



**THE 38th ANNUAL  
CONFERENCE  
OF INTERNATIONAL  
LUNG SOUNDS  
ASSOCIATION**

**第 38 回肺音（呼吸音）研究会  
FINAL PROGRAM AND ABSTRACTS**

**November 14 – 15, 2013,  
The Kyoto Garden Palace  
Kyoto, Japan**

## WELCOME MESSAGE

Welcome to Kyoto and ILSA 2013 on Nov. 14th and 15th. Kyoto is now in the middle of most beautiful and comfortable season. Please enjoy the meeting held in front of the historical Imperial Palace.

ILSA 2013 is the 38th ILSA annual meeting and we are now facing many problems, such as fewer attendants, aging of the researchers and so on. In this meeting we have to discuss about lung sounds while considering future direction of ILSA. In ILSA 2013 you can discuss many new topics, including daily clinical skills to auscultate children and novel automated analysis of lung sounds by new members, as well as many traditional topics from our old friends. I believe our younger new members will lead us to the future lung sounds research.

Luncheon Seminar in the first day was given by Professor Shigeo Wada of Osaka University. He will talk about "Flow-induced sounds in the oral cavity and the branching airway". His talk will include both technological and medical aspects of lung sounds.

I wish all of you can enjoy the meeting and this beautiful historical city, and also wish this ILSA 2013 can be a spring board to our future development of international lung sound research.



Yukio Nagasaka, M.D., PhD, FCCP  
Director  
Rakuwakai Kyoto Pulmonary Center  
Rakuwakai Otowa Hospital

For the memorial of ILSA 38<sup>th</sup> in Kyoto, we have a special gift, a memorial handmade mug cup by a popular ceramic artist in Kyoto, Ms. Fumie Fujimoto. As these mug cups are all handmade, there should be a small difference both in color and shape. At registration in the first day, please choose and take one mug cup, which you like most.

Ms. Fujimoto will be there and welcome you at registration in the first day morning.

Ms. Fumie Fujimoto is a graduate of Kyoto City University of Arts and has been a popular ceramic artist in Kyoto. Her arts are known to invite good luck and happiness! Her arts are modern but based on a traditional Kyo-yaki (Kyoto Ceramic) style as shown below. We wish this mug cup will bring you good-luck and happiness.



Examples of ceramic arts by Fumie Fujimoto. (small dishes, not mug cups!)

## LIST OF ILSA CONFERENCES

No.	Date	Place	Local Organizer(s)	No.	Date	Place	Local Organizer(s)
1.	October 1976	Boston, MA	Raymond L.H.Murphy,Jr.	33.	October 2008	Boston, MA	Sadamu Ishikawa & Raymond L.R. Murphy,Jr.
2.	September 1977	Cincinnati, OH	Robert Loudon	34.	September 2009	Haifa, Israel	Noam Gavriely
3.	September 1978	New Orleans, LA	William Waring	35.	October 2010	Toledo,OH	Dan E. Olson
4.	September 1979	Chicago, IL	David Cugell	36.	September 2011	Manchester, UK	Ashley Woodcock
5.	September 1980	London, England	Leslie Capel & Paul Forgacs	37.	October 2012	Rochester, Minnesota	Michael E. Nemergut
6.	October 1981	Boston, MA	Raymond L.H.Murphy,Jr.	38.	November 2013	Kyoto, Japan	Yukio Nagasaka
7.	October 1982	Martinez, CA	Peter Krumpe	39.	October 2014	Boston, MA	Sadamu Ishikawa
8.	September 1983	Baltimore, MD	Wilmot Ball				
9.	September 1984	Cincinnati, OH	Robert Loudon				
10.	September 1985	Tokyo, Japan	Riichiro Mikami				
11.	September 1986	Lexington, KY	Steve S. Kraman				
12.	September 1987	Paris, France	Gerard Charbonneau				
13.	September 1988	Chicago, IL	David Cugell				
14.	September 1989	Winnipeg, Canada	Hans Pasterkamp				
15.	October 1990	New Orleans, LA	David Rice				
16.	September 1991	Veruno, Italy	Filiberto Dalmaso				
17.	August 1992	Helsinki, Finland	Anssi Sovijärvi				
18.	August 1993	Alberta, Canada	Raphael Beck				
19.	September 1994	Haifa, Israel	Noam Gavriely				
20.	October 1995	Long Beach, CA	Christopher Druzgalski				
21.	September 1996	Chester, England	John Earis				
22.	October 1997	Tokyo, Japan	Masahi Mori				
23.	October 1998	Boston, MA	Sadamu Ishikawa				
24.	October 1999	Marburg,Germany	Peter von Wichert				
25.	September 2000	Chicago, IL	David Cugell				
26.	September 2001	Berlin, Germany	Hans Pasterkamp				
27.	September 2002	Helsinki, Stockholm	Anssi Sovijärvi				
28.	September 2003	Cancun, Mexico	Sonia Charleston, Ramón Gonzales Camarena & Tomás Aljama Corrales				
29.	September 2004	Glasgow, Scotland	Ken Anderson & John Earis				
30.	September 2005	Boston/Cambridge, MA	Raymond L.H.Murphy,Jr.				
31.	September 2006	Halkidiki, Greece	Leontios Hadjileontiadis				
32.	November 2007	Tokyo, Japan	Shoji Kudoh				

## GENERAL INFORMATION

### Conference Venue/Accommodation

The Kyoto Garden Palace (<http://www.hotelgp-kyoto.com/english/>)  
(Room “Gion” on the 2<sup>nd</sup> floor)

**Official language:** English

### Registration

Registration will be held in front of the conference room (Room “Gion”, 2<sup>nd</sup> floor) on:

Thursday, November 14<sup>th</sup> 8:30am - 6:00pm

Friday, November 15<sup>th</sup> 8:30am - 3:00pm

### Registration fees

\$90 / ¥10000 : (Members/Non-members)

\*Note that NO CREDIT CARD will be accepted.

Registration fee includes Get-together party and Lunch.

### ILSA annual membership fee

\$75 / ¥9000

\*Note that NO CREDIT CARD will be accepted.

ILSA members are required to pay the membership fee (if it hasn't paid yet) followed by the ILSA2013 conference registration fee.

### Certificate of attendance

Participants, duly registered, will receive certificates of attendance upon requests.

### Social Events

Get-together party will be held on November 14<sup>th</sup> at Kyoto Garden Palace (Room “Kurama”, 2<sup>nd</sup> Floor).

\*Business meeting will be held around 3:00pm on November 15<sup>th</sup>.

### Sightseeing tour

Excursion to Eikando, Nanzenji Temple after the luncheon seminar (13:30-15:30) on November 14<sup>th</sup>

## Supporting Organizations

Rakuwakai Otowa Hospital

## Sponsors

Astellas Pharma Inc.

Astrazeneca K.K.

Dainippon Sumitomo Pharma Co., Ltd.

Glaxosmithkline K.K.

Kenzmedico Co., Ltd.

MSD K.K.

Ono Pharmaceutical Co., Ltd.

Pfizer Japan Inc.

Taiho Pharmaceutical Co., Ltd.

# PROGRAM

**Thursday, November 14**

8:30 **Registration**

9:00- 9:10 **Opening remarks**

Tadashi Matsumura (President, Rakuwakai Hospitals)

## Session 1

**Chair Persons:** Shoji Kudoh (Fukujuji Hospital, Japan)

Jukka Rasanen (H. Lee Moffitt Cancer Center, Department of Anesthesiology, USA)

9:10-9:40 **History of ILSA, Skype Presentation**

Raymond Murphy (Brigham & Women / Faulkner Hospitals, USA)

9:40-10:15 **Lung sounds in central airways narrowing**

Michiko Tsuchiya

(Department of Pulmonary Medicine, Rakuwakai Otowa Hospital, Japan )

10:15-10:40 **Detailing mechanisms and sites of origin of forced expiratory wheezes**

Vladimir Korenbaum

(Pacific Oceanologic Institute, Far Eastern Branch of Russian Academy of Sciences, Russia)

10:40-11:00 **Tea Break**

## Session 2

**Chair Persons:** Michael Nemergut

(The Mayo Clinic, Departments of Anesthesiology and Pediatrics, USA)

Sadatomo Tasaka

(Division of Pulmonary Medicine, Keio University School of Medicine, Japan)

11:00-11:25 **3 and a half year follow up of 72 year old thriving male with IPF on Pirfenidone therapy**

Sadamu Ishikawa (Steward St Elizabeth Medical Center of Boston, USA)

11:25-11:50 **Speed of low-frequency surface elastic waves in the human chest wall**

Alexander I. Dyachenko

(Prokhorov General Physics Institute/Institute of Biomedical Problems of the Russian Academy of Sciences, Russia)

11:50-12:15 **Some features of sound propagation in human respiratory system**

Vladimir Korenbaum

(Pacific Oceanologic Institute, Far Eastern Branch of Russian Academy of Sciences, Russia)

12:30-13:30 **Luncheon seminar**

Shigeo Wada

(Osaka University, Department of Mechanical Science and Bioengineering, Japan)

**Chairperson:** Yoshinobu Iwasaki, (Kyoto Prefectural Medical University, Japan)

13:30-15:30 **Excursion to Eikando and Nanzenji Temple !!!!!**

Most beautiful and popular place to enjoy autumn leaves and historical old temple in Kyoto!

