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Risk factor for stress incontinence in female patients over 65 years of age: Visceral Adiposity Index

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ABSTRACT

Aims: To investigate whether there is a relationship between stress urinary incontinence and Visceral Adiposity Index (VAI) in older women adults.

Methods: Among 498 patients aged over 65 years who applied to the internal medicine-geriatrics outpatient clinic between January 2024 and June 2024, 95 female patients with stress incontinence (group-1) and 94 female control patients without incontinence (group-2) were included in the study. The remaining 309 patients were patients with other types of incontinence and were excluded from the study. Demographic characteristics, biochemical parameters and VAI values of patients (group-1) and (group-2) were compared statistically.

Results: A total of 95 incontinent female cases with a mean age of 71.7±5.7 years and a total of 94 control female cases with a mean age of 72.0±5.2 years were included in the study. No statistically significant difference was found between the groups in terms of mean age distribution ($p>0.05$). The mean body-mass index (BMI) value of the patients in group 1 was statistically significantly higher than the patients in group 2 ($p=0.037$). The median VAI value of 3.44 [3.07] in group 1 was 2.00 [1.4] higher than the median VAI value in group 2, and a statistically significant difference was observed between the groups ($p<0.001$).

Conclusion: We observed that VAI levels showed comparable values in older patients with and without urinary incontinence (UI), suggest a potential association between increased levels of VAI and the presence of stress urinary incontinence (SUI) in the geriatric population.

Keywords: Urinary incontinence, geriatric patients, Visceral Adiposity Index

INTRODUCTION

Urinary incontinence (UI) is one of the most common geriatric syndromes in older adults, especially in women. The urinary system undergoes anatomical and physiological changes as a result of the aging process, the presence of concomitant diseases, cognitive disorders, and the use of medications to aid in the development of UI.[1] Previous births or pelvic area damage pose a risk for stress incontinence, especially in older women.[2] Due to the fact that urinary system diseases induce significant symptoms that impair quality of life, it is crucial to evaluate the processes underlying these disruptions for effective management and treatment.[3] The International Continence Society (ICS) defines stress urinary incontinence (SUI) as the complaint of any involuntary leak of urine during effort or physical exertion (e.g., sporting activities), or when sneezing or coughing.[4]

Overweight and obesity are acknowledged as independent risk factors for the onset of urine incontinence. Body-mass index (BMI) is wrongly regarded a reasonable predictor of body fat percentage,[5] Many factors influence the relationship between BMI and body fat percentage, including gender, race, high muscle mass, and changes in hydration status (particularly in subjects with extracellular fluid retention, which can lead to significant errors in interpretation of BMI). In older individuals, significant changes occur in both the numerator and denominator of BMI.[6,7] However, it has been reported that there are metabolically unhealthy people in the society despite their BMI measurements being within the normal range, and metabolically healthy people despite their increased BMI values, and that these people's cardiometabolic risk levels are different.[8]

The metabolic disorders linked to these different phenotypes are largely caused by visceral obesity. Visceral adiposity has been associated with increased adipocytokine production, increased inflammatory activity, impoverished insulin sensitivity, risk of acquiring diabetes, elevated blood triglyceride (TG) levels, and decreased blood high-density lipoprotein cholesterol (HDL-C) levels, risk of dyslipidemia, hypertension, development of atherosclerosis, and increased mortality.[9]

Visceral adiposity cannot be directly measured without the use of costly imaging methods, which are frequently unavailable.[10]

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Amato et al.[11] defined the Visceral Adiposity Index (VAI) by developing a mathematical formula that directly reflects visceral adiposity with anthropometric and biochemical measurements. In our study, we examined the association between VAI and stress incontinence in women over 65 years of age.

METHODS

Ethics

Ethics committee approval was obtained from Ankara Bilkent City Hospital Non-interventional Clinical Studies Ethics Committee for this study (Date: 28.08.2024, Decision No: TABED-1 24-542). Since the study was retrospective, consent was not obtained from the participants. The study was conducted following the Declaration of Helsinki.

