

Yu. I. Zaseda, R. I. Solomiany, F. B. Shykhaliiev

THE EXPERIENCE OF COMBINED APPLICATION OF PLATELET-RICH PLASMA THERAPY AND SHOCK-WAVE THERAPY IN TREATMENT OF ERECTILE DYSFUNCTION OF VASCULAR ORIGIN

Men's Health Clinic, Kiev, Ukraine

Annotation

In order to compare the clinical effect of platelet rich plasma-therapy and local negative pressure-therapy on the background of pharmacotherapy with Icariin and combined platelet rich plasma-therapy in combination with shock-wave therapy and vacuum device therapy on the background of pharmacotherapy with Icariin in the treatment of erectile dysfunction of arterial and arterial-venous origin, 50 patients of the Men's Health Clinic (Kiev) were examined with using clinical, laboratory and sonographic methods. Based on the results of the study, the high effectiveness of platelet rich plasma-therapy, shock-wave therapy and vacuum device -therapy and Icariin combinations use in the arterial and arterial-venous erectile dysfunction therapy in comparison with platelet rich plasma-therapy and vacuum device therapy and Icariin. According to our data intracavernosus activation of plate-cells was conducted by shock-wave method in a first time ever.

Key words:

urology, andrology, sexology, erectile dysfunction, platelet rich plasma, shock-wave therapy, Icariin.

Relevance. The recent medical discourse analysis indicates a tendency to the shift from the development of universal pharmacological (pharmacotherapeutic) agents, to improvement of the biological treatment tools effectiveness [6, 7]. This phenomenon can be considered in different perspectives, in particular: as the development of a previously inaccessible area of knowledge, reopened due to progress in sphere of medical research methodology; as an awareness of the significant limitations in the individual effectiveness and safety of structural-unitary pharmacological agents, when they are included in the metabolism of a particular patient; or as a way to avoid the political conjuncture in search of available treatments.

This tendency is especially evident in the andro-urological clinic, where, for more than a quarter of a century, the opposition of biological therapy to the conservative standard of pharmacotherapy erectile dysfunction of vascular origin (EDVO) has been sharply debated [1-5].

Since the last decades of 20th century, phosphodiesterase fifth type inhibitors (PDE-5), as an erectogenic agent, have become the most prescribed group of drugs with EDVO. In spite of the unambiguous symptomatic orientation of the action mechanism of PDE-5 not only doesn't demonstrate absolute effectiveness, but also, due to the marketing image of the "universal remedy", reduce patient's interest in pathogenetic and etiotropic therapy. This leads to the acute demand to consider new, primarily bio- and physiotherapeutic options for the treatment of EDVO [2, 4-6].

In the first two decades of the twenty-first century, cellular and modern physiotherapeutic technologies should be distinguished, by not only its fundamental progress and evolution, but also by overcoming the mistrust of clinicians and entering in to clinical practice as routine therapeutic procedures. With regard to the problem of EDVO, the proven pathogenetic effect has been shown by methods of vector (gene) therapy, stem cells

and local platelet-rich plasma therapy (PRP-therapy), modern physiotherapeutic techniques such as low-intensity pulsed ultrasound and low-intensity extracorporeal shock-wave therapy (LESWT) [1, 4-6].

The analysis of the Ukrainian andrological clinic on the background of law and economic conjuncture – economic and technological (according to vector therapy demands) and legal and ethical (according to embryonic stem cell therapy demands), shows the priority of PRP-therapy and modern physiotherapeutic techniques[2].

At present, there are original clinical studies dedicated to EDVO treatment with PRP-therapy, which results are about to confirm the pathogenetic effect as an intensification of blood circulation in vessels of cavernous bodies by double mechanism: stimulation of neovascularization processes (morphological effect) and correction of endothelial dysfunction (functional effect), as a results of platelet growth factors biological activity. In fact, signal-based native biomarkers, stimulating the restructuring of the tissues of the penis, are meant. This mechanism can be considered as a basic one in the combination of PRP-therapy and LESWT, which mechanism is based on the mechano-biological effects on local tissues [6].

Interdisciplinary researches dedicated to the study of the mechanisms and clinical effects of LESWT on hemodynamics in atherosclerotic vessels indicates an increase of the vascular endothelial growth factor (VEGF) and its Flt-1 receptors expression, that leads to neovascularization and an increase in the efficiency of local hemodynamics [6-8].

