to lung transplantation, and only 12% of programs embrace genomovar testing. In contrast, 60% of programs base their decisions regarding panresistant *Pseudomonas aeruginosa* on *in vitro* testing and synergy.

Seventy-five percent of programs consider noncompliance with medical therapy to be an absolute contraindication for lung transplantation. In practice, precluding a patient based on noncompliance may be very difficult to implement. First, the critical threshold of noncompliance is unclear. Second, a positive change in behavior to secure a place on the list does not necessarily guarantee appropriate behavior posttransplantation. These issues are especially important in the cystic fibrosis population where nonadherence to instructions is not uncommon.9

A small majority of programs have a minimum exercise requirement of 600 feet during a 6-min walk test. This appears to indicate a preference to select patients who are functionally relatively well.7 This may be a pragmatic approach to emphasize the importance of pulmonary rehabilitation. Alternatively, it may be a surrogate for initiating early listing, in order to compensate for the expected time accrued on the waiting list. However, many international programs would transplant patients who can only transfer from bed to chair.

Following transplantation, divergent patterns of treatment emerge. For instance, 50% of programs utilize induction therapy and 50% do not, while four different maintenance immunosuppression regimes are utilized equally across all programs. This heterogeneous theme is most obvious following the diagnosis of bronchiolitis obliterans syndrome (BOS), at which time 11 different treatment options may be employed. However, the most common therapy is a trial of corticosteroids combined with a change from cyclosporin to tacrolimus. The management of progressive BOS is notably consistent. The emerging pattern, based on the irreversible characteristics of the histopathology and the acknowledgment of the importance of clinical infection, is that the majority of programs utilize antibiotic therapy in the treatment of progressive BOS.8

The role of infection in the dynamic of graft survival is emphasized by the observation that 50% of programs utilize cytomegalovirus (CMV) Ig as part of their CMV prophylaxis regimen. Data have identified hypogammaglobulinemia as a potential risk factor for bacterial infection. Interestingly, this latter observation could indicate that the perceived survival advantage observed with the application of CMV Ig may result from broad nonspecific protection against infection.

The data provided by Levine et al emphasize that the published international selection criteria have forged some degree of standardized practice but highlight the diversity in approach to management following lung transplantation. The transplant network of the ACCP demonstrates interesting patterns of practice and uncertainty that can be used as a catalyst for further study and progress.

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**References**


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**Evaluating Noisy Breathing in Children**

**How Far Down the Airway Should One Look?**

The Renaissance biographer Giorgio Vasari quotes Donatello saying to his good friend and fellow artist Paolo Uccello: "Eh, Paolo, this perspective of
your makes you leave what is certain for the uncertain. . .” While Donatello was referring to the art of painting, these words pertain just as well to the art of medicine. Indeed, our perspective affects how we manage patients, and this is definitely true when evaluating children with noisy breathing. Noisy breathing, especially in infants, is a common problem, and its evaluation is not always straightforward. The workup will depend on one’s perspective (eg, training, experience, and patient population). Primary care providers encounter many of these patients first, often make the diagnosis without using invasive diagnostic aids, and refer only a few to specialists. Patients referred to specialists are more likely to undergo fiberoptic nasopharyngoscopy (NP) and flexible fiberoptic bronchoscopy (FB). Otolaryngologists routinely perform NP in the clinic setting without proceeding to FB, while pulmonologists are more likely to look further down the airway via FB.

How much workup for noisy breathing is enough? The majority of infants with inspiratory stridor have laryngomalacia, which can often be diagnosed by history and physical examination. However, infants and children with noisy breathing who are referred for specialty evaluation may be more likely to have lower airway lesions. Reports in the literature consistently have demonstrated that children with noisy breathing can have concomitant upper and lower airway lesions (called synchronous lesions) with the prevalence ranging from 8 to 18%. Importantly, in those studies many of the patients with synchronous lesions had lower airway abnormalities that either did not require emergent treatment (eg, tracheomalacia) or could have been diagnosed by methods other than FB (eg, vascular ring).

