Comparison of Lower Airway Sampling Strategies in Children with Protracted Bacterial Bronchitis (CLASSIC-PBB)

Background

Protracted bacterial bronchitis (PBB) is a type of chest infection in young children. It causes a persistent cough which affects school performance, limits activity and disrupts sleep. PBB is treated with antibiotics but prolonged and / or multiple courses are often required. Recurrent episodes can result in permanent lung damage. Knowing which bug is causing the infection, guides antibiotic choice and reduces the risk of antibiotic resistance but this requires a lower airway sample.

Lower airway samples are difficult to obtain in PBB as affected children rarely cough up sputum. It is done by taking a washing (bronchoalveolar lavage - BAL) during a camera test of the lungs (flexible bronchoscopy - FB). This is invasive and requires a general anaesthetic. Although safe, it is only available at specialist centres and causes significant disruption to families. FB-BAL is therefore only used in PBB if the cough does not improve with treatment or frequently relapses. We wanted to find out if two more child-friendly methods of obtaining lower airway samples (cough swab and induced sputum) are useful alternatives to FB-BAL. Both are commonly used and well tolerated in children with other lung conditions.

Methods

Children aged 1-10 years with PBB at four UK children's hospitals referred by their doctor for FB-BAL were eligible to take part. After informed consent was obtained, participating children provided a cough swab and induced sputum when they attended hospital for their FB-BAL. The cough swab required the child to cough on a sterile swab (like a cotton bud) held in the mouth. An induced sputum was obtained by the child breathing in salt mist during chest physiotherapy (patting or breathing exercises). Before discharge, parents completed a brief questionnaire about the burden associated with the three procedures. Bugs identified from cough swabs and induced sputum were compared to those from FB-BAL.

Results

137 children (average age = 3 years) were recruited from the four centres between February 2022 and March 2024. One family withdrew from the study and another child had their FB-BAL cancelled after providing a cough swab and an induced sputum sample. This meant 135 children underwent FB-BAL. A cough swab was successfully obtained from 134 (99%) children (two did not tolerate the procedure). Induced sputum was attempted in 131 (five declined) with 111 (85%) successfully producing a sample. This met our recruitment target.

Bugs known to cause PBB were grown from 22% of cough swab samples, 60% of induced sputum samples and 78% of BAL samples. When the culture results from cough swab, induced sputum and BAL were combined, the cough swab identified all the bugs in 14% of children, induced sputum identified in 46% and BAL in 78%. In 67% of children, the cough swab failed to identify any bugs, despite bugs being grown on the IS and/or BAL. The induced sputum failed to do this in 27% of children and BAL in 9%.

The pre-procedure burden was highest for FB-BAL with 39% of parents reporting high levels of concern compared to 7% for cough swab and 8% for induced sputum. FB-BAL also had the highest post-procedure burden with 9% of parents reporting moderate or severe side effects compared to 1% for cough swab and 0% for induced sputum. Discomfort during the procedure was highest for induced sputum with 26% reporting this as moderate or severe compared to 8% for cough swab and 11% for FB-BAL. 21% reported the induced sputum as difficult to tolerate or intolerable compared to 10% for cough swab and 5% for FB-BAL.

Conclusions

FB-BAL is the sampling strategy that identified the most bugs. The low number of bugs identified on cough swabs mean this is unlikely to be of use in the assessment of children with PBB. Whilst induced sputum did not identify as many bugs as FB-BAL, it performed much better than cough swabs. As it was also well tolerated it can be perform in the outpatient clinic so it does have a role in the early assessment of children with PBB. Increased use of induced sputum would increase the number of children with PBB in whom the causative bug is known without the need form FB-BAL. This would allow antibiotic prescribing to be targeted, reducing antibiotic resistance. Reduced need for FB-BAL will also reduce parental burden and NHS costs.