Study Population

The demographic characteristics of the patients, BMI, comorbidities, smoking status, and the results of the last biochemical analysis before the procedure were recorded. Patients who were male, had urinary system anomalies, were under 65 years of age, smoked, had alcohol or drug addiction, had a history of urinary surgery, and had a history of pelvic trauma were excluded from the study. Among 498 patients aged over 65 years who applied to the internal medicine-geriatrics outpatient clinic between January 2024 and June 2024, 95 female patients with stress incontinence (group-1) and 94 female control patients without incontinence (group-2) were included in the study. The remaining 309 patients with other types of incontinence were excluded from the study to avoid confusion due to differences in etiology (Figure 1). Education level is categorized as 0=0-5 years, 1=6-12 years, 2>12 years. BMI was calculated as weight/height^2 (kg/m^2). Waist circumference (WC, cm) was calculated by measuring the circumference of the circle covering through the middle of the lines perpendicularly intersecting the 10th rib and the anterior superior spina iliaca on both sides. Laboratory values, especially triglyceride and HDL levels, were recorded in mmol/lt.

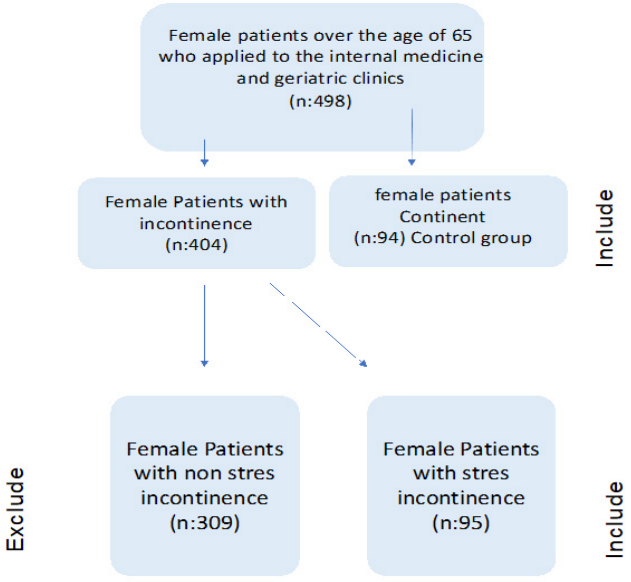

Figure 1. Study design flowchart

Stres Urinary Incontinence Assessment

Self-reporting was used to establish the primary outcome, SUI: "During the previous twelve months, have you spilled or lacked control over any amount of urine with movement like coughing as such, lifting, or exercise?"[4], except for this type of urinary incontinence, they were described as other types of incontinence.

Females VAI Assesment

VAI was calculated as previously described with the formula [Waist circumference/(36.58+(1.89*BMI)]*(TG/0.81)*(1.52/HDL-C) [9]. Values were recorded numerically without any categorization.[11]

Statistical Analysis

The statistical analyses were carried out using the SPSS software package, version 23. The variables were evaluated for normal distribution using visual (histograms, probability charts) and analytical (Kolmogorov-Smirnov test) techniques. Descriptive analyses were introduced by using percentages for categorical variables, mean±standard deviations (SD) for normally distributed variables, and median [IQR] with non-normally distributed quantities. The study employed the Mann-Whitney U test to compare continuous variables and the chi-square test to assess differences between the two types of variables. Every P-value that was released was evaluated against a significance threshold of 5% using two-sided testing. The relationship between SUI and VAI was presented using multivariable binary analysis by logistic regression and receiver operating characteristic (ROC) curve of visceral fat index was made for cut off.

RESULTS

While the average age in women with SUI (group-1) was 71.7±5.7, it was 72.0±5.2 in the control group (group-2) (p=0.71). In group 1, the average height, weight, BMI and waist circumference were 157 [11.0], 75 [22.0], 30.1±6.3, 98.0 [17.0] respectively, while in group 2, they were 160 [11.3], 72 [19.0], 28.5±4.4, 97.0 [13.0]. (p=0.059, p=0.50, p=0.037, p=0.83) respectively. While the VAI average was 3.44 [3.07] in group 1, it was 2.00 [1.4] in group 2, and there was a statistically significant difference (Table 1).

Table 1. Baseline characteristics of study population according to groups. Study sample was divided into two groups absent incontinence group and present incontinence groups

	Incontinence (group 1) (n=95)	Continence (group 2) (n=94)	p
Age, years	71.7±5.7	72.0±5.2	0.71
Marital status, married	58 (61.1)	57 (61.3)	0.97
Education level			
0	59 (62.1)	43 (46.2)	0.085
1	20 (21.1)	30 (32.3)	
2	16 (16.8)	20 (21.5)	
Height, cm	157 (11.0)	160 (11.3)	0.059
Weight, kg	75 (22.0)	72 (19.0)	0.50
Waist circumference, cm	98.0 (17.0)	97.0 (13.0)	0.83
Hip circumference, cm	105 (14.0)	102.5 (12.5)	0.33
BMI, kg/m^2	30.1±6.3	28.5±4.4	0.037
VAI, mmol	3.44 (3.07)	2.00 (1.4)	<0.001

