Patients First
Quality counts when referring patients to hospitals and physicians, so Cleveland Clinic has created a series of Outcomes books similar to this one for many of its institutes. Designed for a healthcare provider audience, the Outcomes books contain a summary of our surgical and medical trends and approaches, data on patient volume and outcomes, and a review of new technologies and innovations.

Although we are unable to report all outcomes for all treatments provided at Cleveland Clinic — omission of outcomes for a particular treatment does not mean we necessarily do not offer that treatment — our goal is to increase outcomes reporting each year. When outcomes for a specific treatment are unavailable, we often report process measures that have documented relationships with improved outcomes. When process measures are unavailable, we report volume measures; a volume/outcome relationship has been demonstrated for many treatments, particularly those involving surgical technique.

Cleveland Clinic also supports transparent public reporting of healthcare quality data and participates in the following public reporting initiatives:

- Joint Commission Performance Measurement Initiative (www.qualitycheck.org)
- Centers for Medicare and Medicaid (CMS) Hospital Compare (www.hospitalcompare.hhs.gov)
- Leapfrog Group (www.leapfroggroup.org)
- Ohio Department of Health Service Reporting (www.odh.state.oh.us)

Our commitment to providing accurate, timely information about patient care is designed to help patients and referring physicians make informed healthcare decisions. We hope you find these data valuable. To view all our Outcomes books, visit Cleveland Clinic’s Quality and Patient Safety website at clevelandclinic.org/quality/outcomes.
Dear Colleague:

I am proud to present the 2007 Cleveland Clinic Outcomes books. These books provide information on results, volumes and innovations related to Cleveland Clinic care. The books are designed to help you and your patients make informed decisions about treatments and referrals.

Over the past year, we enhanced our ability to measure outcomes by reorganizing our clinical services into patient-centered institutes. Each institute combines all the specialties and support services associated with a specific disease or organ system under a single leadership at a single site. Institutes promote collaboration, encourage innovation and improve patient experience. They make it easier to benchmark and collect outcomes, as well as implement data-driven changes.

Measuring and reporting outcomes reinforces our commitment to enhancing care and achieving excellence for our patients and referring physicians. With the institutes model in place, we anticipate greater transparency and more comprehensive outcomes reporting.

Thank you for your interest in Cleveland Clinic’s Outcomes books. I hope you will continue to find them useful.

Sincerely,

Delos M. Cosgrove, MD
CEO and President
what’s inside

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chairman’s Letter</td>
<td>04</td>
</tr>
<tr>
<td>Institute Overview</td>
<td>05</td>
</tr>
<tr>
<td>Quality and Outcomes Measures</td>
<td></td>
</tr>
<tr>
<td>Critical Care Medicine</td>
<td>06</td>
</tr>
<tr>
<td>The Respiratory Special Care Unit (ReSCU)</td>
<td>07</td>
</tr>
<tr>
<td>Bronchology</td>
<td>08</td>
</tr>
<tr>
<td>Asthma Center</td>
<td>09</td>
</tr>
<tr>
<td>Interstitial Lung Disease</td>
<td>10</td>
</tr>
<tr>
<td>Lung and Heart/Lung Transplantation</td>
<td>10</td>
</tr>
<tr>
<td>Patient Experience</td>
<td>12</td>
</tr>
<tr>
<td>Innovations</td>
<td>15</td>
</tr>
<tr>
<td>New Knowledge</td>
<td>18</td>
</tr>
<tr>
<td>Staff Listing</td>
<td>22</td>
</tr>
<tr>
<td>Contact Information</td>
<td>23</td>
</tr>
<tr>
<td>Institute Locations</td>
<td>24</td>
</tr>
<tr>
<td>Cleveland Clinic Overview</td>
<td>25</td>
</tr>
<tr>
<td>Online Services</td>
<td>25</td>
</tr>
<tr>
<td>eCleveland Clinic</td>
<td></td>
</tr>
<tr>
<td>DrConnect</td>
<td></td>
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<tr>
<td>MyConsult</td>
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</tbody>
</table>
Chairman’s Letter