## Session 3

**Chair Persons:** Hiroshi Nakano (Fukuoka National Hospital, Japan)

Masato Takase (Nippon Medical School, Department of Pediatrics, Japan)

15:30-15:55 **Coherence analysis of breath sounds during bronchial provocation test in children**

Yoon Ha Hwang (National Hospital Organization Fukuoka Hospital, Japan)

15:55-16:20 **Evaluation of bronchial dysfunction using a new modality of breath sound analysis in asthmatic children**

Chizu Habukawa (Department of Pediatrics, Minami Wakayama Medical Center, Japan)

16:20-16:45 **Use of blowing toy in the auscultation of younger asthmatic children**

Naruo Saito (Saito Clinic for Asthma and Allergy Children, Japan)

16:45-17:00 **Tea Break**

## Session 4

**Chair Persons:** Sadamu Ishikawa (Steward St Elizabeth Medical Center of Boston, USA)  
Michiko Tsuchiya  
(Department of Pulmonary Medicine, Rakuwakai Otowa Hospital, Japan )

17:00-17:25 **Lung sounds in children with atelectasis**  
Satoshi Adachi  
(Department of Pulmonary Rehabilitation, Fukuoka National Hospital, Fukuoka, Japan)

17:25-17:50 **Breath sounds may reflect lung function in stable adult asthmatics**  
Yukio Nagasaka  
(Department of Pulmonary Medicine, Rakuwakai Otowa Hospital, Japan)

18:30 **Banquet and dinner at Kyoto Garden Palace Hotel !!!!!**

## Friday, November 15

8:50- 9:00 **Welcome remarks**  
Michiaki Mishima (Director, Kyoto University Hospital, Japan)

## Session 5

**Chair Persons:** Alexander I. Dyachenko  
(Prokhorov General Physics Institute/Institute of Biomedical Problems of the Russian Academy of Sciences, Russia)  
Makoto Yonemaru (Department of Internal Medicine, Isehara Kyodo Hospital., Japan)

9:00-9:25 **Development of a new algorithm for the automatic detection and analysis of lung sounds based on the acoustic characteristics**  
Sadatomo Tasaka  
(Division of Pulmonary Medicine, Keio University School of Medicine, Japan)

9:25-9:50 **Coherence analysis of lung sounds: Comparison between COPD and normal subjects**  
Hiroschi Nakano (Fukuoka National Hospital, Japan)

9:50-10:15 **Method and apparatus to evaluate acoustic forced expiratory time for screening and monitoring bronchial obstruction**  
Vladimir Korenbaum  
(Pacific Oceanologic Institute, Far Eastern Branch of Russian Academy of Sciences, Russia)

10:15-10:30 **Tea Break**

## Session 6

**Chair Persons:** Vladimir Korenbaum  
(Pacific Oceanologic Institute, Far Eastern Branch of Russian Academy of Sciences, Russia)  
Yukio Nagasaka  
(Department of Pulmonary Medicine, Rakuwakai Otowa Hospital, Japan)

10:30-10:55 **Breath sounds intensity in COPD patients during tidal breathing**  
Akiko Ishimatsu (Fukuoka National Hospital, Japan)

**Lung sounds in central airways narrowing**

*Michiko Tsuchiya, Yukio Nagasaka, Chikara Sakaguchi, Takuma Minami,  
Ryota Kominami, Tetsuo Hori, Masutaro Ichinose*

Department of Pulmonary Medicine, Rakuwakai Otowa Hospital

10:55-11:20 **The evaluation of the association between sleep disordered breathing and the volume of snoring sounds with a questionnaire in the general medical examination in our hospital**

Hiroshi Ono

(The department of general internal medicine, Kosei-Chuo General Hospital, Japan)

11:20-11:45 **Accuracy of hearing tests for recorded lung sounds among medical staffs**

Kazumasa Yamane (Division of Physical Therapy, Fukujuji Hospital, Japan)

11:45-12:10 **Cardiac response to respiration in smokers and non-smokers**

Sadamu Ishikawa (Steward St Elizabeth Medical Center of Boston, USA)

12:10-13:00 **Business Meeting Lunch**

**Introduction**

We studied if lung sounds in patients with central airways narrowing could suggest the site or laterality of airways narrowing by using our newly developed two-channel lung sound analysis system.

**Methods**

Four cases with central airways narrowing were examined. Lung sounds were recorded in upper anterior chest and analysis (LSA) was performed by sound spectrometer, Kenz-Medico-LSA 2012. The site and degree of airway narrowing was confirmed by chest CT (computed tomogram).

**Results**

Case 1: 76-y.o. male with COPD had wheezes in bilateral upper chest. LSA showed bilateral similar wheezes (R>L) and the harmonics of the wheezes in the right side. Chest CT showed marked narrowing of right upper lobe bronchus (RULB).

Case 2: 73 y.o. male with COPD had wheezes in bilateral upper chest. LSA showed bilateral similar wheezes (R>L) and harmonics of the wheezes in the right side. Chest CT showed temporal narrowing of right main stem bronchus (RMSB).

Case 3: 68 y.o. male with silicosis who was mechanically ventilated had wheezes. LSA showed bilateral similar wheezes (R>L) and harmonics of the wheezes in the right side. Chest CT showed narrowing of RULB due to compression by conglomerate mass.

Case 4: 66 y.o. male with lung cancer noted increasing dyspnea. Bronchial breath sounds were heard in the right upper chest. LSA confirmed the findings of auscultation. No wheezes were noted. Chest CT showed narrowing of RMSB. After insertion of metallic bronchial stent, his dyspnea disappeared and breath sounds became normal.

**Conclusions**

In four cases of central airways narrowing, alteration of lung sounds was observed. LSA was helpful to identify the laterality of airways narrowing. Recording of lung sounds in central airways narrowing was possible in anterior chest and was not difficult even in bed ridden patients. As central airways narrowing is difficult to assess by chest x-ray alone, LSA is considered to be a useful clinical tool in examining patients with possible central airways narrowing. We need further investigation to clarify the mechanisms why wheezes were recorded in some cases and bronchial sound was recorded in another case.

## DETAILING MECHANISMS AND SITES OF ORIGIN OF FORCED EXPIRATORY WHEEZES

V. Korenbaum<sup>1,2</sup>, M. Safronova<sup>1</sup>, I. Pochekutova<sup>1</sup>

<sup>1</sup> V.I. Il'ichev Pacific Oceanological Institute FEB RAS; <sup>2</sup> Far Eastern Federal University.

**Background:** An origin of forced expiratory wheezes remains a discussed issue. Korenbaum et al. (2012) studying symmetry/asymmetry of FEWs above lower lung fields found that FEWs of maximal power are produced in bronchial tree more centrally (trachea and principal bronchi) while FEWs of lower power are produced more distally. Revealed dependence of mid-frequency (MF) and early high-frequency (HF) FEWs on gas density was treated as an evidence of flow-dependent mechanism of these FEWs production.

**The objective** is detailing origin of FEWs by means of study their peak frequency response to bronchodilator test and modeling an influence of forced expiratory airway dynamic compression degree on sites of FEWs origin.

**Method:** Forced expiratory noises were recorded above trachea by means of developed apparatus (Korenbaum et al., 2008). FEWs were identified in spectrograms. Peak frequencies of the most powerful tracheal FEWs and flows near mouth were measured in the group consisting of 85 healthy and 69 asthma patients with reversible bronchial obstruction (both were young males). The responses of peak frequencies of FEWs and flows to bronchodilator test were compared in healthy and asthma patients. Strouhal numbers were calculated for various levels of bronchial tree (Weibel's dimensions) and few experimental estimates of airway compression degree in healthy.

**Results:** Lack of response of FEWs peak frequency in the middle of forced expiratory maneuver (near MEF<sub>50</sub>) to bronchodilator test was found in asthma patients, while significant reduction of FEWs peak frequency was characteristic for healthy. The response of peak frequency of MF (400 - 600 Hz) and early HF (> 600 Hz) FEWs to bronchodilator test observed in the middle of forced expiratory maneuver can be interpreted in favor of flow-dependent mechanism of these sounds production. The behavior is consistent with the predictions of the vortex shedding model. However a response of peak frequency of late HF (> 600 Hz) FEWs to bronchodilator response indicates the possibility of involvement of flow independent auto-oscillatory mechanism. It is evaluated, that in healthy the site of origin of the most powerful FEWs produced by vortex shedding mechanism with Strouhal numbers of 0.2-0.3, is gradually shifted to more central levels of bronchial tree with increase of estimated degree of airway dynamic compression. An application of the most founded experimental estimates of forced expiratory airway dynamic compression in healthy (Brackel et al., 2000; Boiselle et al., 2009 & Litmanovich et al., 2010) results in origin of the most powerful MF FEWs at exit of intra-thoracic part of trachea into its extra-thoracic area as well as at bifurcation of trachea. Meanwhile most powerful early HF FEWs origin may be referred to bifurcations of trachea and principal bronchi.

**Conclusions:** Revealed features of FEWs origin may be pertinent for medical diagnostics usage. The study was partially supported by the Program of Presidium of Russian Academy of Sciences 'Fundamental sciences – to medicine'.

