Sobbing - Phonotherapeutic Characteristics and Possibilities

Soluço - Características e Possibilidades Fonoterapeuticas

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SUMMARY

Introduction: Sobbing is a reflex action that occurs because of a diaphragmatic spasm at the moment of the inspiration with the simultaneous glottic closure, followed by a characteristic noise. In our clinical practice we have found patients who begin to present with persistent sobbing after a neurologic clinical event.

Objective: To characterize sobbing, establish its etiology and therapeutic possibilities.

Method: A bibliographic review of data published in the last 10 years, whose descriptors include: Sobbing, sobbing and stomatognatic system, sobbing and treatment.

Final Comments: Based on the data of the literature, we concluded that sobbing may occur in view of the neurological pathologies, gastrointestinal, thoracic and/or toxic metabolic profiles The treatment forms are related to the forms of sobbing that can be benign, by interruption of the breathing cycle, or persistent, through pharmacological and/or surgical medical procedures, in addition to the use of acupuncture. Depending on its frequency and speed, we presume that it may change the functions of deglutition, breathing and speech, because the pneumo-phono-articulatory organs and the mechanisms in charge of such functions change in view or this event, and cause abnormalities to its functionality, which makes us refer to a possible phonoaudiological therapeutic approach.

Keywords: sobbing, deglutition, breathing, phonoaudiology.

RESUMO

Introdução: O soluço é um reflexo que ocorre por um espasmo diafragmático no momento da inspiração com o concomitante fechamento glótico, acompanhado de ruído característico. Na nossa prática clínica encontramos pacientes que, após evento clínico neurológico, passam a apresentar soluços persistentes.

Objetivo: Caracterizar o evento soluço, estabelecer sua etiologia e possibilidades terapêuticas.

Método: Trata-se de uma revisão bibliográfica de dados publicados nos últimos 10 anos, tendo como descritores: soluço, soluço e sistema estomatognático, soluço e tratamento.

Comentários Finais: Com base nos dados da literatura, temos que o soluço pode ocorrer frente aos quadros de patologias neurológicas, gastrintestinais, torácicas e/ou tóxico-metabólicas. As formas de tratamento encontram-se relacionadas às formas de soluço, que podem ser benigno, por interrupção do ciclo respiratório, ou persistente, através procedimentos médicos farmacológicos e/ou cirúrgicos, além do uso da acupuntura. Dependendo da sua frequência e velocidade, presumimos que o mesmo possa alterar as funções de deglutição, respiração e fala, pois os órgãos pneumofonoarticulatórios e os mecanismos responsáveis por estas funções alteram-se diante deste evento, ocasionando anormalidades em sua funcionalidade, o que nos remete a uma possível abordagem terapêutica fonoaudiológica.

Palavras-chave: soluço, deglutição, respiração, fonoaudiologia.

INTRODUCTION

In our medical experience, sometimes we encountered patients who had intermittent hiccups, after cerebral vascular accident, at a very high frequency per minute, which makes the feeding process difficult.

According to ICD 10 (1) international classification of diseases, hiccup is a result of a diaphragmatic spasm caused by a sudden inhaling that is interrupted by the glottis spasmodic closure, which produces a characteristic noise. This noise is heard when the sudden closure of the glottis occurs, by producing vibration to the vocal cords (2).

This study was planned aiming to evaluate the unleashing of the hiccup and set the base of our clinical experience. We searched for a review of the data supported by the scientific databases of the last ten years, by researching for the keywords: Hiccup, hiccup and stomatognatic system, hiccup and treatment. We found eight articles published in Lilacs database with reference to case studies, description and treatments for this occurrence and its etiology; two hundred and seventy from the Medline database, following the same direction with focus on the medication treatment; and two from Cochrane Library, comparing the drugs effects.

In order to compliment the data regarding the stomatognatic system anatomophysiology, we sought publications from human anatomy and physiology, available in the central library of the Centro Universitário Metodista IPA (Porto Alegre/RS).