*Variables are presented as n (%), mean±SD or median [IQR]
BMI: Body-mass index, cm: Cantimeter, kg: Kilogram, kg/m^2: Kilogram/square meters, VAI: Visceral Adiposity Index, mmol: Milimole

Laboratory parameters of the patients with and without incontinence are in Table 2. Among those with significant differences from laboratory values, the mean values of LDL-C, TG and T cholesterol in group 1 were 118.5±35.9, 160.0 [86.0], 205.0 [54.8] respectively, while in group 2 they were respectively 108.2±32.8, 110.0 [45.3], 190 [50.0] and were higher in group 1 (p=0.042, p<0.001, p=0.084), While the HDL-c average is low in group 1, it is higher in group 2, respectively(45.0 [12.0], 56.0 [19.3](p <0.001).

Table 2. Laboratory parameters of the patients with and without incontinence

	Incontinence (group 1) (n=95)	Continence (group 2) (n=94)	p
Glucose	15.0 (72.0)	30.5 (75.0)	0.24
Urea	34.0 (15.0)	36.0 (15.0)	0.26
Urate	5.4±2.2	4.7±1.8	0.043
Serum creatinine	0.77 (0.21)	0.76 (0.17)	0.072
GFR	76.0 (22.0)	77.0 (20.0)	0.062
Total protein	7.1±0.4	7.2±0.5	0.56
Albumin	4.4±0.3	4.4±0.3	0.32
AST	16.0 (8.0)	17.0 (11.0)	0.54
ALT	19.5 (11.0)	19.0 (11.3)	0.61
Total cholesterol	205.0 (54.8)	190 (50.0)	0.084
LDL cholesterol	118.5±35.9	108.2±32.8	0.042
HDL cholesterol	45.0 (12.0)	56.0 (19.3)	<0.001
Triglyceride	160.0 (86.0)	110.0 (45.3)	<0.001
TSH	2.1 (1.8)	1.7 (1.6)	0.12
HbA1c	6.3 (1.0)	6.0 (0.95)	0.083
WBC	6.7 (0.3)	6.7 (0.2)	0.95
Hb	12.5 (2.5)	13.2 (1.9)	0.005

*Variables are presented as n (%), mean±SD or median [IQR]
GFR: Glomerular filtration rate, AST: Aspartate aminotransferase, ALT: Alanine aminotransferase, LDL: Low-density lipoprotein, HDL: High-density lipoprotein, TSH: Thyroid stimulating hormone, HbA1c: Hemoglobin A1c, WBC: White blood count, Hb: Hemoglobin

In Figure 2, ROC curves were made to determine the cut off for VAI and SUI. VAI values were more significant, cut-off value was 2.70, and the area under the curve was area under curve (AUC); 0.827 (95%CI: 0.769-0.886), (p=<0.001) (Table 3).

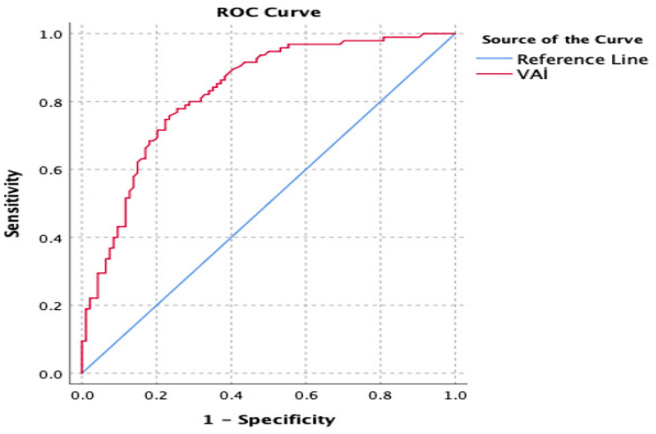

Figure 2. The receiver operating characteristic (ROC) Curve of the Visceral Adiposity Index (VAI)

Table 4 show the binary logistic regression analysis of possible factors influencing VAI. Since there was no difference in univariate analysis, these factors were determined with known factors. VAI had no relationship with changes in age, HBA1C, HB, GFR and TSH levels.

