RESEARCH PAPER

Effectiveness and Feasibility of Transvaginal Ultrasound–Guided Platelet-Rich Plasma Injection for The Management of Female Stress Urinary Incontinence

Ahmed Elsayed Ahmed Abdellatif[1], Almotasembellah A. Elbadwy[2]*, Ahmed Gamal Mohamed Hasab El Naby[3], Akram A. Elmarakbi[4]

[1]*Assistant Professor of Urology, Beni-Suef University Hospital*
[2]*Assistant Lecturer of Urology, Beni-Suef University Hospital*
[3]*Lecturer of Urology, Beni-Suef University Hospital*
[4]*Professor of Urology, Beni-Suef University Hospital.*

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ABSTRACT

Background: Stress urinary incontinence (SUI) is a prevalent condition among women that significantly affects quality of life. Aim: To evaluate the efficacy and feasibility of transvaginal ultrasound-guided periurethral platelet-rich plasma (PRP) injection in the treatment of female stress urinary incontinence. Methods: This prospective clinical study included 54 women diagnosed with SUI who were treated at Beni-Suef University Hospital between February 2023 and March 2024. All patients underwent transvaginal ultrasound-guided periurethral PRP injection, with a second injection administered after three months when indicated. Treatment outcomes were assessed using validated Arabic versions of the International Consultation on Incontinence Questionnaire–Short Form (ICIQ-UI-SF), ICIQ-LUTSqol, stress test, and pad weight test over a follow-up period of nine months. Results: After completion of treatment, 18.5% of patients were cured and 22.2% showed improvement, while 59.3% showed no response. Treatment efficacy was highest in patients with mild SUI (100% after the second injection), moderate in moderate SUI (36%), and lowest in severe SUI (31.3%). Significant improvement in quality of life scores was observed, particularly in mild and moderate cases. Younger age, lower parity, and cesarean delivery were associated with better outcomes. Conclusion: Transvaginal ultrasound-guided PRP injection is a safe and feasible minimally invasive treatment option for female stress urinary incontinence, with the greatest benefit observed in mild cases. Further randomized controlled trials are recommended to validate these findings and optimize patient selection.

Keywords: Stress urinary incontinence; Platelet-rich plasma; Transvaginal ultrasound; Minimally invasive therapy

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INTRODUCTION

Stress urinary incontinence (SUI) is a common type of urinary incontinence in young women; it is defined as involuntary loss of urine on effort, physical exertion or on sneezing or coughing. it occurs coincident with increased intra- abdominal pressure in the absence of bladder contraction (1).

SUI is a major health problem, which affects between 4% and 35% of adult women and has a detrimental impact on their daily activities and quality of life, with older women more likely to be affected; it is either due to intrinsic sphincter deficiency (ISD) or urethral support defect (hypermobility). Risk factors for SUI are aging, menopause, weight gain prior gynaecological surgery including hysterectomy, and any condition causing a chronic increase in abdominal pressure including cough, asthma, constipation weight training and occupations that require heavy lifting (2).

Alpha adrenoreceptor agonists, such ephedrine, pseudoephedrine, and phenylpropanolamine, have all been reported to be effective in SUI, even though they lack selectivity for urethral a-adrenoreceptors. Thus, cardiovascular safety is an issue, and concerns over hemorrhagic strokes have restricted the availability of these agents (3).

Several surgical techniques have been proposed for the treatment of SUI. Among them, Burch colposuspension, autologous fascia slings, mid-urethral synthetic sling, transobturator tapes (TOT), urethral bulking agents and artificial urethral sphincters, are the most used. These operations are not free of complications, intraoperative complications such as bleeding, bladder, and urethral injuries as well as postoperative complications, such as

**Author for Correspondence: Almotasembellah A. Elbadwy*

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pain, voiding dysfunction, infection, and tape erosion are most reported ones (4).

This study aimed to evaluate the efficacy and feasibility of transvaginal ultrasound-guided periurethral platelet-rich plasma (PRP) injection in the treatment of female stress urinary incontinence.

PATIENTS AND METHODS

This prospective clinical study was conducted on fifty-four patients at the Department of urology, Beni-Suef university Hospital between February 2023 and March 2024.

Inclusion criteria: The inclusion Criteria of study included women with complaint of stress urinary incontinence.