Other mechanisms underlie in the effect of PRP-therapy, where the main point is the repair of the vascular wall endothelial membrane, by stimulation of the endothelial progenitor cells induced by platelet growth factors, as well as the synergistic optimization of the endothelial and neuronal NO synthases production and the improvement of the vascular walls smooth muscle cell functions. In addition to the direct effect of proliferation, the phenomenon of recruiting and homing of mesenchymal stem cells is present providing the multimodality of neoangiogenesis [1, 7, 12].

The methodology of PRP-therapy indicates the release of growth factors from platelets, which is realized due to its biochemical activation by thrombin and calcium chloride, as well as recently described techniques – activation by ultrasound

or shock-wave impact [9-11]. An important aspect of the combined use of PRP-therapy and LESWT is the phenomenon of local platelets activation inside the cavernous bodies of penis. It is greatly increases the local concentration of growth factors. Another promising addition to a set of therapeutic procedures may be the local negative pressure therapy (LNP-therapy), which, besides the direct effect, contributes the delay in the leak of PRP from the primal site, minimizing the non-target effects of PRP-therapy.

Among the pharmacotherapeutic agents that promising to be complement to mentioned above mechanisms, we should highlight Ikariin (ICA), the flavonoid of *Epimedium brevicornum* Maxim, with a spectrum of effects: biological activity similar to PDE-5, stimulation of production of nitric oxide (NO), affinity to androgen receptors, as well as antioxidant activity. All that makes ICA the perspective addition to the PRP-therapy, LESWT and LNP-therapy of EDVO, especially taking into account the patients preferences for natural origin substances [8].

Nevertheless, the relative novelty of the PRP-therapy in EDVO treatment, accompanied by lack of patients demands (primarily due to effective marketing of pharmacotherapy), requires a search for ways to improve the effectiveness of PRP-therapy. A promising area is the analysis of the effectiveness of the combined usage of PRP, LESWT and LNP in a single therapeutic model for EDVO treatment [2, 6].

The aim of the study was to compare the clinical effect of combination of PRP-therapy and LNP-therapy and combination of PRP-therapy, LESWT and LNP-therapy, both on the background of pharmacotherapy with ICA in treatment of ED of arterial and arterial-venous origin.

Design. The study was conducted in a prospective design in parallel groups, as part of an open clinical study.

The study was conducted in 3 stages:

1) preliminary: development of research methodology, examination of patients to determine their compliance with the criteria for participation in the study, structuring the contingent, the formation of study groups;

2) therapeutic: treatment according to the proposed therapeutic models in parallel groups;

3) follow-up: monitoring and comparing the clinical effect of the proposed therapeutic models in parallel groups in 3 time-points.

Materials. The contingent of the study comprised 50 patients with EDVO (arterial and combined forms). Homogenization of the study population was carried out according to the age criterion (from 40 to 65 years), the duration of the ED (from 6 months to 5 years), ethnicity (Caucasoid race), and sexual preferences (heterosexual).

The following exclusion criteria were used:

- Isolated-neurogenic ED (priority of etiological therapy before the methods studied);
- Isolated-psychogenic ED (false positive and false-negative results);
- Significant pathology of the prostate gland, inflammatory diseases exacerbations (priority of etiological therapy before the methods studied);

- Significant disorders in the sex-hormones metabolism, that can affect the erectile function (priority of etiological therapy before the methods studied);
- Pathology of sexual preferences with a significant change in the stereotype of sexual intercourse (the impossibility of a correct interpretation of the clinical effect).
- Pronounced somatic pathology requiring priority treatment or induction of remission: cardiovascular pathology that disrupts functioning, oncological pathology, systemic connective tissue diseases, acute infectious diseases.

In the population of the study, comorbid pathology was presented, later it has been symmetrically distributed among the study groups (Table 1).

