

# Abstracts of Outstanding Presentations of the 77th Annual Meeting of the Medical Association of Nippon Medical School

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## Abstracts of Outstanding Presentation (I)

### Detection of Right-to-Left Shunt by Transthoracic Echocardiography

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#### Introduction

Paradoxical embolism via a cardiac right-to-left shunt (RLS) is a well-recognized cause of ischemic stroke<sup>1</sup>. Transesophageal echocardiography (TEE) enhanced by intravenous injection of agitated saline mixed with air is considered the “gold standard” for detection of RLS<sup>2</sup>. A shunt is confirmed when there is rapid detection of the passage of microbubbles to the left side of the heart. However, RLS detection using TEE is accompanied by distress to the patient and it is difficult to perform this procedure for all patients with ischemic stroke. However, transthoracic echocardiography (TTE) is a safe and non-invasive procedure. We prospectively performed TTE in acute ischemic stroke patients on admission and elucidated the clinical characteristics.

#### Subjects and Methods

Study subjects were 115 consecutive patients demonstrating acute ischemic stroke and TIA who were admitted to our Stroke Care Unit (SCU) between February and July 2009. We performed TTE in all patients to identify the presence of RLS screening on admission. TTE was done with an ultrasonography device (LOGIQ 6S General Electric Inc., USA) with a 2-MHz transducer.

The TTE study was performed by mixing saline solution (9 mL), air (1 mL) and one drop of diazepam in a syringe with a 23-G needle. This mixture was then agitated by repeatedly transferring it between two 10-mL syringes connected via a 3-way stopcock. An indwelling catheter was placed in the anterior cubital vein. Seven milliliters of saline containing bubbles was then injected under 2 conditions: 1) without Valsalva maneuver (monitoring the interval from the injection of saline containing bubbles until the bubbles occupied the right ventricle); 2) with Valsalva maneuver at the start of injection. Patients were trained in the Valsalva maneuver before the procedure. The study was considered positive if microbubbles were visualized in the left ventricle transiting from the right atrium (**Fig. 1**). If the patient displayed RLS, venous ultrasonography was performed to assess deep venous thrombosis (DVT) on the day of admission.

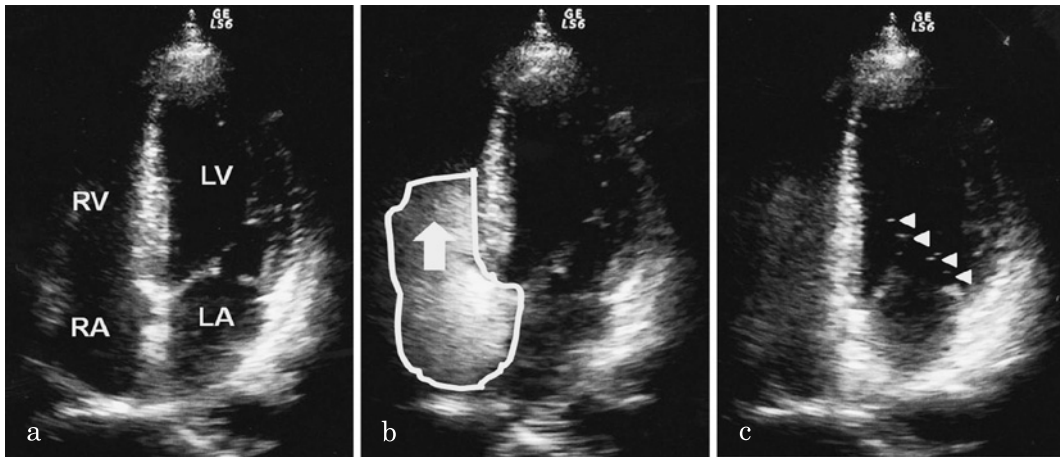


Fig. 1 Contrast echo study with TTE.

- a: Baseline image showing right atrium (RA), left atrium (LA), right ventricle (RV) and left ventricle (LV).
- b: **Arrow** demonstrates agitated saline reaching the RA and RV.
- c: **Triangles** demonstrates passage of bubbles to LA and LV detected within 3 heart cycles after injection of agitated saline.

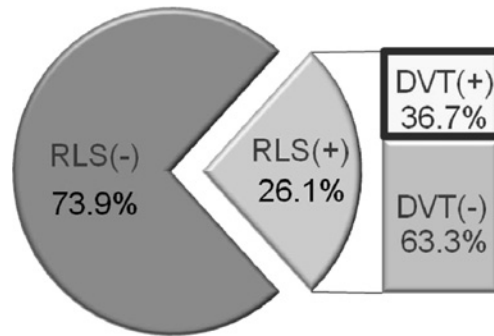


Fig. 2 With TTE methods, RLS were detected in 30 patients (26.1%) of all 115 patients. Furthermore, DVT was observed in 11 patients of RLS-positive cases (36.7%).

