

EDITORIAL

The impact of tracheostomy on spoken language in children: a narrative review

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INTRODUCTION

Paediatric tracheostomy is on the rise, Muller et al.¹ pointing out that almost 40% of tracheostomies in paediatric patients are performed in children under 1 year of age. The statistically significant increase in the rate of tracheostomy in infants is attributed, in part, to the increased survival percentages of extremely preterm infants with severe pulmonary dysplasia who require long-term ventilation^{2,3}. Currently, there are a significant number of patients with tracheostomy tubes, which relapse and affect communication and language development when the device is placed at an early age. These findings have made hospitals to develop teams dedicated to the care of these patients, not only during their initial hospitalization but also on an outpatient basis in collaborative multidisciplinary teams involving various medical specialties⁴. Below, we delve a little deeper into some very interesting aspects found in the literature.

DEVELOPMENT

Some researchers indicate that tracheostomy is more dangerous in children than in adults and carries special risks in younger children^{3,5}. The last 20 years have seen a big change in the age distribution of tracheostomy. Whereas in the past the operation was mainly performed for the treatment of epiglottitis and laryngo-tracheo-bronchitis, today the main indication is to avoid subglottic stenosis in infants as a consequence of intubation due to respiratory distress syndrome and prematurity⁶.

As early as 1990, Hill predicted that speech-language pathologists would have a larger population of children whose communication development has been compro-

mised by long-term placement of a tracheostomy tube⁷.

More than 100,000 tracheostomies are performed each year. Only 5,000 are in children and 50% of them are done in children under 1 year of age⁸⁻¹⁰. The number of children in need of tracheostomy has increased tenfold in the last 15 years^{9,11}. It is hypothesized that this is due to the increasing number of children living with complex chronic diseases and advances in medical technologies that have enabled the use of ventilation devices at home¹¹. On the other hand, the appearance of language is one of the greatest achievements of the first two years of life. During the first eighteen months of life, babies acquire and perfect a whole set of new motor skills that fundamentally transform their experiences with objects and people verbally. Independent motor skills, along with language acquisition, are one of the most impactful in the world of infants¹². This child developmental milestone is one of the most critical and early language deficits that have been found to be associated with difficulties in cognitive abilities, academic performance, occupational outcomes, and socialization¹³. However, multiple environmental influences are related to language development, from prenatal aspects, birth, socioeconomic status, parental language, and sibling behaviour. However, we cannot avoid the effect of the tracheostomy tube on this. Aspects such as behaviour, quality of relationship, sensitivity, and parental warmth have powerful implications for children's language development¹³. Theoretical explanations of this phenomenon are based on the attachment theory, which argues that sensitive and responsive parenting provides a secure foundation for exploration and aids in the formation of secure attachment¹⁴. Considering these childhood events, tracheostomy patients have difficulty producing voice due to the changes in airflow that occur with cannula placement;

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airflow usually enters and exits through the tube, resulting in a lack of airflow around the tube and through the upper airway. Therefore, the voice is affected, due to the lack of sufficient airflow, which limits the production of the voice. Children with this condition can present speech delays, articulation disorders, phonological disorders and difficulties in breathing and speech coordination.

Younger infants, who have survived critical situations of illness at an early age, represent a substantial group of cases that continue to require health care¹⁵⁻¹⁷. With the technological and scientific advances in neonatal care over the past two decades, a large number of children require artificial airway care for prolonged periods of time¹⁸. Some studies have suggested that tracheostomy has little influence on spoken language development^{19,20}, while others have shown a clear pattern of language impairment^{7,17,21}. A multicenter study found that children with tracheostomy have a poor quality of life²². Greene et al.²³ note that tracheostomy is associated with negative effects on voice, speech, and feeding/swallowing. Even studies in adults with Intensive Care Unit tracheostomy found a number of response patterns among patients and staff, highlighting the impact of communication difficulties²⁴. The return of the voice not only enhances patient-reported joy and comprehension by others but it is also associated with a positive change in quality of life^{25,26}. Authors such as Prigent et al.²⁷ describe in a study published in 2010 that low-level positive end-expiratory pressure is as effective as the phonatory valve in ensuring good speech quality in mechanically ventilated patients. With the above, we can understand that the phonatory possibility is feasible from the intensive therapy itself. There are authors, such as Freeman-Sanderson et al.²⁵, who report that these manoeuvres do not expose the patient to greater risks. Returning to the children's group, the research that relates tracheostomy to language development is very limited, it does not provide sufficient evidence on the impact of devices such as a phonatory valve on verbal communication in children. As Zabih et al.²⁸ pointed out, most of the current literature has focused on tolerance to cannula occlusion, rather than communication, this being an important aspect of early childhood development, and this needs to be further investigated.

