The 33rd Annual Meeting of the Japan Academy of Neurosonology
June 13-14, 2014, Morioka, Iwate

ABSTRACT

THE JAPAN ACADEMY OF NEUROSONOLOGY

第 33 回日本脳神経超音波学会
英文抄録集

平成 26 年 6 月 13 日(金)～ 14 日(土)
岩手県盛岡市 いわて県民情報交流センター アイーナ
会長：寺山 靖夫（岩手医科大学医学部 内科学講座神経内科・老年科分野 教授）
Evaluation of neovascularization in carotid plaques using four-dimensional contrast-enhanced ultrasonography

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Purpose: The usefulness of contrast-enhanced ultrasonography has been reported for the assessment of neovascularization in carotid plaques. This study aimed to examine the inflow of contrast medium into plaques using four-dimensional (4D) contrast-enhanced ultrasonography and evaluate the distribution of neoformed vessels.

Methods: The subjects were patients with internal carotid artery stenosis who were candidates for carotid endarterectomy. We performed 4D contrast-enhanced ultrasonography with Perflutane preoperatively. Using the Voluson E8 (GE Healthcare Japan Corporation) ultrasonographic device, we examined the presence/absence of contrast medium inflow from the tunica intima and adventitia and compared the number of neoformed vessels in histopathological samples obtained from surgery.

Results: For the group of contrast medium inflow from the luminal side, the number of neoformed vessels from the tunica intima in the histopathological samples was significantly higher as compared with the group without contrast medium inflow. Moreover, the number of neoformed vessels from the tunica media in the histopathological samples was significantly higher in the group with than in the group without contrast medium inflow from the tunica adventitia.

Conclusions: 4D contrast-enhanced ultrasonography enabled us to evaluate the distribution of neoformed vessels in carotid plaques.

Keywords: Neovascularization, Four-dimensional(4D), Contrast-enhanced ultrasound
**S-1-3**

**Sonographic diagnosis of peripheral neuropathy**

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Recently, we become able to visualize peripheral nerves by high-resolution ultrasonography for patients of peripheral nerve tumor, entrapment neuropathy (carpal tunnel syndrome, cubital tunnel syndrome, etc.), and Charcot-Marie-Tooth disease (CMT). Ultrasonography was superior to be performed at bedside or outpatient clinic. However, findings on ultrasound fluctuated depending on the skills of operator. To obtain accurate quantitative data, it was need reproducible measuring procedures and adjusted normal values by physical parameters.

We previously confirmed reproducible measuring procedures for peripheral nerves of upper arms and cervical roots and adjusted normal values by physical parameters (Sugimoto T et al: Ultrasound Med Biol. 39(9):1560-70,2013). And we reported that this ultrasound measurement method of peripheral nerves was particularly useful for distinguishing CMT from chronic inflammatory demyelinating polyneuropathy (Sugimoto T et al: J Neurol.260(10):2580-7,2013). For spreading ultrasound measurement of peripheral nerves, hands-on-seminars is currently in progress in Japan.

**Keywords:** Ultrasound, peripheral nerve, diagnosis

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**S-1-4**

**Sonothrombolysis for acute ischemic stroke: up-to-date**

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In 1981 Tachibana et al reported that an addition of ultrasound insonation to urokinase enhances the effect of thrombolysis in vitro. Although intravenous recombinant tissue plasminogen activator (IV rt-PA) becomes a standard treatment in many developed countries, only about 40% of treated patients could return to previous social life. Since Alexandrov et al reported the result of the CLOTBUST trial in 2004, a potential acceleration of thrombolysis with transcranial Doppler (TCD) was internationally recognized. In the trial, a combination of TCD insonation and IV rt-PA significantly increased the sustained recanalization of an occluded artery as compared to IV rt-PA alone (38% vs 13%, p=0.002). They developed an operator-independent transcranial device with multiple 2MHz transducers. Using the device, they started a Randomized, Placebo-Controlled, Double-blinded trial of the Combined Lysis of Thrombus With Ultrasound and Systemic Tissue Plasminogen Activator for Emergent Revascularization in Acute Ischemic Stroke (CLOTBUST-ER; ClinicalTrials.gov Identifier, NCT01098981) since May. 2013. In Japan Furuhata et al revealed that 500kHz ultrasound is safe and effective in preclinical studies. We are collaborating with Jikei University (Professor Iguchi), Kaneka Corporation and Teikyo University (Professor Maruyama) to develop our handy device which is operator independent and effective on various skull thicknesses, and hopefully we will conduct a clinical trial in the near future.

**Keywords:** Sonothrombolysis, CLOTBUST, CLOTBUST-ER

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**Symposium 2**

**The past, present and future of TCD**

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Transcranial Doppler is a useful device of detection the blood flow signal of intracranial blood vessels non-invasively, and has been widely used in stroke examination. In our medical center, using transcranial color flow imaging (TCCFI), we evaluate the degree of stenosis of intracranial arteries, and detect the vasospasm after subarachnoid hemorrhage, and predict the hyperperfusion after revascularization of carotid artery. We attempt to detect the microembolic signals by performing transcranial Doppler (TCD) monitoring to stroke patients. Furthermore, we can detect of the right-to-left shunt using TCD. However, the vascular lesions can be evaluated at any time by MRA and DSA, and the opportunity of using TCD and TCCFI has decreased. Because TCCFI and TCD is sonography that require the practice to learn skills, there is a problem that young residents are unable to learn the skills of TCCFI and TCD. In our medical center, we should create the environment to learn the skills of TCCFI and TCD for young residents.

**Keywords:** Transcranial Doppler, Transcranial color flow imag-
Changes in transcranial Doppler examination in cerebrovascular diseases

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Transcranial Doppler (TCD) and transcranial color-coded sonography (TCCS) are indispensable screening tools in the diagnosis of cerebrovascular diseases. Those are useful in (1) diagnosis of the stenosis or occlusion of the intracranial cerebral arteries, (2) diagnosis of recanalization of occlusion in the cerebral arteries in the acute phase of ischemic stroke, (3) detection of micro embolic signals (MES) for evaluation of the etiology of ischemic stroke or effectiveness of antithrombotic treatment, (4) intra or postoperative evaluation of the hemodynamic status such as hyperperfusion syndrome in CEA or CAS, and (5) diagnosis of the vasospasm in subarachnoid hemorrhage. TCD or TCCS are noninvasive and repeatable in the bedside. However, in some patients, they are unavailable due to an inadequate temporal bone window. In the early period, TCD or TCCS were used mainly for diagnosing the stenosis or occlusion of the intracranial cerebral arteries in the acute phase of ischemic stroke. Recently, MR angiography or CT angiography can be available at all hours in the major stroke center, thus, the role of TCD or TCCS as a diagnostic tool for cerebral artery stenosis is reducing. Now, TCD or TCCS should be performed for detection of MES in patients with stenosis of cerebral arteries, perioperative hemodynamic monitoring in CEA, CAS, and EC-IC bypass procedures. Diagnostic accuracy of ultrasonography can be affected by the skill of investigators. Training program for young investigators is strongly required.

Keywords: transcranial Doppler, cerebrovascular disease, hemodynamics

Clinical use and future foresight of TCD/TC-CFI; from Neurosurgeon

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Background: Transcranial Doppler (TCD) and transcranial color-coded flow imaging (TC-CFI) are simple and easy examination which is performed on bedside. We consider how to use TCD/TC-CFI for perioperative monitoring.

Methods: TCD/TC-CFI are examined for detection of intraoperative micro-embolic signals, patency of bypass and vasospasm after aneurysmal subarachnoid hemorrhage.

Results: TCD/TC-CFI are very effective examination, however TCD/TC-CFI can observe only M1 or A1 like a midstream of long river.

Conclusion: Craniotomy can make an artificial cranial window of ultrasound. After surgery, TCD/TC-CFI get easy and good view of cerebral arteries, which might bring new technic such as cerebral blood flow by using contrast agent.

The discrepancy between physicians and technologists for carotid ultrasound imaging

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Recently carotid ultrasound imaging becomes more important for diagnosis of the cerebral stroke with advances of ultrasound imaging. Also they have been frequently performed by sonographers/ultrasound technicians even in Japan. We have performed independently carotid ultrasound imaging and Transcranial Color Doppler for over 8000 patients for 20 years in our hospital. These include detection of cerebral embolism and preoperative evaluation for carotid intervention. We sometimes support the decision making of physicians by echocardiogram and ultrasound venography. Physicians use the images created by sonographers to make diagnoses and monitor stroke event based on our reports. We reviewed our series and present some illustrative cases in this paper. Also the questionnaire survey is conducted for 30 Institutions in Japan as follows; 1 Who performs carotid ultrasonography? 2 What examination do Physicians do? 3 The guideline for carotid ultrasound is followed or not? 4 What do technicians research? (embolism and/or effect evaluation) 5 Do it combine with Transcranial Color Doppler? We describe status quo of carotid ultrasound, proposal from technicians, the
support system, the discrepancy between physician and technicians based on our results in this paper.

**Keywords:** Carotid ultrasound imaging, physicians and technicians, discrepancy

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**S-3-4**

**Ultrasonography of Carotid artery is very useful for cardiologists**

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Carotid artery lesions is a part of the disease of the blood vessels throughout the body, but neurologists and neurosurgeons, in order to adequately enforced its therapeutic, the play an important role is a cardiologists, but its the key that causes the action of the first, it is a laboratory technician (sonographer) to enforce carotid echo.

Information obtained from the carotid echo often, the cases wherein the meaning is different.

That side to request an inspection or want is what information, how the treatment policy is what is standing in the test results, and mutual exchange of information with each other densely imperative, the quality of the medical team is enhanced by it, professionalism of each but I think we can be exhibited. And I think it's leading to the outcome of treatment.

**Keywords:** carotid artery lesion, cardiologist, sonographer

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**Symposium 4**

**Atherosclerosis and ultrasonography**

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**S-4-1**

**Clinical aspect of Neurosonology for atherothrombotic disorders**

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Atherothrombotic disorders (ATIS) are based on westernized life-style and strongly related to the vascular risk factors (hypertension, diabetes, dyslipidemia and smoking). For a last decade, most of Japanese have been candidates with ATIS. Neurosonology, such as transcranial Doppler (TCD), carotid duplex ultrasound, and transesophageal echocardiography, plays an important role of treating not only ATIS patients, but also pre-ATIS individuals. In this session, we would like to discuss the topics of transcranial Doppler. At first, microembolic signals detected by TCD seem to be related to ischemic event in a case with internal carotid arterial disease. Secondary, although aortic plaque is commonly diagnosed by using TEE, the best medicine for aortogenic embolic stroke is still concerned. While we examine TCD through thrombolysis for hyper acute stroke due to ATIS, TCD are able to estimate the vascular recanalization which may be enhanced by ultrasound. Main stream of medication for ATIS is anti-platelet agents, so we should focus into the prophylaxis of both ischemic and hemorrhagic events in the lifetime of “ATIS”.