## 3 AND A HALF YEAR FOLLOW UP OF 72 YEAR OLD THRIVING MALE WITH INTERSTITIAL PULMONARY FIBROSIS (IPF) ON PIRFENIDONE THERAPY

S.Ishikawa<sup>\*①</sup>, S. Izumi<sup>②</sup>, S. Kudoh<sup>③</sup>, A. Vyshedskiy<sup>④</sup>, R.L.Murphy<sup>⑤</sup>, P. LaCamera<sup>⑥</sup> and E. Amst<sup>⑦</sup>

<sup>①,⑥</sup> Pulmonary & Critical Care, Steward St Elizabeth's Medical Center and Dept. of Medicine, Tufts University School of Medicine, Boston, MA U.S.A.

<sup>②</sup> Dept. of Respiratory Medicine, National Center of Global Health, Tokyo, Japan

<sup>③</sup> Fukujuji Hospital, Tokyo, Japan

<sup>④,⑤</sup> Brigham & Women's / Faulkner Hospital Boston, MA, U.S.A.

<sup>⑦</sup> Reliant Medical Group, Worcester, MA., U.S.A.

We have been following a patient diagnosed as Idiopathic Pulmonary Fibrosis (IPF) by Lung biopsy for past 3 and a half years. On the first Consultation (01-04-2010), this 70 year old, Japanese Engineer with a history of heavy smoking, was evaluated because of 'Crackle' was heard on 'Routine Physical'.

He claimed that he was able to climb stairs without difficulties. On auscultation dry Crackles were heard on Right base of the Lung. Peak Flow 500 L/min., FEV1 2.56, FVC 3.04L. Lung sounds recordings were made with Murphy's STG16., which showed Crackles on both bases but in low intensity. Therefore, 'Close Observation' was recommended. Six months later (06-29-2010), he returned., claiming shortness of breathing on stair climbing. He had bilateral Crackles, 1/3<sup>rd</sup> up on the Left, and 1/5<sup>th</sup> up on the Right.

Lung sound recording showed increase of crackles on intensity and distribution. FEV1 declined to 2.15, and FVC 2.84 L. Trans-Bronchial Right Middle Lobe Biopsy revealed suggestive lesion of IPF.

High dose Steroid therapy was started. Because of further deterioration on Steroid therapy, Pirfenidone was prescribed on 11-25-2010..( initially 1,800 mg/day, which gradually increased to 2,200mg/day.).

He came back to Boston on 12-24-2010, Lung sounds recordings showed high intensity of Crackles on both lower zones of the Lung.

On Pirfenidone therapy for over a year, he returned to Boston (01-16-2011). At that point he was able to climb stairs without difficulties.. On examination the chest was remarkably clear. Lung sounds recording confirmed presence of inspiratory and expiratory Crackles of low intensity on Left, Right side was clear. FEV1 improved to 2.84, with FVC of 3.08L.

Then, he returned on 07-03-2013 to Boston (5<sup>th</sup> visit), claiming he is able to do all Daily activities, and off shore fishing for Fluke without any limitations.

\* I walked down and up I flight with him without stopping., while monitoring his Oxygen Saturation..

Which declined from 95% (at rest) to 86%, but returned to 95% within 3 min. of rest on chair. (pulse rate changed from 67 to 97/min. and back to 66/min.). His Peak Flow was 520 L/min, FEV1 2.43, FVC 2.74L.

On Auscultation he had very little Crackles on both bases on deep breathing. Lung sounds recording confirmed presence of low intensity Crackles on both bases on deep breathing.

Evolution of the Crackles coincided improved Vital Capacity as well as his Physical Capacity. Therefore, it is worth considering a beneficial effect of Pirfenidone for treatment of IPF, although it is only one case...

## SPEED OF LOW-FREQUENCY SURFACE ELASTIC WAVES IN THE HUMAN CHEST WALL

A. Dyachenko<sup>1,2,3,4</sup>, E. Timanin<sup>5</sup>, V. Vasiliev<sup>3</sup>, A. Mikhaylovskaya<sup>1</sup>, Yu. Semenov<sup>1,4</sup>

<sup>1</sup> Institute of Biomedical Problems of RAS, Moscow;

<sup>2</sup> Prokhorov General Physics Institute of RAS, Moscow;

<sup>3</sup> Bauman Moscow Technical State University, Moscow;

<sup>4</sup> Moscow Institute of Physics and Technology (State University), Dolgoprudny,

<sup>5</sup> Applied Physics Institute, N.Novgorod, Russia

**Introduction:** Chest percussion generates propagation of a percussion waveform in the chest wall. Oscillations of chest wall near the tapping area affect the percussion sound. Important characteristics of the oscillations are attenuation and speed of the elastic waves in the chest wall.

**The objective** of this study was to measure speed of surface elastic waves propagation in the chest wall of normal subjects.

**Method:** A laboratory setup devoted for a study of low-frequency surface elastic waves in the human chest wall was developed. The setup included a percussion vibrator with accelerometer, the second accelerometer, control block for delivering impulse input to chest wall and registration the chest wall reaction. The setup provided controlled percussion taps of the chest wall and a registration of its acoustical reaction on these impulse inputs. Each tapping test included about 15 s of tapping with 5 taps/s rate. Accelerations of the intender of the percussion vibrator and acceleration of the second accelerometer glued to the chest wall at a distance 2–10 cm from the site of a tap were measured.

**Results:** In a group of 6 healthy male volunteers aged 20–21 years the phase wave speed in chest wall at vital capacity was studied in the following way. On the basis of accelerations we obtained local transfer function for vibrations propagation on the chest wall. For most subjects in the frequency range 30–200 Hz there were frequency subbands with coherence of both accelerometers signals about 0.8–0.9. In these frequency subbands there was a specific dependence of transfer function phase upon frequency with phase decrease from +180° to -180° intermittent by phase surges from -180° to +180°. Coherence 0.6-0.7 and the same dependence of phase upon frequency were obtained as well in a higher frequency band 200–400 Hz in a few subjects. This phase-frequency dependence characterizes chest wall oscillations as induced by a traveling wave. Traveling wave speed was 1.42–12.1 m/s, increasing with frequency about 0.05 m/s/Hz.

Tapping waveform transit time (i.e. time delay between accelerations of the plunger and the second accelerometer) was measured in a group of 10 healthy male volunteers aged 20–21 years. Transit time was measured in the sitting position during 3 different respiratory maneuvers: functional residual capacity (FRC) maneuver with relaxation of respiratory muscles and open larynx, vital capacity (VC1) maneuver with open larynx and vital capacity (VC2) maneuver with closed larynx and relaxation of the respiratory muscles. Transit time was determined by cross-correlation between signals of the plunger and the second accelerometer with frequency cutoff 1000 Hz. Transit time (mean±SD) was 7.9±3.2 ms, 8.4±3.1 ms, 10.7±3.7 ms in VC1, VC2 and FRC maneuvers respectively. In FRC maneuver transit time was more than in both VC maneuvers (p=0.012 by Wilcoxon signed ranks test). The average group speed estimated as ratio of distance between centers of the plunger and the second accelerometer to transit time was 5.5 m/s, 5.1 m/s and 4.1 m/s for VC1, VC2 and FRC maneuvers respectively. As soon as the sizes of plessimeter and receiver are comparable with the distance, the transit time is a more reliable parameter than estimated group speed.

**Conclusions:** A significant rise of wave speed with frequency was revealed in chest wall of normal volunteers. Tapping waveform propagates in the chest wall faster at vital capacity than at functional residual capacity.

## SOME FEATURES OF SOUND PROPAGATION IN HUMAN RESPIRATORY SYSTEM

V. Korenbaum<sup>1,2</sup>, A. Shiryaev<sup>1</sup>, A. Tagiltsev<sup>1</sup>, D. Vlasov<sup>2</sup>, S. Gorovoy<sup>2</sup>, S. Kamenev<sup>1</sup>

<sup>1</sup> V.I. Il'ichev Pacific Oceanological Institute FEB RAS; <sup>2</sup> Far Eastern Federal University.

**Background:** Sound propagation in human respiratory system remains poor studied. Korenbaum et al. (2010, 2011) experimentally revealed two sound transmission mechanisms being involved simultaneously. The first mechanism was determined as air-structural transmission while the second mechanism was referred to pure structural one.

**The objective** is a study of sound propagation features including spectral characteristics of these mechanisms, evaluation of distance of wheezing sources for structural propagation, estimating sound speed of structural propagation in frequency band of 10-20 kHz.

**Method:** The laboratory installation was developed, which included loudspeaker and small vibration source, fed through an amplifier from an output of sound card of laptop, a system of acoustic sensors, connected to analog inputs of 16-channel computer laboratory PowerLab (ADInstruments). Frequency sweep signals were used for injection into mouth or into supraclavicular area of thorax. Wheezes during spontaneous inspiration and forced exhalation were recorded too. Cross-spectral phase, convolution and intensimetric techniques were applied to evaluate signal parameters.

**Results:** The entire frequency band of low frequency transmission from mouth to various areas of lung is separated into 2 frequency areas – the first one of about 90 – 280 Hz is characteristic for both air-structural and structural mechanisms, while the second one of about 280 – 500-700 Hz is characteristic only for air-structural mechanism. In other words the revealed previously phenomenon of two sound transmission mechanisms has certain selectivity in frequency domain. It is interesting that approximately the same selectivity in frequency domain was found in independent study by means of intensimetric processing of respiratory noises and transmitted human voice (Korenbaum et al., 2003).

