High Yield Technique to Diagnose Immotile Cilia Syndrome: A Suggested Algorithm

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Abstract

Objectives: To determine the efficacy of our nasal brush biopsy technique to diagnose primary ciliary dyskinesia. Study Design: Retrospective chart review at an urban children’s hospital. Methods: We obtained medical records of all patients who underwent an endoscopic guided ciliary brush biopsy from January 2000 to June 2008. Data recorded included the procedure date, biopsy location, presence of motility on light microscopy, and whether specimen was sent for electron microscopy and those results. Results: Sixty pediatric patients between the ages of 16 months and 17.3 years with chronic sinusitis (56 males, 25 females) were identified. Three were excluded because biopsies were taken from a non-nasal location. Forty-seven specimens had light microscopy evaluation only, as normal motile cilia were identified. Ten had haphazard or absent motility and required further evaluation with electron microscopy. Electron microscopy ruled out defects for three samples, was non-diagnostic for five, and the remaining two could not be found. Overall, in 47/57 (82%) cases, light microscopy alone ruled out primary ciliary dyskinesia (PCD). Using both methods, there was a 91% success rate in ruling out PCD. Conclusions: Obtaining an endoscopic biopsy with a cytosoft cytology brush (Camarillo California) from the posterior portion of the inferior turbinate gave sufficient specimen to examine for PCD. Light microscopy alone or in concert with evaluation by electron microscopy confirmed normal cilia in 91% of specimens ruling out the diagnosis of PCD. The algorithm suggested is simple and has high success in allowing the clinician to exclude the diagnosis of PCD in the patient with chronic or recurrent upper respiratory infections.

Methods

A retrospective chart review at an urban free-standing children’s hospital identified sixty patients with chronic sinusitis (35 males, 25 females) between the ages of 16 months and 17.3 years who underwent endoscopic guided ciliary brush biopsy between January 2000 and June 2008. Data obtained from the charts included date of procedure, location of biopsy, motility assessment on light microscopy, and electron microscopy result when applicable.

Technique: While the child is under general anesthesia a cytosoft cytology brush (Camarillo, California) is placed using a 4.0 zero degree telescope into the nasal cavity. The brush is directed at the posterior third of the inferior turbinate where it makes contact and is rotated 360 degrees allowing cells to be obtained. The brush is withdrawn and sent to the pathologist for immediate light microscopic evaluation.

Results

Sixty pediatric patients between the ages of 16 months and 17.3 years with chronic sinusitis (56 males, 25 females) were identified. Three were excluded because biopsies were taken from a non-nasal location. Forty-seven specimens had light microscopy evaluation only, as normal motile cilia were identified. Ten had haphazard or absent motility and required further evaluation with electron microscopy. Electron microscopy ruled out defects for three samples, was non-diagnostic for five, and the remaining two could not be found. Overall, in 47/57 (82%) cases, light microscopy alone ruled out primary ciliary dyskinesia (PCD). Using both methods, there was a 91% success rate in ruling out PCD. Conclusions: Obtaining an endoscopic biopsy with a cytosoft cytology brush (Camarillo California) from the posterior portion of the inferior turbinate gave sufficient specimen to examine for PCD. Light microscopy alone or in concert with evaluation by electron microscopy confirmed normal cilia in 91% of specimens ruling out the diagnosis of PCD. The algorithm suggested is simple and has high success in allowing the clinician to exclude the diagnosis of PCD in the patient with chronic or recurrent upper respiratory infections.

Background

Children with disorders of ciliary motility trend to present with recurrent infections of the upper and lower respiratory tract. Primary ciliary dyskinesia can result from various gene mutations, with a broad ciliary presentation from haphazard movement to complete absence of motility. There is also a secondary version in which the cilia have ultra-structural deformities, which can be due to numerous causes including respiratory infections, aging, pollutants, exposure, or smoking.

Currently, there are numerous tests available to help assess the motility of cilia including nasal nitric oxide test, the saccharin test, being rotary motion, lack of ciliary coordination in direction or timing requires further electron microscopic study.

Discussion

Primary Cilia Dyskinesia should be excluded from the diagnosis in the child with numerous or overwhelming recurrent upper respiratory and/or pulmonary infections. Presently there is no definitive technique offered to obtain or exclude the diagnosis with high accuracy. A review of the literature identified three studies that included pediatric patients without any standard in nasal biopsy or diagnostic technique. MacCormick et al 1 did a prospective trial comparing four techniques including nasal brushing, nasal biopsy, bronchial biopsy, and tracheal biopsy. The results showed that a nasal brush biopsy was found to be the most optimal in their hands, however their sample sizes were small limiting the strength of their study. Friedman et al 2 published 27 patient who had 31 biopsies, 15 completed with a cup forceps and 16 using a cytology brush. Of those specimens obtained, ten samples were non-diagnostic. It was determined that the method of specimen collection did not make a significant difference in obtaining an adequate specimen. They suggested an algorithm for diagnosis that excluded the need for electron microscopy if normal ciliary motility was appreciated on light microscopy. Specimens with no motility or dysmotility were further evaluated by electron microscopy. Last, Caruso et al 3 found that in 62 of 64 patients using the nasal scraping technique yielded a sufficient amount of specimen to make a diagnosis of PCD. They used EM in the diagnosis for all their specimens. We use Friedman’s algorithm but only with brush biopsy samples to determine the efficacy. We believe this allows us to be less invasive to patients as well as being cost considerate. Using the brush biopsy technique followed by light microscopy gave excellent success in confirming normal ciliary motility in 82% of our patients. Immediate light microscope evaluation by the pathologist ensures an adequate sample of cilia present increasing diagnostic yield. It also offers in some patients an immediate assessment when normal cilia motility is identified. The remaining suspicious samples are sent forward for electron microscopy. A total of 91% of samples provided sufficient evidence to exclude PCD as the diagnosis for these patients in following this technique and algorithm.

Conclusion

Obtaining a brush biopsy endoscopically with a cytology brush from the posterior portion of the inferior turbinate successfully ruled out ciliary dyskinesia in 91% of patients tested. We found this algorithm to be easy to follow and to have a high success rate in identifying normal ciliary motility while excluding the diagnosis of PCD in these children. We therefore suggest using this as a standard technique and algorithm to rule out primary ciliary dyskinesia.

Bibliography