**Keywords:** atherothrombotic disorders, transcranial Doppler, anti-platelet agents

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**S-4-3**

**Surgical Approach for the Carotid Artery Stenosis**

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In 1953, DeBakey first performed a carotid endarterectomy (CEA) on of the carotid artery stenosis successfully. Since then, a lots of study, such as NASCET, ECSA, and ACAS, indicated the usefulness of the CEA for the carotid artery stenosis, and it has been widely performed by the skillful surgeon. Recently, medical treatment for the ischemic vascular disease has developed. Valuable anti-thrombotic agents were introduced. However, CEA has been still the best treatment maneuver in some cases.

The indication for the CEA is depending on the clinical symptoms and the condition of the carotid artery stenosis lesion. The condition of the carotid artery plaque is evaluated by the conventional angiography, 3D-CT angiography, MRI and ultrasound examination. Ultrasound examination for the carotid artery stenosis also shows the stenosis degree, presence of ulcer with or without embolism, and the plaque contents. Recently, the technique and the outcome of the carotid artery stenting (CAS) has been improved. Therefore, in some cases indicated to the carotid artery reconstruction, the CAS was performed instead of the CEA.

In this paper, the author described the topics of the surgical treatment including the CAS.
**Keywords:** carotid artery stenosis, Doppler sonography, surgery

### S-4-4

**Method for evaluating of arteriosclerosis – diagnosis of stenosis using pulse Doppler waveform**

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Atherothrombotic brain infarction is embolism or occlusion related to large artery stenosis based on atherosclerosis. In the neurosonology field, diagnosis is made according to stenosis in the intracranial arteries and carotid arteries. Area method, ECST method and NASCET method and peak systolic velocity (PSV) as well as acceleration time (AcT) are used for diagnosing stenosis in the extracranial internal carotid arteries (ICA).

Aortic stenosis (AS) is known to increase AcT in all the arteries. Our previous study showed no correlation of AS with age, gender, laterality, aortic regurgitation and left ventricular ejection fraction but AS was associated with increased AcT of carotid artery. However, the AcT ratio, calculated as ICA-AcT/ipsilateral CCA-AcT, had no influence on the presence of AS.

In addition, a positive correlation between AcT ratio and stenosis rate measured by ECST method has been reported: ECST 65% indicates ACT ratio ≥ 1.5.

On the other hand, diagnosis of stenosis of the vertebral artery (VA) origin is important in evaluation of atherosclerotic changes. VA origin stenosis ≥50% leads to increased VA-AcT ratio, calculated as VA-AcT/ipsilateral CCA-AcT, and VA-AcT ratio of 1.25 can be useful in screening VA stenosis. AcT measurement is a notable carotid sonographic parameter in evaluating atherosclerosis.

**Keywords:** acceleration time, stenosis, extracranial artery

### Oral Presentations

#### Session 1: Carotid artery 1

**O-1-1**

To compare Hemodialysis patients with Non-dialysis patients to clarify the feature of a carotid artery ultrasonographic observation

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**Purpose:** To compare hemodialysis (HD) patients with non-dialysis (NonHD) patients to clarify the feature of a carotid artery ultrasonographic observation.

**Object:** HD(s)(n=40 21 men/ 19women (74.5 ± 9.2 years old), NonHD(s)(n=80 42 men&38women (74.3 ± 9.2 years old). From September, 2013 to May, 2014.

**Methods:** This examination was studied used maxIMT, Plaque score (PS), flow velocity, and Calcification score (CS).

**Result:** PS showed significant difference between HD12.26 ± 7.07 and NonHD9.46 ± 6.01 (p= 0.0001). There were significant difference between HD 1.528 ± 0.985 and NonHD1.182 ± 0.580 (p= 0.0182) in R-Cmax. However, there were no significant difference between HD 1.607 ± 0.975 and NonHD1.356 ± 0.716 (p=ns) in L-Cmax. On the other hand, R-CCAVmax showed significant difference between HD50.65 ± 17.18 cm/s and NonHD62.95 ± 17.74 cm/s (p= 0.0004). L-CCAVmax also showed significant difference between HD53.35 ± 18.20 cm/s and NonHD64.84 ± 19.63 cm/s (p= 0.0025).There were significant difference RightCS HD4.36 ± 4.38 NonHD1.42 ± 2.93 (P< 0.0001), LeftCS HD4.59 ± 4.70 NonHD1.86 ± 2.75 (p= 0.0001) in CS.

**Conclusion:** We confirmed the flow velocity of HD, Vmax-Vmin-Vmean, showed the significant reduction compared with NonHD, PS of HD had a significant difference compared with NonHD. We confirmed CS of HD showed the significant difference compared with NonHD, PS of HD showed the significant different compared with NonHD. RightCS and leftCS of HD showed the significant different compared with NonHD. (P< 0.0001).

**Keywords:** Hemodialysis Carotid artery Ultrasonography
O-1-2
The relationship between carotid artery stenosis and history of cancer

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Purpose: In the previous JAN meeting, we reported that in-stent re-stenosis in patients who had undergone carotid stenting (CAS) was related to a history of cancer. Therefore we investigated the relationship between internal carotid stenosis and cancer from the viewpoint of plaque thickness determined by carotid ultrasonography (CDU).

Material and Methods: This study was collected retrospectively in our department between Jan. 2008 and Dec. 2012. The data included patients who had undergone CDU. Post-CAS patients were excluded. We evaluated the correlations between maximum plaque thickness (mm) and presence of cancer.

Results: One hundred sixty-seven patients were included (M:F=152:15, age 72 ± 10 yr). One hundred twenty-four patients had no history of cancer (non-cancer group: NC) and 43 had a history of cancer (cancer group: C), comprising 12 with active cancer, 29 with inactive cancer, and 2 with unknown cancer status. Plaque thickness was 5.13 in group C and 5.79 in group NC (inactive 5.89; active 5.75). With regard to cancer origin, plaque thickness was as follows: lung 7.75, colon 6.90, prostate 6.16, esophagus 6.05, stomach 4.98, oral region 5.13, larynx 5.75, and bladder 4.20, liver 4.90, and skin 5.90. None of these correlations were statistically significant.

Conclusions: Plaque thickness was greater in patients with cancer than in those without cancer, but not to a significant degree. Further examinations of carotid plaque in cancer patients are needed.

Keywords: cancer, carotid ultrasonography, internal carotid stenosis

O-1-3
Neurosonological Application of Wave Intensity Analysis in the Cervical Arteries

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Objective: Utilizing a simultaneous measurement of blood pressure (BP) and velocity in the cervical arteries based on a combined color-duplex and echo-tracking system, wave intensity (WI) analysis is able to evaluate backward-traveling waves from the peripheral brain. To elucidate neurosonological applicability, we measured the negative area (NA) in the common carotid and vertebral arteries (CCA and VA2), and compared transcranial Doppler (TCD) in the middle cerebral and intracranial vertebral arteries (MCA and VA4).

Methods: Utilizing Prosound F75, WI analysis was evaluated in 7 normal and 7 cerebrovascular subjects, regarding 1) technically reproducible NA recordings, 2) comparison with TCD; time-averaged maximum velocity (Vmax), Pulsatility index, and estimated cerebrovascular resistance (eCVR) = mean BP/Vmax.

Results: a) Normal Subjects: CCANAs and VA2NAs were obtainable in all. CCANA was significantly higher than VANA. Compared with TCD in the VA4, a higher Vmax and lower eCVR were significant in the MCA. b) Patients: CCANAs were obtainable in all, but VA2NA was not observable in all but one. CCANA was not consistently differed from normal subjects. CCANA of dural AVF and atrial fibrillation cases tended to be low.

Conclusion: WI analysis in the cervical arteries appears to represent a new noninvasive method for evaluating intracranial hemodynamics.

Keywords: Wave intensity analysis, Neurosonology, Cervical arteries

O-1-4
Ultrasonographic evaluation of dicrotic notch of common carotid artery

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Purpose: Dicrotic notch, a negative wave, appears after the peak systolic pressure on brachial-ankle pulse wave velocity (baPWV), which reflects closure of the aortic valve. The same notch be-
between systolic and diastolic phase is observed on a wave form of blood flow velocity using carotid ultrasonography. We compared the results of carotid ultrasonography and other modalities and evaluated the cause and clinical significance of the dicrotic notch.

**Methods:** Carotid ultrasonography, transthoracic echocardiography and baPWV were performed in healthy subjects. Flow-volume measurements were taken at a location approximately 2 cm below the carotid bulb in the common carotid artery (CCA). BaPWV and phonocardiogram were measured using form PWV/ABI (Omron Colin, Japan). Dicrotic notches obtained by different modalities were then compared.

**Results:** The appearance of dicrotic notch of CCA coincided with the aortic valve closure, overlapping with the second heart sound. The dicrotic notch of arterial wave of brachial artery appeared just after the notch of CCA. Age-related analysis showed that the depth of the notch in the 30s, 50s and 80s were 16.0cm/sec, 9.8cm/sec and 6.5cm/sec, respectively.

**Conclusions:** A steep decrease in blood flow velocity waveform of CCA may reflect a decrease in blood flow velocity due to aortic valve closure.

**Keywords:** dicrotic notch, carotid ultrasonography, common carotid artery

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**O-1-5**

**Sonographic parameters of common carotid artery for detection of middle cerebral artery stenosis**

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**Purpose:** In patients with cardiogenic embolism (CE), middle cerebral artery (MCA) M1 occlusion shows an increase in the end diastolic flow velocity (EDV) ratio in the common carotid artery (CCA); however, whether this finding is observed in patients with atherothrombotic brain infarction (ATBI) is unclear. We investigated carotid ultrasonographic findings in MCA M1 stenosis/occlusion.

**Methods:** Acute ATBI patients in MCA territories were included in this study and then subdivide into the 2 group: patients with (M1S group, n=16) and without severe stenosis or occlusion of MCA M1 on magnetic resonance angiography (NC group, n=16). Peak systolic velocity (PSV), time averaged maximum velocity (TAMV), end diastolic velocity (EDV), pulsatility index (PI) and resistance index (RI) of CCA were measured.

**Results:** In M1S group increased male-to-female ratio and decreased TAMV (27.6 cm/s vs. 30.5 cm/s) and EDV (14.4 cm/s vs. 16.4 cm/s) were observed compared with NC group. The ROC curve analysis revealed the optimal cut-off points for M1 stenosis/occlusion were 27 cm/s of TAMV (AUC 0.7) and 14.8 cm/s of EDV (AUC 0.7).