The intensimetric processing involving cross-spectrum calculation of coaxially arranged microphone and accelerometer sensors is applied here to evaluate a distance of wheezing sources from chest surface. The mathematic model is developed for transverse quadrupole source emitting through lung parenchyma, which provides the distance estimation by means of calculating the ratio of imaginary and real parts of cross-spectrum. Nine wheezes with various frequencies are recorded above right basal area of healthy volunteer (inspiration and forced exhalation). The distances of 6 wheezing sources seem to be in concordance with anatomic considerations. Three wheezes during forced exhalation (341, 498, 537 Hz) look having the common source with distance of about 16 cm. Three wheezes during inspiration (175, 234, 322 Hz) have sources with distances ranged between 22 and 14 cm. Thus wheezing sources with different distances can be resolved.

High frequency 10 – 750 kHz sound propagation through lung tissues has been found recently (Rueter et al., 2010). Amplitude of transmission of wideband pulses through lung was found dependent on air volume. Sound speed was estimated being close to 1500 m/s. We repeated this experiment by means of our installation, injecting frequency sweep signal 10 – 20 kHz into right supraclavicular area of healthy volunteers. The dependence of sound transmission to basal area on air volume of lung (RC, FRC, TLC) was confirmed. Meanwhile sound speed was estimated as 200 – 350 m/s (convolution technique). The sound speed is much less than obtained in previous study, and it results in wavelength of about 1.5 – 2 cm. Such wavelengths seem to be perspective for high resolution visualization of pathologic inhomogeneities in lung tissue.

**Conclusions:** Revealed features of sound propagation probably may be pertinent for transmission-emission acoustic tomography of human lungs. The study was partially supported by the grant 13-08-00010-a of Russian Foundation for Basic Research.

**Coherence analysis of breath sounds  
during bronchial provocation test in children**

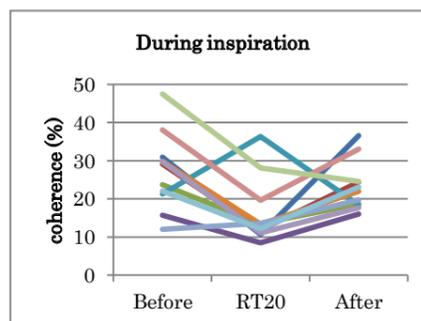
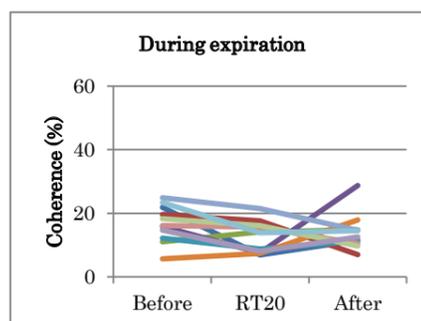
*Yoon Ha Hwang, Hiroshi Odajima, Hiroshi Nakano*

Fukuoka National Hospital, Fukuoka, JAPAN

**Background:** In normal adults, breath sounds on the chest wall in the expiratory phase are generated from central airway and those in inspiratory phase are produced at more peripheral sites (lobar~segmental bronchus). In asthmatic patients, many studies indicate breath sounds change in frequency distribution during bronchial provocation test(BPT), of which underlying mechanism is unknown. We investigate coherence of lung sounds with tracheal sound during BPT to elucidate the mechanism.

**Methods:** Subjects were well-controlled asthmatic male patients of 5 to 15 years old. During BPT, we recorded the breath sounds and analyzed using FFT. We obtained the coherences between tracheal sound(as reference) and lung sounds at six chest locations. Data which contained wheezes were excluded from the analysis.

	Age (yr)	Height (cm)	Weight (kg)	BMI	ACT	FeNO (ppb)	RT20
1	10	139	38	19.7	23	7	5
2	8	117	22	16.1	25	20	5
3	9	138	31	16.3	26	35	6
4	15	167	65	23.3	23	48	6
5	13	164	57	21.2	21	51	6
6	10	133	30	17	26	86	3
7	14	168	52	18.4	25	15	10
8	13	172	62	21	25	159	4
9	13	167	77	27.6	25	69	6
10	14	161	46	17.7	25	32	8
11	11	146	35	16.4	25	12	8



**Results:**

1. Expiratory breath sounds Coherence(400-800Hz) changed from before test (average 17.0%) to RT20 (respiratory threshold 12.0%) and after bronchodilator use (15.4%). These changes are statistically significant. (p<0.01)

2. Inspiratory breath sounds

Coherence changed from before test (average 27.7%) to RT20 (17.3%) and after bronchodilator use (29.7%). These changes are statistically significant. (p<0.01)

**Conclusions:** Coherence analysis suggested peripheral shift of breath sounds origin during BPT. It is more prominent in inspiration.

**Evaluation of bronchial dysfunction using a new modality of breath sound analysis in asthmatic children**

*Chizu Habukawa, M.D.<sup>1</sup>, Katsumi Murakami, M.D.<sup>2</sup>, Yukio Nagasaka, M.D.<sup>3</sup>*

<sup>1</sup>Department of Pediatrics, Minami Wakayama Medical Center,

<sup>2</sup>Department of Pediatrics, Kinki University Sakai Hospital,

<sup>3</sup>Department of Pulmonary Medical Center, Otowa Hospital

**Background:** Reliable assessment of symptoms, lung function and effect of ICS treatment is essential in asthma management.

We developed new technology for analyzing breath sounds and assessed its clinical usefulness in asthmatic children.

**Methods:** One hundred thirty five asthmatic children and 16 non-asthmatic children underwent breath sound analysis and lung function test in asymptomatic state. In asthmatic children, their asthma control was assessed by Asthma Control Test™ or Childhood ACT.™ Breath sounds were recorded using a sensor, located on right upper anterior chest. We calculated an index of breath sound parameter from an amplitude at mid frequency range (*icM*: the index of midrange). Influence of flow and body size were reduced from the *icM*. The *icM* were compared with spirometric parameters and ACT or C-ACT scores. In addition, the 120 asthmatic children who were being not treated with ICS (inhaled corticosteroid) were started to treat with ICS, all patient were performed these tests at least 3 times during 12 weeks and they were evaluated before, between and after treated with ICS.

**Results:** There was a significant difference of *icM* between asthmatic children and non-asthmatic children and *icM* correlated with classification of asthma severity. (p<0.01,

p<0.05, respectively). The *icM* correlated with FEV1.0%, MMF and FEF50 (p<0.05, 0.01, 0.05, respectively). The *icM* of 120 asthmatic children decreased significantly in comparison with that of before ICS treatment. (p<0.05). In addition, the *icM* of the patients who still had respiratory symptoms after ICS treatment was significantly higher than that of asymptomatic patients after ICS treatment (p<0.01).

**Conclusions:** It was possible to evaluate bronchial dysfunction and control level of asthma by a new index calculated from breath sound analysis.

## Use of blowing toy in the auscultation of younger asthmatic children

Naruo Saito, M.D.

Saito Clinic for Asthma and Allergy Children

**Background:** Younger children do not give breath until the end of expiration even during auscultation because they cannot understand the instruction of the doctors. We use blowing toy in the auscultation of younger asthmatic children and studied if the use of this toy may encourage expiration and makes auscultation of expiratory wheezes easier.

**Methods:** Breath sounds were recorded while children were playing with pinwheel, a blow-up ball (ball) or a blow-up thread (thread) and then analyzed by a sonogram. Seventy seven (among 101) physicians answered the questionnaire on the efficacy of blowing toys.

**Results:** Sonogram showed a low inspiratory-expiratory time ratio (IE ratio) and the greatest dispersion when the pinwheel was used. The highest IE ratio but large dispersion when the ball was used, and higher IE ratio and the smallest dispersion when the thread was used. Questionnaires showed that physicians rated the thread most highly for auscultation of breath sounds and wheezing. Physicians pointed out that the ball was difficult to handle and involved the risk of accidental ingestion.

**Discussion:** The present study showed that children repeated forced respiration regularly to the end of expiration while playing with the thread. Questionnaires have also revealed that the thread was rated highly as an aid to auscultation. This toy is expected easy to hear wheezing at the end of expiration and more reliable asthma management in children.



Fig. The toys which were used for this study

## Lung sounds in children with atelectasis

Satoshi ADACHI<sup>1</sup>, Hiroshi NAKANO<sup>2</sup>, Hiroshi ODAJIMA<sup>3</sup>, Chikako MOTOMURA<sup>3</sup>

<sup>1</sup>Department of Pulmonary Rehabilitation, Fukuoka National Hospital, Fukuoka, Japan,

<sup>2</sup>Department of Pulmonary Medicine, Fukuoka National Hospital,

<sup>3</sup>Department of Pediatrics, Fukuoka National Hospital

**Background:** Atelectasis is a common complication of pneumonia and asthmatic attack in children. It occurs predominantly in the right middle lobe. The purpose of this study is to elucidate characteristics of the lung sounds in children with atelectasis and the change in the recovery process.