The purpose of this review is to establish the features of hiccup and their possible relationship with the orofacial functions and the therapeutic possibilities.

The Hiccup

Hiccup is described as a violent inspiratory act that occurs due to a sudden involuntary (spasmodic) contraction repeated by the diaphragm (of one or the two of the hemidaphragms) and the external intercostal muscles, interrupted by a sudden, momentary and simultaneous closure of the vocal cords, that suspends the exchange of air and produces a hoarse noise (2-4).

The noise is explained by the clonic spasm of the diaphragm passing through the glottis that is narrow, and by the simultaneous traction of the larynx, provoking an abrupt passage of inspiratory air and causing a contraction with the noise. Its occurrence is determined by the motion of the respiratory muscles in an uncommon manner, which are controlled by the supraspinal center and connect the upper cervical segments of the spinal cord (5-6).

The hiccup is a reflex superposed onto a normal breathing that unleashes a reflex-arc transmitted by the vacant nerve and sensitive fibers of the phrenic nerve, in its afferent branch and by the motor fibers and their afferent branch by joint contraction of such nerves (5-6).

The alveolar pressure of a hiccup may be of up to 200 $cm^2 H2O$. The air is released in an explosive manner and expelled through the upper and oral airways at a speed of 120 to 160 km. Its pressure is higher than the respiratory tract whose alveolar pressures may reach up to 150 cm^3 H_2O in maximum inspiratory efforts (3).

The physiopathology and central connections of this reflex act are not well defined. We consider the reflex-arc may be connected to the phrenic nerve in a sympathetic chain and to the vacant nerve and its branches. Hypothetically, the afferent branch of the reflex-arc has a continuation in respiratory centers in the brain, ascending activating reticular formation and hypothalamus, which act as central mediators and finally the glottis nerves and intercostal muscles as afferent branch (7).

The rhombencephallon also takes part in the event because it is part of the parasympathetic bulbar system and relates the efferent fibers composed by the phrenic, vacant, laryngeal, recurrent and intercostal nerves between the thoracic vertebrae 1 and 11 (7).

The nervous branches of the cervical vertebrae from 5 to 7 and the hemidiaphragms, trapezoids and glottis are the producers of the reflex, connected to the glossopharyngeal nerve (7).

The vacant and phrenic nerves are members of the hiccup reflex and the thoracic sympathetic fibers of 6 to 12 associate the hiccup to a variety of intra-abdominal and intrathoracic disorders (8).

Stomatognatic aspects

The diaphragm is the hiccup generator and is formed by a muscle and tendons that separate the abdominal and thoracic cavity.

It is a cupola-shaped muscle higher at the right than the left side and is located between the thorax (lungs, heart, small structures inside the mediastinum) and the abdomen (digestive system, glands and other organs). Its function is to contract and move the central tendon of diaphragm downwards and forwards, and increases the

vertical dimension of the thorax cavity and, by the pleural connection, the lungs are stretched and produce negative alveolar pressure (5).

When the lungs contract and go down, they compress the abdominal viscera, by displacing them downwards and forwards against the abdominal wall. Such movements generate the breathing function and are controlled by the right and left phrenic nerves that cross the diaphragm up to the point of the abdominal surface and are composed by three branches: lateral, anterior and posterior (5).

The breathing system is characterized by mechanical events that produce the air exchange during breathing through the inspiration and expiration movements.

Inspiration occurs by the contraction of the diaphragm, intercostal and scalene muscles, while the lungs increase in size and squeeze the abdominal viscera by the diaphragm whose intra-abdominal pressure is elevated (3).

When the intra-alveolar pressure is equal to the atmospheric pressure, the inspiration muscles gradually stop compressing. The expanded thorax produces a positive intra-alveolar pressure and the air is expired. Therefore, the expiration phase occurs without active muscular contraction, that is, in inspiration there is an active muscular contraction and in expiration the force is passive (3).