**Conclusion:** In ATBI patients, TAMV and EDV may be useful in predicting MCA M1 stenosis.

**Keywords:** middle cerebral artery horizontal segment, common carotid artery, diagnosis

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**O-1-6**

**Evaluation of factors related to the pulse Doppler waveform of the common carotid artery**

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**Purpose:** To evaluate factors related to the pulse Doppler waveform of common carotid artery (CCA).

**Methods:** Sixteen consecutive subjects (32 vessels) who underwent carotid ultrasonography and transthoracic echocardiography were included in this study. Peak systolic velocity (PSV), time averaged maximum velocity (TAMV), end diastolic velocity (EDV), pulsatility index (PI) and resistance index (RI) of CCA were measured. The pulse Doppler waveforms of CCA were categorized into the following patterns: type A (15 vessels, bimodal peaks with the latter being small), type B (9 vessels, bimodal peaks with the both peaks being similar or higher) and type C (8 vessels, monomodal peak).

**Results:** The frequency of aortic regurgitation (p<0.05, chi-square test) and values for EDV and TAMV and RI were different among the groups (p<0.1, p<0.05, p<0.1, respectively, one-way analysis of variance). In multivariate analysis, no factor related to type B was identified but TAMV and RI were associated with type C.

**Conclusion:** TAMV and RI of CCA may contribute to the change in the CCA waveform.
Keywords: pulse Doppler waveform, common carotid artery

O-1-7
Thrombus-like mobile plaque associated with cervical carotid plaque

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We have diagnosed the extremely fragile plaque as Youdousei plaque in Japanese, and reported the clinical characteristics and the therapeutic importance. The floating mobile mass associated with the fragile plaque as well as the Youdousei plaque might be a cause of the embolic stroke. However, the occurrence and the pathogenesis still has been uncleared. Presently we investigated them from the pathological features of the floating mobile mass we previously had experienced.

We have four cases that we could pathologically check following carotid endarterectomy. The mobile plaque dominantly existed a far part of the fragile plaque and consisted with thrombus pathologically. The relation of hemostasis and existence of thrombotic core as the edge of the ruptured intima were thought as the mechanism. This could cause embolic stroke and should be treated surgically as soon as possible.

Keywords: Floating mass, thrombus, CEA

O-1-8
3D navigation system is useful ultrasound method for characterization carotid plaque

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Case: A 69-year-old man. Based on the results of plain magnetic resonance angiography (MRA), multiple microcerebral infarction of the right cerebral hemisphere and moderate stenosis of the right internal carotid artery were diagnosed.

Clinical course: Carotid ultrasound showed severe stenosis and the plaque was unstable with the contents bulging from the partially ruptured capsule. Videos and three-dimensional (3D) imaging were employed for better visualization. Stent placement and examinations were not feasible as the patient had contrast media allergy. Therefore, As preoperative examinations, we identified the relationship between the stenosis site and cervical vertebrae using a navigation system and nerve ultrasound. Stenosis was detected cervical vertebrae C4-C3, and this examination successfully provided preparation for thromboendarterectomy.

With perioperative ultrasound, we were able to mark the stenosis site just before carotid arteriotomy, and the condition of the intimal surface and blood flow with Doppler video before and after clamping were checked on B-mode images.

Results and Discussions: In this case, we assessed an unstable plaque employing videos and 3D images. As preoperative examinations, we identified the relationship between the stenosis site and cervical vertebrae using a navigation system and nerve ultrasound. This is an extremely effective method for patients with contraindication to contrast media. The procedure can be performed in several minutes. The stenosis site was detected by perioperative ultrasound just before carotid arteriotomy. In addition, blood flow assessment after clamp release and reperfusion and evaluation of the intimal surface after the removal of the thrombus were performed.

Ultrasound may certainly be a clinically useful method.

Keywords: navigation system, 3D image, characterization carotid plaque

Oral Presentations

Session2: Case reports: Carotid lesion

O-2-1
A case of cerebral infarction with mobile plaque in distal portion of common carotid artery occlusion in patient with Takayasu Arteritis

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A 39-year-old female was admitted to our hospital because of acute cerebral infarction involved with left middle cerebral artery. Neurological examination discloses motor aphasia, dysarthria and mild right hemiparesis. The blood pressure was 94/67 mmHg in the left and 72/50 mmHg in the right arm. Both radial pulses were not palpable and vascular bruits over the both subclavian and carotid arteries were heard on auscultation. Laboratory findings showed an elevated erythrocyte sedimentation rate of 32 mm/h and serum C-reactive protein level of 1.2 mg/dl. Carotid ultrasonography revealed mobile plaque and hemodynamics of both retrograde and antegrade blood flow in distal portion of the left common carotid artery occlusion. She diag-
nosed with Takayasu Arteritis according to the diagnosis criteria of American College of Rheumatology. The cerebral infarction was seen to A to A embolism due to the mobile plaque and steroid and anticoagulation was started. On 5 days after admission, her neurological symptoms were deteriorated and cerebral infarction was involved with the same territory. The carotid ultrasonography after recurrence of cerebral infarction showed diminished plaque mobilization. Carotid ultrasonography seems very useful in evaluating the morphological change and hemodynamics of carotid artery in patients with Takayasu Arteritis.

Keywords: carotid ultrasonography, mobile plaque, Takayasu Arteritis

O-2-2

A spontaneous closure of traumatic dural arteriovenous fistula observed by means of carotid Doppler ultrasonography -case report-

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A 75-year-old man fell down to the ground and hit the face. Head CT revealed no traumatic change, however, MRA showed a dilation of the right sphenoparietal sinus. Digital subtraction angiography (DSA) revealed a traumatic dural arteriovenous fistula (AVF). The right middle meningeal artery flew into the fistula and drained into the right sphenoparietal sinus. Carotid sonography was performed to screen traumatic carotid dissection. In Doppler examination, laterality of the diastolic velocity of external carotid artery (ECA) was observed. The diastolic velocity of the right side elevated to 31.6 cm/s and the RI decreased to 0.63. Internal carotid artery (ICA) to ECA ratio was 0.92. dAVF was suspected by findings of brain MRI. DSA revealed arteriovenous shunts between occipital artery and sigmoid sinus.

Case 2: A 73-year-old man with right thalamic infarction and hypertension. The patient had residual sensory disturbance on the left side. CDS showed increased EDV (35.2 cm/s) and ICA to ECA ratio of 0.83. DSA showed retrograde flow into the Labbe vein and transverse sinus from occipital artery.

Conclusions: Normal values of ECA-EDV and ICA to ECA ratio are 0.7 or more and 0.9 or less, respectively. The combined use of CDS parameters of EDV of ECA and ICA to ECA RI ratio is useful in screening dAVF.

Keywords: dural arteriovenous fistula, carotid artery ultrasonography, external carotid artery

O-2-3

Two cases with dural arteriovenous fistula diagnosed by carotid artery ultrasonography

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Purpose: Dural arteriovenous fistula (dAVF) is diagnosed by using MRI or digital subtraction angiography (DSA). We herein report 2 patients with dAVF diagnosed by carotid duplex sonography (CDS).

Case 1: A 60-year-old man was referred to our hospital with thickened intima-media complex mesothelium pointed out at the regular health check-up. On CDS, end-diastolic velocity (EDV) of the right external carotid artery (ECA) increased to 31.6 cm/s and the RI decreased to 0.63. Internal carotid artery (ICA) to ECA ratio was 0.92. dAVF was suspected by findings of brain MRI. DSA revealed arteriovenous shunts between occipital artery and sigmoid sinus.

Conclusions: Normal values of ECA-EDV and ICA to ECA ratio are 0.7 or more and 0.9 or less, respectively. The combined use of CDS parameters of EDV of ECA and ICA to ECA RI ratio is useful in screening dAVF.

Keywords: dural arteriovenous fistula, carotid artery ultrasonography, external carotid artery

O-2-4

Spontaneous recanalization of intracranial vertebral artery detected by carotid duplex ultrasonography: a case report

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The case was an 85-year-old woman who had mild cognitive
impairment. She came to emergency room complaining dizziness, however, went to home because brain CT was normal. After that, she came to hospital again after 8 days because she could not live alone according to low activity and always needed care of family. On physical examination, her blood pressure was 160 over 50 mmHg. ECG was sinus rhythm, and blood examination showed dyslipidemia and diabetes. Neurologically, she had no focal sign, however, there was multiple acute ischemic lesions of posterior circulation on MRI. Occlusion of right intracranial vertebral artery (VA) and stenosis of left intracranial VA were detected by MRA. Carotid duplex ultrasonography (CUS) showed flow pattern with occlusion of right VA before PICA branch. According to antegrade flow of right intracranial VA evaluated by TC-CFI, distal VA territory might have been maintained via collateral flow. Due to antiplatelet therapy and intravenous injection of argatroban, her low activity gradually improved equal to the state before admission. Recanalization of right VA was seen on MRA and CUS at 14 days from admission. The follow up examinations by ultrasound were useful for evaluation of intracranial hemodynamic change with neurological improvement.

**Keywords:** carotid duplex ultrasonography, vertebral artery, recanalization

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**O-2-6**

**Two Case of Oscillating Thrombus diachronically observed by carotid ultrasonography**

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Case 1 is 77-year-old woman with chronic atrial fibrillation, implanted cardiac pacemaker, developed embolic strokes of bilateral of middle and anterior cerebral artery territories with unconsciousness. Carotid ultrasonography (CU) showed occlusion flow pattern of distal internal carotid artery (ICA) and oscillating thrombus was existed in left ICA origin. Antithrombotic therapy was not performed due to hemorrhagic infraction. Day 39, CU showed the same flow pattern, even though, oscillating thrombus was disappeared.

Case 2 is 56-year-old man developed embolic strokes of right middle cerebral artery territories with left hemiparesis and unconsciousness. CU detected oscillating thrombus and right ICA occlusion. Anticoagulation therapy was started. In computed tomography angiography, vanishing and occlusion were existed of a few centimeters from ICA origin. Transoral carotid ultrasonography revealed vasodilatation and hypoechoic occlusion. Magnetic resonance showed intramural hematoma in same lesion. We diagnosed occlusion was formed of carotid artery dissection. Day 7, CU showed oscillating thrombus being vanished, even though, flow study indicated ICA occlusion.