The Respiratory Institute is pleased to present our fourth edition of Respiratory Disease Outcomes. This booklet provides a condensed overview of our clinical activities and programs, including reports of clinical volumes and patient outcomes. We believe it is important and useful to share this information with our referring physicians, training program alumni, potential patients and other individuals interested in respiratory diseases. At Cleveland Clinic, patients with respiratory disease benefit from the expertise of a multidisciplinary team consisting of clinicians specializing in pulmonary and critical care medicine, allergy and clinical immunology and thoracic surgery, all working in close collaboration with thoracic radiologists and pulmonary pathologists. In 2007, we experienced continued growth in our clinical programs, research funding and application of innovative technologies. We are proud of these accomplishments and thankful to all who helped us achieve this level of success. We are firmly committed to providing ever-increasing levels of clinical excellence in the future.

Herbert P. Wiedemann, MD
Chairman, Respiratory Institute
Institute Overview

At the Respiratory Institute, patients with pulmonary disorders benefit from the expertise of a multidisciplinary team of specialists. At Cleveland Clinic, experts in four departments – Pulmonary, Allergy and Critical Care Medicine; Thoracic and Cardiovascular Surgery; Thoracic Imaging; and Pulmonary Pathology – collaborate to care for these patients.

We provide comprehensive care for all patients with respiratory disorders. National experts treat patients with the following conditions:

- Acute Respiratory Distress Syndrome (ARDS)
- Asthma
- Beryllium-induced lung disease
- Chronic obstructive pulmonary disease (COPD), including alpha-1 antitrypsin deficiency
- Idiopathic pulmonary fibrosis
- Interstitial lung disease
- Intervventional bronchology
- Lung cancer
- Lung volume reduction surgery
- Lymphangioleiomyomatosis (LAM)
- Pulmonary alveolar proteinosis (PAP)
- Pulmonary vascular diseases (idiopathic pulmonary hypertension pulmonary embolic disease, etc.)
- Sarcoidosis

The Respiratory Institute’s six formal sections provide advanced sub-specialized care in the fields of allergy and clinical immunology, bronchology, critical care medicine, lung transplantation, respiratory therapy and sleep medicine. Diagnosing and managing the full spectrum of respiratory and allergic disorders, the Respiratory Institute serves nearly 60,000 patients annually.

Also within our Institute are the following centers: Center for Major Airway Diseases (in conjunction with thoracic surgery), Asthma Center and Alpha-1 Antitrypsin Deficiency Center of Excellence.

Our Institute also brings care into the community, providing outpatient services at the Beachwood Family Health and Surgery Center (Pulmonary & Allergy), Brunswick Family Health Center (Pulmonary), Independence Family Health Center (Pulmonary & Allergy), Strongsville Family Health and Surgery Center (Pulmonary & Allergy), Westlake Family Health Center (Allergy), and the Willoughby Hills Family Health Center (Allergy). Respiratory Institute staff also provide comprehensive (ICU, inpatient, outpatient) pulmonary care at Hillcrest Hospital and Euclid Hospital.

This past year, our Institute has seen continued growth in our clinical programs and research activities, which are primarily conducted at Cleveland Clinic’s main campus facilities (clinics, hospital and research laboratories). The collaboration between our clinicians and researchers helps to shorten the gap between the laboratory discoveries of today and the patient care of tomorrow.

<table>
<thead>
<tr>
<th>2007 Total</th>
<th>% Increase 2005 - 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Visits</td>
<td>57,808</td>
</tr>
<tr>
<td>Interstitial Lung Disease Visits</td>
<td>2,094</td>
</tr>
<tr>
<td>Pulmonary Arterial Hypertension Visits</td>
<td>1,375</td>
</tr>
<tr>
<td>Sarcoidosis Visits</td>
<td>1,317</td>
</tr>
<tr>
<td>Lung Cancer Visits</td>
<td>760</td>
</tr>
<tr>
<td>COPD Visits</td>
<td>4,015</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2007 Total</th>
<th>% Increase 2005 - 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Funding</td>
<td>$4,700,000</td>
</tr>
<tr>
<td>Research Grants/Contracts</td>
<td>72</td>
</tr>
</tbody>
</table>
The Respiratory Institute manages and staffs the Medical Intensive Care Unit (MICU) at Cleveland Clinic. We have seen a 28 percent increase in MICU admissions over the past five years, with 1,463 admissions in 2007. Hospital transfer cases are a major source of admissions and have increased 40 percent over 2003.

