Research Center for Medical Sciences Division of Ultrasound Device Development and Application

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Research Activities

Development of ultrasonic prevention of vascular occlusion
Reocclusion occurred after various recanalization therapies. In particular, reocclusion was frequently observed immediately after the recombinant tissue-type plasminogen activator (rt-PA) treatment. This is a fatal problem, because anticoagulant therapy is prohibited within 24 hours after the rt-PA treatment. We report the thrombus growth control effect of non-invasive ultrasound (US) in an in vitro clot growth model. In this study, we showed that the non-invasive US could control the growth of thrombus. This safe and simple US method may be used to prevent the reocclusion after recanalization therapy.

Study of leveling of transcranial ultrasound transmittance
Transcranial ultrasound thrombolysis promotion therapy for acute stage cerebral infarction is being researched and developed. In this therapy, ultrasonic cranial bone permeability is an important factor regulating effectiveness and safety. In this research, we are studying ultrasonic modulation technology which greatly fluctuates the transmittance and reduces the fluctuation.

Development of decision supporting system of breast ultrasound using deep learning
The purpose of this study is to develop decision supporting system of breast ultrasonography using deep learning which is one of machine learning techniques. The goal of this system is a classification tool between benign and malignant breast mass lesions. For this study, at least 1,000 cases of supervised data sets including breast ultrasound images and pathologic diagnosis results are required. This study has already approved by the Jikei University Ethics Committee. We are preparing the installation of the deep learning program and the experiment of AI tests. Improvement of diagnostic efficiency of breast ultrasound diagnostic radiologists is expected by this study.

Education and awareness activities to promote AI utilization in diagnostic radiology
From 12th January to 29th March 2017, a roundtable discussion meeting on promotion of AI utilization in the health care field was held at the Ministry of Health, Labor and Welfare four times in total. Director Nakata participated as a member from this research department and deepened the discussion about the current situation and future prospects for utilization of AI in healthcare policy in Japan in diagnostic imaging, and summarized the recommendations as a report
 (Reference: http://www.mhlw.go.jp/stf/shingi/other-kousei.html?tid=408914).

Publications

Wang Z, Komatsu T, Mitsumura H, Nakata N, Ogawa T, Iguchi Y, Yokoyama M. An uncovered risk factor of sonothrombolysis: Substantial fluctuation of ultrasound transmittance through the human skull. *Ultrasonics.* 2017; **77:** 168–75.

Wang Z, Sawaguchi Y, Hirose H, Ohara K, Sakamoto S, Mitsumura H, Ogawa T, Iguchi Y, Yokoyama M. An In Vitro Assay for Sonothrombolysis Based on the Spectrophotometric Measurement of Clot Thickness. *J Ultrasound Med.* 2017; **36:** 681–98. Epub 2017 Feb 2.

Sawaguchi Y, Wang Z. Ultrasound Acceleration of rt-PA Thrombolysis Depends on Acoustic Intensity. *Biol Pharm Bull.* 2017; **40:** 97–103.

Shiraishi K, Wang Z, Kokuryo D, Aoki I, Yokoyama M. A polymeric micelle magnetic resonance imaging (MRI) contrast agent reveals blood-brain barrier (BBB) permeability for macromolecules in cerebral ischemia-reperfusion injury. *J Control Release.* 2017; **253:** 165–71. Epub 2017 Mar 18.

Yokoyama M, Wang Z, Nakata N, Mimura H, Iguchi Y. Leveling the transcranial ultrasound transmittance. *Ultrasonic Technology.* 2016; **28:** 24–7.