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INHIBITORY CONTROL TASK IS DECREASED IN VASCULAR INCONTINENCE PATIENTS

Hypothesis / aims of study

The incidence of urinary frequency/ urgency (also called overactive bladder), with or without incontinence in the general population over 40 years in age, is estimated to be 12.4-16.6%. However the prevalence increases significantly with age (35–50%). Mechanism of incontinence in the frail elderly is age related changes in the bladder itself, or central nervous system changes innervating the bladder. A recent view has emerged that there may be an important cerebral vascular component in the occurrence of elderly incontinence [1]. Patients with white matter changes (WMC) often have 'vascular parkinsonism' and 'vascular dementia' in various combination. However, the degree of dementia in WMC is usually milder than other dementing diseases such as Alzheimer's disease. Similarly, bladder symptom due to WMC can be referred to as 'vascular incontinence', and this condition can appear as the sole initial symptom in WMC without parkinsonism and dementia. Previously, no detailed reports have been available to see the relationship between cognitive function and bladder function in the elderly cohort. Hence we studied the relationship between cognitive task and urodynamic detrusor overactivity (DO) in vascular incontinence patients.

Study design, materials and methods

We recruited 40 patients in our outpatient clinic. Most of them were referred patients. Inclusion criteria are 1) patients who underwent a brain MRI scan due to various neurologic complaints and showed WMC as defined more than grade 2/4 of Brant-Zawadzki 's 0-4 grading scale by a FLAIR imaging, 2) patients who underwent two cognitive tasks that are a routine assessment of neurologic examination at our clinic, and 3) patients who underwent urodynamics because of lower urinary tract (LUT) symptoms. Exclusion criteria are 1) patients with concurrent normal-pressure hydrocephalus, dementia with Lewy bodies/ Parkinson's disease, fronrotemporal lobar degeneration, progressive supranuclear palsy, Alzheimer's disease, and other diseases that might potentially produce cognitive and LUT symptoms by performing neurological examination, MRI volumetry and MIBG myocardial scintigraphy in all patients, and brain SPECT if necessary, 2) patients who were taking drugs that might interfere with cognitive and LUT function, 3) patients with stress urinary incontinence by a detailed history taking and apparent prostatic hypertrophy by an abdominal echography. They were 20 male, 20 female patients; mean age 77 years, range 60-89 years. All patients underwent a urodynamics according to the International Continence Society standards. All patients underwent two cognitive tasks, e.g., the Mini-Mental State Examination [MMSE] (general cognitive task), and the Frontal Assessment Battery [FAB] (frontal lobe task) [2]. Statistical analysis was performed by Bonferroni's method.

Results

All the patients had LUT symptoms. The most common LUT symptom was urinary urgency (27 patients), followed by urinary incontinence (26) and nocturnal urinary frequency (more than twice / night) (25). Urodynamic test revealed that mean volume at the first sensation was 89 ml (12-220 ml; 100 ml < normal < 300ml) and mean bladder capacity was 270 ml (49-600 ml; 200 ml < normal < 600ml). Mean volume of post-void residuals was 21 ml (0-120 ml). DO was noted in 22 patients. Cognitive tasks revealed that mean value of MMSE was 25.8 (15-30; normal > 24), and mean value of FAB was 13.6 (4-18; normal > 16), respectively. There was no statistical significant relationship between DO with total MMSE or FAB score. We further analyzed relation between DO and 6 subdomains of MMSE, e.g., orientation, registration of new information, attention and calculation, recall, language, and visuospatial construction. However, no statistical significant relationship was observed. We also analyzed relation between DO and 6 subdomains of FAB, e.g., conceptualization, mental flexibility, programming, sensitivity to interference, inhibitory control, and environmental autonomy. As a result, there was a statistical significant relationship between DO with inhibitory control task ($p<0.01$) **(Figure 1)**. There was no apparent relationship between frontal lobe function and the presence/absence of urgency.