Patient outcomes in the MICU continue to be excellent, as exhibited by mortality rates significantly below the risk-adjusted predicted values. SAPS II and APACHE II are two validated statistical models for predicting mortality risk based on patient physiology 24 hours after admission to the ICU.

### MICU Actual vs. Expected Survival (Based on 24-hour Assessment)

<table>
<thead>
<tr>
<th>SAPS II Risk Quintile</th>
<th>Cases</th>
<th>Deaths</th>
<th>Actual Survival (%)</th>
<th>Expected Survival (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First (highest risk)</td>
<td>85</td>
<td>73</td>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td>Second</td>
<td>57</td>
<td>29</td>
<td>49</td>
<td>30</td>
</tr>
<tr>
<td>Third</td>
<td>94</td>
<td>33</td>
<td>65</td>
<td>51</td>
</tr>
<tr>
<td>Fourth</td>
<td>122</td>
<td>25</td>
<td>80</td>
<td>72</td>
</tr>
<tr>
<td>Fifth (lowest risk)</td>
<td>293</td>
<td>31</td>
<td>89</td>
<td>92</td>
</tr>
</tbody>
</table>

### MICU Actual vs. Expected Survival (Based on 24-hour Assessment)

<table>
<thead>
<tr>
<th>APACHE II Risk Quintile</th>
<th>Cases</th>
<th>Deaths</th>
<th>Actual Survival (%)</th>
<th>Expected Survival (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First (highest risk)</td>
<td>58</td>
<td>47</td>
<td>19</td>
<td>11</td>
</tr>
<tr>
<td>Second</td>
<td>90</td>
<td>38</td>
<td>58</td>
<td>44</td>
</tr>
<tr>
<td>Third</td>
<td>116</td>
<td>36</td>
<td>69</td>
<td>62</td>
</tr>
<tr>
<td>Fourth</td>
<td>183</td>
<td>42</td>
<td>77</td>
<td>75</td>
</tr>
<tr>
<td>Fifth (lowest risk)</td>
<td>139</td>
<td>5</td>
<td>96</td>
<td>87</td>
</tr>
</tbody>
</table>
The Respiratory Special Care Unit (ReSCU)

The Respiratory Special Care Unit (ReSCU) was created for persons who depend on mechanical ventilation to breathe but who are otherwise healthy enough to leave the intensive care unit. The primary goals of the ReSCU are to:

- have patients breathe without the ventilator
- teach patients self-care
- teach family members how to care for the patient and manage the ventilator at home
- prepare the patient and family for the patient’s discharge to another facility

### Disposition of ReSCU Discharge

<table>
<thead>
<tr>
<th></th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completely Weaned</td>
<td>46%</td>
</tr>
<tr>
<td>Partial Ventilator Support</td>
<td>10%</td>
</tr>
<tr>
<td>Complete Ventilator Support</td>
<td>4%</td>
</tr>
<tr>
<td>Expired in ReSCU</td>
<td>4%</td>
</tr>
<tr>
<td>Transferred to Intensive Care Unit</td>
<td>36%</td>
</tr>
</tbody>
</table>

### Primary ReSCU Stats for the Weaning Ventilator Unit

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Discharged Patients</td>
<td>62</td>
</tr>
<tr>
<td>Total ReSCU Days</td>
<td>1,672</td>
</tr>
<tr>
<td>Percent Completely Weaned from Ventilation</td>
<td>28/62 = 45.2%</td>
</tr>
<tr>
<td>Percent Survival</td>
<td>60/62 = 96.8%</td>
</tr>
<tr>
<td>Average Length of Stay</td>
<td>27.0 days</td>
</tr>
</tbody>
</table>

