海外招請講演

[IL(E)3]海外招請講演3

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Fri. Mar 1, 2019 4:00 PM - 4:50 PM 第2会場 (国立京都国際会館2F Room A)

[IL(E)3]Electrical impedance tomography: The past, the present and the future

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【 同時通訳付き】

Prof Frerichs is a graduate of the Comenius University in Bratislava, Slovakia in 1985 (MD), where she completed her PhD in physiology (1991). She held research fellowships in respiratory physiology at the Max Planck Institute for Experimental Medicine, Göttingen (1988-1990), Germany, the Zürich University, Switzerland (1992-1993) and Department of Anaesthesiology, Emergency and Intensive Care Medicine, University of Göttingen as a senior researcher (1993-2004). Currently, she is a Professor of Physiology at the Christian Albrechts University in Kiel, Germany. She is the head of the Electrical impedance tomography (EIT) group at the Department of Anaesthesiology and Intensive Care Medicine at the University Medical Centre Schleswig-Holstein, Campus Kiel. Prof Frerichs has published 143 original articles, 14 reviews, 17 book chapters and 1 book in her career. Although she was active in various research fields, especially related to the respiratory system, her major research focus has been EIT since 1993. She is internationally recognized as one of the leading experts on EIT, since she decisively contributed to the development, validation and implementation of this method in the clinical setting. This is evidenced by the fact that 99 out of the total of her 143 original papers are dedicated to EIT. Prof Frerichs has given 66 invited presentations at national and international meetings. Her research papers are frequently cited by other scientists (h-index: 35, total citations 3617). She is an active member of the International Steering Committee on EIT. She initiated the TREND Chest EIT international consensus group promoting the translation of EIT into clinical practice. She has provided decisive inputs in the publication of the first consensus statement on chest EIT resulting from the collaboration among EIT researchers from Europe, North and South America, Australia and Asia. Thanks to her expertise on EIT, her group has become part of three international research consortia funded by the European Union grant programs.

Electrical impedance tomography (EIT) is a functional imaging method invented already in the early eighties of the last century. Its use in a clinical setting is rather recent but still often limited to clinical studies in neonatal, paediatric and adult intensive care units. EIT generates cross-sectional images (i.e. scans) of the body like all other established medical imaging tomographic techniques (i.e. computed tomography or magnetic resonance imaging). In contrast to these radiological methods, EIT examinations can be performed continuously at the bedside without the need of patient transport to specialized radiological departments and without any exposition to radiation. The maximum scan rate of modern EIT devices is in the range of about 40 to 80 images per second. This very high scan rate allows the imaging of dynamic physiological processes like pulmonary ventilation and perfusion, their pathophysiological changes as well as their instantaneous responses to therapy. This feature of EIT explains the suitability of this method for long-term patient monitoring. Because of its limited spatial resolution, anatomical imaging is not considered to be the primary application of EIT, its strength lies in functional imaging. Chest EIT dominates the clinical use of EIT [1], imaging of other organs than the lungs is very limited. The measuring principle of EIT is based on the repetitive rapid measurement of electrical voltages at the surface of the chest resulting from cyclic applications of very small alternating currents of only a few millivolts. To accomplish this, an array of single

electrodes or an electrode belt is placed on the chest circumference. The acquired data is used to calculate the distribution of electrical bioimpedance within the chest which typically is modulated by the instantaneous changes in regional air content. This in turn enables EIT to assess regional lung ventilation and aeration. EIT lung imaging is most frequently used in critically ill mechanically ventilated patients of all age groups. The main benefits of EIT in these patients are 1) the early identification of adverse events like pneumothorax or tube malposition and 2) the guidance in ventilation therapy. EIT enables the assessment of regional ventilation and aeration during spontaneous breathing, assisted and controlled modes of mechanical ventilation. It also can trace the regional lung behavior in response to ventilation manoeuvres like the quasi-static low-flow inflation and deflation, incremental and decremental positive end-expiratory pressure (PEEP) trial or a step change in airway pressure. Functional EIT images and various EIT parameters continuously derived from the patient examinations enable the visualization of regional ventilation distribution or local changes in end-expiratory lung volume and identification of lung recruitment, atelectasis formation or overdistension. It is expected that this information will allow individual optimisation of ventilation therapy and lung-protective ventilation with the least injurious ventilator settings.

References:

[1] Frerichs et al. Chest electrical impedance tomography examination, data analysis, terminology, clinical use and recommendations: consensus statement of the TRanslational EIT developmeNt stuDy group. Thorax 2017;72:83-93.