Exclusion criteria: Untreated urinary tract infection, thrombocytopenia, anticoagulant users, urinary tract malignancy and complicated SUI.

Methods

All patients were subjected to the following:

All patients provided verbal informed consent after the risks and benefits of the procedure were explained and were informed of their right to withdraw without affecting their medical care. Each patient underwent a comprehensive evaluation, including detailed personal, obstetric, surgical, and medication history, as well as a thorough physical examination (general, abdominal, and pelvic) to rule out conditions such as pelvic organ prolapse or urethral diverticulum. Stress urinary incontinence (SUI) severity was assessed using validated Arabic versions of the ICIQ-UI-SF and ICIQ-LUTSqol questionnaires, with scores classified as mild (1–5), moderate (6–12), or severe (>13). Additional assessments included a stress test, urine analysis and culture, complete blood count, random blood sugar, and kidney and liver function tests. All patients received an initial transvaginal ultrasound-guided PRP injection (using BK Flex Focus 300), with a second session administered after three months if clinically indicated.

PRP Preparation and Administration

Patient blood (2 × 10 mL tubes with anticoagulant) was gently mixed and centrifuged at 3400 rpm for 15 min, yielding three layers: platelet pellet, separating gel, and red blood cells. The platelet pellet was resuspended by gentle inversion, producing ~5 mL of PRP per tube, which was collected into a 5 mL Luer-Lock syringe. Under transvaginal ultrasound guidance, after local anesthetic gel application and urethral catheter placement, 2 mL of PRP was injected at five periurethral sites (12, 3, 5, 7, 9 o'clock) at the mid-urethra, ensuring proximity to the urethra.

Patient follow-up

All patients were followed each two weeks for 9 months by ICIQ- SF, ICIQ-LUTSqol questionnaires, Stress test, number and weight of pads to assess severity of leakage. The collected data after injection were compared to the collected data before injection to assess the efficacy of PRP injection.

Statistical analysis

The required sample size was calculated using G*Power 3.1 for a two-tailed point-biserial correlation test, with an effect size of 0.45, $\alpha = 0.05$, and power = 0.95, yielding a total sample of 54 participants (df = 52, critical t = 2.007, actual power = 0.953). Collected data were checked for accuracy, coded, entered, and analyzed using SPSS version 25. Descriptive statistics included numbers and percentages for qualitative data and mean ± standard deviation for quantitative data. Analytical statistics considered $p \leq 0.05$ as significant. Normality was assessed using the Shapiro-Wilk test. Categorical variables were analyzed with Chi-square or Fisher's exact test, while quantitative variables were analyzed using Student t-test or Mann-Whitney test for two groups, ANOVA or Kruskal-Wallis for more than two groups, paired t-test for repeated measurements, and MANOVA for multiple dependent variables.

RESULTS

Table (1): Sociodemographic data among study participants

Variables	**(N=54)**
Age	
Min. – Max.	33.0 - 70.0
Mean ± SD	52.648 ± 8.519
Obstetric history	
Min. – Max.	2.0 - 5.0
Mean ± SD	3.333 ± 0.93162
Obstetric history	**N (%)**
P2	10 (18.5%)
P3	23 (42.6%)
P4	14 (25.9%)
P5	7 (13.0%)
BMI	**N (%)**
Normal	15 (27.8%)
Overweight	24 (44.4%)
Obese	15 (27.8%)
Mode of delivery	**N (%)**
NVD	40 (74.1%)
CS	14 (25.9%)

Age of study participants ranged from 33 to 70 years with mean± SD of 52.648 ± 8.519. Obstetric history of study participants ranged from 2 to 5 with mean ± SD of 3.333 ± 0.9316 and 42.6% of them was para 3. Overweight and obesity prevalence were 44.4% and 27.8% respectively. The prevalence of normal vaginal delivary was 74.1% among study participants. (Table 1)

