

Paper # 67

****RUSSELL A. HIBBS AWARD NOMINEE FOR BEST BASIC SCIENCE PRESENTATION**

VEPTR Improves Pulmonary Hypoplasia in a Postnatal Rabbit Model of Thoracic Insufficiency Syndrome

Hemal Mehta, MSc (Beth Israel Deaconess Medical Center); Brian D. Snyder, MD, PhD; Stephen R. Baldassarri, BA; Melissa J. Hayward, MD; Michael J. Giuffrida, MD; Supriya P. Bansal, BS; Vahid Entezari, MD; Nipun D. Patel, MS; Andrew C. Jackson, PhD

Introduction: Using a VEPTR, Campbell demonstrated that expansion thoracoplasty of a constricted hemithorax improves respiratory function and controls scoliosis in children with TIS. We hypothesized that expansion thoracoplasty of the constricted hemithorax improves postnatal pulmonary hypoplasia by allowing the lung to expand, improving respiratory function and stimulating normal lung growth.

Methods: In this feasibility study, tethering left ribs 3-8 in 7 five week old rabbits constricted the left hemithorax by 10 weeks and induced postnatal pulmonary hypoplasia of the left lung and scoliosis. Expansion thoracoplasty through the fused ribs was performed in 4 rabbits using a mini-VEPTR. These were compared to 3 DISEASE rabbits that grew until maturity with a constricted left hemithorax and 2 NORMAL rabbits. Thoracic deformity, scoliosis, right, left and total lung volumes were measured on 3-D CT reconstructions of the thorax at regular intervals 8-18 weeks. At maturity (24 weeks), lungs were excised and quantitative histology used to estimate alveolar air space fraction and surface density. ANOVA and Fisher's least significant difference comparative statistics were performed.

Results: Compared to DISEASE rabbits, expansion thoracoplasty of the constricted left hemithorax using mini-VEPTR improved the scoliosis but only minimally increased left lung volumes (Fig. 1a). Compared to NORMAL, compensatory increases in right lung volumes stabilized the total lung volume/kg for DISEASE and VEPTR treated rabbits. Alveolar air space fraction was significantly greater in DISEASE rabbits, indicating improved emphysematous changes in VEPTR treated rabbits. Capillaries adjacent to alveoli were also more prominent in VEPTR treated rabbits (Fig. 1b).

Conclusion: These data suggest that while expansion thoracoplasty reduces scoliosis and increases the volume of the constricted hemithorax, the relative increase in the ipsilateral lung volume is small since compensatory hypertrophy of the contralateral lung has already occurred. Thus VEPTR may improve respiratory function by increasing alveolar capillaries and preventing emphysematous changes.

