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VIBRATION RESPONSE IMAGING IN THE QUANTIFICATION OF PLEURAL EFFUSIONS

Devanand Anantham MD* David Feller-Kopman FCCP Adnan Majid MD Armin Ernst FCCP Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, MA

PURPOSE: Vibration Response Imaging (VRIXP®) technology utilizes two arrays of pressure sensors to record vibration energy generated by airflow within the lungs. A digital image and quantitative data is then generated. The efficacy of VRIXP® in the diagnosis of pleural effusions has been presented in previous pilot data. A direct comparison with chest radiographs in the quantification of effusions was sought in this study.

METHODS: The reference gold standard was the amount of fluid drained via therapeutic thoracentesis. Complete drainage was possible using pleural manometry. Radiologist's report of patients' upright chest radiographs was used. Effusion size defined on a visual analogue scale was co-related against volume of fluid drained. A reader who was blinded to the chest radiograph findings assessed all VRIXP® recordings. Quantitative analysis of effusion size by VRIXP® technology involved calculation of pixels in the affected hemithorax and was also co-related against volume of effusion drained.

RESULTS: Twenty-nine patients (13 females) with a mean age 69 ± 13 years were recorded because of suspected pleural effusions. In qualitative analysis, the percentage of agreement between VRIXP® and chest radiograph for effusion location was 86% and effusion size was 72%. Quantitative analysis of effusion size showed a correlation between VRIXP® and chest radiograph in both the affected hemithorax ($r=-0.81$) and the affected region ($r=-0.80$). Thoracentesis was performed on 16 patients with a mean 1721 ± 1262 cc drained. The correlation between VRIXP® readings and volume of fluid drained ($r=-0.68$) was comparable to correlation between the chest radiograph reports and effusion drained ($r=0.60$).

CONCLUSION: This pilot study shows that VRIXP® performs as well as chest radiograph in quantifying pleural effusions.

CLINICAL IMPLICATIONS: VRIXP® may become a bedside tool in the diagnosis and monitoring of pleural effusions because it appears comparable to chest radiograph in quantifying the size of pleural effusions. It is also noninvasive and radiation free.

DISCLOSURE: Devanand Anantham, Grant monies (from industry related sources) This study was sponsored by Deep Breeze, Ltd.; Product/procedure/technique that is considered research and is NOT yet approved for any purpose. VRIXP® has been approved for clinical use in Europe but does not have FDA approval yet.

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PREVALENCE AND IMPACT OF PULMONARY HYPERTENSION IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD) LISTED FOR LUNG TRANSPLANTATION

Michael J. Cuttica MD* Katrina Anderson Christopher F. Barnett MD Oksana A. Shlobin MD Shahzad Ahmad MD Scott Barnett MD Roberto Machado MD Mark Gladwin MD Steven D. Nathan MD National Institute of Health, Bethesda, MD

PURPOSE: Pulmonary hypertension (PH) is common in advanced COPD with published incidences around 50% in the literature. PH is an important predictor of mortality in COPD. We attempted to characterize the prevalence of PH in a large cohort of patients with COPD listed for lung transplant.

METHODS: Retrospective review of the United Network for Organ Sharing (UNOS) database of patients listed for transplant due to COPD.

RESULTS: 1133 patients with the diagnosis of COPD were listed for transplant over a 10 year period (1997-2006). Of these 456 (40%) were found to have a mean pulmonary artery pressure (mPAP) of greater than 25mmHg at rest. The presence of PH seemed to correlate with an increased oxygen requirement; 44% of patients with PH required greater than 3 lpm as opposed to 35% of those without PH. PH also appeared to influence functional capacity as measured by the Six Minute Walk Test; 24.1% of patients with PH walked less than 500 ft versus 16.5% of those

without PH. Of those patients with Very Severe (FEV1 <25%) and Severe (FEV1 25-34%) COPD, 41% and 35% respectively had mPAPs greater than 25mmHg, while in the Moderate (FEV1 35%+) COPD group 49% of patients had PH.

CONCLUSION: PH is common in patients with severe COPD listed for lung transplant and its presence seems to correlate with decreased functional capacity and increased oxygen needs. There is also a suggestion of a group of patients with relatively preserved lung function who have worse hemodynamics which may be contributing to their need for transplantation.