Based on data from January 1-December 31, 2007
The Respiratory Institute provides the full range of advanced diagnostic and interventional bronchoscopy techniques. We have some of the world’s most extensive experience with:

- electromagnetic navigation
- lung transplant related airway disease
- self-expanding metallic stents
- management of airway complications due to histoplasmosis
- benign airway diseases
- metallic stent removal

We performed 2,391 bronchoscopies during 2007, a 78 percent increase over 2003. Importantly, our complication rates remain low.

### Flexible Bronchoscopies 2007

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transbronchial Lung Biopsy</td>
<td>1,501</td>
</tr>
<tr>
<td>Airway Examination</td>
<td>415</td>
</tr>
<tr>
<td>Endobronchial Biopsy</td>
<td>113</td>
</tr>
<tr>
<td>Electrocautery</td>
<td>129</td>
</tr>
<tr>
<td>Bronchial &amp; Tracheal Dilation/Stenting</td>
<td>213</td>
</tr>
<tr>
<td>Laser Ablation</td>
<td>20</td>
</tr>
</tbody>
</table>

### Post-Bronchoscopy Complication Rate

<table>
<thead>
<tr>
<th>Complication</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumothorax</td>
<td>0.4</td>
</tr>
<tr>
<td>Clinically Significant Bleeding</td>
<td>0.3</td>
</tr>
<tr>
<td>Reversal of Sedation</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Asthma control can be assessed by use of validated instruments, including the Asthma Control Test (ACT). The ACT includes five questions that assess daytime symptoms, nighttime symptoms, reliance on “rescue” medication, the impact of asthma on everyday functioning, and patient assessment of control, with each of these five responses scored on a 1-5 scale.

Use of serial ACT scores in asthma management objectifies the degree to which the goals of management as described in asthma guidelines are being achieved. A major objective of asthma management is to achieve well- (ACT=20-24) or totally- (ACT=25) controlled asthma. If asthma is poorly controlled (ACT<15) or not well controlled (ACT=15-19), evidence indicates such patients are at elevated risk for exacerbation of asthma over time.

We have used the ACT in Allergy/Immunology at Cleveland Clinic for three years on a routine basis, for all initial and return visits. Shown below are serial ACT scores categorized as totally- or well-controlled, not well-controlled, or poorly controlled, in patients seen in 2007 who completed ACT at their initial appointments and also at return visits.

Care in Allergy/Immunology at Cleveland Clinic is associated with improvement in asthma control over time.

<table>
<thead>
<tr>
<th>ACT Score Categories</th>
<th>Initial Visit</th>
<th>Return Visit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well and Totally Controlled</td>
<td>26%</td>
<td>57%</td>
</tr>
<tr>
<td>Not Well Controlled</td>
<td>22%</td>
<td>18%</td>
</tr>
<tr>
<td>Poorly Controlled</td>
<td>52%</td>
<td>25%</td>
</tr>
</tbody>
</table>
Interstitial Lung Disease

The interstitial lung disease program continued to grow with 2,094 total visits for idiopathic pulmonary fibrosis, sarcoidosis, hypersensitivity pneumonitis, and connective tissue disease associated ILD. This was an increase of 15 percent over 2006. We enrolled patients into clinical research trials of pirfenidone and bosentan for IPF and bosentan for sarcoidosis.

Nationally sanctioned outcomes for ILD have not been determined. However, our program has designated improved lung function after immunosuppressive therapy for cryptogenic organizing pneumonia (COP) as an achievable goal. This outcome encompasses our program’s ability to correctly diagnose and treat these complex patients. During 2007, 13 patients with COP were treated with immunosuppressive medications other than prednisone. Prior literature shows that if these patients are correctly diagnosed and treated, the majority should have improved lung function as measured by forced vital capacity (FVC) during treatment and, importantly, were able to reduce oral corticosteroid dosage. Our results are depicted in the table below. Patients were treated for an average of 674 days and 12 patients had stable or improved FVC at most recent evaluation.