Oscillating thrombus is specific to acute embolic ICA occlusion, particular of cardioembolic stroke. But, other cause, like case 2, can be existed. Our two cases indicated that follow up CU are useful observation of oscillating thrombus.
Keywords: Oscillating thrombus, Carotid ultrasonography, Acute ICA occlusion

O-2-7
The case of carotidynia followed by carotid ultrasonography

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A 69-year-old man presented with right-sided neck pain. His history included bladder cancer and diabetes, and he had been hospitalized for chemotherapy for recurrence of bladder cancer and multiple lymph node metastasis. 18 days after admission, he had persistent pains on the right-side neck with a temporary loss of consciousness. We found no local warmth, redness, and swelling of the lymph nodes on the neck. The laboratory data showed a slight increase in the number of leucocyte and C-reactive protein.

The carotid ultrasonography showed the adventitial thickness and the blurred iso-echoic lesion in the common carotid artery matched with the pain, and the carotid computed tomography scan also showed that the swelling and dilatation of the surrounding tissue in the right-side more than the left. From these findings, we finally diagnosed this pain as carotidynia.

The pains disappeared in about one week after taking non-steroidal anti-inflammatory drugs.

The follow-up carotid ultrasonography one week after showed that the adventitia in the lesion became thicker and had multiple layers.

We report the changes of the features followed by carotid ultrasonography in carotidynia.

Keywords: Carotidynia, inflammation, neck pain

O-2-8
A recurrent stroke case associated with carotid mobile plaque

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An 83-year-old man with a history of hypertension, dyslipidemia, diabetes mellitus, peripheral artery disease and chronic renal failure was diagnosed with asymptomatic brain infarction and carotid plaque. Follow-up 7 years after first diagnosis showed asymptomatic brain infarction in the territory of the left middle cerebral artery (MCA). Despite anti-platelet therapy, he was admitted with symptomatic cerebral infarction associated with the left internal carotid artery (ICA) 9 years after first diagnosis, and relapsed four times during the following year. Duplex ultrasonography on the first of these admissions detected a mobile structure attached to the plaque and associated with mild stenosis. This mobile structure probably represented thrombus, and was enlarged on the fourth admission; therefore, we diagnosed microemboli arising from the mobile structure of the left ICA plaque passing into the MCA circulation and the patient underwent carotid artery stenting (CAS). Follow-up duplex ultrasonography performed 7 months after CAS demonstrated coverage of the mobile plaque. No recurrences have been identified as of 6 months after CAS.

Keywords: mobile plaque; carotid ultrasonography; carotid artery stent

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Oral Presentations
Session 3: Carotid artery

O-3-1
Usefulness of carotid artery ultrasound for screening for acute thoracic aortic dissection in IV t-PA

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Brain infarction with acute thoracic aortic dissection (ATAD) is contraindication for intravenous injection therapy of alteplase (IV t-PA). We validated the usefulness of carotid artery sonography for screening for ATAD. Among consecutive 1499 acute stroke patients who were considered about indication of IV t-PA, 10 cases (female 7, mean 76.3 year-old) were diagnosed as having ATAD finally with thoracic enhanced CT scan. We evaluated examinations that were key factors for suspicion about ATAD. Among them, 4 cases were suspected as having ATAD from findings of carotid artery sonography and other 4 cases were suspected from thoracic ultrasonic cardiography. 8 cases were examined carotid echography. Among these 8 cases, we found dissected lumen progressing to common carotid artery from aor-
tic arch in 6 cases on day 1 and did not find in remaining 2 cases on day 5 and 12.

Carotid artery sonography is useful for screening for ATAD in real clinical IV t-PA.

Keywords: acute thoracic aortic dissection, IV t-PA, screening

O-3-2
A case showing massive influx of contrast material into carotid plaque detected by contrast-enhanced ultrasound

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Background: We have observed intraplaque neovascularization in carotid artery plaque using contrast-enhanced ultrasonography with the contrast agent perflubutane prior to undertaking carotid endarterectomy (CEA). We report a case in which significant contrast flow in the plaque was detected and discuss the findings from the pathological specimen.

Case: Asymptomatic but severe left-sided intra-carotid stenosis was detected on ultrasonography (US) in a 71-year-old man at a clinic, and CEA was subsequently performed in our hospital.

Past history: Surgery for colon cancer at 64 years old.

Life history: Smoking, 20 cigarettes/day from 20 years old to 64 years old; occasional drinking.

Present symptoms: No clear neurological abnormalities were evident.

Results: No abnormalities or ischemic lesions were seen on brain magnetic resonance imaging. The carotid plaque on the left side showed hypo-echoic intensity and a smooth surface with 83% stenosis, and peak systolic velocity was 409.2 cm/s at the stenotic region according to US. Conventional angiography showed 78% stenosis at the same site. We were able to observe the inflow of significant contrast-enhancement in the plaque from a blood vessel lumen on contrast-enhanced US, and the whole plaque became stained with contrast media over time. According to pathological findings after CEA, little fibrosis was present and inflammatory cells had permeated the plaque. Extensive neovascularization was evident on immunostaining using CD34.

Conclusion: The significant flow of contrast into the plaque on US matched the neovascularization apparent on histopathological examination. The presence of intraplaque neovascularization has been identified as a factor in unstable plaque. Evaluation of intraplaque neovascularization is also important to prevent ischemic stroke. Contrast-enhanced US with the contrast agent perflubutane may allow the evaluation of unstable plaque with neovascularization.

Keywords: neovascularization, carotid artery plaque, contrast-enhanced ultrasonography

O-3-4
Association between contrast-enhanced ultrasonography and black-blood MRI findings in carotid plaque imaging

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Purpose: T1 weight black-blood MRI (BB-MRI) and contrast enhanced ultrasonography (CEUS) are recognized as useful methods for identification of vulnerable carotid plaque. The aim of present study was to investigate the correlation between the two carotid plaque imaging; BB-MRI and CEUS.

Methods: We studied 30 patients with carotid stenosis, who were conducted carotid endarterectomy (CEA). All patients were performed BB-MRI and CEUS before CEA. All patient was classified into 2 groups by relative overall plaque MR signal intensity (roSI); high intensity plaque; roSI ≥1.25, low intensity plaque; roSI <1.25. All carotid lesions were divided into two groups by CEUS findings (enhanced plaque, non-enhanced plaque). We studied the correlation between high intensity plaque on T1WI BB-MRI and enhanced plaque on CEUS.

Results: T1WI BB-MRI revealed high intensity plaque in 12 (40.0%) of 30 patients enrolled in the study. With CEUS imaging, 26 (86.6%) of 30 plaque was enhanced plaque. The association between the high intensity plaque on T1WI BB-MRI and enhanced plaque on CEUS was not significant (Table).

<table>
<thead>
<tr>
<th>CEUS imaging</th>
<th>Enhanced plaque</th>
<th>Non enhanced plaque</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1WI BB-MRI</td>
<td>roSI &lt;1.25</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>roSI ≥1.25</td>
<td>9</td>
</tr>
</tbody>
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Conclusion: High intensity plaque on T1WI BB-MRI was not correlate with enhanced plaque on CEUS.

Keywords: black-blood MRI, contrast enhanced ultrasonogra-
O-3-5
The sonographic evaluation of carotid artery plaque with the embolic shower

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Purpose: The sonographic findings on the cases that underwent CEA. (especially the cases with embolic shower presented by MRI)

Subjects and method: The 83 cases underwent carotid endarterectomy (CEA). We were recognized the 37 cases with embolic shower (ES). Ultrasound instrument was HDI5000 (PMS). The modalities were carotid artery wall perfusion by contrast agents with pulse inversion harmonic imaging method (CAWP), B-mode. The data before image processing were studied using the software (QLAB).

Results and Discussion: The characteristic sonographic findings of the case with ES presented as follow. 1. B-mode showing the ruptured points as ulceration or dimple. 2. The ruptured points usually presented circle by the intraoperative appearance and unstable plaque "jelly fish sign" by B-mode. 3. Mobility of the plaque could be evaluated objectively by QLAB. 4. The impedance value (dB) changes of the unstable plaques were greater than the other sites. 5. Their stenosis was usually mild or moderate in many cases. 6. The pathological findings proved neovascularization (NV) that was present in most cases. There were the statistically differences between bleeding and ulceration, bleeding and pathologically NV existence, CAWP positive and bleeding. We will to suggest the CEA criteria on the case of carotid stenosis with ES and without other cardiovascular diseases.

Keywords: Unstable plaque, carotid stenosis, embolic shower

O-3-6
Evaluation of cases intimal flap-like findings are observed in the internal carotid artery by duplex carotid ultrasonography with B-flow imaging

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Background: At the duplex carotid ultrasonography (DCU), B-flow imaging (BFI) is useful for detection of intimal flap, blood flow in the false and pseudo-lumen. BFI is also useful for detailed evaluation in the internal carotid artery (ICA) stenosis, because its Blooming artifact is impaired compared to color Doppler imaging. However, an intimal flap or similar structure identified by BFI may be observed in cases without carotid artery dissection. The purpose of this study is to observe characteristics and frequency of the intimal flap like findings by DCU with BFI.

Method: From April 2010 to March 2012, we examined ICA by DCU about 560 vessels of 280 cases. We retrospectively reviewed the recorded BFI images of 541 vessels of the ICA.

Result: Nineteen vessels in 541 vessels (3.5%) showed intimal flap like findings. Two cases have been diagnosed ICA dissection. Other 16 vessels have diagnosed ICA stenosis. In 92 vessels with carotid artery stenosis, peak systolic velocity of ICA was significantly higher in the group with intimal flap findings than without intimal flap (263.8±137.7 vs 174.7±107.7 cm/sec, p = 0.024).

Conclusion: Intimal flap like findings easily be recognized in advanced carotid artery stenosis with a flow rate increased in the vessel at the DCU with BFI. Artifacts due to turbulent flow was considered as a contributor of intimal flap-like findings.

Keywords: B-flow imaging, intimal flap, internal carotid artery dissection

O-3-7
The efficacy of rosuvastatin on carotid intima media thickness

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Purpose: Lipid-lowering therapy with statin has been shown to reduce cardiovascular events and progression of intima-media thickness (IMT) in a large number of studies. However, the progression of IMT in ischemic stroke patients remains unclear. We investigated the effect of rosuvastatin on carotid IMT progression.

Methods: Twenty-three outpatients with ischemic stroke (13...
males and 10 females) were enrolled. All had hypercholesterolemia and were treated with rosuvastatin. Maximum common carotid IMT (C-IMT) was measured by B-mode ultrasonography before and after treatment with rosuvastatin.

**Results:** The average dosage of rosuvastatin was 3.1 mg/day, and the mean observation period was 11.2 months. The reduction of mean LDL cholesterol level was 38.6%, and that of C-IMT was 9.05%.

**Conclusion:** Carotid IMT progression strongly correlated with LDL-C reduction. Furthermore, it was possible that the reduction rate of C-IMT with rosuvastatin treatment was better in Japanese patients than in Caucasian.