Table (2): Comparison between ICIQ SF score before injection and other data

Variables	ICIQ SF score before injection			Test of significance	P value
	Mild (N=8)	Moderate (N=25)	Severe (N=21)		
Obstetric history				X^2 = 18.007#	**0.002***
P2	5 (62.5%)	0 (0%)	5 (23.8%)		
P3	3 (37.5%)	12 (48.0%)	8 (38.1%		
P4	0 (0%)	10 (40.0%)	4 (19.0%)		
P5	0 (0%)	3 (12.0%)	4 (19.0%)		
BMI				X^2 = 16.117#	**0.002***
Normal	6 (75.0%)	7 (28.0%)	2 (9.5%)		
Overweight	2 (25.0%)	14 (56.0%)	8 (38.1%)		
Obese	0 (0%)	4 (16.0%)	11 (52.4%)		
Mode of delivery				X^2 = 26.863	**<0.001***
NVD	0 (0%)	22 (88.0%)	18 (85.7%)		
CS	8 (100.0)	3 (12.0%)	3 (14.3%)		
Age				H = 13.742	**0.001***
Min. – Max.	33.0 - 50.0	48.0 - 70.0	33.0 - 69.0		
Mean ± SD	41.125 ±7.357	55.920 ±6.006	53.191 ±9.511		
Obstetric history				H = 12.282	**0.002***
Min. – Max.	2.0 - 3.0	3.0 - 5.0	2.0 - 5.0		
Mean ± SD	2.375± 0.5176	3.640 ± 0.700	3.333 ± 1.065		
Duration of menopause				F = 5.615	**0.007***
Min. – Max.	1.0 -3.0	5.0 - 18.0	3.0 - 20.0		
Mean ± SD	1.750 ± 0.957	8.556 ± 3.451	10.632 ±6.175		

X2; Chi square test, H; Kruskal Wallis test, #; Fisher's exact test, F; ANOVA test, *; Significant at P value <0.05

This table showed that increased parity, normal vaginal delivary, increase duration of menopause, older age, overweight and obesity cause significant severe SUI degree (P value < 0.05). (Table 2)

Table (3): Distribution of cases according to ICIQ SF score before and after injection

	Pre injection (N = 54)	First injection (N = 54)	Second injection (N = 45)
Refuse		0	5
Cured		4 (7.4%)	6 (13.3%)
Mild	8 (14.8%)	9 (16.7%)	10 (22.2%)
Moderate	25 (46.3%)	23 (42.6%)	18 (40%)
Severe	21 (38.9%)	18 (33.3%)	11 (24.4%)

According to ICIQ SF score 8 (14.8%) patients had mild SUI, 25 (46.3%) patients had moderate SUI while 21 (38.9%) had severe SUI before injection. After first injection, 4 (7.4%) patients cured, 9 (16.7%) patients had mild SUI, 23 (42.6%) patients had moderate SUI while 18 (33.3%) had severe SUI. Five patients refused second injection and from who received the second injection, 6 (13.3%) patients cured, 10 (22.2%) patients had mild SUI, 18 (40%) patients had moderate SUI while 11 (24.4%) had severe SUI. (Table 3)

**Author for Correspondence: Almotasembellah A. Elbadwy*

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Table (4): Improvement and efficacy at the end of treatment

	N (N= 54)	%
Cured	10	18.5
Improved	12	22.2
Failure	32	59.3

By the end of treatment, 10 (18.5%) patients cured, 12 (22.2%) patients improved in severity and the failure rate was 59.3%. (Table 5)

Table (5): Comparison between improvement after second injection and other data

Variables	Improved (N=18)	Not improved (N=27)	Test of significance	P value
Mode of delivery			$X^2 = 19.286$	**< 0.001***
NVD	8 (44.4%)	27 (100.0%)		
CS	10 (55.6%)	0 (0%)		
Age			U = 79.0	**< 0.001***
Min. – Max.	35.0 - 58.0	37.0 -70.0		
Mean ± SD	48.167 ± 5.793	56.259 ± 6.671		
Obstetric history			U = 147.50	**0.020***
Min. – Max.	2.0 - 5.0	2.0 - 5.0		
Mean ± SD	3.333 ± 0.985	3.667 ± 0.817		
Duration of menopause			t = 0.621	0.543
Min. – Max.	1.0 - 18.0	3.0 - 20.0		
Mean ± SD	8.333 ± 6.095	9.583 ± 4.800		
History of treatment			$X^2 = 0.375$	0.760
Yes	7 (38.9%)	13 (48.1%)		
No	11 (61.1%)	14 (51.9%)		

X2; Chi square test, U; Mann Whitney test, t; Student t test, #; Fisher's exact test *; Significant at P value<0.05

The previous table showed that increased parity, normal vaginal delivary and advancing age cause significant decrease in improvement after second injection (P value < 0.05). (Table 6)

DISCUSSION

In the present study, the age of the studied patients ranged from (33 - 70) years with mean ± SD of (52.648 ± 8.519) years. There was statistically significant positive correlation between severity of SUI using ICIQ-SF and age where SUI severity increased with old age.