Table 1

Comorbid pathology in the study population

Nosology	N	%
Hypertensive disease I-II stages	32	64%
Ischemic heart disease I stages	26	52%
Abdominal obesity I-II stages	24	48%
Diabetes mellitus type II (in the phase of compensation)	18	36%
Metabolic Syndrome	26	48%

The division of population into groups had been done by the symmetry of the patients' age and the duration of ED manifestations with the informed consent to participate in a particular study group. The following research groups were formed:

- the main group (MG): 25 patients undergoing a course of therapy with concurrent use of a combination of PRP-therapy, LESWT and LNP-therapy and pharmacotherapy with ICA;
- control group (CG): 25 patients undergoing the course of therapy by the concurrent use of a combination of PRP-therapy and LNP-therapy and ICA;

Methods:

1) clinical examination and observation + clinical questionnaire "International Index of Erectile Function (IIEF), in order to establish the extent of erectile dysfunction;

2) a standard set of laboratory and instrumental studies – to exclude counter indications for treatment. Also, all patients passed expanded immunogram, the study of IgG, IgM and PCR in saliva and blood to HCV 1,2; HCV 6, HCV 7, Varicella zoster, EBV, CMV, followed by consultation of a clinical

immunologist and infectious disease specialist (to exclude causes of pathological immune status to avoid biological therapy effect distortion). Prior to the main treatment, antiviral, immunomodulating and hepatotropic drugs has been prescribed.

3) sonographic:

- trans-rectal sonographic examination of the prostate to determine the presence of pathology;
- pharmacodopplerography of penis with video-erotic stimulation (pharmacological stimulation – a standard dose of sildenafil 1 hour before the beginning of session, conducted on the background of video-erotic stimulation of erection) in order to establish the actual violations of erectile hemodynamics and further monitoring of clinical effects of treatment.
- ultrasound scanning of cavernous bodies: to control the injections of PRP (imaging echographic phenomena occurring after injection of PRP and its time recording) in setting the procedure of PRP-therapy (for indicating a delay in PRP leak from cavernous tissue).

Results. According to the research tasks, the following therapeutic models were used in parallel groups:

- MG (25 patients): parallel application of combination PRP-therapy (1 complex of injections per week for 6 weeks), LESWT (2 times a week 3000 strikes in 7 standard areas of the penis, frequency 10 Hz, total power up to 1 mJ/mm²) for 6 weeks (each first weekly procedure was carried out in combination with PRP and LNP procedures (for intracavernous platelet activation), the second procedure without PRP), ICA pharmacotherapy, orally, 50 mg/day in 1 reception (evening), during all course of therapy + 6 weeks (total 12 weeks).
- CG (25 patients): PRP-therapy (1 complex of injections per week for 6 and weeks) combined with LNP and ICA pharmacotherapy, orally, 50 mg / day in one session (evening), during all course of therapy + 6 weeks (total 12 weeks).

Within the framework of the development of the research methodology, a standardized technique for obtaining PRP was chosen. It consist of taking 72 ml of blood from the patient's ulnar vein (followed by placement in 9-ml vacuum tubes with 3,8% sodium citrate solution), centrifuging at

500g for 5 min, subsequent collection of plasma and repeated centrifugation at 1538g for 3 min, release of the lower plasma layer in a volume of 1 ml, activation of platelet growth factors with 0,1 ml of 10% calcium chloride solution [4].

The treatment procedure using PRP consists of a complex of injections performed using a syringe (1,0 ml capacity) along the lateral surface of the penis: proximally, distally 1,0 ml per each locus; further 1,0 ml approaching albuginea (multifocal); further on 0,5 ml of PRP in both ischia-cavernous muscles; and 1,0 ml per each peduncle of the penis.

In the MG, after this (in a period of 5-10 minutes, that corresponds to ultrasonographic data of PRP presence in cavernous tissue), LESWT and LNP procedures are performed to reach the condition of intracavernous platelet activation.

Effectiveness control and comparison was performed using dopplerography of the penis, control by: peak systolic velocity (PSV), end-diastolic velocity (EDV) and the clinical questionnaire of IIEF in three time-points: 6th week of treatment (the end of PRP-therapy course), 12th week (the end of ICA course) and 24th week. The results of the follow-up phase of the study are presented in Table. 2.

