Acta Tropica 111 (2009) 316–320

Contents lists available at ScienceDirect

Acta Tropica

journal homepage: www.elsevier.com/locate/actatropica

Oral sensorimotor function for feeding in patients with tetanus

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ARTICLE INFO

Article history:
Received 13 March 2009
Received in revised form 20 May 2009
Accepted 22 May 2009
Available online 29 May 2009

Keywords:
Deglutition disorders
Tetanus
Stomatognathic system
Evaluation
Speech therapy

ABSTRACT

Tetanus still remains a significant health problem in developing countries; it is a serious disease with a high mortality rate. The purpose of this study was to characterize the oral sensorimotor function for feeding in patients with tetanus. Thirteen patients clinically diagnosed with tetanus and admitted to an intensive care unit between December of 2005 and May of 2007 underwent a screening tool for dysphagia, involving the assessment of clinical features and 2 swallowing tests. Results indicate that the oral sensorimotor function for feeding in these patients is severely compromised, with the exception for the clinical feature of palate elevation and performance in the saliva swallowing test. The factor analysis indicated that the evaluation of tongue movement change in the oromotor examination is important in predicting alterations of cough/voice in the water swallowing test, thus suggesting that oral feeding might be unsafe. When looking at developing countries, the prolonged intensive medical and nursing care required by many patients with tetanus places extra demands on an already stretched healthcare budget. Intervention by a speech pathologist could mean that time in the ICU would be reduced as well as the number of re-admissions due to complications.

1. Introduction

Tetanus still remains a significant health problem in developing countries, although it is very rare in developed countries. The global incidence of tetanus is thought to be about a million annually. Tetanus is a serious disease with a high mortality rate, but is easily prevented by vaccination. Most cases of tetanus occur in adults who are not immunized or who are inadequately immunized (Bleck, 1995; Habib, 2003; Dundar et al., 2005).

This infectious disease is caused by the tetanus toxin, which is produced by toxigenic strains of the bacteria *Clostridium tetani* (Bleck, 1991; Veronese et al., 1991; Tapajós, 1996; San Martin et al., 2003; Santos et al., 2004; Karabay et al., 2005; Horn et al., 2006; Solsona et al., 2007). The infection typically occurs due to the introduction of *C. tetani* spores through an injury or wound. Anaerobic conditions facilitate bacterial proliferation and toxin production. The tetanus toxin present in the lesion or focus of infection spreads through the underlying amorphous substance in which the adjacent muscles and connective tissue are embedded. When the tetanus toxin reaches the neuromuscular junction, it adheres to and penetrates the axonal terminals of the lower motor neurons. The toxin is retrogradely transported to the central nervous system, following the motor axon to cell bodies in the spinal marrow or brainstem (Bleck, 1991; Veronese et al., 1991; Tapajós, 1996; San Martin et al., 2003; Thwaites and Farrar, 2003; Horn et al., 2006; Solsona et al., 2007). At this point, the tetanus toxin crosses the synapse and invades the axons of local inhibitory neurons. The tetanus toxin prevents the release of inhibitory neurotransmitters (glycine or gamma-aminobutyric acid) that are active in the lower motor neurons. The final consequence is the increase in the lower motor neuron discharge frequency (Bleck, 1991; Veronese et al., 1991; Tapajós, 1996; San Martin et al., 2003; Thwaites and Farrar, 2003; Horn et al., 2006; Solsona et al., 2007).

Clinically, lower motor neuron hyperexcitability manifests as muscle hypertonia and muscle spasms upon sensory stimulation. The muscles most commonly (and earliest) affected in tetanus are the proximal muscles, resulting in risus sardonicus (a sneering grin caused by facial spasm), trismus (rigidity of the masseter muscles, producing inability to open the mouth), neck stiffness, and choking. However, in the systemic form of the disease, the trunk and appendicular muscles are also involved. The musculature presents alterations in tonus and mobility (Bleck, 1991; Veronese et al., 1991; Tapajós, 1996; San Martin et al., 2003; Thwaites and Farrar, 2003).

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doi:10.1016/j.actatropica.2009.05.015

Tetanus requires careful clinical observation and advanced life support in intensive care unit (ICU), since the lethality of the disease is high, and can be influenced by several factors, such as severity of clinical presentation, age of the patient, and selected treatment (Veronese et al., 1991; Thwaites and Farrar, 2003; Meaudre et al., 2005). Support treatment of the disease is mainly aimed at maintaining airway permeability and ensuring pulmonary ventilation. If these goals are not met through neuromuscular relaxation and analgesia, sedation, invasive mechanical ventilation, and tracheostomy will be necessary.

Weaning patients with tetanus from mechanical ventilation should be done with caution, and it is particularly difficult for the ICU physician to determine the timing of tracheostomy. It is often necessary to prolong the period of tracheostomy and gastric tube use due to dysphagia, choking, and patient inability to clear secretions (Thwaites and Farrar, 2003).

The purpose of this study was to characterize the oral sensorimotor function for feeding in patients with tetanus.