**Keywords:** intima media thickness, rosuvastatin, carotid artery

**O-3-8**

**Acceleration time of carotid ultrasonography is even useful parameter for evaluating restenosis after carotid artery stenting (CAS)**

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**Purpose:** The aim of this study was to investigate correlations of diameter stenosis (NASCET method), peak systolic velocity (PSV) and acceleration time (AcT) of carotid ultrasonography, and to identify the characteristic in severe restenosis after CAS.

**Method:** We consecutively evaluated 64 ICAs which were performed CAS. PSV and AcT were measured by using carotid ultrasonography in all cases. AcT was measured at distal ICA adequately away from stent. NASCET was measured in digital angiography in 11 cases.

**Results:** There were significant correlations between PSV and AcT (p value < 0.01, correlation coefficient r =0.51). PSV had a good correlation with NASCET in stented carotid artery (p value= 0.05, r=0.60). PSV of more than 300 cm/s suggested severe stenosis (more than 70%). AcT tended to correlate with NASCET in stented carotid artery (p value= 0.08, r=0.55), and AcT of more than 120 msec suggested severe stenosis. Similarly, AcT of 130 msec suggested severe stenosis in non-stented carotid artery.

**Conclusions:** AcT of 120-130 msec suggested severe stenosis regardless of stent, so it is even available to assess restenosis after CAS.

**Keywords:** carotid artery stenting, severe restenosis, acceleration time

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**Oral Presentations**

**Session 4: Carotid endarterectomy / Carotid artery stenting / Neurosonic surgery**

**O-4-3**

**The utility of transoral carotid ultrasonography before and after carotid artery stenting**

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**Background and Purpose:** Transoral carotid ultrasonography (TOCU) can evaluate the distal extracranial internal carotid artery (ICA) that is invisible on transsurface carotid ultrasonography (TSCU). The aim of this study was to examine the utility of TOCU before and after CAS, that had not yet been evaluated.

**Methods:** Ten consecutive patients who underwent CAS in our hospital from May to December 2009 were prospectively examined. We evaluated the ICA stenotic lesion, the distal extracranial ICA, and stent by TOCU and TSCU within about a month before and after CAS.

**Results:** The average age of the patients was 69 ± 6 (mean ± SD) years, and all the patients were men. Before CAS, a stenotic lesion of the ICA was detected in all the 10 patients by TSCU and in 4 patients by TOCU. In contrast, the distal extracranial ICA was detected only in 4 patients by TSCU but in all the 10 patients by TOCU. Poststenotic blood flow could be assessed by TOCU in 7 patients. After CAS, the proximal edge of the stent was detected in 10 patients by TSCU but not in any patients by TOCU. Conversely, the distal edge of the stent was detected in 2 patients by TSCU and in 10 patients by TOCU. All the poststenotic blood flow velocities were improved after CAS. The combination of TSCU and TOCU could evaluate the proximal and distal edge of the stent, and confirm the absence of thrombosis and restenosis. After CAS, the extracranial distal ICA diameter dilated significantly.
Conclusions: The combination of TSCU and TOCU may be useful for evaluation of ICA before and after CAS.

Keywords: TOCU, CAS, stent

O-4-4
Usefulness and problems of ultrasound guidance by ultrasound technologist for carotid artery stenting (CAS)

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Purpose: The aim of this study was to evaluate the usefulness and problems of ultrasound guidance by ultrasound technologist for CAS and percutaneous transluminal angioplasty (PTA).

Method: We retrospectively evaluated five procedures (four CAS, one PTA) which were performed by ultrasound guidance. We chose the size of devices based on the measurements by pre-procedural ultrasound. During procedure, we performed ultrasound to identify location and direction of devices and change of blood flow by embolic protection device (EPD). After stenting, conditions of stent and vessels were identified.

Results: In all procedures, the measurement by pre-procedural ultrasound was appropriate to choose the size of the device. Intraprocedural ultrasound gave us accurate information of device location, blood flow change by EPD and conditions of more proximal portion of stent and vessels. However, it was difficult to understand device direction, movement and conditions of more distal portion of stent and vessels. Additionally, it spent much time compared to conventional procedure. However, these problems were improved by combining with intravascular ultrasound (IVUS) and fluoroscopy and connecting ultrasound instrument to fluoroscopic system.

Conclusions: Ultrasound guidance by technologist is available for CAS by combining with IVUS and fluoroscopy.

Keywords: carotid artery stenting, ultrasound guidance, ultrasound technologist

O-4-6
Case report: Restenosis in internal carotid artery stent with carotid ultrasonography

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An 86-year-old man was received carotid artery stenting (CAS) on right internal carotid artery (rtICA) and checked whether he has restenosis or not with carotid ultrasonography after 2 year. There was plaque with 1.2mm thickness in rtICA, and appearance of rtICA petrous segment was insufficient with magnetic resonance angiography. 3years later, there was plaque with 2.8mm thickness, velocity was 120cm/s, but stenosis ratio was 72.1% on area method with power Doppler mode ultrasonography. It’s important periodic check whether there is stenosis or not after carotid artery stenting with B-mode and power Doppler mode carotid ultrasonography.

Keywords: carotid artery stenting, carotid ultrasonography, power Doppler mode

O-4-7
Acute contralateral common carotid artery occlusion with oscillating thrombus immediately after intravenous thrombolysis for ipsilateral common carotid artery occlusion with oscillating thrombus: Case report

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An 85-year-old woman was brought to our department because of left hemiparesis two hours after onset. On admission, her NIHSS was 12 point. Computed tomography showed no hemorrhage and frank territorial infarct. Intravenous thrombolysis was started 40 minutes after admission. Diffusion-weighted imaging (DWI) during thrombolysis revealed acute small infarct on the right frontal lobe. Carotid ultrasonography showed oscillating thrombus on the distal segment of the right common carotid artery (CCA). Two hours after the finish of intravenous thrombolysis, she had become comatose state. Emergent carotid
ultrasonography showed oscillating thrombus on the distal segment of the contralateral CCA. We tried to endovascular revascularization for the left CCA occlusion by forced suction technique from guiding catheter and Penumbra system, but failed. Three days after the procedure, she had died because of brain herniation. Oscillating thrombus was reported as a specific finding of acute embolic occlusion of the ICA. We described here for the first time an acute stroke patient with oscillating thrombi on the bilateral CCA. Because of its poor prognosis, patients with early recurrence after thrombolysis might have to be treated with endovascular therapy.

**Keywords:** common carotid artery, oscillating thrombus, intravenous thrombolysis

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**O-4-8**

**Clinical experience of usage of “Flow Insight, a quantitative analysis equipment using of Indocyanine green**

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We experienced the “Flow Insight Ver1.0.0 (Inficom Corporation), a quantitative indocyanine green analysis equipment, with a microscope of M525 OH4 (Leica Microsystems). ICG visualizes the flow of vessels intraoperatively, and furthermore, Flow Insight calculates the blood flow (BF), blood volume (BV) and mean transit time (MTT) in the region of interest (ROI) which we can freely draw in an operative field on personal computers during operation. These values are calculated ones, so we measure the real quantitative flow of superficial temporal arteries (STA) by an ultrasonic blood flowmeter, HT 300 series (Transonic Japan Inc.) and we determine the transform coefficients between virtual (calculated) BF and actual BF in the ROI on the STA. We assume that the transform coefficients is applied in the every area in the operative field. Finally, we can know the calculated BF, BV and MTT on a ROI by applying the transform coefficients. Dates we gained are not enough and it needs futher investigations to evaluate the accuracy of the hypothesis and cerebral blood flow dates.

**Keywords:** Indocyanine green, transform coefficients, quantitative analysis

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**O-4-9**

**How to classify the type of probe intraoperatively**

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**Background:** Intraoperative ultrasound is very useful in neurosurgery to operate a safety surgery. We use three type of probe, burr hole type sector probe, micro-convex probe and linear probe to accurately diagnose with ultrasound.

**Methods:** We enrolled patients who underwent neurosurgery with ultrasound in our hospital between November 2012 and January 2014. Three type of probe were introduced according to the operation mode.

**Results:** Eighty patients were included, 45 patients with burr hole type sector probe, 31 patients with micro-convex probe and 4 patient with linear probe. Sector probe was mainly introduced for burr hole surgery. Micro-convex probe was introduced for craniotomy such as a removal of tumor. Linear probe was used to distinguish tumor or contusion from normal brain.

**Conclusion:** Considering specificity of each probe, intraoperative ultrasound in neurosurgery could indicate useful information.

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**O-4-10**

**The usefulness of sonographic study on the patients with cerebral aneurysm**

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**Purpose:** The interesting sonographic findings of aneurysm (An) were examined using QLAB that is the analysis software.

**Results and Discussion:** The B-mode of An findings provide us a lot of the interesting findings as follow. The unruptured An was observed over the entire circumference as a thin wall. The ruptured An was observed the lost thin wall with thrombus cap at the ruptured points, the disappearance or attenuation of the An wall, the blood flow signal loss in CFM and the blood flow changings (platelet derived micro particles) in the aneurysmal interior by B-mode after An or the parent artery clippings. Fur-
thermore the An observation from any direction are possible by 3D analysis from the volume data, it is useful as an intraoperative navigational. We have experienced a case that PI revealed the impaired blood flow after the clipping, so we have tried the rec​clipping preventing the occurrence of complication. The functional and organic assessments of the surrounding tissue by PI are possible using the data before image processing by QLAB. The intraoperative US has a possibility that substitute for the CT and MRI.

Keywords: Aneurysm, B-mode, Aneurysmal wall

Oral Presentations
Session 5: Cardiac and/or aortic lesion

O-5-1
Floating thrombus in the ascending aorta as a potential embolic source in a patient with cerebral embolism

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Purpose: In addition to atrial fibrillation, plaque lesions in the aortic arch account for cardiogenic cerebral embolism (CE).

Case report: 59-year-old man presented with difficulty in speech and dragging of the right leg in the morning. He had been treated for idiopathic dilated cardiomyopathy. The patient showed disturbance of consciousness (JCS I-2) and right hemiparesis. Diffusion-weighted MRI of the brain showed fresh infarcts in the left thalamus, left subcortical parietal lobe and right cerebellar hemisphere. Electrocardiogram revealed sinus rhythm. Mild atherosclerotic changes were observed by carotid artery ultrasonography. Transthoracic echocardiogram revealed a normal cardiac function (ejection fraction, 69%) without left ventricular asynergy. However, a mobile, pedunculated structure (20 x 5 mm) in the ascending aorta was detected. No left atrial thrombus was found by transesophageal echocardiogram. Neither decrease in left atrial appendage blood flow velocity nor right to left shunt was detected. Intravenous heparin administration did not decrease the size of thrombus, and surgical thrombectomy was performed, revealing a pathologically organized thrombus in the lumen.