<table>
<thead>
<tr>
<th>n = 13</th>
<th>Pretreatment</th>
<th>Posttreatment</th>
<th>Paired t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>FVC</td>
<td>61 ± 4%</td>
<td>70 ± 6%</td>
<td>p = 0.041</td>
</tr>
<tr>
<td>Prednisone dosage</td>
<td>40 ± 7 mg/day</td>
<td>15 ± 5 mg/day</td>
<td>p = 0.002</td>
</tr>
</tbody>
</table>

Lung and Heart/Lung Transplantation

2007 was another year of growth for Cleveland Clinic Lung and Heart/Lung Transplant Program, one of the most active in the country. The Transplant Program completed its 626th transplant since the program’s inception in 1990, and in 2007, performed 72 lung transplants, including three heart-lung transplants and the first lung-liver transplant in Ohio. More than 415 end-stage lung disease patients were evaluated nationally and internationally by the transplant team. The Transplant program continues a reputation for accepting and transplanting challenging complex patients. Cleveland Clinic’s Lung Transplant Team is involved in a series of multicenter trials aimed at therapy of primary graft dysfunction, acute rejection and induction therapy. In addition, our surgeons have pioneered certain transplant surgical techniques, including bronchial artery revascularization, that may improve outcomes further by reducing ischemic injury.

The average waiting time for a graft in our program remains stable despite the new Lung Allocation Score (LAS). Currently our average waiting time is 75 days. The Lung Transplant program has achieved very strong survival rates that are at or above the national average. Median and long-term outcomes continue to improve, with a one-year survival rate of 86 percent and two-year survival rate of 74 percent. A continued emphasis on quality assurance and quality improvement remain central to the program, reflected by the decrease in post-transplant length of stay to an average of 13 days.

Another unique feature of Cleveland Clinic’s transplant program is that patients can live within 1,000 miles of the Cleveland area while awaiting an organ without having to relocate to Cleveland. We follow our patients for the life of their transplant for continuity of care along with local physicians. Our transplant physicians are committed to helping the transplanted patients receive as much care as possible close to their homes. The goal is to return each transplant patient to his or her primary care physician or referring physician within three to six months after transplant.

By the end of 2007
Cleveland Clinic performed 626 transplants.
Patient Experience

Outpatient - Respiratory Institute

We ask our patients about their experiences and satisfaction with the services provided by our staff. Although our patients are already indicating we provide excellent care, we are committed to continuous improvement.

Overall Rating of Care 2007

Overall Rating of Provider Care 2007
**Inpatient - Cleveland Clinic**

With the support of the Center for Medicare and Medicaid Services (CMS) and its partner organizations, the first national standard patient experience survey was implemented in late 2006. Adult medical, surgical, and obstetrics and gynecology patients treated at acute care hospitals across the country are included in the survey. Results collected for initial public reporting, published on www.hospitalcompare.gov in March 2008, are shown here.

**Overall Rating of Care (0 worst - 10 best scale)**  
**October 2006 - June 2007**

![Graph showing overall rating of care](image)

Total Cleveland Clinic Survey Respondents = 4,725

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**Would Recommend Facility**  
**October 2006 - June 2007**

![Graph showing would recommend facility](image)

Total Cleveland Clinic Survey Respondents = 4,725
Ohio's First Lung/Liver Transplant

In January 2007, a 25-year-old cystic fibrosis patient with end-stage lung and liver disease underwent a 12-hour operation at Cleveland Clinic, becoming Ohio's first lung and liver transplant recipient. The patient began her workup at Cleveland Clinic in 2006. However, after the birth of her son, her cystic fibrosis disease progressed. Both her lungs and her liver continued to decline, and she began to have frequent and worsening episodes of hemoptysis that required several interventions. Because her liver would not withstand the immunosuppressive therapy needed for new lungs, the team decided to proceed with both a double-lung and a liver transplant simultaneously.