**Method:** Lung sounds were recorded in 13 patients with right middle lobe atelectasis (3 - 7 y.o) and 18 healthy children (3 - 7 y.o) as controls. We recorded lung sounds using an IC recorder with two air-coupled microphones and analyzed the data using a personal computer (PC). Microphones were placed over the both 5th intercostal space on the mid-clavicular line (R and L). Lung sounds were recorded about 30 seconds during slow and deep breathing in supine position. The recording was performed before and after a course of chest physiotherapy. We calculated lung sound power spectra using FFT on the PC.

**Results:** In the atelectasis patients, the inspiratory sound intensity of R was significantly lower than that of L in all frequency bands ( $P < 0.01$ ). Furthermore, the R to L difference was greater in the patient than in normal subjects (Fig.1;  $P < 0.01$ ). The inspiratory sound intensity of R increased significantly after the atelectasis was resolved as compared with that before the treatment, but the R to L difference was remained except for the frequency band of 100Hz - 200Hz (fig.2;  $P < 0.05$ ). The expiratory sound intensity was not different between the both sides, and it did not change after the treatment.

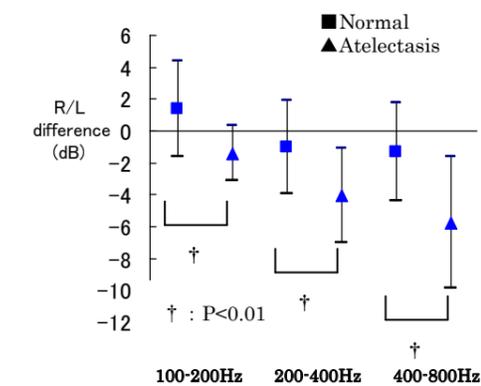


Fig 1.

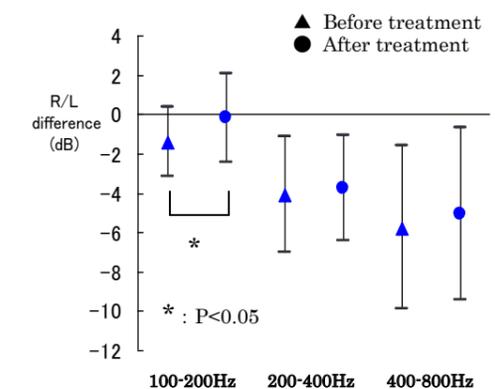


Fig 2.

**Conclusions:** Inspiratory breath sound intensity decreased at the site of atelectasis, and it increased with atelectatic improvement. However, breath sound intensity of particular frequency bands remained to be decreased even after the atelectasis was resolved on X-ray, suggesting that persistent structural change relating to atelectasis affects the generation or transmission of the sound.

Lung sound analysis may be useful for bed-side evaluation of improvement process of atelectasis.

## Breath sounds may reflect lung function in stable adult asthmatics

Yukio Nagasaka<sup>1</sup>, Terufumi Shimoda<sup>2</sup>, Michiko Tsuchiya<sup>1</sup>, Chikara Sakaguchi<sup>1</sup>,  
Takuma Minami<sup>1</sup>, Ryota Kominami<sup>1</sup>, Tetsuo Hori<sup>1</sup>, Masutaro Ichinose<sup>1</sup>

<sup>1</sup>Department of Pulmonary Medicine, Rakuwakai Otowa Hospital,

<sup>2</sup>Department of Clinical Research National Fukuoka Medical Center

### Introduction

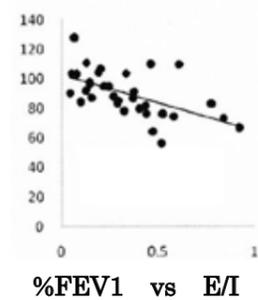
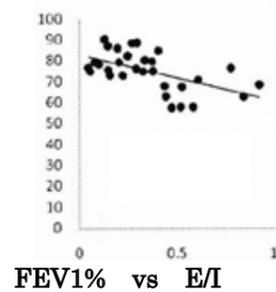
Many studies of experimentally induced airway narrowing showed that an increase of frequency and power of breath sounds may be more sensitive than wheezes to detect airway narrowing. In this study, we evaluated if the changes of lung sounds may reflect lung function of stable asthmatic subjects.

### Subjects and Methods

Thirty six asthmatics (aged 41±13 years) underwent breath sound analysis and lung function tests when they had no asthmatic symptoms. Breath sounds were recorded in the right posterior chest and analyzed by sound spectrometer. We measured average sound power of low frequency range (LF: 100 to 195 Hz) during inspiration (I), expiration (E) and their ratio (E/I) as reported in ILSA 2011.

### Results

E/I negatively correlated with FEV1% (FEV1/FVC×100,  $p < 0.001$ ), %FEV1 (FEV1/PrFEV1×100,  $p < 0.001$ ). (Figure)



### Conclusions

It will be possible to assess pulmonary function from breath sound analysis in stable asthma. Clinically, when the patients have well audible expiratory breath sounds or bronchial breath sounds, they may have obstructive airways dysfunction. Breath sounds may be useful in the evaluation of stable adult asthmatics.

## Development of a new algorithm for the automatic detection and analysis of lung sounds based on the acoustic characteristics

Sadatomo Tasaka<sup>1</sup>, Tomoko Betsuyaku<sup>1</sup>, Masato Sugano<sup>2</sup>, Makoto Yonemaru<sup>3</sup>,  
Tadashi Abe<sup>4</sup>

<sup>1</sup>Division of Pulmonary Medicine, Keio University School of Medicine,

<sup>2</sup>Core Technologies Development Department, CE Strategic Business Planning Operation, JVC KENWOOD Corporation,

<sup>3</sup>Department of Respiratory Medicine, Isehara Kyodo Hospital,

<sup>4</sup>Department of Respiratory Medicine, Tokai University School of Medicine

[Background] Listening and interpreting lung sounds by a stethoscope has been an important component of screening and diagnosing lung diseases. However, this practice is vulnerable to poor quantitativity, inter-observer variations and poor reproducibility. In this study, we aimed to develop a new algorithm for the automatic detection and analysis of lung sounds based on the acoustic characteristics.

[Methods] In 57 patients with interstitial pneumonia, bronchiectasis, and other chronic pulmonary diseases, lung sounds were recorded with a stethoscope microphone on the chest. The acoustic data was analyzed using a new algorithm based on the acoustic characteristics.

[Results] After filtering between 500 and 4,000 Hz, the envelope of the wave was obtained with Hilbert transform. The envelope was smoothed using curve approximation and the second derivatives were obtained to identify the inhalation and exhalation. Crackles were successfully detected with statistical correction of the peaks of the envelopes. Continuous sounds were identified from the frequency distribution obtained with a fast Fourier transform. The frequency distribution was associated with the pitch and monophony/polyphony of the lung sounds.

[Conclusion] Our new algorithm successfully detected and analyzed the lung sounds based on the acoustic characteristics. It is indicated that the lung sounds could be visualized and quantitatively assessed with the algorithm. Because the algorithm can be implemented in a smartphone application, it may be utilized for home medical care or telemedicine.

## Coherence analysis of lung sounds: Comparison between COPD and normal subjects

Hiroshi Nakano, Akiko Ishimatsu, Tomoaki Iwanaga

Fukuoka National Hospital, Fukuoka, JAPAN

**Background:** We have reported enhanced high frequency component in COPD lung sounds (Sano 1998, Ishimatsu 2013). Ishimatsu is presenting an interesting finding that the high frequency component relates to the CT emphysema score. We aimed to elucidate the mechanism underlying this phenomenon.

**Methods:** Subjects were 16 normal subjects and 12 COPD patients. Tracheal sounds and lung sounds at six sites (R&L-upper, R&L-middle, R&L-lower) during deep breathing were analyzed separately for inspiratory and expiratory segments (0.5 s). Cross-spectra and power-spectra of two sites were calculated using FFT (0.082 s window; 25% overlapping) and averaged to calculate coherence function, from which a coherence value for 400-800Hz bandwidth was obtained.

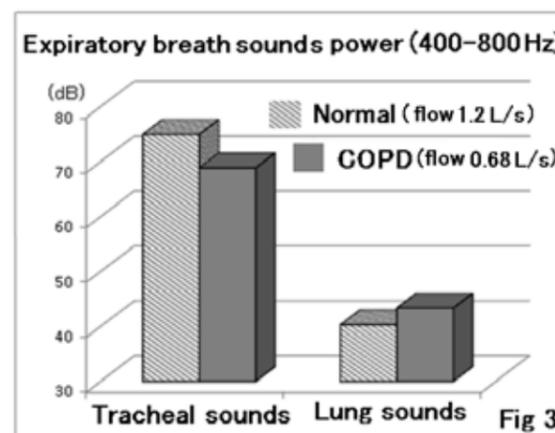
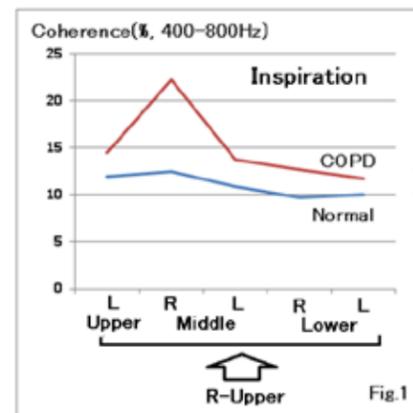
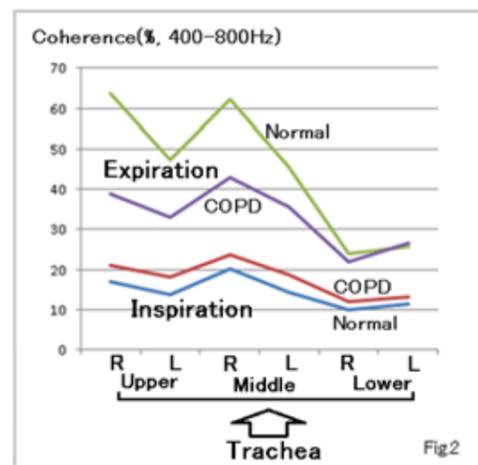
### Results

#### 1. Inspiratory breath sounds:

Coherence functions between lung sounds at six sites and tracheal sounds were not different between normal subjects and COPD patients (Fig.2). However, coherence of 400-800 Hz bandwidth between R-upper and R-middle was greater in COPD patients than in normal subjects (Fig.1;  $p=0.038$ ). The lung sounds power of 400-800Hz was greater in COPD patients when compared with normal subjects at equivalent airflow. These results suggest increased high frequency sound transmission property of COPD lung.