Conclusion: We report a patient with CE due to floating thrombus in the ascending aorta. A detailed investigation for possible embolic source including the aorta is important in patients suggestive of CE.

Keywords: ascending aorta, embolic source, floating thrombus

O-5-2
Relationship between carotid artery diameter and aortic aneurysms -second report-

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Purpose: Diameter measurement of inner and outer membrane of common carotid artery (CCA) is useful for diagnosing thoracic and abdominal aortic aneurysm (AA); however, it is unclear which measurement is more reliable.

Methods: We evaluated 52 AA patients (AA group) and 52 controls (NC group). External and internal diameters of CCA during diastolic phase were measured. Mann-Whitney U test and logistic analysis were used for statistical analysis, and ROC curve was employed to evaluate optimal sensitivity and specificity for diagnosing the co-morbidity of AA.

Results: In AA group, prevalence rates of hypertension and dyslipidemia were higher than NC group. With regard to findings of ultrasonography, all diameters were significantly larger in AA group than NC group. In a logistic analysis, hypertension, dyslipidemia and diameter of outer membrane of right CCA were associated with the presence of AA. Based on ROC curve analysis, the area under curve of the right CCA external diameter was 0.710. The sensitivity and specificity using a cutoff level of 8.5 mm were 65.4% and 65.4%, respectively, and using a cutoff level of 9.0 mm were 51.9% and 86.5%, respectively.

Conclusions: Our findings suggest that the increased right side external diameter of CCA is associated with AA co-morbidity.

Keywords: common carotid artery diameter, aortic aneurysm, carotid ultrasonography
O-5-3  
Clinical features of stroke caused by pulmonary arteriovenous fistula (PAVF) detected only in Transesophageal Echocardiography (TEE)

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Background: Even if PAVF is doubted in TEE, sometimes it is difficult to prove by detailed examination such as contrast-enhanced CT (CECT).

Patients and Methods: We investigated clinical features of 19 ischemic stroke patients (14 male; mean age, 60.8) suspected PAVF in TEE but not proved in added examination. Patients with af, aortic atherosclerosis, ipsilateral carotid or intracranial stenosis and other risk of stroke, were excluded.

Results: The details of infarct region were 12 in middle cerebral artery, 2 in posterior cerebral artery, 1 in vertebral artery, 3 in multiple arterial sites, and 2 undetermined. We added CECT to 17 patients (3D CT reconstruction to 7 of them), ventilation/perfusion lung scintigraphy to 1, and contrast-enhanced MRI to 1. The modified ranking scale (mRS) at discharge was 0 in seven patients, 1 in six, 2 in one, 3 in four patients. The mRS of one patient who complicated Wernicke’s encephalopathy was 4. Contrastively, outcome of two cases which PAVF was detected in CECT, were 2 and 5 in mRS.

Conclusion: Patients not proved PAVF tended to have better outcome than them proved. These findings may be very small PAVF. We will continue to consider that matter.

Keywords: ischemic stroke, pulmonary arteriovenous fistula, Transesophageal Echocardiography

O-5-4  
Influence of cilostazol on left ventricular contraction

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Purpose: Positive effect are observed on protect for re-attack of cerebral infarction with cilostazol, positive chronotropic and inotropic effects of cilostazol are often lead to progress left ventricular contraction and intraventricular outflow velocity, but not all. We studied to clarify to influence of cilostazol on left ventricular contraction.

Method: We studied 256 patients with administration of cilostazol to prevent re-attack of cerebral infarction. Left intraventricular outflow velocity, hyperkinetic motion and other parameters were assessed by echocardiography, and heart rate(HR) at rest was checked.

Results: HR was 73 ± 14/min, there ware 53 patients over 85/min (20.1%), ejection fraction was 0.676 ± 0.141, there ware 56 patients over 0.75 (21.9%). Over 1m/s of left intraventricular outflow velocity was in 49patients(19.1%), over 1.5m/s was in 26patients(10.2%), max velocity was 3.6m/s. Hyperkinetic motion and left ventricular obstruction on systolic phase were in 4 (1.6%) patients. On multivariate analysis, interventricular septal thickness, sex(femal) ware significant to high left intraventricular outflow velocity (p<0.05), HR was significant to hyperkinetic motion (p<0.05), sigmoid septum, antiarrithmia drugs nor drugs bradycardia induced were not significant.

Conclusion: We conclude that echocardiography have to performed to assess left ventricular contraction with administration of cilostazol, especially in female and patients with tachyadria.

Keywords: cilostazol, Left ventricular contraction, Echocardiograph

O-5-5  
Ultrasonographic evaluation of aortic regurgitation using velocities of carotid artery

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Purpose: In Aortic valve disease, abnormal patterns of blood flow velocity waveform of carotid arteries are reported. Increased acceleration time and decreased end-diastolic velocity (EDV) are observed in patients with aortic stenosis (AS) and in patients with aortic regurgitation (AR), respectively. In this study, we evaluated the influence of the presence of AR on common carotid artery (CCA) waveforms.

Methods: Carotid ultrasonography and transthoracic echocardiography were performed in 43 subjects. According to the re-
sults of transthoracic echocardiography, the subjects were classified into the following categories: 1) control group (no aortic valve disease); 2) moderate to severe AR group and; 3) moderate to severe AS group. The differences in peak systolic velocity (PSV) and EDV of CCA were then compared.

**Results:** There were no differences in age and sex among the groups (control group, n=18, mean age 65.4 years; AR group, n=12, mean age 67.3 years; AS group, n=13, mean age 76.2 years). CCA-EDV significantly decreased in AR group (4.9 cm/sec), when compared to AS group (11.7 cm/sec) and control group (12.8 cm/s). No between-group difference was found in CCA-PSV.

**Conclusions:** Decreases in bilateral CCA-EDVs may be suggestive of the presence of AR, reflecting the return flow to the heart.

**Keywords:** carotid ultrasonography, aortic regurgitation, end diastolic velocity

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O-5-9
**Stroke patients with atrial fibrillation who had left atrial thrombus are likely to have increased recurrence in long term**

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**Purpose:** This study retrospectively investigated the long term recurrence in stroke patients with atrial fibrillation (AF) who had left atrial thrombus (LAT).

**Methods:** We enrolled 359 consecutive stroke patients with AF less than 7 days after onset who had undergone tranesophageal echocardiography. Patients were divided into LAT and non-LAT groups based on the presence or absence of LAT. We compared clinical background, neurological findings, imaging findings and stroke recurrence within 3 years of discharge between the two groups.

**Results:** We classified 59 patients into the LAT group and 300 patients into the non-LAT group. Median age of the LAT and non-LAT groups was 78 and 76 years, respectively (p=0.57). The proportion of patients with maximum diameter of cerebral infarction ≥3 cm was greater in the LAT group (61%) than in the non-LAT group (37%; p=0.02). The recurrence rate (RR) during hospital stay was 3.4% vs. 7.3% (p=0.40). However cumulative RR during the 3-year period after discharge was significantly higher in the LAT group (25%) than in the non-LAT group (12%; HR, 2.61; p=0.03).

**Conclusion:** Compared with patients without LAT, stroke patients with AF who had LAT are more likely to have recurrence in long term, but not in short term.

**Keywords:** Transesophageal echocardiography, Left atrial thrombus, Stroke recurrence

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O-6-1
**Relation between ultrasonographic peripheral nerve size and findings of nerve conduction study in patients with chronic inflammatory demyelinating polyneuropathy and diabetes mellitus**

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**Objective:** We evaluated the relationship between ultrasonographic peripheral nerve size and findings of nerve conduction study (NCS) in patients with chronic inflammatory demyelinating polyneuropathy (CIDP) and diabetes mellitus (DM).

**Methods:** We examined 14 CIDP patients (33-85 years, five females) and 17 DM patients (52-89 years, six females). The cross-sectional area (CSA) was measured at multiple sites along the median and ulnar nerves as previously described (Sugimoto et al. J Neurol 2013; 260:2580-7). The distal latency (DL), distal compound muscle action potential (dCMAP), proximal compound muscle action potential (pCMAP) and motor conduction velocity (MCV) were measured.

**Results:** There were 16 median nerves and 15 ulnar nerves evaluated in CIDP patients and 33 median nerves and 33 ulnar nerves evaluated in DM patients. CSA (6-18mm²) at the carpal tunnel inlet along the median nerve was positively associated with DL (3.1-15.5ms) in CIDP patients (r²=0.54, p<0.01). CSA (4-20mm²) at the elbow along the ulnar nerve was negatively associated with pCMAP (0.75-9.72mV) in CIDP patients (r²=0.32, p<0.05). CSA (5-12mm²) at the elbow along the ulnar nerve was negatively associated with pCMAP (0.80-15.30mV)
in DM patients ($r^2=0.13$, $p<0.05$).

**Conclusion:** The relationship between the CSA and NCS findings depends on the type of disease and the site of evaluation.

**Keywords:** cross-sectional area, nerve conduction study, chronic inflammatory demyelinating polyneuropathy

### Oral Presentations

**Session 7: Embolus and blood flow wave form**

**O-7-1**

Quantitative evaluation of factors affecting cerebral blood flow in newborn infant

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**Purpose:** It is important to evaluate cerebral blood flow to diagnose asphyxia or to predict prognosis of a newborn. On the other side, cerebral blood flow is influenced by ductal shunt in a newborn infant. We quantitatively evaluate the influence of ductal shunt and other factors to cerebral blood flows in newborn infants.

**Methods:** Eligible for inclusion in the study were 133 infants without major cardiac malformations whose blood flow velocity curves of internal carotid artery (CA) and left pulmonary artery (LPA) were recorded by pulsed Doppler ultrasonography on the first day after birth. Systolic maximal velocities (CAS, LPAS) and end-diastolic velocities (CAD, LPAD) were measured in CA and LPA, respectively, and RI, PI and LPAD/LPAS were calculated. Apgar scores at 1 and 5 minutes after birth, base excess, pCO₂ and CK of blood samples were also examined.

**Results:** LPAD/LPAS has positive correlation to RI ($r=0.21$). Apgar scores and CK have negative correlation to RI.

**Conclusions:** Ductal shunt is approved one of the factors affecting cerebral blood flows. We must consider quantitative ductal shunt when we evaluate cerebral blood flow in newborn infants.

**Keywords:** Cerebral blood flow, ductal flow, newborn infant

**O-7-2**

A case of hereditary hemorrhagic telangiectasia complicated with paradoxical cerebral embolism by post-operative recurrent pulmonary arteriovenous fistula

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**Introduction:** Echo intensity is important finding in muscle echo, but echo intensity is relative finding that changes by changing the gain, sensitivity time control and angle of the probe.