The concern for missing lower airway abnormalities led one of the pioneers of pediatric FB, Dr. Robert Wood, as well as others, to recommend consideration of FB in addition to NP when evaluating children with stridor. The American Thoracic Society statement on pediatric airway endoscopy and the American College of Chest Physicians interventional pulmonary procedures guidelines both state that noisy breathing is a common indication for FB in children, but neither comments on when it is appropriate to perform NP without FB. A European Respiratory Society task force on pediatric FB concluded that there was insufficient information on the frequency of concomitantly upper and lower airway lesions. It recommended performing FB plus NP in infants with severe or persistent symptoms and hypoxemia, and, also in older children with unexplained noisy breathing. In a review of pediatric FB, Nicolai emphasized the importance of looking below the vocal cords. However, the performance of FB in children, unlike that of NP, requires deep sedation, cardiorespiratory monitoring, and a significant amount of scheduled time. Thus, when is it really necessary?

The study by O’Sullivan et al in this issue of CHEST challenges the need to perform FB in most children presenting with noisy breathing, provided that the noisy breathing is primarily inspiratory. The authors retrospectively reviewed their 10-year experience with children presenting to their clinic for evaluation of noisy breathing. The same group of pulmonologists did all of the assessments, so while there was no preset decision tree for when to perform diagnostic tests, the evaluations were fairly consistent. Patients with inspiratory or biphasic noise were considered for FB early in the evaluation. Patients with primarily inspiratory noise were first assessed clinically. Those who were not in respiratory distress and had noise typical for laryngomalacia were observed, and those who did not meet these criteria underwent NP. Patients with findings on NP that reasonably explained their noisy breathing were observed, but if the results of the NP were normal or did not sufficiently explain the noisy breathing, then FB was performed. The authors performed 82 NP procedures on 81 of the 356 children referred for evaluation of noisy breathing. More than half of the 81 patients were < 6 months old. The majority of patients (76%) presented with inspiratory stridor, and laryngomalacia was diagnosed in 50% of them (31 of 62 patients). Another 35% (22 of 62 patients) had other abnormalities identified on NP that explained their noisy breathing. Only 6% of the patients with plausible explanations for their noisy breathing identified by NP had synchronous lower airway lesions, none of which went undiagnosed for long.

There are some problems with the study by O’Sullivan et al. The patients were assessed retrospectively, and the decision to perform NP and/or FB was not standardized. The sample size was rather small, and 22% of the 81 children underwent FB shortly after NP, suggesting that the threshold for performing FB was fairly low. Nevertheless, their findings reassure us that many children who undergo NP for assessment of inspiratory stridor do not need to undergo FB.

Based on the studies by O’Sullivan et al and other investigators, I propose the following plan for the use of NP and FB in assessing children with noisy breathing. First, infants and children with expiratory or biphasic noise without an obvious cause often require a lower airway evaluation with FB or rigid bronchoscopy, although airway fluoroscopy is another option. Second, infants with inspiratory stridor who have significant respiratory signs and symp-
Vagal Pas de Deux

Heart-Lung Interplay in Postexercise Heart Rate Recovery

At the end of maximal exercise, heart rate drops exponentially in healthy humans, as vagal tone returns from its profound exertional withdrawal and sympathetic activation wanes.1–4 After Bruce protocol exercise, for example, the healthy heart slows by >10 to 12 beats/min, 60 s after end-exercise (18 beats/min for stress echocardiography).5 A delayed heart rate recovery (HRR) has been associated with increased all-cause mortality in most studies,6–11 but not all.12 Cole et al6 reported that the 6-year mortality rate from all causes was 19% in patients with an HRR of <13 beats/min, at 1 min after end-exercise (relative risk, 4.0; 95% confidence interval [CI], 3.0 to 5.2). Later, patients studied by Nishime et al8 who had an abnormal HRR experienced a 5-year all-cause mortality rate of 8% (risk ratio, 4.16; 95% CI, 3.33 to 5.19), and a mortality rate of 9% in patients whose abnormal HRR was coupled with chronotropic incompetence. When both of these abnormalities occurred in persons with Duke treadmill scores of 4 or worse, the 5-year all-cause mortality rate was 18%.13 The report of Seshadri et al in this issue of CHEST (see page 1287) raises the possibility that some of this excess mortality is due to underlying pulmonary disease rather than to cardiovascular causes. Their retrospective analysis of 627 treadmill patients identified 229 (36.5%) with an abnormal HRR, while 188 (30%) had an abnormal chronotropic index. These HRR and chronotropic index abnormalities appear to be closely correlated (r = 0.86 for the respective means, as percentages of

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