

## Development of a new portable automatic urinary catheterization device: Cadaver study

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### Introduction

Neurogenic bladder dysfunction is one of the most important sequelae after spinal cord injury, stroke, traumatic brain injury, or multiple sclerosis. In addition, many geriatric patients show voiding difficulty owing to dementia, Parkinson's syndrome, or benign prostate hypertrophy. Intermittent catheterization (IC) is an effective bladder management strategy for patients with incomplete bladder emptying. However, since self IC requires precise hand functions, the patients with impaired hand function, such as high level spinal cord injury, are difficult to perform and dependent to caregivers. We had developed an automatic urinary catheterization device for the patients with bladder dysfunction and upper extremity impairment. However, the size and design of the device were not applicable in practical environment. Thus, we developed a new small-sized portable device for self catheterization. In this study, we aimed to evaluate the efficacy of the new small portable device for urinary catheterization using fresh cadavers.

### Methods

This study was performed using 4 fresh cadavers. At first, the bladder was filled with 400 ml of normal saline through manually inserted urinary catheter. The bladder scanner confirmed that the bladder was filled with saline. Then, the urinary catheterization was done using the newly developed device. The catheterizations were performed 3 times. The ultrasonography was performed on the lower abdomen during the catheterization to confirm whether the catheter was inserted into the bladder. To evaluate effective evacuation, the volume of normal saline discharged through the catheter was measured and the residual volume was evaluated using the bladder scanner.

### Results

The catheterization using newly developed device was conducted smoothly without any resistance in all cadavers. In the ultrasonography, the catheter was successfully observed after catheter insertion. The bladders were evacuated well. The average amount of normal saline discharged through catheter from the cadaver was  $261.17 \pm 25.14$  ml. The average amount of residual saline after catheter removal was  $113.83 \pm 28.69$  ml. The urethrovesical junction was not injured during the catheterization.

### Conclusion

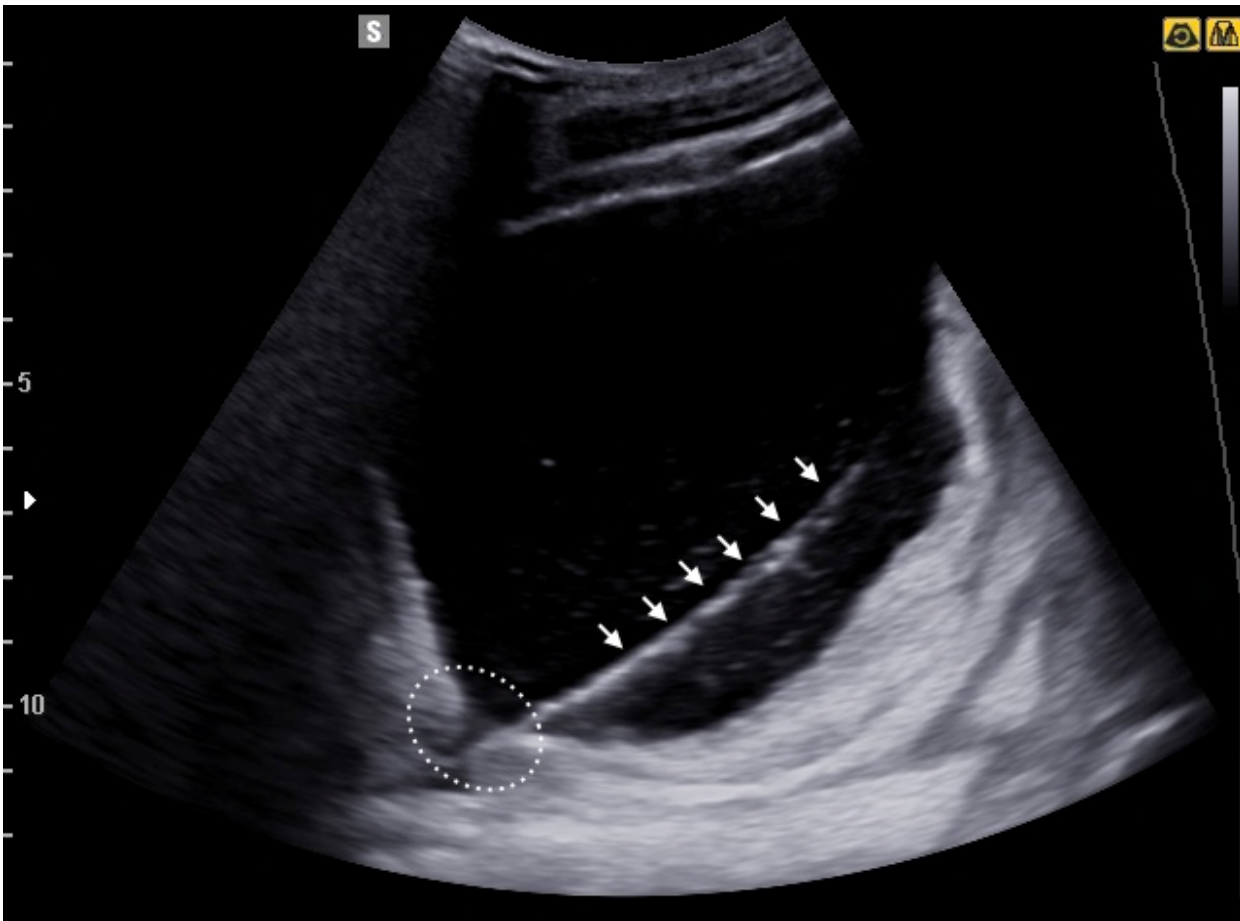
The newly developed automatic urinary catheterization device could insert the catheter effectively and safely. This device would be a useful tool for the urinary catheterization of spinal cord injury patients.

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The urinary catheterization using a new portable automatic device. (A) The catheterization is advanced by the operating part combined with disposable penis cap. (B) The operating part is separated from the penis cap after the catheterization is completed.



The ultrasonographic findings after catheter insertion. Arrows indicate the urinary catheter. Dotted circle is the neck of bladder.