Interpretation of result

In the present study, DO was independent from general cognitive status, e.g., mean MMSE score was normal in patients with WMC; and in patients with DO, DO was not related with total MMSE score or any of its subdomains. This is in accordance with the facts that overactive bladder occurs in otherwise healthy elderly population. FAB assesses several categories of frontal function, e.g., conceptualization, mental flexibility, programming, sensitivity to interference, inhibitory control, and environmental autonomy [2]. We showed for the first time that inhibitory control task of FAB is decreased in vascular incontinence patients with DO ($p<0.005$). Few studies are available to see relationship between FAB subdomain with neuropsychological function or the anatomical substrate. In the FAB, the inhibitory control or go-no-go paradigm can be assessed by: not tapping when the examiner taps twice, and not once as was previously asked when examining the sensitivity to interference. This task can be sensitive among executive performance of the FAB; since it is reported that the inhibitory control task can differentiate early stage Alzheimer's disease from amnestic mild cognitive impairment, independent of the disorientation and memory disorder [3]. Considering the relationship between frontal lobe function and the bladder, one explanation might be that the bladder is under general inhibitory control concerning decision-making and emotion by the prefrontal cortex. In patients with WMC, this neural network might be impaired, leading to both frontal-type behavior and DO. In order to clarify this issue, larger studies including other frontal lobe tests such as Wisconsin Card Sorting Test are needed. Since 'vascular incontinence' is a part of geriatric incontinence, our study results will shed light to the brain mechanism of geriatric incontinence.

Concluding message

The results of the present study showed that inhibitory control task is decreased in vascular incontinence patients with DO. This finding suggests that the bladder is under general inhibitory control; and DO is a result of frontal hypo-function in WMC as reported previously.

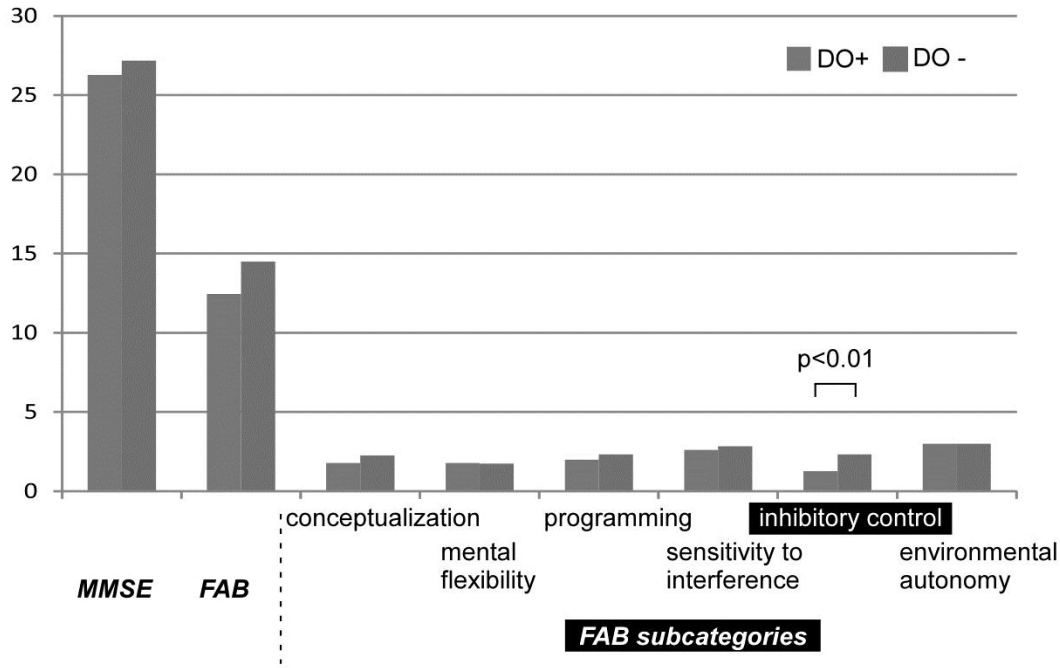

Figure 1 Relationship between detrusor overactivity (DO) with two cognitive tasks in patients with white matter change.

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