#### 2. Expiratory breath sounds:

Coherence functions between lung sounds at six sites and tracheal sounds were greater in normal subjects than in COPD subjects (Fig.2). On the other hand, the ratio of expiratory lung sounds power to tracheal sound power was greater in COPD patients than in normal subjects (-26dB vs. -35dB;  $p=0.0025$ ; Fig.3). These results suggest more peripheral origin of sound generation in COPD patients as compared with normal subjects



**Conclusion:** Enhanced high frequency lung sounds in COPD patients may be due to increased intrapulmonary sound transmission (inspiration) and / or peripheral shift of sound generation sites (expiration).

## METHOD AND APPARATUS TO EVALUATE ACOUSTIC FORCED EXPIRATORY TIME FOR SCREENING AND MONITORING BRONCHIAL OBSTRUCTION

V. Korenbaum<sup>1,2</sup>, I. Pochekutova<sup>1</sup>, A. Kostiv<sup>1</sup>, A. Tagiltsev<sup>1</sup>, S. Shubin<sup>1</sup>

<sup>1</sup>V.I. Il'ichev Pacific Oceanological Institute FEB RAS; <sup>2</sup>Far Eastern Federal University.

**Background:** Increased forced expiratory time was first recognized as a marker of obstruction about half a century ago. However, the reported diagnostic capabilities of both auscultated forced expiratory time (FETas) and spirometric forced expiratory time (FETs) are contradictory. Computer analysis of respiratory noises provides a precise estimation of acoustic forced expiratory noise time (FETa) being the object-measured analogue of FETas.

**The objective** of this study is to develop acoustic method to evaluate FETa and analyze its diagnostic capabilities in screening and monitoring bronchial obstruction.

**Methods:** The apparatus is developed which contains acoustic sensor, input device, portable personal computer and specially designed software. The acoustic sensor (microphone with stethoscopic head) is attached to lateral neck surface. It was found that FETa is directly proportional to bronchial resistance under forced exhalation. FETa values were estimated by means of developed computer procedure, including bandpass filtration (200–2000 Hz), waveform envelope calculation with accumulation period of 0.01 s, automated measurement of FETa at 0.5% level from the peak amplitude. A group of asthma patients involved 149 males aged 16–25 years was studied. In this group, 71 subjects had spirometry features of bronchial obstruction, meanwhile, the remaining 78 had normal spirometry. A control group involved 77 healthy subjects. Spirometry and forced expiratory tracheal noise recording were sequentially made for each participant.

**Results:** Specificity, sensitivity and area under Receiver Operating Characteristic curve of FETa and its

ratios to squared chest circumference, height, weight were indistinguishable with baseline spirometry index FEV<sub>1</sub>/FVC in training sample, consisting of healthy and asthma patients with spirometry confirmed obstruction. Meanwhile, acoustic features of obstruction were revealed in 41% – 49% of subgroup of patients with asthma, having normal spirometry. The method was also successfully used for monitoring lung function of divers after immersion (Pochekutova, Korenbaum, 2011) and the crew of MARS-500 International Experiment (Dyachenko et al., 2012). The developed technology and instrumentation is informative, simple, and cheap. Moreover it completely excludes a danger of between-subject respiratory infection, making bronchial obstruction revealing possible even in a field conditions.

**Conclusions:** FETa test of tracheal noise seem to be sensitive and specific instrument to reveal and monitor bronchial obstruction in young males. The study was partially supported by the Program of Presidium of Russian Academy of Sciences 'Fundamental sciences – to medicine'.

## Breath sounds intensity in COPD patients during tidal breathing

Akiko Ishimatsu, Hiroshi Nakano, Tomoaki Iwanaga

Fukuoka National Hospital, Fukuoka, JAPAN

**Background:** Breath sounds intensity in COPD patients is believed to be diminished. Previous studies on this issue were performed using airflow-standardized measurement of breath sounds or auscultation assessment at a nearly maximal breath. Thus, knowledge about the breath sounds intensity during subjects' usual breathing is lacking.

**Objective:** To elucidate whether breath sounds intensity in COPD patients is diminished or not during tidal breathing.

**Method:** Subjects were 20 stable COPD patients and 20 normal controls. Microphones were attached to six sites on the chest wall. Measurement of breath sounds along with airflow at the mouth was done in a sitting position during tidal breathing and thereafter deep breathing. Power spectra of breath sounds were obtained using a fast Fourier transform.

**Results:** During tidal breathing, breath sounds intensity during both inspiration and expiration was significantly greater in COPD group than in control group at all frequency bands, regardless of the recording site. The intensity during expiration was positively correlated with CT visual emphysema score but not with FEV1.0. Airflow at resting breathing was not different between the two groups. During deep breathing, inspiratory breath sounds intensity at the dominant frequency band was diminished over the upper and middle lung fields. However, the intensity during expiration was not diminished. Airflow during deep breathing was reduced in the COPD group as compared with the control group.

**Conclusion:** Breath sounds intensity during tidal breathing is increased in COPD patients as compared with normal subjects.

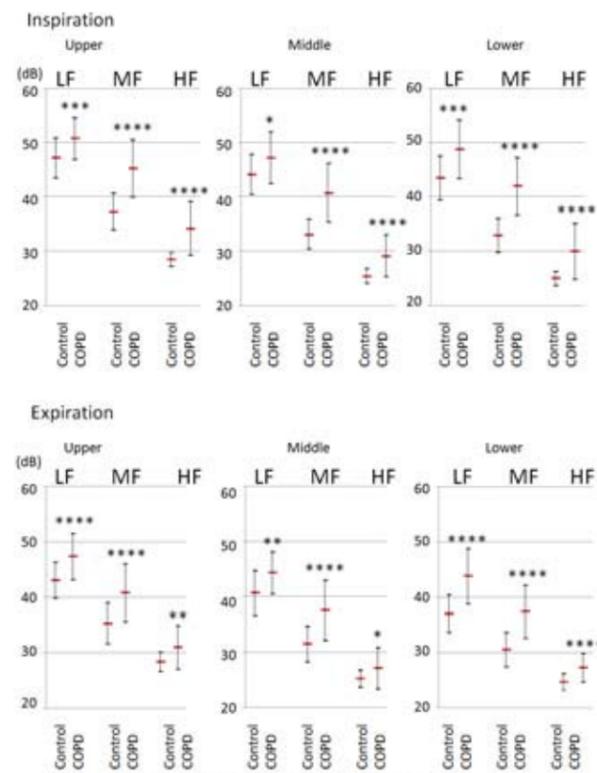


Figure1: Breath sounds intensity during tidal breathing

The evaluation of the association between sleep disordered breathing and the volume of snoring sounds with a questionnaire in the general medical examination in our hospital

oHiroshi Ono, Naoyuki Kitagawa, Michio Sakurai

The department of general internal medicine, Kosei-Chuo General Hospital

**【Backgrounds and purpose】** Although snoring has a close association with sleep disordered breathing (SDB), there is few study about the association between the volume of snoring sounds and SDB. In the general medical examination in our hospital, we perform the checkup about SDB with a questionnaire and a portable device which monitors oxygen saturation (SpO2) and a pulse. In the present study, we evaluated whether the volume of snoring sounds associate with SDB in the testees in our general medical examination. **【Subjects and methods】** The subjects are 346 consecutive persons (249 men and 97 women) who were hospitalized for the general medical examination in our hospital from 19 April to 24 July, 2013. The subjects were assigned into 3 groups: the non-snore (NS) group including the 76 persons who answered that they didn't snore on the questionnaire, the non-loud snore (NLS) group including the 136 persons answered that they snored but their volume of snoring sounds were as loud as, or lower than that of their speech and the loud snore (LS) group including the 134 persons who answered that the volume of their snoring sounds were louder than their speech. Among 3 groups, we compared 3% oxygen desaturation index (ODI), the length of the duration in which SPO2 was below 90% (DSpO2 < 90%), the median level of SpO2, the lowest level of SpO2 and the ratio of the persons who were diagnosed SDB. The criteria of diagnosing SDB we assumed were 3% ODI ≥ 15, or 15 > 3% ODI ≥ 5 and Epworth Sleepiness Scale ≥ 11. **【Results】** As for 3% ODI, the median and the lowest level of SpO2 and DSpO2 < 90%, LS group was significantly higher than other groups although there was no significant difference between NS group and NLS group. In addition, in LS group, the ratio of the persons diagnosed SDB was 32%, significant higher than both of NS and QS groups, in which the ratio was 9%. **【Discussion】** It is supposed that if the volume of snoring sounds is louder than that of speech, it is associated with SDB, but there is poor association between SDB and snore of which the volume is lower than speech's volume.