## Results

A total of 115 patients were prospectively classified according to the TOAST criteria and TIA; 22 (19.1%) cardioembolism; 20 (17.4%) large-artery atherosclerosis; 21 (18.3%) small-vessel occlusion; 29 (29.6%) stroke of other determined or undetermined etiology; and 18 (15.7%) transient ischemic attack (TIA). RLS were detected by TTE in 30 (26.1%) patients with acute ischemic stroke and TIA. Furthermore, DVT was diagnosed by ultrasonography in 11 (36.7%) RLS-positive patients (**Fig. 2**).

**Figure 3** shows the frequency of different stroke subtypes in patients with RLS: 3 (13.6%) cardioembolism; 4 (20.0%) large-artery atherosclerosis; 3 (14.3%) small-vessel occlusion; 12 (35.3%) stroke of other determined or undetermined etiology; and 8 (44.4%) TIA. TIA and stroke of other determined or undetermined etiology was highly associated with RLS. With TTE methods, RLS were detected in 30 of 115 patients (26.1%) examined. Moreover, 11 RLS-positive cases (36.7%) demonstrated DVT. Detection of RLS in cases of TIA (44.4%) and stroke of other determined or undetermined etiology (35.5%) was higher than that in other subtypes.

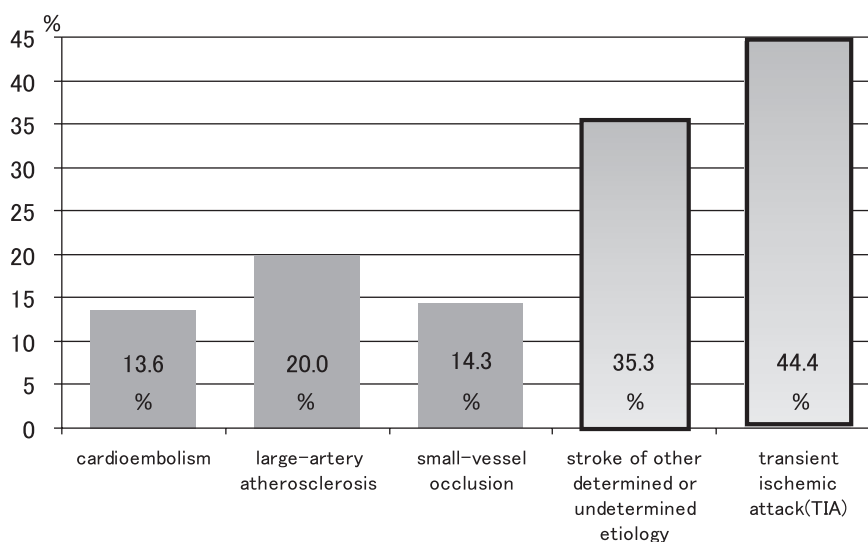


Fig. 3 The rate of RLS detection in cases of TIA (44.4%) and stroke of other determined or undetermined etiology (35.5%) was higher than that in other subtypes.

### Discussion

We demonstrated that in acute stroke patients, RLS was detected with contrast TTE imaging in 26.1% of the study patients. This is a higher rate of RLS detection than that in a previous TTE study, which reported an approximately 20% RLS detection rate<sup>3</sup>. This result may partly be due to using agitated saline with one drop of diazepam added for RLS detection. In a study by Orita, the method of adding one drop of diazepam to saline was a simple and useful method for improving the detection rate of HITS in patients with RLS<sup>4</sup>. Furthermore, it is well appreciated that PFO is a common and generally benign finding present on autopsy in approximately 26% of the population<sup>3</sup>. Therefore, our finding of RLS rate is partly in line with previous reports.

The number of TIA patients with RLS was higher than that in other stroke subtypes. In patients with acute stroke with RLS, the embolic source is thought to be a fibrin-rich thrombus in the deep venous system<sup>5</sup>. It is suggested that fibrin-rich thrombus has a spontaneous thrombolytic effect.

TTE is a useful, safe, repeatable, bedside procedure for detecting the presence of RLS in patients with unknown cause of embolic stroke. If TTE shows RLS, investigation of DVT is warranted to prevent recurrent paradoxical brain embolism. Anticoagulant therapy can be started immediately after detecting thrombus on whole-leg ultrasonography on the day of admission.

Detection of RLS by TTE contrast study may be not only a useful and safe procedure but may also facilitate the initiation of immediate therapy to prevent recurrent stroke.

### References

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