CLINICAL IMPLICATIONS: Identification of COPD patients with relatively well-preserved lung function but increased pulmonary artery pressures may represent a subgroup of patients in whom PAH therapy might be of benefit.

DISCLOSURE: Michael Cuttica, No Financial Disclosure Information; No Product/Research Disclosure Information

EFFECT OF BOSENTAN ON THE EXERCISE TOLERANCE AND PFT SCORE IN PULMONARY HYPERTENSION ASSOCIATED TO ADVANCED COPD

Giuseppe Valerio MD Pietro Bracciale MD, FCCP* Claudio Imperiale MD Alfredo Scoditti MD Salvatore Bellanova MD Sergio Pede MD Anna Grazia D'Agostino MD Department of Respiratory Disease, ASL BR/1, San Pietro Vernotico (BR), Italy

PURPOSE: Pulmonary Hypertension (PH) is associated to advanced COPD in 20% to 40% of patients. PH contributes to a greater amount of exercise limitation even in presence of dynamic hyperinflation. Because Idiopathic pulmonary hypertension and COPD pulmonary hypertension share a common vascular intimal thickening, excess endothelin receptor expression and excess of endothelin 1, our aim is to demonstrate whether oral endothelin-1 antagonist, eg Bosentan, can also improve PH, Exercise tolerance and PFT score in patients affected by severe COPD and PH.

METHODS: We studied 20 patients affected by COPD moderate to severe and PH suspected, initially, by symptoms, by the shape of pulmonary artery on chest radiograph, by ECG and Cardiac-Echo-Doppler and confirmed by Right Side Catheterization. All patients were submitted to whole body pletismograph, to blood gas analysis, to six minutes walking test (6MWT) at baseline and after three, six and twelve months of administration of Bosentan 125 mg bid. Right Side Catheterization was performed at baseline and after 1 year of treatment. Control group were 20 patients affected by COPD but without PH.

RESULTS: 12/20 patients showed, after 1 year of treatment, an improvement of respiratory functional parameters and increase of 6MWT from baseline with improvement of Borg Scale's score. Five patients were not responder to treatment; three patients dropped out the study.

CONCLUSION: The regular assumption of Bosentan 125mg bid in patients affected by COPD+PH, showed efficacy on improvement of 6MWT and on the PFT score with no significant collateral effect. These reflect, most likely, anti vasospastic, anti bronchospastic, anti secretive and anti mithogenic effects, formerly proved, of this drug.

CLINICAL IMPLICATIONS: It would be attractive to investigate about the impact of the therapy on the inevitable clinical worsening of PH along the natural history of disease and to verify if it is able to determine a favourable impact on morbidity and mortality. Further, long-term, clinical studies will be necessary to understand these encouraging supposition.

DISCLOSURE: Pietro Bracciale, None.

UTILITY OF CT SCAN FOR DETECTION AND GRADING THE SEVERITY OF PULMONARY HYPERTENSION IN PATIENTS WITH PARENCHYMAL LUNG DISEASE

Roberto C. Santos MD* Anubha Sinha MD Sandeep S. Riar MD Dat D Nguyen MD Rashpal Singh MD Robby T. Ayoub MD Beshar Kabak MD Marc Adelman MD, FCCP Alan J. Klukowicz MD, FCCP Richard A. Miller MD, FCCP St. Michael's Medical Center, Newark, NJ

PURPOSE: Pulmonary Hypertension (PH) is defined as Pulmonary Artery Pressure (PAP) >25 mm Hg. Although right heart catheterization is the gold standard, 2D Echo is commonly used to detect PH and to grade its severity. 2D Echo detects PH based on the presence of tricuspid regurgitation and measurement of the regurgitant jet using the modified Bernoulli's equation ($4 \times \text{velocity squared}$). PAP measurements between

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21 and 40 mm Hg and > 40 mm Hg are consistent with Mild-moderate and severe pulmonary hypertension respectively.

METHODS: Retrospective review of 2D Echo and CT Scan results of 30 patients referred to pulmonary service over one year period for evaluation of parenchymal lung disease who were found to have pulmonary hypertension based on 2D Echo results. We measured the Mean Pulmonary Artery Diameter (MPAD) on the CT Scan at the widest portion of the main pulmonary artery within 3 cm of the bifurcation.

