconda Università di Napoli, via Costantinopoli 16, 80138 Napoli, Italy. Fax 1782216248. E-mail: maria.costantino@unina2.it