Our study results are comparable with the study done by Ibrahim et al. (5), they found that mean age of women with SUI was 54.80 ± 6.01 years. Willison et al. (6) in their study that included women with SUI also reported that mean of age of patients was 55.98 (SD = 11.27). Also Ninomiya et al. (7) reported that aging was a risk factor for SUI (age ≥40 years). Zhang et al. (8) and Wang et al. (9) also reported that aging was a risk factor for SUI. This could be caused by functional decline in the bladder and urethra with age.

Regarding efficacy of PRP in treating SUI in our study, the primary outcomes were evaluated by ICIQ-SF and pad test that were assessed before and after treatment. Our results showed that after 2 doses of PRP injection 10 (18.5%) patients cured, 12 (22.2%) patients improved in severity and the failure rate was 59.3%. The efficacy of one dose of PRP injection in improving of SUI was 22.2%; 50% in mild SUI, decreased to 20% in moderate SUI and decreased to reach 14.3% in severe SUI. While the efficacy of the second dose of PRP injection was 40%; 100% in mild SUI, decreased to 36% in moderate SUI and decreased to reach 31.3% in severe SUI.

This results are supported by the result of pad test which revealed that patients with mild SUI in the present study, showed significantly decrease in leakage per day from the first injection (P value <0.05), in patients with moderate SUI, leakage per day wasn`t significantly decreased except after second injection (P value <0.05) while in patients with severe SUI, leakage per day wasn`t significantly decreased even after 2 doses of injection (P value >0.05).

Athanasiou et al. (10) observed a significant improvement in SUI symptoms 3 months after PRP injections into the lower one third of the anterior vaginal wall with a further improvement at 6 months. A mean reduction of 50.2% in urine loss was observed in the 1-hour pad test. At the 6-month follow-up, 80.0% of women reported to be at least improved. Also, Long et al. (11) found significant improvement in incontinence symptoms with no significant adverse reactions. Daneshpajooh et al. (12) compared between PRP and midurethral

Chiang & Kuo (13) investigated the therapeutic effect of repeated urethral sphincter injections of PRP in treatment of SUI in women due to intrinsic sphincter deficiency

(ISD) refractory to medical treatment or after the first anti-incontinence surgery. They revealed that the overall success rate was 50%. Complete dryness was achieved in 12 patients (46.2%) after the PRP treatment, and 7 (26.9%) kept total continence at 12 months. In addition to that, the abdominal leak point pressure increased significantly.

PRP injection caused significant improvement in quality of life in patients with SUI in the present study; LUTsqol score significantly decreased after PRP injection (P value < 0.001). However further analysis revealed that patients with mild SUI in the present study, showed significantly decrease in LUTsqol score from the first injection (P value <0.05), in patients with moderate SUI, LUTsqol score wasn`t significantly decreased except after second injection (P value <0.05) while in patients with severe SUI, LUTsqol score wasn`t significantly decreased even after 2 doses of injection (P value >0.05).

Regarding factor affecting efficacy of PRP in treatment of SUI, our results revealed that increased parity, normal vaginal delivary and aging are associated with poor outcome after first and second injection (P value < 0.05). Long et al. (11) also reported that younger women seemed to have slightly better outcomes after PRP in treatment of SUI; however, their observation did not reach statistical significance.

CONCLUSION

Transvaginal ultrasound-guided periurethral PRP injection represents a safe and minimally invasive treatment option for female stress urinary incontinence. The treatment showed the highest efficacy in patients with mild SUI, with moderate improvement observed in patients with moderate disease, while limited benefit was noted in severe cases. Younger age, lower parity, and cesarean delivery were associated with better treatment outcomes. PRP injection also led to significant improvement in quality of life among responsive patients. Further randomized controlled studies with larger sample sizes and longer follow-up periods are recommended to confirm these findings and to better define the optimal patient selection criteria.

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