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TEST-RETEST RELIABILITY OF CLITORAL AND PUDENDAL ARTERIES' BLOOD FLOW USING COLOR DOPPLER ULTRASONOGRAPHY WOMEN WITH GENITOURINARY SYNDROME OF MENOPAUSE

Hypothesis / aims of study: The internal pudendal artery (IPA) is one of the main arteries irrigating the pelvic floor muscles (PFM) and vulvo-vaginal tissues. Assessment of its blood flow with color Doppler ultrasound has been done before, proximally at the level of the ischial spine and more distally at the level of its terminal branch, the dorsal clitoral artery. Test-retest reliability of those two arteries' vascular parameters has been done recently in young women. However, reliability has not been assessed in women with genitourinary syndrome of menopause (GSM) yet. Assessing blood flow in this subpopulation (along the length of the IPA) may be important as menopause could affect vulvo-vaginal vascularity. Therefore, the purpose of this study was to assess the test-retest reliability of clitoral and IPA blood flow measurements at rest and after repeated PFM contractions in women using color Doppler ultrasonography.

Study design, materials and methods: Women aged 55 years old and older with GSM participated in this test-retest cohort study. Exclusion criteria were pathology or medication likely to interfere with blood flow measurements. Dosage of hormonal therapy or arterial hypertension medication had to be stable for six months to ensure perineal blood flow stability. One observer performed the two repeated measurement sessions of the clitoral and the IPA blood flow (T1 and T2) two weeks apart at the same time of the day (± 2 hours). Caffeine and tobacco intake, sexual activity, physical activity as well as creams or other product applications in the vulvar and gluteal area were controlled for a period of 24 hours before the assessment as it has been shown to influence blood flow parameters.

Participants were asked to rest in the supine position for 15 minutes to ensure standardized conditions. Using a clinical ultrasound system (Voluson E8, GE healthcare) with a 4-13 MHz linear probe according to the procedure described by Khalifé et al [1], three consecutive clitoral blood flow measurements were taken at rest and after a standardized PFM contraction protocol. Then, participants took the prone position and rested for an additional 15 minutes. With a 2-7 MHz curved-array probe on the participant's right gluteal area according to Kovac's procedure [2], IPA blood flow measurements were again taken three times at rest and after the PFM contractions protocol. Each time, peak systolic velocity (PSV), time-averaged maximum velocity (TAMX) and pulsatility index (PI) were collected. Test-retest reliability of clitoral and IPA blood flow was assessed using the paired t-test, the intraclass correlation coefficient (ICC) and Bland-Altman plots.

Results: A total of 20 women aged between 57 and 82 years old (68.1 ± 7.1 years old) with a mean parity of 1.7 ± 1.1 delivery and a mean BMI of 26.7 ± 4.6 were recruited. Thirteen were sexually active, one was taking systemic hormonal therapy and four were taking local hormonal therapy. Among the data set, 18/20 measures were adequately visualized for the clitoral blood flow analysis and 16/20 for the IPA blood flow analysis.

Clitoral blood flow

At rest, there was no significant difference between T1 and T2 for all parameters. Based on the ICC results, PSV and TAMX parameters showed excellent reliability while PI showed fair to good reliability (Table 1). Bland-Altman plots demonstrated minimal bias with the mean difference close to zero for all parameters. The 95% limits agreement range was narrow only for PSV parameter, indicating a high consistency between both tests (Table 1).

After PFM contractions, there was no significant difference between T1 and T2 for all parameters. Based on the ICC results, PSV showed excellent reliability while TAMX showed fair to good reliability (Table 1). Poor reliability was found for PI parameter in this condition (Table 1). Bland-Altman plots demonstrated minimal bias with the mean difference close to zero for all parameters and the 95% limits agreement range was narrow also for PSV parameters after PFM contractions (Table 1).

IPA blood flow

At rest, there was no significant difference between T1 and T2 for all parameters. Based on the ICC results, PSV parameters showed excellent reliability while TAMX and PI showed poor reliability (Table 2). Bland-Altman plots demonstrated minimal bias with the mean difference close to zero for PSV parameters with a narrow 95% limits agreement range (Table 2).

After PFM contractions, there was no significant difference between T1 and T2 for all parameters. Based on the ICC results, PSV showed excellent reliability while TAMX and PI showed fair to good reliability (Table 1). However, Bland-Altman plots demonstrated minimal bias with the mean difference close to zero for all parameters, but the 95% limits agreement range was narrow for only PSV parameters after PFM contractions (Table 2).