Cardiothoracic surgeon Gösta Pettersson, MD, PhD, Director of Heart/Lung Transplantation, and surgeon Charles Miller, MD, Director of Liver Transplantation, transplanted the patient’s lungs and liver, respectively. Currently in the United States, only a handful of centers are able to perform this type of multi-organ transplant surgery.

Following an uneventful recovery and four weeks after her landmark operation at Cleveland Clinic, the patient returned home to her family. At her first follow-up visit, she reported that she has begun to play the flute again, a hobby she had given up because of limited respiratory capacity.
Innovations

Our mission includes research into pathophysiology of respiratory diseases to develop innovative methodologies and techniques that enhance and advance our ability to diagnose and treat respiratory diseases. The number of externally funded research grants and contracts, and the total funding of these activities, has increased substantially.

Major areas of research activity include asthma, acute respiratory distress syndrome (ARDS), mast cell function, the role of nitric oxide in respiratory disorders, pulmonary hypertension, beryllium-induced lung disease, idiopathic pulmonary fibrosis (IPF), sarcoidosis, chronic obstructive pulmonary disease (COPD) (including alpha-1 antitrypsin deficiency), and pulmonary alveolar proteinosis (PAP).

The Respiratory Institute was proud to sponsor five innovation summits in 2007.

“Asthma Summit 2007”

The Respiratory Institute, in association with the Department of Pathobiology, presented the Asthma Summit 2007 in April 2007. The Asthma Summit focused on research and clinical care advances by global leaders in asthma. The meeting highlighted perspectives on future research that will influence the practice of asthma care, and described the most up-to-date diagnostic tools, asthma educational programs and new insights into clinical care. Each of the more than 175 attendees from around the country and the world were provided detailed information on recent innovations in asthma and potential interface with new technology. Speakers and participants, including physicians, nurses, allied health professionals, and researchers from both academics and industry, were provided with the opportunity to interact in breakout groups regarding priorities on research that will influence the future practice of medicine in the treatment of asthma in clinical care. The Asthma Summit was highly successful in promoting the rapid movement forward to realize today’s research becoming tomorrow’s asthma care.

“Major Airway Disease Summit 2007”

The Major Airway Disease Summit, conducted by the Respiratory Institute in April 2007, focused on the interfaces among innovative technology, research and clinical care. This Summit was attended by physicians and allied health care professionals with an interest in pulmonary disease and diseases of the major airways, as well as individuals in the medical technology industry. The Summit provided a unique perspective on cutting-edge technologies that will influence the future practice of pulmonary and major airway disease.


This summit in May 2007, part of the Lung Summit series in the Respiratory Institute, addressed topical issues of the science and management of respiratory care. The state-of-the-art lectures and interaction engaged respiratory therapists, RT students, nurses and physicians. Summit objectives included addressing the issues of supply of RTs, demand for their services and manpower in respiratory care today, key issues in managing a respiratory therapy group, and current issues regarding new modes and optimal strategies of mechanical ventilation, and optimal aerosol delivery.

“Breath Analysis Summit 2007: Clinical Applications of Breath Testing”

In November 2007, the Respiratory Institute hosted the first “International Breath Analysis Summit” and the Scientific Meeting of the International Association for Breath Research (IABR). The Summit was directed by Raed A. Dweik, MD, and was held in collaboration with the National Aeronautics and Space Administration (NASA), the Environmental Protection Agency (EPA), the Monell Chemical Senses Center and the Electrochemical Society (ECS).

The Summit brought together industry executives, entrepreneurs, scientists and clinicians to discuss key trends, future directions and upcoming technologies in breath analysis and medicine. Breath testing is an innovative new approach for non-invasive disease diagnosis and monitoring and represents the new frontier in medical testing. The major focus of the Summit was on medical applications. Topics included exhaled nitric oxide, exhaled breath condensate, electronic nose and sensor arrays, mass spectrometry and bench top instrumentation, and cutting edge sensor technologies. Medical applications that were covered included asthma, COPD, pulmonary hypertension, other respiratory diseases, gastrointestinal diseases, occupational diseases, critical illness, and cancer.
Participants in the two-and-a-half-day Summit came from 23 countries and 18 states. In his concluding remarks, the President of IABR, Professor Anton Amann of Austria, thanked Dr. Dweik and Cleveland Clinic for hosting a “perfect meeting at a perfect venue.”