## Accuracy of hearing tests for recorded lung sounds among medical staffs

*Kazumasa Yamane<sup>1)</sup>, Estuko Asai<sup>1)</sup>, Youko Kuwahara<sup>1)</sup>, Jyuri Fukuda<sup>1)</sup>,  
Satoshi Takao<sup>1)</sup>, Daisuke Tamon<sup>1)</sup>, Natsuki Hoshino<sup>1)</sup>, Shoji Kudoh<sup>2)</sup>*

<sup>1)</sup>Division of Physical Therapy, <sup>2)</sup>Respiratory Medicine, Fukujuji Hospital, Tokyo

**Background:** The lung auscultation is an important method for disease diagnosis, patient condition assessment and evaluating effects on pulmonary rehabilitation intervention. However, the sounds heard through a stethoscope are various, and it is sometimes difficult for medical staff to classify lung sounds heard from patients accurately. Therefore, we studied how many medical staffs could correctly classify recorded lung sounds\* when they listened from CD player randomly.

**Method:** 77 medical staffs (16 doctors, 55 nurses, 6 physical therapists) participated in this study. The medical staffs listened to seven kinds of lung sounds (vesicular breath sounds, tracheal breath sounds, rhonchi, wheezes, coarse crackles, fine crackles and pleural friction rub) from CD player randomly, and choose a single answer among these seven sounds.

**Result:** Accuracy of hearing tests as follows; vesicular breath sounds 52 %, tracheal breath sounds 47%, rhonchi 88%, wheezes 87%, coarse crackles 55%, fine crackles 43% and pleural friction rub 38%.

**Discussion and Conclusion:** Many staffs answered vesicular breath sounds and tracheal breath sounds adversely. It might influence to lung sounds distinction that a border between inspiration and expiration was unclear by the recorded sounds. However, differentiation of these sounds is also important to notice “the change to bronchial breath sounds from vesicular breath sounds”, and it is necessary to understand the characteristics of normal breath sounds. In addition, among adventitious sounds, although accuracy was high about the rhonchi and wheezes, a correct answer rate was low on the coarse crackles, fine crackles, and pleural friction rub. Many staffs confused these three sounds. Needless to say, not only generating mechanism but also clinical meaning of these three sounds is different.

We will start re-education on lung sounds for medical staffs and would like to try again this hearing test after the re-education.

\* Yonemaru R, et al: Auscultation training on respiratory sounds by CD for nurses, 2001, Nankodo, Tokyo, Japan

## CARDIAC RESPONSE TO RESPIRATION IN SMOKERS AND NON-SMOKERS

*Sadamu Ishikawa\*<sup>(1)</sup>, Andrey Vyshedskiy<sup>(2)</sup>, Raymond LH Murphy<sup>(3)</sup>  
and Peter LaCamera<sup>(4)</sup>*

<sup>(1,4)</sup> Pulmonary & Critical Care, Steward St Elizabeth's Medical Center,  
Dept. of Medicine Tufts University School of Medicine, Boston, MA U.S.A.

<sup>(2,3)</sup> Brigham & Women's/ Faulkner Hospital, Boston, MA U.S.A.

It has been said that the Heart beat becomes slower on Inspiration, when one takes a deeper breath, more negative pressure within the Chest is generated which leads to more blood returning to the Left Ventricle, hence a delay of the next Heart beat.

We used a 2 channel ECG / Lung sounds to simultaneously record ECG and Tracheal sounds. ECG (QRS) was used to identify Heart beat and Lung sound tracing was used to monitor breathing.

All recordings were done at sitting position. Two ECG electrodes were mounted on anterior Chest, at the level of 3<sup>rd</sup> inter-costal space on both sides of Sternum, and the 3<sup>rd</sup> electrode on the lower part of the Left side of the Chest. Tracheal sounds were recorded while listening by Stethoscope on the Neck.

After 2 or 3 regular breathing, the subject was instructed to take a deep breath and hold for few seconds

Recording of ECG and Tracheal sounds were made during that period. In order to ensure reproducibility, the same maneuver and recordings were made 4 times on each subject at one sitting.

Measurements of QRS interval of 2 beats during Inspiration, and QRS interval of 2 beats before Inspiration were made.

Forty non-smoking subjects showed larger QRS intervals during Inspiration (47 msec.) comparing to shorter 2 QRS intervals (34 msec.), and the ratio was 1.34.

Four subjects had 3 visits of 4 recording sessions. The ratios were averaged at 1.34, 1.43, 1.53 and 1.33.

Fifteen subjects who were healthy but currently smoking, there were no significant difference of 2 QRS intervals during Inspiration (36 msec.) and before the Inspiration (37 msec.) and ratio was 0.97.

There was a clear evidence of slowing of Heart beat during deep Inspiration in Healthy non-smoking subjects which was not observed in Healthy smokers..

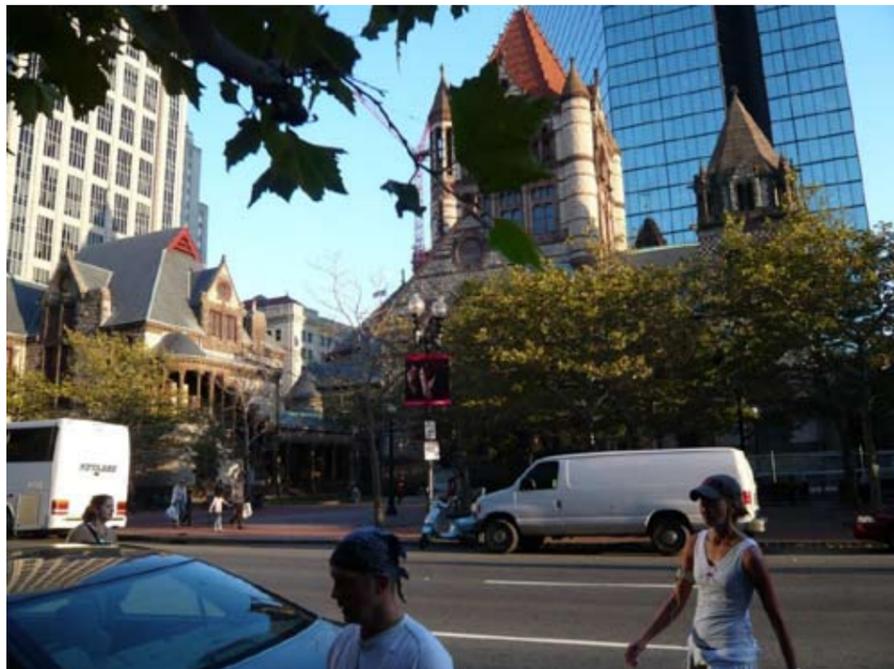


ILSA 2014 will be held in Boston  
on Oct. 10<sup>th</sup> (Fri) & 11<sup>th</sup> (Sat), 2014,  
at Steward St Elizabeth's Medical Center in Boston.

We will appreciate your kind participation.  
Please join us in Boston.



Boston, in front of MIT



Boston, Down Town

## 第39回肺音（呼吸音）研究会 演題募集のご案内

平成25年10月吉日

拝啓

秋冷の候 益々ご健勝のこととお慶び申し上げます。平素は当研究会に格別のご高配を賜り厚く御礼申し上げます。

さて、第39回肺音（呼吸音）研究会の開催にあたり下記のとおり演題を募集いたします。多くの皆様に症例提示をいただき、有意義な討論の時間が持てればと考えております。ご多忙の折とは存じますが、宜しくご配慮の上、ご出席くださいますようお願い申し上げます。末筆ながら、先生のご健勝を心から祈念申し上げます。

敬具

第37回肺音（呼吸音）研究会  
当番幹事 長 澄人  
（済生会吹田病院 呼吸器病センター長）

記

日 程：平成26年10月26日（日）15：00～18：00

場 所：なら100年会館 小ホール（改札を出て西出口すぐ）

〒630-8121 奈良市三条宮前町7番1号 TEL: 0742-34-0100  
(<http://www.nara100.com/acs.html>)

主 催：肺音(呼吸音)研究会

参加費：1,000円

演題募集：特にテーマを設けません。肺音（呼吸音）に関する症例なら受け付けさせていただきます。

症例発表をご予定の先生は、研究会事務局メールアドレスよりご登録をお願いいたします。

プログラム作成のため、メール本文に演題名、筆頭演者、共同演者、ご所属を明記の上、発表者のメールアドレス、日中に連絡が取れる電話番号を明記の上、送信してください。

\*演題受付のメールは折り返し事務局よりご返信させていただきます。

演題募集期間 平成26年8月19日（火）～平成26年9月18日（木）

演題応募先メールアドレス 肺音（呼吸音）研究会 [haion@coac.co.jp](mailto:haion@coac.co.jp)