Table 1. Clitoral blood flow measurements

		Data			ICC		Bland-Altman plots	
		Mean T1 ±SD	Mean T2 ±SD	P value	ICC	95% ICC	Mean difference	Limits of agreement
At rest	PSV(cm/s)	5.5±1.2	5.4±1.0	0.615	0.85	0.62–0.94	0.09	-1.53–1.73
	TAMX(cm/s)	1.8±0.9	1.6±0.9	0.302	0.88	0.71–0.95	0.14	-1.02–1.30
	PI	3.9±1.7	3.8±1.3	0.902	0.71	0.26–0.88	0.40	-2.41–3.21
After PFM contractions	PSV(cm/s)	5.3±1.3	5.7±1.1	0.095	0.79	0.47–0.92	-0.39	-2.30–1.51
	TAMX(cm/s)	1.7±0.7	1.7±1.0	0.937	0.70	0.18–0.89	-0.01	-1.39–1.36
	PI	3.6±1.4	3.9±1.6	0.549	0.35	-0.75–0.75	-0.27	-4.01–3.48

Table 2. IPA blood flow measurements

		Data			ICC		Bland-Altman plots	
		Mean T1 ±SD	Mean T2 ±SD	P value	ICC	95% ICC	Mean difference	Limits of agreement
At rest	PSV(cm/s)	40.1±2.4	40.0±2.4	0.940	0.97	0.87-0.98	0.06	-5.98-6.09
	TAMX(cm/s)	6.6±0.5	7.6±0.7	0.207	0.24	-0.79-0.72	-1.01	-7.07-5.03
	PI	6.3±0.4	5.3±0.5	0.086	0.23	-1.05-0.72	1.06	-3.46-5.58
After PFM contractions	PSV(cm/s)	41.6±2.5	41.9±2.6	0.350	0.98	0.94-0.99	-0.72	-6.36-4.92
	TAMX(cm/s)	8.5±0.7	5.3±0.5	0.618	0.57	-0.19-0.85	-0.81	-4.80-3.18
	PI	5.41±0.5	8.87±1.2	0.518	0.64	-0.14-0.89	0.28	-8.62-9.18

Interpretation of results: Results from this intra-observer test-retest reliability study indicates high correlation with no significant mean difference for PSV measurements of the clitoral and the IPA blood flow in the two conditions: at rest and after PFM contractions. Those results were confirmed by the Bland-Altman plots analysis, which showed narrow limits of agreements. Reliability of TAMX and PI parameters were poor at rest and after PFM contractions. Assessment of the IPA blood flow obtained lower reliability results compared to clitoral blood flow measurements because of a higher difficulty level in finding and measuring this artery.

Only two other studies in healthy younger women have evaluated clitoral blood flow measurement's reliability using color Doppler ultrasonography. Khalifé et al. assessed PSV and PI measurements test-retest reliability at rest, and found results similar to ours [1]. Mercier et al. reported excellent reliability at rest and after PFM contractions for the PSV and TAMX parameters for the clitoral blood flow and for the PSV parameter for the IPA blood flow, again with similar reliability coefficients [3]. Of note, reliability of TAMX and PI parameters were better in younger women than in post-menopausal women.

Concluding message: Our research findings are original as they suggest that PSV are reliable parameters of clitoral blood flow and IPA blood flow at rest and after PFM contractions in post-menopausal women. These parameters can form the basis of further research on the perineal vascular properties.

References

1. Khalifé, Y. M. B., Deborah R. Cohen, Rhonda Amsel, Samir (2000). "Evaluation of clitoral blood flow by color Doppler ultrasonography." *Journal of Sex & Marital Therapy* 26(2): 187-189.
2. Kovacs, P., et al. (2001). "New, simple, ultrasound-guided infiltration of the pudendal nerve." *Diseases of the colon & rectum* 44(9): 1381-1385.
3. Mercier J, Tang A, Lemieux MC, Morin M, Khalifé S, Reichetzer B, et al. Test-retest reliability of clitoral blood flow measurements at rest and after pelvic floor muscle contractions in healthy adult women using color Doppler ultrasonography. ICS; 15 September 2016; Tokyo, Japan 2016.

Disclosures

Funding: Réseau québécois de recherche sur le vieillissement grant. Fond de recherche du Québec en santé fellowship. **Clinical Trial:** Yes **Public Registry:** No **RCT:** No **Subjects:** HUMAN **Ethics Committee:** Comité d'éthique de la recherche de l'Institut universitaire de gériatrie de Montréal **Helsinki:** Yes **Informed Consent:** Yes