**“Pulmonary Hypertension Summit 2007”**

The Pulmonary Hypertension Summit 2007, on November 16 and 17 on the Cleveland Clinic campus, attracted more than 220 participants from 20 states and five countries to hear state-of-the-art presentations by 40 distinguished Cleveland Clinic and visiting faculty. Summit attendees included physicians and other health care professionals, researchers and scientists, industry representatives, patients and care givers and patient advocacy groups.

Outside of these summits, other major innovations included:

**Non-invasive Diagnosis of Lung Cancer**

A Cleveland Clinic team of pulmonologists and oncologists evaluated the ability of gaseous chemical sensing devices to detect lung cancer by analyzing exhaled breath. Prior study has suggested the pattern of chemicals in the breath, or volatile organic compounds, may be unique in individuals with lung cancer.

Previously, we described the use of a carbon polymer sensor system. The output from this system is a change in the conductivity of the sensors based on the chemicals in the breath that contact them. We also reported the use of a colorimetric sensor array. The sensor used in this system was composed of 36 colored dots impregnated on a disposable cartridge. The dots were made of chemically responsive compounds that change their color based on the pattern of chemicals with which they come in contact. We hypothesized that the pattern of color changes on the sensor would be unique in subjects with lung cancer.

In our first study, smellprints were obtained on the exhaled breath of 14 individuals with bronchogenic carcinoma, 19 with alpha-1 antitrypsin deficiency (a1-ATD), six with chronic beryllium disease (CBD) and 20 healthy controls. Unlike a1-ATD and CBD, exhaled breath of lung cancer patients clustered distinctly from controls. These data indicated that the exhaled breath of lung cancer patients has distinct characteristics that can be identified with a carbon polymer sensor system.

Subsequently, a cancer prediction model was prospectively evaluated in a group of 52 individuals, 12 with and 40 without cancer. In the prospective study, exhaled breath analysis by the electronic nose showed 71.4 percent sensitivity (CI: 41.9 to 91.6) and 91.9 percent specificity (CI: 82.1 to 97.3) for the diagnosis of lung cancer.

These results support the potential for breath analysis to be developed into a useful diagnostic test for lung cancer, confirming previously performed work by us and others. We hope to learn more about the unique constituents of the breath of subjects with lung cancer and develop analysis systems that accurately screen for, and diagnose, lung cancer in a noninvasive manner.

**Time to Board the “E-Bus”**

**Bronchoscopy and Real-Time Ultrasonography: Partners in New Technology**

Endobronchial ultrasound (EBUS) is a new technology being used to evaluate airway, lung and lymph node abnormalities. EBUS offers pulmonologists and thoracic surgeons an improved ability to diagnose disease, stage cancer and determine which patients are candidates for surgery. The three general uses for intra-thoracic ultrasound include:

**Peripheral Endobronchial Ultrasound (P-EBUS)**

To evaluate peripheral lung lesions better and increase diagnostic accuracy, we use a peripheral probe. A miniaturized probe is introduced through the working channel of the bronchoscope. The differences in density between the lung lesion and the normal lung architecture are highlighted as the probe is introduced into the abnormal area. A catheter is then left in place and samples are taken. Recent data suggest an improved yield using P-EBUS.
Balloon Probe

Often it is difficult to distinguish between tumor invasion in an airway wall vs. compression from outside the airway. To help differentiate an abnormal airway (airway involved with cancer) from a normal airway, we can insert an ultrasound probe, enveloped inside a balloon, into the airway. Once the balloon is inflated with saline, the ultrasonic image can show intrinsic (involved airway) from extrinsic (compression outside the airway) involvement. This technique can allow for improved detection of airway invasion and determine which patients are candidates for resection.