**Methods:** When we captured the target muscle, we also captured examiner’s biceps as the control muscle by the same conditions. And we displayed on the two screens [dual screen method]. We also captured by conventional methods [single screen method]. We measured using pixel values of the histogram of the adobe photoshop elements (intensity) a captured image. We measured the difference of the intensity of target muscle and control muscle. We measured in a similar method for the single screen method.

**Subjects:** We examined the echo images of ten disease muscles and ten normal muscles as target muscles.

**Results:** By the dual screen method the muscle intensity for the muscle disease patients in the pixel value (20.0 ± 21.2) was significantly higher than normal control (-19.8 ± 13.9) ($p=0.007$). By the single screen method the muscle intensity for the muscle disease patients in the pixel value (49.8 ± 14.9) was also significantly higher than normal control (35.0 ± 12.3) ($p=0.047$).

**Discussion:** We cannot show the usefulness of the dual screen method.

**Keywords:** muscle echo, echo intensity, control muscle
**O-7-3**

**A case of reversible cerebral vasoconstriction syndrome with multiple high-intensity transient signals in transcranial Doppler**

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We describe a 49-year-old female presenting with sudden onset of severe headache as the chief complaint. Brain magnetic resonance angiography (MRA) demonstrated multisegmental vasoconstriction of cerebral arteries; brain magnetic resonance imaging (MRI) indicated a normal cerebral parenchyma. Transcranial color-flow imaging (TC-CFI) demonstrated flow velocity elevation in bilateral middle cerebral arteries (MCA). While monitoring the region of vasoconstriction in the right MCA, transcranial Doppler (TCD) detected 11 High-intensity transient signals (HITS) during 30 min. Improvement of multisegmental vasoconstriction was observed MRA 6 weeks after onset. Therefore we diagnosed a reversible cerebral vasoconstriction syndrome (RCVS). Only one HITS was detected during a 30-min TCD, 10 weeks after onset, no HITS have been detected on TCD since then. At approximately 10 weeks, TC-CFI still showed elevation of the flow velocity in MCAs despite the improvement of vaso­spasm on MRA. Since then, the flow velocity gradually im­proved. This case is noteworthy because no other cases of HITS has been detected at RCVS. TC-CFI is useful for RCVS diagno­sis because of the elevation of the flow velocity of intracranial ar­teries, despite unclear vasospasm on MRA.

**Keywords:** Pulmonary arteriovenous fistula, Paradoxical cerebral embolism, Transcranial Doppler

**O-7-4**

**An early experience with the novel ultrasound Doppler machine for microembolus detection from the cervical arteries**

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**Purpose:** We report an early experience with the novel ultrasound Doppler machine for microembolus detection from the cervical arteries which has been developed by the program supported by the Ministry of Economy, Trade and Industry.

**Method:** We studied 15 patients (6 with right-to-left shunts (RLS), 11 with proximal lesion such as arch atheroma or proximal CCA stenosis, and 2 with both of them using this machine. We tried to monitor Doppler spectrum from the unilateral CCA, to detect contrast MES (cMES) from patients with RLS for 90 seconds after contrast injection for several times, to detect MES from patients with the proximal lesions for 10 minutes, to find problems with this machine.

**Results:** We could monitor Doppler spectrum from all patients and the mean required time was 10.3 minutes. We detected cMES from 4 patients, but the automated MES detection software in this machine didn't work. We couldn't detect MES from all patients. We found several problems.

**Conclusions:** We plan to solve the problems sequentially and propose to call this machine FURUHATA (FUtuRe Ultrasound HAMonic Thromboembolus Analyzer), with respect for Dr. Hiroshi Furuhata who greatly contributed to the development of this machine.

**Keywords:** TCD, microembolic signals, the cervical arteries
O-8-1

Association of interleukin-6 with the progression of carotid atherosclerosis

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Background and Purpose: Limited information is available on the long-term effects of interleukin-6 (IL-6) on atherosclerosis. The purpose of the present study was to clarify the relationship between chronic elevation of IL-6 and the long-term progression of carotid atherosclerosis.

Methods: We prospectively evaluated 210 patients with vascular risk factors for 9.0 ± 1.0 years. Carotid mean-maximal intima-media thickness (mmIMT), the serum high-sensitivity C-reactive protein (hs-CRP) level, and the serum IL-6 level were measured at baseline and every 3 years. The associations between the progression of mmIMT and the long-term average levels of hs-CRP and IL-6 were analyzed.

Results: Carotid mmIMT increased throughout the study period (0.031 ± 0.026 mm/year). Progression of mmIMT was positively correlated with average hs-CRP (p = 0.001) and average IL-6 (p < 0.001) levels. When adjusted for age, sex, traditional risk factors, and baseline mmIMT, mmIMT progression remained significantly associated only with the average IL-6 level (standardized β=0.17, p=0.03), but not with the average hs-CRP level (standardized β=0.09, p=0.23).

Conclusions: Chronic elevation of serum IL-6 was closely associated with the progression of atherosclerosis in patients with vascular risk factors. IL-6 could be used as a quantitative marker and a potential therapeutic target for accelerated atherosclerosis.

Keywords: atherosclerosis, inflammation, interleukin-6

O-8-2

Association between Carotid Stenosis and Incident Dementia in Patients with Vascular Risk Factors

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Background: The association between vascular risk factors and dementia is of interest. However, the significance of cerebral large vessel disease (LVD) on dementia development has not been thoroughly examined.

Methods: OSACA2 was a prospective cohort study of cardiovascular events and dementia in which patients (n=1106) with vascular risk factors underwent carotid ultrasound. Of these patients, 600 who received brain magnetic resonance imaging (MRI) and had normal cognitive function were included in this study. The presence of carotid stenosis served as a marker of LVD.

Results: Among 600 subjects (mean: 68 years, male: 57%), 94 patients (16%) showed carotid stenosis. During the follow-up period of median 8.0 years, 57 patients had incident dementia. Patients with carotid stenosis were significantly more likely to be diagnosed with dementia (Log-rank test: p=0.037). However, the presence of carotid stenosis was not associated with incident dementia after adjusting for age and sex (p value=0.477).

Conclusions: This study demonstrated that carotid stenosis had little association with developing dementia.

Keywords: Carotid stenosis, dementia, cohort study

O-8-3

A regional, prospective observational study of subjects at risk of atherothrombosis in Tohoku

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Purpose: The TOHOKU Registry Working Group is compiling a TOHOKU area data set to extend our knowledge of atherothrombotic risk factors, carotid atherothrombotic lesions, and ischemic events in the outpatient setting.

Subjects: Patients living in the TOHOKU area, which consists of 6 prefectures (Aomori, Iwate, Akita, Miyagi, Yamagata, and Fukushima), ≥45 years old, and with at least 3 atherothrombotic risk factors or documented cerebrovascular, coronary artery, or peripheral arterial disease, were enrolled.
Methods: Medical history, risk factors, demographic information, and patient management information are currently being collected. Carotid ultrasonography, ankle-brachial pressure index (ABI) and serologic tests were performed at baseline and will be measured after 1 and 3 years. Clinical events that occur during the follow-up period of up to 3 years will also be recorded.

Results: A total of 1167 outpatients were recruited (male:female, 837:330), with a mean age of 70±9 years. Patient profile at baseline showed atherothrombotic risk factors of hypertension in 917 patients (78%), dyslipidemia in 600 (60%), diabetes in 366 (31%), hyperuricemia in 145 (12%), and renal dysfunction in 96 (8%). At baseline, 804 patients (64%) had cerebrovascular disease, 107 (8%) had coronary artery disease, 77 (6%) had peripheral arterial disease and 260 (21%) had at least 3 atherothrombotic risk factors. Mean maximum intima-media thickness by carotid ultrasonography was 1.99±1.05/2.03±1.05 mm (right/left), and mean ABI was 1.10±0.13/1.09±0.13 (right/left).

Conclusion: The TOHOKU Registry offers an opportunity to provide a better understanding of the prevalence and clinical consequences of atherothrombosis among outpatients in the TOHOKU area.

Keywords: atherothrombosis, Tohoku

O-8-4
Evaluation of factors related to the maximal intima-media thickness of the common carotid artery in Tochigi prefecture citizens

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Purpose: We investigated carotid artery lesions in residents in Tochigi prefecture where mortality rate of stroke is high.

Method: Among 191 individuals who underwent carotid ultrasonography in the health festival held in cities and towns in Tochigi prefecture, 181 individuals completed the questionnaires. The questionnaires consisted of age, gender, risk factors for stroke and medication use. Carotid ultrasonography was performed in the sitting position, and maximum intima-media thickness of the common carotid artery (IMT-Cmax) was measured. For statistical analysis, Spearman’s rank-correlation coefficient was used to evaluate a correlation between IMT-Cmax and clinical factors and a logistic regression analysis was performed to determine contributing factors to IMT-Cmax >1.0mm.

Results: The average of IMT-Cmax was 0.79mm. IMT-Cmax correlated significantly with age, gender, diabetes mellitus with ongoing treatment and antiplatelet therapy (p<0.05). In logistic regression analysis, undertreated diabetes (p=0.01 Odds ratio 11.5) was significant determinants of IMT-Cmax>1.0mm.

Conclusion: In our study, the most contributing factor to increased IMT-Cmax in Tochigi prefecture was undertreated diabetes. Based on our study results, a regular diabetes check-up is important not only in managing blood glucose levels but also in preventing complications of diabetes including stroke.

Keywords: Maximal intima-media thickness. Tochigi prefecture. Diabetes

O-8-5
Clarification of the factors exerted on the thickening of the carotid intima-media thickness

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Purpose: Aimed to clarify the factors that may influence on the average IMT’s thickening.

Method: Subjects are 730 patients (male: 403) with plaque score 5 and less who had been seen at Toho University Omori Medical Center during 2005 to 2008. The average IMT was sought by measuring 3 areas without plaque by using carotid echo. The factors we compared were: age, BMI, systolic blood pressure, diastolic blood pressure, cardio-ankle vascular index, average maximum IMT of left and right and plaque score.

Results: The average IMT was: IMT = 0.463 + 0.00343 × age. In terms of IMT thickening cases, there were 93 cases of + 0.1mm thicker than the age average value. 543 cases of the age average value that were less than ± 0.1mm were observed, and 94 cases with thinning IMT by 0.1mm and more were observed. The standard partial regression coefficient of IMT average sought by multivariate analysis was: 0.314 at plaque score, 0.283 at age, 0.138 at BMI, 0.113 at systolic blood pressure, and 0.112 at cardio-ankle vascular index.