Table 2

Results of the follow-up phase of the study

Criterion (mean values)	therapy start		6th week (end of PRP- therapy course)		12th week (end of ICA course)		24th week	
	MG	CG	MG	CG	MG	CG	MG	CG
pahrmacodopplerography								
PSV in rest (cm/s)	8,1 ±0,13	7,9 ±0,14	8,1 ±0,12	8,0 ±0,15	8,9 ±0,18	8,5 ±0,22	9,7 ±0,2	9,0 ±0,29
PSV in stimulation (cm/s)	23,6 ±0,12	23,4 ±0,14	24,1 ±0,17	24,1 ±0,19	25,7 ±0,15	24,2 ±0,17	32,6 ±0,17	30,7 ±0,15
EDV in stimulated condition (cm/s)	5,5 ±0,18	5,4 ±0,22	5,1 ±0,19	5,0 ±0,21	4,9 ±0,23	4,9 ±0,18	3,9 ±0,2	4,3 ±0,17
IIEF-5								
Erectile function	17,2 ±0,15	17,4 ±0,17	18,1 ±0,28	17,6 ±0,17	19,2 ±0,19	18,8 ±0,15	22,8 ±0,19	20,7 ±0,24
Sexual intercourse satisfaction	7,1 ±0,16	7,0 ±0,2	7,6 ±0,24	7,4 ±0,18	9,4 ±0,19	8,8 ±0,18	10,9 ±0,22	9,8 ±0,26
Orgasmic function	4,4 ±0,14	4,5 ±0,18	5,2 ±0,26	4,7 ±0,22	6,9 ±0,17	6,2 ±0,22	7,8 ±0,19	7,0 ±0,21
Libido	6,4 ±0,18	6,3 ±0,22	6,9 ±0,23	6,3 ±0,32	8,6 ±0,28	7,1 ±0,22	8,8 ±0,19	7,9 ±0,24
General satisfaction level	4,1 ±0,28	4,2 ±0,24	5,2 ±0,21	4,5 ±0,23	6,0 ±0,18	5,1 ±0,16	6,4 ±0,26	5,4 ±0,3

*The gray color indicates cases with no significant difference

Based on the results of the pharmacodopplerographic study, significant differences in the parameters of erectile hemodynamics were revealed at different stages of the study. Thus, by the 12th week, the mean PSV index in the state of stimulation in MG significantly exceeded the same indicator in CG – $25,7 \pm 0,15$ cm/s and $24,2 \pm 0,17$ cm/s, respectively. A similar trend persisted in the 24th week: the value of PSV in stimulation in MG ($32,6 \pm 0,17$ cm/s) is significantly greater than in CG ($30,7 \pm 0,15$ cm/s).

The presence of an earlier effect on the PSV in stimulation indicates the therapeutic efficacy of PRP+LESWT+LNP+ICA model according to the functional condition of cavernous tissues upon activation of erectile hemodynamics, demonstrating a greater activation of PRP in MG that is confirmed by a lesser effect in CG.

Significant differences in the PSV in stimulation among the groups of study are observed only by the 24th week: at this time-point the mean group value among CG patients was $4,3 \pm 0,17$ cm/s, while for MG it was $3,9 \pm 0,2$ cm/s.

Basing on the results of the IIEF evaluation, significant differences in the rates of erectile dysfunction were revealed at different time-points. Thus, by the 24th week, the mean group value of erectile function in MG significantly exceeded the same indicator in CG – $22,8 \pm 0,19$ and $20,7 \pm 0,24$, respectively. In addition, significant differences in sexual intercourse satisfaction in groups of study were found in different time-points: by the 12th week, MG patients had demonstrated greater sexual intercourse satisfaction than patients of CG, $9,4 \pm 0,19$ versus $8,8 \pm 0,18$, respectively; by the 24th week the average value for this domain for MG was $10,9 \pm 0,22$, versus $9,8 \pm 0,26$ for CG.

Significant differences between the groups were also detected by the index of the orgasmic function: by the 12th week MG had their orgasmic function index higher than CG patients – $6,9 \pm 0,17$ and $6,2 \pm 0,22$, respectively. A similar tendency persisted by the 24th week in MG ($7,8 \pm 0,19$) and CG ($7,0 \pm 0,21$).

By the libido parameter, significant differences in comparison groups were found only in the last two time-points: by the 12th week, MG patients have shown a significantly higher level of sexual desire compared to CG – $8,6 \pm 0,28$ versus $7,1 \pm 0,22$ points, respectively; by the 24th week the mean value for this domain for MG was $8,8 \pm 0,19$ points, versus $7,9 \pm 0,24$ points in CG.