The digestive system is characterized by the function of pressing, chewing, chemical transformation, deglutition, food absorption and the expelling of body useless waste. This is comprised by alimentary canal, composed by the organs: oral cavity, fauces, pharynx, esophagus, stomach, intestines, rectus and anus. Salivary glands, liver and pancreas are organs connected to the digestive system (9).

The deglutition is the process of transport of the food from the oral cavity to the stomach, and is carried out by a complex process that depends on the neuromuscular system. It occurs in a sequential manner, including several structures that are also part of breathing, such as nasal cavity, oral cavity, pharynx, larynx and esophagus (10-11).

In the pressure transfer of the food from the oral cavity to the pharynx, there is a deglutition apnea and the closure of the glottic rhyme, with the consequent opening of the upper esophageal extremity (upper esophageal sphincter) and the passage of the bolus to the inner part of this organ due to the opening of the cricopharyngeal muscle. In view of the excitation of the mucosa and the plexus of the esophagus walls there occur sequential primary and secondary peristaltic contractions that allow the arrival of the bolus to the stomach (11).

When the primary peristaltic wave reaches the esophagus lower sphincter, it relaxes and allows the passage of the bolus to the stomach reaching the end of the deglutition process (10-11).

The larynx is a tubular organ that starts at the root of the tongue and has there functions: protection, breathing and phonation (9).

During breathing, each respiratory cycle occurs by the pressure difference between the external and the alveolar environments generated by the thoracic bellows. If there are secretions, liquids or food wastes accumulated in the laryngeal inlet there is a pressure difference that may cause their entry by lower airway that results in aspiration and its consequences (9, 12).

The airways are protected from aspiration during deglutition due to several mechanisms that include: the upper and anterior movement of the larynx, the approaching of the vocal cords, the replacement of the aryepiglottic cords and the epiglottis and the coordination between the breathing and deglutition functions (12).

Etiology

Hiccup has several causes and the main ones relate to the diaphragm, such as diaphragmatic hernias. However, other pathologies may produce it, including the diseases that involve the pleura and the mediastinum: by irritation of the vacant nerve cause by chest injury or surgery; heart diseases such as myocardial infarction; subphrenic diseases, tuberculosis and neoplasms (2, 4, 6, 8, 13).

Among the gastrointestinal we found in the literature the following causes: Hiatal hernia; gastritis; megaesophagus; metabolic acidosis; gastroesophageal reflux; abdominal distention; hepatic masses; esophageal cancer; Chagas' disease and the postoperative of abdominal surgeries (4, 6, 8, 14-16).

As for the neurological causes, the following are included: infections (meningitis, encephalitis and abscesses); the cerebrovascular accidents; malformations; cranioencephalic traumatisms; neoplasms; hydrocephaly; systemic diseases caused by a dimorphic fungi; multiple sclerosis and a co-morbidity of the treatment for Parkinson's disease (4, 6, 8, 16-17).

As metabolic causes we have: uremia; hyponatremia; hypocalcemia and hypocalemyia. The toxic causes are:

enolism; smoking; drugs - corticoids, benzodiazepines and by imipenem (4-5, 7, 19-20).

Hiccup Classification

Due to its duration it may be classified into: acute, transitory or self-limited, when its duration is lower than 48 hours; persistent, with duration between 48 hours to one month; and intractable, with a duration of over two months (6, 21).

It is a normally benign disorder, but sometimes it is so intense, frequent and durable that may cause sleeplessness, weight loss, atrioventricular block, including the possibility of suicide (6, 21).