Endobronchial Ultrasound Trans-Bronchial Needle Aspiration

The hybrid bronchoscope (convex probe or puncture scope) is currently being used to improve the diagnostic yield of transbronchial needle aspiration (TBNA). The endobronchial ultrasound TBNA scope is designed with a small ultrasound probe on the tip that allows visualization of the lymph nodes. The scope also features a needle for sampling. The EBUS TBNA scope allows physicians to visualize the lymph nodes and vessels as well as to see the needle puncture the lymph node in real time, providing an improved recovery and a potentially safer procedure for the patient. Our current yield exceeds 94 percent using this technique. We currently are using the EBUS TBNA scope for minimally invasive mediastinal staging as well as initial diagnosis. We are adding a second EBUS TBNA scope so that we may serve more patients.
New Knowledge

Journal Articles


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Golish J, Ioachimescu OC. Ambulatory titration of continuous positive airway pressure was as effective as polysomnography for obstructive sleep apnea. ACP J Club. 2007 Sep;147(2):45.


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Cleveland Clinic Overview

Cleveland Clinic, founded in 1921, is a nonprofit multispecialty academic medical center that integrates clinical and hospital care with research and education. Today, 1,800 Cleveland Clinic physicians and scientists practice in 120 medical specialties and subspecialties, annually recording more than 3 million patient visits and more than 70,000 surgeries.

In 2007, Cleveland Clinic restructured its practice, bundling all clinical specialties into integrated practice units called institutes. An institute combines all the specialties surrounding a specific organ or disease system under a single roof. Each institute has a single leader and focuses the energies of multiple professionals onto the patient. From access and communication to point-of-care service, institutes will improve the patient experience at Cleveland Clinic.

Cleveland Clinic’s main campus, with 37 buildings on 140 acres in Cleveland, Ohio, includes a 1,000-bed hospital, outpatient clinic, specialty institutes and supporting labs and facilities. Cleveland Clinic also operates 14 family health centers; eight community hospitals; two affiliate hospitals; a 150-bed hospital and clinic in Weston, Fla.; and health and wellness centers in Palm Beach, Fla., and Toronto, Canada. Cleveland Clinic Abu Dhabi (United Arab Emirates), a multispecialty care hospital and clinic, is scheduled to open in 2011.

At the Cleveland Clinic Lerner Research Institute, hundreds of principal investigators, project scientists, research associates and postdoctoral fellows are involved in laboratory-based research. Total annual research expenditures exceed $150 million from federal agencies, non-federal societies and associations, and endowment funds. In an effort to bring research from bench to bedside, Cleveland Clinic physicians are involved in more than 2,400 clinical studies at any given time.

In September 2004, Cleveland Clinic Lerner College of Medicine of Case Western Reserve University opened and will graduate its first 32 students as physician-scientists in 2009.

Cleveland Clinic is consistently ranked among the top hospitals in America by U.S. News & World Report, and our heart and heart surgery program has been ranked No. 1 since 1995.

For more information about Cleveland Clinic, visit clevelandclinic.org.

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eCleveland Clinic uses state-of-the-art digital information systems to offer several services, including remote second medical opinions to patients around the world; personalized medical record access for patients; patient treatment progress for referring physicians (see below); and imaging interpretations by our subspecialty trained radiologists. For more information, please visit eclevelandclinic.org.

DrConnect

Online Access to Your Patient’s Treatment Progress

Whether you are referring from near or far, DrConnect can streamline communication from Cleveland Clinic physicians to your office. This online tool offers you secure access to your patient’s treatment progress at Cleveland Clinic. With one-click convenience, you can track your patient’s care using the secure DrConnect website. To establish a DrConnect account, visit eclevelandclinic.org or email drconnect@ccf.org.

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Cleveland Clinic

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Cleveland Clinic is a nonprofit multispecialty academic medical center. Founded in 1921, it is dedicated to providing quality specialized care and includes an outpatient clinic, a hospital with more than 1,000 staffed beds, an education institute and a research institute.

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