Table 4. Binary regression analysis of the VAI

	OR	95 % CI	p
Unadjusted model			
VAI, mmol	2.10	1.60-2.77	<0.001
Model 1			
VAI, mmol	2.29	1.65-3.17	<0.001
Age, years	0.99	0.93-1.07	0.91
Hb	0.99	0.98-1.00	0.14
HbA1c	0.86	0.64-1.16	0.33
GFR	0.98	0.96-1.01	0.23
TSH	1.0	1.00-1.01	0.42

OR: Odds ratio, CI: Confidence interval, VAI: Visceral Adiposity Index, mmol: Milimole, HbA1c: Hemoglobin A1c, Hb: Hemoglobin, GFR: Glomerular filtration rate, TSH: Thyroid stimulating hormone

DISCUSSION

This study revealed the importance of VAI in older women with stress incontinence. According to our results, the VAI value of those with stress incontinence was found to be significantly higher than those without. The author interpreted this result as reducing VAI can be considered an effective option in the management of stress incontinence.

VAI has been considered and evaluated as a risk factor for some pathologies in many studies. Visceral fat index has been considered and evaluated as a risk factor for some pathologies in many studies. For instance, in hypertensive populations, the VAI was more prevalent in non-hypertensive women than in males and was significantly correlated with a higher risk of type 2 diabetes.[12] In a national cohort of 9028 outcomes with data from China, Xiaomei Ye et al.[13] found that VAI is a reliable biomarker with strong aiming capability for cardiometabolic multiple medical conditions and could be used for early detection, avoidance, and treatment in by primary health care in the future.

Another study evaluating the association of VAI with all-cause mortality in the older was a population-based cohort study with large sample sizes and long-term follow-up in older individuals, showing a J-shaped association between VAI levels and all-cause mortality. Understanding the independent roles of VAI in the association between BMI and mortality was found to be significant for understanding the obesity paradox phenomenon.[14] In a study examining the association with VAI and lung function impairment, a relationship was found between these two conditions.[15]

In the cross-sectional study by Wang et al.[16] the VIA values of those who exercised for 150 minutes per week were shown to be lower than those of those who did not.

In a research involving people over 60, VIA was found to be a risk factor for later-life cognitive deterioration.[17] In a retrospective

Table 3. ROC analysis of the Visceral Adiposity İndex

	Cut-off	AUC	Sensitivity	Specificity	95% CI	p
VAI	2.70	0.827	80.0%	71.3%	0.769-0.886	<0.001

ROC: Receiver operating characteristic, VAI: Visceral Adiposity İndex, AUC: Area under curve

study conducted in a urology clinic in Turkey, the relationship between overactive bladder and VAI was examined and although the study was not statistically significant, the median VAI level was found to be higher in patients with overactive bladder. However, it was conducted with participants over the age of 18.[18] Another study similarly found a high correlation between obesity and overactive bladder.[19]

Our study examined the relationship between stress urinary incontinence in older female patients over the age of 65 and it was found to be statistically significant. Similarly, in another study examining the relationship between stress urinary incontinence and VAI in young women, it was reported that, unlike our study, VAI levels were higher in patients over the age of 30 with stress urinary incontinence.[20]

There is an on going debate about the effect of excess weight on urinary incontinence. Similar to our study, Al-Shaiji and Radomski[21] studied 113 obese patients with a mean age of approximately 55 years and found that a BMI over 30 was associated with an increased incidence of mixed incontinence. Because of the simplicity of WC and BMI measurements, in addition to TG and HDL assessments, the VAI is a useful index for assessing visceral fat dysfunction. The VAI could serve as an effective index for assessing and calculating the risk of stress urinary incontinence There are some limitations of our study: the concept of sarcopenia, which has begun to be included in the etiology of incontinence in the current literature[22], was not evaluated, the diagnosis of incontinence was given according to the patient's self-declaration, the number and type of birth that caused stress incontinence, and patients with pelvic surgery or trauma were excluded in the design of the study.

CONCLUSION

In our study evaluating the VAI parameter in individuals aged 65 and over with and without stress UI, VAI levels demonstrated comparable values in older patients with and without UI and were found to be statistically significant, suggest a potential association between increased levels of VAI and the presence of SUI in the geriatric population. In addition to the underlying mechanisms and causal factors responsible for this observed relationship, it is imperative for future research to investigate the potential therapeutic implications of targeting triglyceride, HDL, BMI and waist circumference included in the VAI calculation to the safe range in the management of stress UI in geriatric individuals. Future research is needed to evaluate the relationship between the two and to elucidate the mechanisms underlying this relationship.

ETHICAL DECLARATIONS

Ethics Committee Approval

Ethics committee approval was obtained from Ankara Bilkent City Hospital Non-interventional Clinical Studies Ethics Committee for this study (Date: 28.08.2024, Decision No: TABED-1 24-542).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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