The hiccup may be classified according to its characteristics and etiologies and these include (6-7):

- peritoneal, due to acute peritonitis, hemorrhagic pancreatitis, intestinal obstruction, gastric tumors and acute gastric dilatation in postoperative, and when persistent it indicates a bad prognosis;
- hysterical, generally appears in women aged between 15 and 25 years and its frequency is from 2 to 3 hiccups per minute and disappears during the sleep;
- by irritation of the phrenic nerve, located at the level of the mediastinum and its main causes include mediastinal adenomegaly by tuberculosis and lymph nodes proliferative processes that may appear as intractable crises;
- infectious epidemics, considered to be rare, but may be fatal when a precise and fast diagnosis is not performed. The events are constant during day and night and intractable;
- abdominal, caused by intra-abdominal pathology and sometimes with direct diaphragmatic irritation. These include abdominal and pelvic surgical procedures;
- uremic, whose appearing is rare and has a bad prognosis. Its diagnosis is determined in patient with renal failure;
- medullary, associated to a cerebral and medullary pathology and its main causes include tumors, meningitis and hemorrhages.

Diagnosis

The literature refers to the hiccup diagnosis from the following procedures (8):

- the diaphragm fluoroscopy, due to the existence of intra-abdominal and intrathoracic disorders connected to chronic hiccup;
- electromyography of the diaphragm, scalene and intercostal muscles, recommended in view of the sensation of the presence of pharyngeal globus, that may appear as a result from: diaphragm unilateral involvement (left hemidiaphragm), whose focus will be to notice the phrenic nerve of the injured side; or of the bilateral diaphragmatic motion, due to an afferent or central origin;
- lab tests such as complete blood test, chemical triage, abdomen single radiography, endoscopy and/or radiography of the thorax, used in the occurrence of organic symptoms.

Treatment for hiccup

The forms of treatment correspond to the types of hiccup, that is, faced with the benign type the interruption of the breathing cycle is applied (by holding the breathing for some seconds; by water deglutition; by Valsava maneuvers; or by the repeated breathing into a bag, because then the diaphragm will be forced to restart working along with the breathing, in addition to increasing the concentration of carbon dioxide in the blood, which is usually enough to stop the hiccups (8)).

For the benign type there is also the inclusion of ingestion of hard bread or crushed ice, pulling the tongue outwards, softly scrubbing the eyes or apply pressure on the eyeball; the relief of the stomach distension by regurgitation; beating on the nape or scrubbing it, massaging the carotid sinus; and compressing the breast by elevation of the knees or inclining the torso downwards, maneuvers that are sufficient to stimulate the vacant nerve (6).

In the occurrence of the persistent and/or intractable types, the pharmacological and surgical medical procedures are included and these depend on each case by taking into account the reserved prognosis (8).

In the pharmacological treatment we have gabapentin as mostly mentioned by the authors. It is a cyclic amino acid related to GABA neurotransmitter that can overcome the hematoencephalic barrier. This drug belongs to the group of anticonvulsants whose secondary effects are dizziness, sleep and fatigue (19-22).

Besides gabapentin, that acts as an inhibitor of the hiccup, we find baclofen, a myorelaxant of antispasmodic action that is used in the treatment of lesion on the spinal cord. Its therapeutic effect results from the action in spinal and supraspinal regions, by reducing the excitatory transmission (19-23).

There are also references in the literature of the medicines chlorpromazine and omeprazol, taken as not effective (21, 24-25).

Surgically there is the placement of pacemaker in the left hemidiaphragm by intra-thoracic passage. This is placed at the level of the left phrenic nerve, at the height of the pericardium through a minimum thoracotomy. An electrode and a receiver located at the subcutaneous level is connected, whose intention is to control the diaphragm motions by the electric stimulation of this nerve (26).

Another surgical procedure is the microvascular decompression through which a suboccipital craniotomy is carried out laterally to the foramen Magnum, where the incision is made on the medullary cervical junction. This procedure is used to relieve the pressure on the tenth cranial nerve and oblong marrow, which results in almost its totality in the resolution of the hiccup (27).

The posterior pharynx firm digital stimulation is also described as a form of treatment of the hiccup. For such stimulation a nasogastric tube is installed for removal of the patient's gastric content, which at the same time provokes the ablation of the phrenic nerve (8).

In addition to these methods, there is the use of acupuncture and ear acupuncture described as a treatment of hiccup in cases of heart and lungs transplants and acute myocardial infarction (28-30).

