Purpose

- Scoliosis occurs in 2-3% of the pediatric population. Progression of the curve can result in significant deformity and cause cardiorespiratory compromise.
- Scoliosis with a Cobb angle > 40 degrees is typically managed with spinal fusion surgery.
- At our institution, patients are required to perform pulmonary function testing prior to surgery.
- Given that scoliosis affects lung volumes and mechanics of the respiratory muscles, a restrictive defect is expected. However, we have documented reversible airway obstruction in some asymptomatic pre-operative patients.

- Obstructive defect is defined as the ratio of the forced expiratory volume in one second (FEV₁) over FVC (FEV₁/FVC) < 80% predicted value and reversibility by at least a 12% improvement in FEV₁ or normalization of the FEV₁/FVC ratio after administration of a bronchodilator. An improvement in FEF₂₅-₇₅ of at least 20% also suggests reversibility in the lower airways.

Descriptive Study

- From May-August 2019, 31 pre-operative patients who were scheduled for spinal fusion surgery performed PFTs at our clinic.
- Patients with known asthma history and those with fixed airway obstruction were excluded from this study.
- We found four patients with ages ranging from 11-18 years who had no history of asthma or inhaler use and showed significant reversibility.
- On further inquiry all four patients had risk factors for asthma such as family history of asthma and/or seasonal allergies.

Initiative Details

- Our practice initiated the unique approach of treating asymptomatic patients with unexpected findings of reversible obstruction pre-operatively with use of combination inhaled steroid and long acting bronchodilator to optimize lung function in the perioperative period.
- Repeat spirometry two weeks after initiation of combination medication prior to surgery showed an improvement of FEV₁ of 12-15% as well as a normalized FEV₁/FVC ratio.

Pulmonary Function Testing

- Reversible obstruction and mild restriction seen with decreased TLC

*Improved FVC, FEV1 and FEF25-75 while on Symbicort maintenance

Outcomes

- These patients had uneventful post-operative courses from a respiratory standpoint.
- Poor compliance with follow up in pulmonary clinic (1 of 4 patients).
- Step down therapy initiated for 1 patient.

Next Steps

- Post-op follow up:
  - If PFTs are normal and patients remain asymptomatic, step down therapy is indicated.
  - Continue bronchodilators PRN.
  - For future pre-operative pulmonary clearance: Collaborate with orthopedics to evaluate patients in a more timely fashion, ideally 3-6 months prior to surgery to identify reversible obstruction and treat appropriately.

References


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Optimizing Lung Function in Reversible Obstruction found in Preoperative Pulmonary Function Tests in Adolescent Idiopathic Scoliosis Patients

Adolescent idiopathic scoliosis is the most common type of scoliosis and occurs in 2-3% of pediatric patients. Progression of the curve can result in significant deformity and cause cardiorespiratory compromise. Scoliosis with a Cobb angle > 40 degrees is typically managed with spinal fusion surgery. At our institution, pediatric patients who are scheduled for posterior spinal fusion are required to perform pulmonary function testing (PFTs). Spirometry can suggest obstructive or restrictive lung disease. Given that scoliosis affects lung volumes and mechanics of the respiratory muscles, a restrictive defect is expected. However, we have documented reversible airway obstruction in some asymptomatic pre-operative patients. Obstructive defect is defined as the ratio of the forced expiratory volume in one second (FEV1) over FVC (FEV1/FVC) < 80% predicted value and reversibility by at least a 12% improvement in FEV1 or normalization of the FEV1/FVC ratio after administration of a bronchodilator. Also an improvement in FEF25-75 of at least 20% suggests reversibility in the lower airways.

Thirty-one pre-operative patients with idiopathic scoliosis who were scheduled for spinal fusion surgery performed PFTs in our clinic from May to August 2019. Patients with known asthma history and those with fixed airway obstruction were excluded from this study. We found four patients with ages ranging from 11-18 years who had no history of asthma or inhaler use and showed significant reversibility with an 8-16% improvement from baseline FEV1 and a 25-50% improvement from baseline FEF25-75 after bronchodilator use. Those who reversed less than 12%, had a normalized FEV1/FVC ratio post bronchodilator. On further inquiry all four patients had risk factors for asthma such as family history of asthma and/or seasonal allergies.

Our practice initiated the unique approach of treating asymptomatic patients with unexpected findings of reversible obstruction pre-operatively with use of combination inhaled steroid and long acting bronchodilator to optimize lung function in the perioperative period. Repeat spirometry two weeks after initiation of combination medication prior to surgery showed an improvement of FEV1 of 12-15% as well as a normalized FEV1/FVC ratio. Additionally, these patients had uneventful post-operative courses.

This is a descriptive study demonstrating the efficacy of therapeutic intervention to optimize preoperative status in patients with scoliosis with unexpected reversible airway obstruction. We plan to implement this intervention as a protocol in the pre-operative evaluation of patients with scoliosis and to follow these patients post-operatively to ascertain outcomes within the domains of lung function, respiratory status, indication or need for inhaled medications and diagnosis of asthma.

No funding was used for this study.