In a group of children with non-neurological disorders, 60.9% had normal speech and language development, achieving earlier decannulation, which improved the chances of normal language development¹⁷. So, one can see that we have a large number of children who can benefit from the use of phonatory valves. But most cases do not have this device and much less are they given speech therapy during the wearing of the tracheostomy tube.

Patients with cannula may have the ability to speak. This can be achieved by generating a flow of air around the tracheostomy tube, so that air passes through the vocal cords. An occlusion of the tube could effectively

serve so that the air passing through the cords generates a clear and audible voice. There are some devices, such as the phonatory valves, which allow the entry of air when inhaling and prevent its exit when exhaling, diverting the air to the expiration around the tube and therefore to the vocal cords. First, it is important to check that the cannula has a balloon; if yes, make sure that it is deflated. This ensures that the air rises to the upper airway. Digital occlusion, or finger occlusion, is one of the techniques in which a clean finger, usually with a glove, is placed at the end of the tracheostomy tube; it may also be easier for the person to occlude it only when exhaling. Some research proposes that devices such as Passy-Muir phonatory valves may improve infection control compared to digital occlusion, likewise having a hands-free approach to speaking. This valve is placed at the end (cube) of the tracheostomy tube. Phonatory valves fit tracheostomy tubes of any size, as the tube connector is universally 15mm. Once the valve is in place, air enters through the tube and exhaled air flows around the cannula, through the vocal cords and out through the upper airway to speak. The use of the phonatory valve in addition to the voice includes restoring positive airway pressure, improving secretion management and swallowing, may reduce the risk of aspiration, faster decannulation, use of in-line ventilator, better smell and better oxygenation. Phonatory valves have been shown to improve positive end-expiratory pressure, subglottic pressure, and restore protective expiration to the upper airway after swallowing²⁹⁻³⁴.

Crucial factors affecting speech and language development within the neurologically normal group are age at the time of the procedure and the duration of tracheostomy until decannulation. Achieving early decannulation improves the chances of normal speech and language development¹⁷. Speech valves have been shown to enhance the rehabilitation process in many ways and we believe their use should be encouraged³³.

Research suggests that a multidisciplinary protocol decreases the time between tracheostomy insertion and phonatory valve testing³⁵⁻³⁸. There are even studies that indicate that speech therapist services are underutilized in the rehabilitation of patients with tracheostomy³⁸. Findings from a qualitative study of interviews with parents and health professionals, conducted by Nicola Hall et al.³⁹, suggest that there is a need to facilitate greater standardization of care and support available to parent caregivers and that this may be transferable to other regions. Potential solutions to explore could include developing a paediatric tracheostomy service specification, increasing the use of tracheostomy nurse specialist roles, and addressing the emotional and psychological support needs of carers³⁹. We believe that research should focus on speech and language acquisition in patients with tracheostomy, as it represents a specific communication milestone in the early stages of life, and focusing study designs in this field would help us clarify a number of uncertainties.

CONCLUSIONS

The population with tracheostomy has increased in the last two decades. A series of conjectures are pointed out in which technological advances in medical devices and improvements in care are included. The body of literature points out that patients with tracheostomy present difficulties in generating language and oral communication, as well as the development itself when the cannula is installed at an early age, negatively impacting cognitive progress and socialization skills.

It should be noted that research that relates tracheostomy to language development in childhood is very limited, and does not provide sufficient evidence on the impact of devices such as phonatory valves on verbal communication, since most of the literature is restricted only to analysing occlusion tolerance. The few investigations point to a benefit with the use of these devices. In both adults and children, it can even improve infection control compared to digital occlusion, in addition to having hands-free to speak, along with other series of improvements such as better secretion management, improved swallowing, reduction of the risk of aspiration, better smell and better oxygenation. There are articles that show that the multidisciplinary protocol decreases the time between the insertion of the tracheostomy and decannulation.

Our proposal focuses on inviting scientists to increase research in the group of patients with tracheostomy and not limit themselves only to the tolerance of cannula occlusion, but also to investigate the effect of speech and language acquisition.

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