Conclusion: IMT thickening is more affected by atherosclerosis, age and BMI, and it is thought that the blood pressure measured at the time and the stiffness of the aorta were not much of influence.
Keywords: cardio-ankle vascular index, IMT, stiffness

O-8-8
The calf deep vein thrombosis as a risk factor for cerebral infarction following the disaster

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Purpose: To investigate the medium to long term prevalence of deep vein thrombosis (DVT), which had been reported as the risk for cerebral infarction, in victims in Ishinomaki city after the Great East-Japan earthquake.

Methods: The residents in temporary emergency accommodations and own housings in the tsunami-flooded area were examined their calves using ultrasonography. The changes in the prevalence of DVT since the earthquake were also investigated.

Results: The prevalence of DVT in the residents in temporary emergency accommodations was increased from 7.3% to 14.3% (at one and two-year after the quake, respectively, P<0.01). That in own housings, where was thought to have better living condition than those accommodations, was 8.0% and 10.8% (not significant). The victims with calf DVT was significantly older than that without DVT (72.5 ± 8.7 and 68.6 ± 9.8 years-old, respectively, P<0.01)

Conclusion: The prevalence of DVT in victims was not improved during a year both in those accommodations and own housings, which indicates that the living conditions of victims might not affect the long term prevalence of DVT. The elders were reported to loose their mobility in those accommodations and indicated high prevalence of DVT. Therefore, immobility was supposed to cause DVT in the elder victims in long term after disaster.

Keywords: deep vein thrombosis, earthquake, temporary emergency accommodation

O-9-2
Predictive factor of basilar artery stenosis in ultrasonography -2nd report-

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Purpose: Time averaged maximum velocity of vertebral artery (TAMV) less than 18cm/s has been suggested as hypoplasia or occlusion of distal side of vertebral artery (VA). We have found 30% of patients with bilateral VA-TAMV < 18cm/sec had basilar artery (BA) stenosis.

Methods: According to the results of ultrasonography, the subjects were classified into the following groups: 1) both side group (n=92, bilateral VA-TAMV < 18cm/sec); 2) one side group (n=25, unilateral VA-TAMV < 18cm/sec); 3) control group (n=30, bilateral VA-TAMV > 18cm/sec). We evaluated a relationship between TAMV and BA stenosis.

Results: In both side group (n=92), 30 subjects had BA stenosis. No BA stenosis was found in one side group and control group. TAMV and end diastolic velocity (EDV) tended to decrease in BA stenosis subjects in both side group. A similar trend was observed for TAMV and EDV in BA stenosis subjects in acute ischemic stroke group (n=48). Based on the ROC curve analysis for diagnosis of BA stenosis (≥50%) in acute ischemic stroke group, the sensitivity and specificity of the TAMV using the cutoff point of 13.8cm/sec were 85.0% and 60.7%, respectively.

Conclusion: Decreases in bilateral VA-TAMV can be the predictive factor of BA stenosis.

Keywords: carotid ultrasonography, vertebral artery, basilar artery stenosis
O-9-3
Relationship between acceleration time and vertebral artery stenosis -the 3rd report-

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Purpose: Increased acceleration time (AcT) is thought to reflect stenosis at the origin of artery. We have reported that ipsilateral vertebral artery origin (V0) stenosis (≥50%) was the most significant determinant of increased AcT of vertebral artery (VA). In this study, we evaluated a diagnostic accuracy of VA-AcT ratio for V0 stenosis.

Methods: Carotid ultrasonography and cerebral digital subtraction angiography (DSA) were performed in 82 stroke patients (151 vessels) admitted to our hospital. By using the ultrasonography, we measured AcT of VA and common carotid artery (CCA), and calculated VA-AcT ratio (VA-AcT divided by ipsilateral CCA-AcT). V0 stenosis was diagnosed by DSA findings using ECST method. We performed ROC curve analysis to evaluate the optimal cut-off of VA-AcT ratio for diagnosing V0 stenosis.

Results: Stenosis at V0 portion was observed in 40 vessels, 15 of which had stenosis greater than 50%. A positive correlation was found between VA-AcT ratio and V0 stenosis (p<0.01). Based on the ROC curve analysis for diagnosis of V0 stenosis (≥50%), the sensitivity and specificity of the VA-AcT ratio using the cut-off point of 1.25 were 93.3% and 88.2%, respectively.

Conclusions: VA-AcT ratio is a useful method for diagnosis of VA origin stenosis.

Keywords: carotid ultrasonography, vertebral artery stenosis, acceleration time

O-9-4
An unusual case of repetitive ischemic stroke by iatrogenic vertebral artery injury after cervical spine surgery

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A 55-year-old Japanese man with a number of recurrence of stroke was transferred to our hospital. He underwent cervical spine surgery for cervical spondylotic myelopathy secondary to cerebral palsy, with insertion of multiple pedicle screws into his cervical vertebrae, being connected with rods. At five months after the surgery, he was admitted to the previous hospital with newly-onset infarcts at bilateral occipital lobes. Despite multiagent antithrombotic therapy, posterior-circulation infarcts recurred four times during the following three months. Duplex ultrasound (DUS) examination of left vertebral artery (VA) showed normal flow velocity at the neutral supine position but deceleration of end-diastolic flow velocity at the hyperextended neck position. Vertebral angiogram at the hyperextended neck position revealed that the left VA was wedged between the rod and bony structure of the cranial base to be blocked at the V3 segment. A pseudoaneurysm considered an embolic source was opacified at the affected site. We performed endovascular trapping of left VA at V4 segment using multiple platinum coils. During the following eight months, he was free from a recurrent stroke. DUS was of much value in the diagnosis and management of this rare disorder due to intermittent compression of the VA after cervical spine surgery.

Keywords: cervical spine surgery, posterior-circulation infarct, hyperextended neck position

O-9-5
Evaluation of rotational vertebral artery occlusion using ultrasound facilitates the detection of arterial dissection in the atlas loop

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Purpose: Head rotation can cause occlusion of the vertebral artery most commonly at the atlas loop, and repetitive compression from head turning induces vertebral artery dissection (VAD). Although ultrasound examinations are useful in diagnosis, dissected lesions unaccompanied by hemodynamic changes can be overlooked. Because the narrowed, dissected vessel in the atlas loop may cause rotational occlusion, we confirmed whether adding submaximal head rotation to a cervical ultrasound examination would facilitate the detection of VAD in the atlas loop.
Methods: We investigated seven patients who developed infarction in the posterior circulation and were clinically suspected of VAD. Using a 7.5-MHz linear probe, we recorded the waveform of the vertebral artery at the C4 to C6 level and diagnosed rotational vertebral artery occlusion (RVAO) when head rotation induced the disappearance of end-diastolic flow.

Results: All three patients with VAD in the atlas loop demonstrated RVAO of the dissected vertebral arteries in the acute stroke phase. RVAO was not observed in the dissected vertebral arteries excepting the atlas loop, nor in the non-dissected vertebral arteries of any patients.

Conclusion: For posterior circulation stroke patients, adding submaximal head rotation to the cervical ultrasound examination facilitated the detection of VAD in the atlas loop.

Keywords: rotational vertebral artery occlusion, vertebral artery dissection, atlas loop

O-9-7
Vertebrobasilar Autoregulation during Postural Changes

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Objective: To clarify autoregulation mechanism in the vertebrobasilar artery (VBA), continuous monitoring of transcranial color duplex sonography (TCDS) was evaluated during postural changes.

Methods: Subjects were five normal adults and seven patients; three dizziness, two hypertension, one lacunar infarction (LI) with diabetes mellitus, and one spino-cerebellar degeneration (SCD). TCDS with the transducer holder Sonopod in the intracranial VA or BA and blood pressure (BP) were monitored continuously. During two series of postural changes (supine or sitting to/from standing), a) clinical symptoms, b) BP: systolic, mean, and diastolic pressures (SBP, MBP, and DBP), c) TCDS: Time-averaged maximum velocity (Vmax), pulsatility index (PI), estimated cerebrovascular resistance (cCVR) = MBP/Vmax, and autoregulation index (ARI) = (ΔcCVR/ΔMBP) were evaluated.

Results: a) Symptoms: Dizziness resulted in an inability to remain standing in two (LI and SCD) patients. b) BP changes: DBP>10mmHg in all cases. SBP>20mmHg in 2 control subjects and all but one patient (CD), but hypotension during standing only in 1 SCD patient. c) TCDS: Tendencies of increased ΔcCVR and ΔPI were observed in the two symptomatic patients. ARI was variable during each series in both normal subjects and patients.

Conclusion: Variability of vertebrobasilar autoregulation during postural changes is probably relevant to autonomic dysregulation.

Keywords: Transcranial color duplex sonography, Vertebrobasilar autoregulation, Postural changes

O-9-8
Sonographic observation of the larynx - the around parts of arytenoid cartilage -

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Purpose: Sonographic assessment of laryngeal movement

Method and Subjects: The subjects were 83 cases. The instrument was HDI 5000(PMS) and a linear probe (L12-5). We were observed larynx by B-mode and analyzed the pre-processing data by QLAB.

Results and Discussion: The VF and VE are usually used the evaluation of swallowing disturbance, but they observe only the interior structure. That is one-side, so we need the swallowing assessment of the outside structures by US. On the normal swallowing patterns of larynx by B-mode, they move simultaneously. But on the patients with dysphagia, the movement was saccadic, no simultaneous or dyskinetic movement. Furthermore contrast sonographic swallowing test was observed contrast agent appearances before swallowing and the abnormal existence of remnants on the patients with dysphagia.

Vocal cords, cartilago arytenoidea, thyreoidea and cricoidea closely related to the main tissue of laryngeal movement. The axial B-mode images of CA showing that the vocal movement linked with abduction and adduction of CA. The sagittal B-mode images of CA showing the sliding up and down of CA on the swallowing movement. But they're weak or abnormal movement on the patients with dysphagia by CVD. In addition, we studied the impedance changes of tissue related to the movements by QLAB.

Keywords: Larynx, swallowing, Ultrasound sonography
A case of incidental thrombus in carotid vein detected by carotid echocardiography

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Purpose, Methods and Results: A 63-year-old man had an open abdominal drainage for the treatment of peritonitis caused by a perforation of colon diverticulum, he was also diagnosed diabetes and dyslipidemia. He underwent a carotid echocardiography for the assessment of atherosclerosis, and a movable carotid vein thrombus was found incidentally. No thrombus was found in left atrium and lower extremities. After the diagnosis of carotid vein thrombosis, he started warfarin therapy and carotid echocardiography was used for the follow up assessment.

Conclusions: Carotid echocardiography was quite useful for the detection and follow up assessment of carotid vein thrombosis.

Keywords: carotid echocardiography, carotid vein thrombosis, mobility