Relation of hiccup with orofacial functions

Since the presence of the hiccup, the respiratory functions and deglutition occur by a sequence of chained muscular actions, we may infer that its occurrence may cause disorders and alterations to the breathing function and deglutition.

When we relate hiccup to the breathing and deglutition functions, we consider the physiopathological data in which hiccup is taken as an act opposite to inspiration, that occurs in a bottom-up motion, that is, from the diaphragm to the vocal cords.

Due to the occurrence of involuntary contraction of the diaphragm and abrupt closure of the vocal cords, the hiccup occurs so as to disorganize breathing and consequently deglutition, because such functions occur in a synchronic and interdependent manner, in which faced with the first there is interruption of the latter and vice-versa.

The data from the literature allows us to understand that an individual who has any disease of esophagus would have a higher possibility to have such involuntary act of sudden contraction of the diaphragm and glottic closure (causing the hiccup).

At the same time, for the fact the occurrence of the hiccup is due to a change of the nervous system, that involves the vacant nerve, it may also interfere with the deglutition process.

Taking into account the etiology of hiccup and relating it to oropharyngeal dysphagia, we set up its interference with the process of forwarding the bolus from the mouth to the stomach, which may unleash a laryngeal penetration and/or aspiration and consequently a profile of pneumonia.

Faced with its occurrence and the breathing function, the data allowed us to characterize it as a respiratory disorganization, dyspnea, because hiccup occurs at the moment of inspiration. At the same time, this dyspnea makes deglutition difficult due to its synchrony and interdependency.

The hiccup may also relate to the production of verbal fluency, since for the speech to happen there is the need for coordination of breathing and articulating movements, providing the necessary fluency so that communication may proceed.

From such considerations we may suppose we may establish phonoaudiological therapeutic actions faced with the hiccup, and these may be of coordination of the pneumo-phono-articulatory and deglutition functions that enable the respiratory control, reorganizes the inspiration and expiration steps and thus diminishes the frequency of the hiccup or enlarging the time between the events, by increasing the maximum times of phonation in addition to the coordination with the deglutition function and stipulating procedures that make the deglutition apnea conscious and longer so as to allow the synchrony between these oral functions.

The interference with stomatognatic functions and phonoaudiological therapeutic actions faced by this even are not described in the literature, but are made through the action with the patient, by complementing the medicine treatment.

Final Comments

The hiccup is defined as a violent and sudden contraction of a group of inspiratory muscles, specially the diaphragm, with simultaneous closure of the glottis, which produces an audible sound of hoarse acoustic quality.

The reflex mechanism of the hiccup is connected to the afferent path of the vacant and phrenic nerves and of sympathetic fibers that innervate the breast organs, abdomen

etc., effected by stimulation of the central nervous system and may generate psychogenic and/or metabolic disorders already described in the literature.

It may have the duration of up to 48 hours, when benign and/or self-limited, but it may be a symptom of a chronic disease and need differential treatment, being called persistent and/or recurrent, with duration of up to one month; and intractable, whose duration is over two months, without a physiologic function recognized.

Among its causes we may mention the following affections: in the central nervous system - neoplasms, infections and vascular brain accidents; toxic-metabolic; irritation of the phrenic and vacant nerves; surgical and psychogenic factors.

As the hiccup provokes a disorder to the respiratory system and given its frequency and duration time, we may infer a commitment of the phonoaudiological aspects connected to feeding and the respiratory function, which causes dyspnea, a possible dysphagia and speech alterations, susceptible to be reorganized through therapeutic procedures.

In the phonoaudiology clinical practice with the patient we found some patients with such characteristics. In view of this clinical observation and the scarce bibliographic reference about this event in the scientific literature in phonoaudiology, and without its reference nor of its consequences connected to phonoaudiology, a search of information is required which may help this professional faced with its occurrence aiming to recognize possibilities of related orofacial myofunctional changes and to establish the suitable treatment.

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