Contemporary Clinical Trials 37 (2014) 170–175

Contents lists available at ScienceDirect

Contemporary Clinical Trials

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

Dysphonia in preterm children: Assessing incidence and response to treatment

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ARTICLE INFO

Article history:
Received 26 September 2013
Received in revised form 19 November 2013
Accepted 22 December 2013
Available online 28 December 2013

Keywords:
Preterm
Paediatric
Dysphonia
Voice
Intervention
Trial

ABSTRACT

Background: Mild dysphonia in childhood is surprisingly common, yet moderate to severe dysphonia is rare. The latter has been associated with complex medical conditions and congenital abnormalities. Intubation injury has also been documented as a cause of childhood dysphonia. Children born very preterm may be intubated as part of the intensive care administered in the perinatal and neonatal periods, yet there are few studies investigating dysphonia in this population. This study will be the first to: use an objective acoustic voice assessment in a paediatric study, document the incidence of dysphonia in very preterm children at school age, and conduct a controlled trial of behavioural voice therapy in this population.

Design: This study will consist of three phases: assessment of voice quality and its impact on quality of life in up to 200 children born at less than 32 weeks' gestation: assessment of the nature and extent of laryngeal pathology in children with moderate to severe dysphonia; and a non-blinded, randomised controlled trial of behavioural voice therapy in children with moderate to severe dysphonia.

Discussion: This study will be the first to use clinical assessment to examine the voice quality of very preterm children, and to use fibre optic endoscopic evaluation of laryngeal function to determine the nature and extent of any laryngeal pathology in such children. Those participants with significant voice difficulties will be randomised to receive treatment immediately or after the eight week assessment.

Trial registration: This study is registered on the Australian New Zealand Clinical Trials Registry (ACTRN12613001015730/ACTRN12613001012763).

1. Introduction

Dysphonia is defined as deviance in the sound quality of the voice produced during speech. An individual's voice is considered dysphonic when it differs perceptually from norms associated with gender, age, stature and culture, or when it impedes the activities of daily living [1].

Abbreviations: NICU, Neonatal Intensive Care Unit; AVQI, Acoustic Voice Quality Index; GRBAS, Grade, Roughness, Breathiness, Aesthenia, Strain Scale; CAPE-V, Consensus Auditory-Perceptual Evaluation of Voice; pVHI, Pediatric Voice Handicap Index; GCQ, Growing and Changing Questionnaire.

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1551-7144/$ – see front matter.
http://dx.doi.org/10.1016/j.cct.2013.12.004

Mild dysphonia in childhood is common. The true incidence is debated but rates between 0.12% and 40% have been reported in otherwise typically-developing children [2–5]. One large-scale study reported an incidence of 11% [6]. Communication behaviours frequently seen in children, such as shouting, making noises in play and prolonged voice use at elevated volumes place strain on the vocal mechanism and cause superficial mucosal injury, resulting in hoarseness [7,8]. Such hoarseness usually resolves with changes to the vocal mechanism associated with adolescence and the maturation of communication behaviour in adolescence and adulthood [9]. More severe forms of dysphonia in childhood are rare, and causative conditions include juvenile recurrent respiratory papillomatosis, vocal fold paralysis, glottic webs and intubation injury [10–12].

Dysphonia has adverse effects on academic, social and employment outcomes [13–16]. Children with dysphonia are evaluated negatively, in comparison to their normophonic peers, on characteristics such as physical appearance and personality traits [15,17,18]. Thus, dysphonia can have a significant impact on quality of life.

Tracheal intubation has been associated with laryngeal injury in neonates, and resultant dysphonia in children born very preterm has been reported in case study series [19–21]. Many children born very preterm require resuscitation and ventilator support in the neonatal period [22,23]. Dysphonia associated with emergency intubation in extremely preterm, extremely low birthweight infants at twelve months corrected age has been reported [24]. Our laboratory has published a pilot study into dysphonia at school age in children born extremely preterm, who were born at less than 25 weeks' gestation and intubated, and demonstrated that there is a strong association between intubation variables and voice outcomes [4]. The requirement to initiate endotracheal intubation to relieve respiratory distress syndrome and to administer surfactant is universal at less than 25 weeks' gestation in Western Australia, and decreases with increasing gestational age. By 32 weeks in our series, fewer than 25% of children are intubated, usually briefly for surfactant administration, and fewer than 2% require a second intubation. Thus, there is a need to investigate the long-term voice outcomes of preterm infants across a wider range of gestational ages, as they may also be considered at high risk of developing dysphonia.

A three-pronged approach to the assessment of the presence and severity of dysphonia, consisting of objective, perceptual and quality of life measures, is considered best practice [25]. Objective assessment refers to acoustic, computerised analysis of the speech signal [26]. Greater accuracy in identification, differential diagnosis and severity judgements is achieved when objective and perceptual methods are used in combination [27–29]. However, few composite objective measures have been validated for use in a paediatric population. The AVQI is an index score of the presence and severity of dysphonia calculated from acoustic parameters of the voice signal. It has been found to have diagnostic accuracy, with appropriate sensitivity and specificity, in a paediatric population in a pilot study in our laboratory [30]. However, the responsiveness of the AVQI to therapeutic change in children has yet to be investigated (Fig. 1).

1.1. Overall aims of the study

The overall aims of the study are to assess:

1. The presence, severity and impact on quality-of-life of dysphonia for each participant group and to compare the incidence at each gestational age and intubation frequency (Phase I).
2. The nature, extent and severity of laryngeal pathology in a sample of children born very preterm, at school age (Phase II).
3. The effect of behavioural voice treatment on very preterm children's AVQI scores, G scores, CAPE V results and pVHI scores, in comparison to those who receive no treatment (Phase III).

2. Methods

This study will address the aims by:

i) assessing the voice quality of up to 200 very preterm children, investigate its relationship to demographic and medical variables and use the AVQI to assess the presence of dysphonia based on acoustic parameters of the voice (Phase I assessment);
ii) documenting the nature and extent of laryngeal pathology in the subgroup of very preterm children with moderate to severe dysphonia (Phase II videostroboscopy); and
iii) determining the effect of behavioural voice therapy on the voice quality of Phase II participants (Phase III intervention).

2.1. Phase I assessment

2.1.1. Specific aims

1. The factors associated with increased odds ratios of the presence and severity of dysphonia.
2. The correlation between the AVQI and perceptual evaluations of dysphonia severity and to determine whether the threshold for pathology in children of 3.46 found in the pilot study is applicable to this larger population.

2.1.2. Participants

A total of up to 200 participants will be recruited. Eligible participants were born at less than 32 weeks' gestation and hospitalised in the Neonatal Intensive Care Unit (NICU) at King Edward Memorial Hospital, the sole tertiary perinatal centre in Western Australia. Participants will be aged between 5 and 12 years at the time of assessment, to ensure compliance with assessment tasks. Selection will be stratified by intubation frequency and gestational age from a total of 1851 NICU discharges <32 weeks over the study period, with a random case selection within strata based on a medical record number algorithm, having excluded those children with a known disability likely to preclude successful assessment and/or who are resident greater than 200 km from the study centre. The families of 391 children were approached to take part in the study.

Data from children born at ≤ 24 weeks' gestation were collected in the previous pilot study and will be included in the data analysis for this study. Increasing gestational age