たくさんのご応募をお待ちしております。

以上

# 第4回肺聴診セミナーのご案内

【第1報】

拝啓 晩秋の候、益々ご清祥のこととお慶び申し上げます。平素は当研究会に格別のご高配を賜り厚く御礼申し上げます。

さて、第4回肺聴診セミナーは下記の通り開催の予定です。プログラムは未定ですが、例年の内容に則して肺聴診に携わる全ての職種の皆様の診療に役立つセミナーとする予定です。

ご多忙の折とは存じますが、皆様のご参加をお待ち申し上げます。

敬具

平成25年10月吉日

第4回肺聴診セミナー講習会長 長 澄人  
(済生会吹田病院 副院長・呼吸器病センター長)

記

日 程 : 平成26年10月26日(日) 10時00分～

(受付開始9時30分より)

場 所 : なら100年会館 小ホール (JR奈良駅改札を出て西出口すぐ)

〒630-8121 奈良市三条宮前町7番1号 TEL: 0742-34-0100

(<http://www.nara100.com/acs.html>)

講習会長 : 長 澄人 (済生会吹田病院 副院長・呼吸器病センター長)

主 催 : 肺音(呼吸音)研究会

定 員 : 100名

参加費 : 事前参加登録 8,000円 (昼食・テキスト代含む)

当日参加登録 10,000円 (昼食・テキスト代含む)

以上

肺音(呼吸音)研究会ホームページ <http://coac.jp/haion/>



肺音(呼吸音)研究会 運営事務局 (株)コンベンションアカデミア

〒113-0033 東京都文京区本郷 3-35-3 本郷 UCビル 4階

TEL: 03-5805-5261 FAX: 03-3815-2028 MAIL: [haion@coac.co.jp](mailto:haion@coac.co.jp)

<p><b>A</b></p> <p>All for one</p> <p>患者さん第一主義。</p>	<p><b>B</b></p> <p>Best in the class</p> <p>各分野で、 最良の医薬品を 届けたい。</p>	<p><b>C</b></p> <p>CSR</p> <p>Corporate Social Responsibility (企業の社会的責任)。</p>	<p><b>D</b></p> <p>Doctor</p> <p>ドクターの “ベストパートナー” になるために。</p>	<p><b>E</b></p> <p>Evidence</p> <p>科学的根拠に基づいて、 医薬品と医療情報を 提供します。</p>
<p><b>F</b></p> <p>First in the class</p> <p>さまざまな分野で、 はじめての 医薬品を届けたい。</p>	<p><b>G</b></p> <p>Global</p> <p>世界の医療に 貢献している グローバル企業です。</p>	<p><b>H</b></p> <p>Hospital</p> <p>病院にとって、 “かかせない存在” であり続けたい。</p>	<p><b>I</b></p> <p>Imagine</p> <p>想像から創造へ。</p>	<p><b>J</b></p> <p>Just</p> <p>望まれることに、 正確に応えたい。</p>
<p><b>K</b></p> <p>Kids</p> <p>子どもたちの 健康と幸せを願って。</p>	<p><b>L</b></p> <p>Library</p> <p>研究・治験データが 豊富にあります。</p>	<p><b>M</b></p> <p>MR</p> <p>医薬品情報担当者。 提供と提案。 それがアストラゼネカのMR。</p>	<p><b>N</b></p> <p>Nobel</p> <p>アストラゼネカの 研究者には ノーベル賞者がいます。</p>	<p><b>O</b></p> <p>Oncology</p> <p>オンコロジー(がん)の 分野で、日本の リーディングカンパニーです。</p>
<p><b>P</b></p> <p>Primary care</p> <p>脂質異常症などの 生活習慣病をはじめとする アストラゼネカの専門分野。</p>	<p><b>Q</b></p> <p>QOL</p> <p>患者さんの クオリティ・オブ・ライフに 貢献します。</p>	<p><b>R</b></p> <p>Relationship</p> <p>医療に、人に、社会に、 関係している 企業でありたい。</p>	<p><b>S</b></p> <p>Spirit</p> <p>熱意を持ってすべてに 取り組みます。</p>	<p><b>T</b></p> <p>Technology</p> <p>よりよい医薬品づくりの ために最先端技術を 駆使しています。</p>
<p><b>U</b></p> <p>Unique</p> <p>ユニークな発想で 研究開発に 取り組んでいます。</p>	<p><b>V</b></p> <p>Vision</p> <p>医療の リーディングカンパニーを 目指しています。</p>	<p><b>W</b></p> <p>Why?</p> <p>新たな発見は「なぜ？」 と問いかける姿勢から。</p>	<p><b>X</b></p> <p>X</p> <p>治療法が見つからない 病気など未知なる 領域に貢献したい。</p>	<p><b>Y</b></p> <p>Yellow-card</p> <p>生活習慣病の予防に、 ベストをつくします。</p>
<p><b>Z</b></p> <p>Zero</p> <p>世界中の病気が ゼロになる日まで。</p>				

医療の「A」から「Z」まで。

**AstraZeneca**

ア ス ト ラ ゼ ネ カ

病気の予防と治療のために革新的で優れた医薬品を提供すること。  
私たちは、すべての医療に、すべての患者さんに貢献していきます。



新緑 (Goldcrest)

感染症領域は、アステラス。

経口用セフェム系製剤(日本薬局方 セフジニルカプセル、セフジニル細粒) [薬価基準収載]

**セフゾン®** 細粒小児用 10%  
カプセル 50mg  
100mg  
Cefzon®  
(薬価基準収載)  
(番号:CFDN)

処方せん医薬品 (注意-医師等の処方せんにより使用すること)

カンディン系抗真菌剤(注射用ミカファンギンナトリウム) [薬価基準収載]

**ファンガード®** 点滴用  
25mg  
50mg  
75mg  
Funguard®  
(薬価基準収載)  
(番号:MCFG)

処方せん医薬品 (注意-医師等の処方せんにより使用すること)

合成セファロスポリン製剤(注射用セファゾリンナトリウム水和物) [薬価基準収載]

**セファメジン®** α 点滴用キット 1g/2g  
注射用 0.25g/0.5g/1g/2g  
筋注用 0.25g/0.5g  
Cefamezin® α  
(薬価基準収載)  
(番号:CEZ)

処方せん医薬品 (注意-医師等の処方せんにより使用すること)

ウイルスワクチン類  
生物学的製剤基準 乾燥細胞培養日本脳炎ワクチン  
**エンセバック®** 皮下注用  
ENCEVAC  
(薬価基準適用外)  
(番号:VNS)

生物由来製品、創薬、処方せん医薬品 (注意-医師等の処方せんにより使用すること)

アステラス製薬株式会社

東京都板橋区進根3-17-1

[資料請求先] 本社/東京都中央区日本橋本町2-5-1

■ご使用に際しましては、製品添付文書をご参照ください。

2013/04作成 A41/2.A.01



ポリエンマクロライド系抗真菌性抗生物質製剤 [薬価基準収載]  
毒薬・処方せん医薬品 (注意-医師等の処方せんにより使用すること)

**アムビゾーム®** 点滴静注用 50mg  
注射用アムホテリシンBリボソーム製剤 (略号:L-AMB) AmBisome®

効能・効果、用法・用量、禁忌を含む使用上の注意等については、  
添付文書をご参照ください。

製造販売元(資料請求先)

大日本住友製薬株式会社

〒541-0045 大阪市中央区道修町 2-6-8

〈製品に関するお問い合わせ先〉

くすり情報センター

☎0120-034-389

受付時間/月~金 9:00~18:30(祝・祭日を除く)

【医療情報サイト】 <http://ds-pharma.jp/>

提携

GILEAD

2010.4月作成



気管支喘息治療薬・アレルギー性鼻炎治療薬  
ロイコトリエン受容体拮抗薬 〈薬価基準収載〉

**シングレア<sup>®</sup>** 5mg錠 10mg錠  
(モンテルカストナトリウム錠)

**SINGULAIR<sup>®</sup>**  
(montelukast sodium, MSD)

本剤のご使用にあたり、【効能・効果】、【用法・用量】、【禁忌を含む使用上の注意】、【用法・用量に関連する使用上の注意】等については、製品添付文書をご参照ください。



製造販売元〔資料請求先〕  
**MSD株式会社**  
〒102-8667 東京都千代田区九段北1-13-12 北の丸スクエア  
<http://www.msd.co.jp/>

2010年8月作成 08-15-SGA-10-J-A04-J



選択的NK<sub>1</sub>受容体拮抗型制吐剤 薬価基準収載

**イメンド<sup>®</sup>** カプセル125mg  
カプセル80mg  
カプセルセット

アプレピタントカプセル **EMEND<sup>®</sup>**  
処方せん医薬品<sup>®</sup> 注)注意—医師等の処方せんにより使用すること

© Registered Trademark of Merck Sharp & Dohme Corp., a subsidiary of Merck & Co., Inc., Whitehouse Station, N.J., U.S.A.

●効能・効果、用法・用量、禁忌を含む使用上の注意等、詳細は製品添付文書をご参照ください。

資料請求先  
**ono 小野薬品工業株式会社**  
〒541-8564 大阪市中央区久太郎町1丁目8番2号

120601



THE 38th ANNUAL CONFERENCE OF INTERNATIONAL LUNG SOUNDS ASSOCIATION