Reliable difference between the comparison groups for the indicator of general satisfaction were detected already at the early post-therapeutic stage and persisted for the whole period of follow-up observation. By the 6th week MG and CG patients showed values of general satisfaction at the levels of $5,2 \pm 0,21$ and $4,5 \pm 0,23$, respectively, by the 12th week – $6,0 \pm 0,18$ and $5,1 \pm 0,16$; by the 24th week – $6,2 \pm 0,26$ and $5,4 \pm 0,3$.

It was revealed that the improvement in hemodynamic parameters in MG occurred at earlier stages and was followed by more pronounced clinical effect. It was also found that the severity of clinical markers of erectile dysfunction correlates with the degree of compensation of cavernous hemodynamics.

Among the additional effects of therapy, it noteworthy that 16 MG patients and 14 CG patients after the course of treatment completely abandoned pharmacological support, with argumentation of erectile function restoration. 3 more MG patients left from the group of PDE-5non-responders.

Basing on the research materials, an application for the grant of a patent for invention No. a2018 04939 dated 05/05/2018 "A method of treatment of erectile dysfunction of vascular origins", has been registered.

Conclusions.

1. By the results of the study, the efficacy of PRP-therapy of arterial and combined forms EDVO in combination with LESWT, LNP-therapy and ICA was higher in comparison to a similar therapeutic model, but with no LESWT component. This efficacy impact appears to be associated with intracavernous activation of PRP (and a corresponding increase of growth factors levels), what requires further confirmation in more detailed clinical studies.
2. It was revealed that improvement of hemodynamic parameters in MG occurred at earlier stages and was followed by more pronounced clinical effect. It was also found that the severity of the clinical markers of erectile dysfunction correlates with the degree of cavernous hemodynamics compensation that indicates the compliance of the clinical effect with the functional condition of cavernous hemodynamics. The structure of the differences in the therapeutic models clinical effects indicates the presence of a significant

delayed effect of PRP+LESWT combination on the functional condition of the cavernous tissues when the erectile hemodynamics is activated.

3. It was found that the greatest differences between the compared therapeutic models are observed at late post-therapeutic stages (by the 12th-24th week of the follow-up period).
4. Instrumental (ultrasonographic) markers of the injected PRP presence in cavernous bodies have been established. Time of echo-phenomena that indicates the presence of injected PRP is from 5 to 10 (with LNP-stimulation) minutes.
5. For the first time, according to our data, PRP activation for the release of platelet growth factors was performed by the LESWT method.

АННОТАЦІЯ

ОПЫТ КОМБИНИРОВАННОГО ПРИМЕНЕНИЯ АУТОПЛАЗМЫ ОБОГАЩЕННОЙ ТРОМБОЦИТАРНЫМИ ФАКТОРАМИ РОСТА И УДАРНО-ВОЛНОВОЙ ТЕРАПИИ В ЛЕЧЕНИИ ЭРЕКТИЛЬНОЙ ДИСФУНКЦИИ СОСУДИСТОГО ГЕНЕЗА

Ю.И. Заседа, Р.И. Соломенный, Шихалиев Фарид
Боюкага оглы

Клиника "Мужское здоровье", г. Киев, Украина

С целью сравнения клинического эффекта терапии аутоплазмы обогащенной тромбоцитарными факторами роста и терапии локальным отрицательным давлением на фоне фармакотерапии икарином и комбинированной терапии аутоплазмой обогащенной тромбоцитарными факторами роста в сочетании с низкоэнергетической ударно-волновой терапией и терапии локальным отрицательным давлением на фоне фармакотерапии икарином в лечении эректильной дисфункции артериального и артериально-венозного генеза, при помощи клинического, лабораторного и сонографического методов исследования было обследовано 50 больных клиники «Мужское здоровье» (г. Киев). По результатам исследования была подтверждена более высокая эффективность применения комбинаций аутоплазмы обогащенной тромбоцитарными факторами роста, низкоэнергетической ударно-волновой терапии и

локальным отрицательным давлением в схеме терапии эректильной дисфункции артериального и артериально-венозного генеза по сравнению с терапией аутоплазмой обогащенной тромбоцитарными факторами роста. Впервые, по нашим данным, проведена интракавернозная активация тромбоцитов методом низкоэнергетической ударно-волновой терапии.