2. Materials and methods

This study involved patients with clinically diagnosed tetanus who were admitted to the Infectious Diseases IC of a School Hospital (Hospital das Clínicas) in the city of São Paulo, Brazil. This ICU has seven beds designated for patients with tetanus, botulism, leptospirosis, hepatitis, hemorrhage fever, aids, and other conditions.

The study received prior approval of the Institution's Ethics Committee (CAPPesq – HCFMUSP 841/06) and free informed consent was obtained from all of the participants' families.

The inclusion criteria were having been clinically diagnosed with tetanus; being age 18 or older. Patients who underwent surgical procedures involving the head or neck were excluded from the study, as were those presenting neurological disease, cognitive impairment, or impairment of the level of consciousness that made it impossible to understand the verbal information requested for the evaluation.

Patients were evaluated during the convalescence phase. For patients with tetanus convalescence was considered based on the ability of the patient to breathe spontaneously, without the need for mechanical ventilation or with only intermittent use of mechanical ventilation. After the withdrawal of sedation, all of the patients presented a level of consciousness that allowed the understanding of instructions and the performance the simple tasks required for the evaluation (Hammond and Goldstein, 2006).

During 24 months, a total of 13 patients, 12 male and 1 female, took part in the research. The mean age was of 53.69 years (range, 36–85 years). Tetanus was characterized as severe in 10 patients and as extremely severe in 3 according to the scale of prognostic indicators proposed by Bleck (1991) and Veronese et al. (1991).

The evaluation methodology adopted in this study was that described in the Simple Screening Tool for Dysphagia in Patients with Stroke (Nishiwaki et al., 2005). As determined by the authors of the protocol, the following areas were assessed.

2.1. Oral motor function

For the assessment of oral motor function, 6 items were scored using a binary (normal/abnormal) approach. The items scored included lip closure, tongue movement, palatal elevation, gag reflex, voice quality, and speech motor control. Lip, tongue, and soft palate function were scored by assessing the symmetry, strength, and agility of each isolated movement. Gag reflex, elicited through the use of a standard method (mouth mirror touching the pillars of fauces, dorsum of the tongue, and into the valleculum), was rated as abnormal if the reflex was absent or reduced (stimulation needs to be repeated for several times in order to obtain an adequate response). Voice quality was characterized as impaired if classified as wet, breathy, strained, and nonspecifically hoarse. Speech motor control was evaluated based on articulatory precision as well as on agility in spontaneous speech and repetition of the syllables /pa/, /ta/, /ka/.

2.2. Clinical swallow tests

Patients were asked to swallow their saliva, and were classified as abnormal if they could not do so (i.e. if the examiner could not confirm any laryngeal elevation within 30 s – laryngeal elevation was monitored with the positioning of the index and middle finger over the hyoid bone and the thyroid cartilage). In the present study, the laryngeal elevation was considered adequate if it reached an average elevation of two fingers of the examiner (Goldsmith, 2000; Leslie et al., 2003). For the water swallow test, 30 mL of water were necessary. The patient, sitting in an upright position, was given a teaspoonful (5 mL) of water to drink, and this was then repeated. Subsequently, the patient was asked to drink 5 mL of water from a beaker. This procedure was terminated if the patient coughed or if the voice became altered. In this test, we evaluated oral phase abnormalities, absence of laryngeal elevation during swallowing, and cough or voice alteration after swallowing. Oral phase abnormalities were defined as water escaping from the lips or inefficient oral transit. The absence of laryngeal elevation during swallowing was determined by observing or manually monitoring the laryngeal movement. Cough or voice alteration was assessed within 1 min of swallowing.

Based on the performance and results observed in each phase, the researcher determined whether it was possible to continue the evaluation or not, taking into consideration the procedures recommended in the adopted evaluation protocol – i.e. the procedure was terminated if the patient coughed or voice change occurred in the saliva swallow test.

As already mentioned in Section 1, Nishiwaki et al. (2005) suggest the comparison of clinical findings to fluoroscopic findings. In the present study, the direct and indirect oropharyngeal and esophageal imaging was not possible since the removal of the patients from the ICU and the adaptation of the equipments to the ICU environment was not considered feasible by the medical team. Therefore the study was restricted to describing the speech motor function and oral sensorimotor function for feeding in patients with tetanus.

2.3. Reliability

Interjudge realiability measurements were made by comparing two sets of assessment for each patient. Five patients were randomly selected during the period of the research; these patients were evaluated by two experienced independent speech pathologists in two distinct moments on the same day. Agreement on the assessed clinical features between the first author and an experienced speech pathologist was of 82.5%. The level of agreement indicates the existence of high interjudge compatibility.

2.4. Data analyses

In order to study the sensorimotor function for feeding, a total of 10 factors (six related to oral motor function and four related to two clinical tests) were analyzed using the test of equality of paired proportions, along with the factor analysis.

The factor analysis is a multivariate statistical method in which the variables that have similar characteristics are grouped into a single factor, thereby reducing the number of variables under study. For the factor analysis, the number of components was determined by solution, creating a simple structure for the factor loading and