RESULTS: In our study we found that patients with 2D Echo PAP between 25-40 mm Hg graded as mild-moderate PH have CT determined mean MPAD 34 mm(SD =6.57) and those with PAP >40 mm Hg graded as severe PH have mean MPAD 48.5 mm(SD =7.45). There is statistically significant difference between the above two categories based on the Two-Sample T-Test (P-Value 0.001). Also we noted a linear correlation between the MPAD on CT Scan and PAP as measured by 2D Echo (P-Value 0.002).

CONCLUSION: CT Scan, a non invasive and readily available modality, is frequently used to evaluate chest pathology. Our study demonstrates that CT scan measurement of main pulmonary artery diameter (MPAD) can be a useful tool for detection and grading the severity of pulmonary hypertension.

CLINICAL IMPLICATIONS: Utility of CT scan for detection and grading the severity of pulmonary hypertension in patients with parenchymal lung disease.

DISCLOSURE: Roberto Santos, No Financial Disclosure Information; No Product/Research Disclosure Information

BODY MASS INDEX AND RISK FOR PULMONARY HYPERTENSION (PH)

Roberto C. Santos MD* Rashpal Singh MD Sandeep S. Riar MD Dat D Nguyen MD Anubha Sinha MD Beshar Kabak MD Robby T. Ayoub MD Mark Adelman MD, FCCP Alan J. Klukowicz MD, FCCP Richard A. Miller MD, FCCP St. Michael's Medical Center, Newark, NJ

PURPOSE: PH has a multifactorial etiology and is a major cause of morbidity and mortality among patients. Obstructive sleep apnea (OSA) is a possible contributor for PH, but there have been no conclusive studies on BMI alone causing PH. We performed a retrospective study on the relationship of BMI and PH.

METHODS: Medical records of patients who had sleep studies in our institution over the past one year were reviewed. Patients were divided into two groups based on BMI (patients who are morbidly obese and patients who are not morbidly obese). Two-dimensional Echocardiography reports of mean pulmonary artery pressure (PAP) were obtained, together with other data like age, sex, race, co morbidities, respiratory disturbance index (RDI), Epworth sleepiness scale (ESS), and neck circumference.

RESULTS: The mean BMI of patients belonging to the morbidly obese group is 49.72 (SD 4.83), with mean PAP of 30.62 (SD 11.79), and mean RDI of 21.39 (SD 27.17). For the other group the mean BMI is 33.46 (SD 5.07), with mean PAP of 28.2 (SD 4.71), and mean RDI of 63.52 (SD 44.06). Using one-way ANOVA, there is no statistically significant difference in the MPAP among the two groups, with a p-value of 0.663. However, there is a statistically significant correlation between BMI and RDI of our patients with p-value of 0.008. There is also a statistically significant correlation between neck circumference and RDI among our patients with p-value of 0.037.

CONCLUSION: Our study indicates that there is no statistically significant correlation between BMI and MPAP. Further investigation, in the form of a prospective, case-control study, is needed to determine if BMI alone has a causative effect on PH. Our study also shows that there is linear correlation between RDI and BMI, and neck circumference and BMI.

CLINICAL IMPLICATIONS: Body mass index (BMI) and risk for pulmonary hypertension (PH).

DISCLOSURE: Roberto Santos, No Financial Disclosure Information; No Product/Research Disclosure Information

SCREENING FOR PULMONARY ARTERIAL HYPERTENSION WITH EXERCISE-STRESS-ECHOCARDIOGRAPHY AND CARDIOPULMONARY EXERCISE TESTING

Gabor Kovacs MD* Robert Maier MD Stefan Scheidl MD Christian Hesse MD Elisabeth Aberer Prof., MD, Marianne Brodmann Prof., MD, Ekkehard Grünig MD Horst Olschewski Prof., MD, Medical University Graz, University Clinic of Internal Medicine, Pulmonology, Graz, Austria

PURPOSE: In the early stages of Pulmonary Arterial Hypertension (PAH), the pulmonary arterial pressure may be normal at rest, but elevated during exercise. Exercise-Stress-Echocardiography (EE) may detect these abnormal reactions.

METHODS: We examined patients with a risk factor for PAH with EE and Cardiopulmonary Exercise Testing (CPET), and we determined the systolic PAP at rest (rSPAP) and during exercise (exSPAP). Right Heart Catheterisation (RHC) and the measurement of the mean PAP (mPAP) was recommended for patients with an abnormal EE result (exSPAP>40mmHg) and for patients with a VO₂ peak<75% predicted. The results of the EE and RHC examinations were compared. Patients with known PAH were excluded.

RESULTS: 60 patients with Systemic Sclerosis, Systemic Lupus Erythematoses and liver cirrhosis were examined. rSPAP was elevated in 1 patient (54mmHg) (RHC mPAP: 27mmHg), 27 patients had normal rSPAP (27±5mmHg), and abnormal exSPAP (54±9mmHg). 18 of these patients were examined by RHC. 1 patient had PAH at rest (mPAP: 27mmHg), 10 had an exercise-induced PAH (mPAP at rest: 17±3mmHg, ex mPAP: 36±4mmHg). 6 patients had an exercise induced PH with pulmonary capillary wedge pressure (PAWP) elevation (PAWP at rest: 7±2mmHg, ex PAWP: 32±10mmHg), and 1 patient had normal SPAP at rest and during exercise. EE showed normal values in 32 patients at rest and during exercise (rSPAP: 23±3mmHg, exSPAP: 29±7mmHg). Out of these, 6 patients underwent RHC because of limited exercise capacity. 4 of them had an exercise-induced PAH (mPAP at rest: 18±4mmHg, ex mPAP: 39±7mmHg), 2 of them had normal values.

CONCLUSION: In patients with a risk factor for PAH, EE showed an abnormal reaction in 47%. At the given indication, the positive predictive value of EE for exercise-induced PAH is 95%, the negative predictive value 33%.

CLINICAL IMPLICATIONS: EE combined with CPET might be a suitable method to diagnose PAH in the very early stage of the disease.

DISCLOSURE: Gabor Kovacs, No Financial Disclosure Information; No Product/Research Disclosure Information

TREATMENT OF PAH: DATA FROM THE QUALITY ENHANCEMENT RESEARCH INITIATIVE

Vallerie McLaughlin MD* Anatoly Langer MD Alina Dragomir MD Amparo Casanova MD, PhD Mary Tan BSc Ronald Oudiz MD Philip Clements MD, MPH Victor Tapson MD Richard Channick MD Rubin Lewis MD University of Michigan Health System, Ann Arbor, MI

PURPOSE: Implementation of the 2004 ACCP Recommendations for the Management of Pulmonary Arterial Hypertension (PAH) was studied in quality enhancement research initiative (QuERI) in PAH 517 patients among 52 US specialists.

METHODS: Physicians were asked to enroll PAH patients (known or newly diagnosed) and provide data on their medical management.

RESULTS: PAH was idiopathic in 37%, familial in 3%, had associated conditions in 50%: CTD in 28%, drug exposure in 9%, shunt in 7%, portal hypertension in 4%, HIV in 3% and venous/capillary involvement in <1%. WHO class was available in 471 patients: 9% were class I, 39% class II, 47% class III, and 5% class IV. Data on disease-specific treatments was available in 450 patients (87%). Epoprostenol/inhaled iloprost/treprostinil (PGI) was used in 33.7% overall and alone in 8.0%. Sildenafil (SID) was used in 37.3% overall and alone in 8.8%. Bosentan (BOS) was used in 53.1% and alone in 26.0%. Combination therapy was PGI + SID in 16.9%; BOS + SID in 18.2%; PGI + BOS in 15.6%; and PGI + BOS + SID in 6.7%. 19.8% were on no therapy. All of these therapies were more frequently used as symptom class worsened. Among 96 patients on CCB, only 27 had acute vasoreactivity testing performed; only 6 of these were reported to have ACCP-defined vasoreactivity (22% of those tested for vasoreactivity and only 6.3% of the total population). Recommended PAH therapy of anticoagulants (warfarin) was used in 38% of class II, 52% of class III and 44% of class IV (44% overall). Diuretics were used in 40%, 53%, and 72% of class II, III, and IV, respectively. Modulators of renin system were used in 21% of patients and digoxin in 16%.