Ключевые слова: урология, андрология, сексология, эректильная дисфункция, аутоплазма обогащенная тромбоцитарными факторами роста, низкоэнергетическая ударно-волновая терапия, икариин.

АНОТАЦІЯ

ДОСВІД КОМБІНОВАНОГО ЗАСТОСУВАННЯ АУТОПЛАЗМИ ЗБАГАЧЕНОЇ ТРОМБОЦИТАРНИМИ ФАКТОРАМИ РОСТУ І УДАРНО-ХВИЛЬОВОЇ ТЕРАПІЇ В ЛІКУВАННІ ЕРЕКТИЛЬНОЇ ДИСФУНКЦІЇ СУДИННОГО ГЕНЕЗУ

Ю.І. Заседа, Р.І. Солом'яний, Шихалієв Фарід
Боюкага огли

Клініка "Мужское здоровье", м. Київ, Україна

З метою порівняння клінічного ефекту аутоплазми збагаченої тромбоцитарними факторами росту і терапії локальним негативним тиском на тлі фармакотерапії Ікарііном і комбінованої терапії аутоплазмою збагаченої тромбоцитарними факторами росту в поєднанні з низкоенергетичною ударно-хвильовою терапією і терапією локальним негативним тиском на тлі фармакотерапії Ікарііном в лікуванні еректильної дисфункції артеріального і артеріально-венозного генезу, за допомогою клінічного, лабораторного та сонографічного методів дослідження було обстежено 50 хворих клініки «Мужское Здоровье» (м. Київ). За результатами дослідження було підтверджено більшу ефективність застосування комбінацій аутоплазми збагаченої тромбоцитарними факторами росту з низкоенергетичною ударно-хвильовою терапією і локальним негативним тиском та ікарііном у схемі терапії еректильної дисфункції артеріального і артеріально-венозного генезу в порівнянні зі схемою терапії аутоплазмою збагаченою тромбоцитарними факторами росту, локальним негативним тиском та ікарііном. Вперше, за нашими даними, проведена інтракавернозна активация тромбоцитів методом низкоенергетичної ударно-хвильової терапії.

Ключові слова: урологія, андрологія, сексологія, еректильна дисфункція, аутоплазма збагаченої тромбоцитарними факторами росту, Ікаріін.

REFERENCES

1. Аксьонов П.В., Романюк М.Г., Мироненко В.І. Ударно-хвильова терапія у лікуванні еректильної дисфункції / Здоровье мужчины. – 2017. – №4 (63) – 64-70.
2. Горпинченко И.И. Современное лечение эректильной дисфункции. Использование ингибиторов фосфодиэстеразы 5-го поколения / Горпинченко И.И. // Здоровье мужчины. – 2013. – № 3 (46). – С. 87–90.

-
3. Горпинченко І.І. Ерекtilьна дисфункція та пов'язана зі здоров'ям якість життя / І.І. Горпинченко, Д.З. Воробець, П.Л. Свердан // Здоровье мужчины. – 2010. – №1 (32). – С. 54-60.
 4. Чалый М.Е., Вилькин Я.Ф., Епифанова М.В. Способ лечения эректильной дисфункции. – Патент на изобретение РФ No 2514639. Москва. 5 марта – 2014. // Бюллетень № 12 от 27.04.2014.
 5. Чалый М.Е., Григорян В.А., Епифанова М.В., Краснов А.О. Эффективность интракавернозного введения аутоплазмы, обогащенной тромбоцитарными факторами роста, в лечении эректильной дисфункции. // Урология. – 2015. – №4 –С. 76-79.
 6. Rizk PJ, Krieger JR, Kohn TP, Pastuszak AW. Low-Intensity Shockwave Therapy for Erectile Dysfunction. Sex Med Rev. 2018 Mar 22. pii: S2050-0521(18)30011-8. doi: 10.1016/j.sxmr.2018.01.002. [Epub ahead of print].
 7. Matz EL, Pearlman AM, Terlecki RP. Safety and feasibility of platelet rich fibrin matrix injections for treatment of common urologic conditions. Investig Clin Urol. 2018 Jan;59(1):61-65.
 8. Seabaugh, K. A., Thoresen, M., & Giguère, S. (2017). Extracorporeal Shockwave Therapy Increases Growth Factor Release from Equine Platelet-Rich Plasma In Vitro. *Frontiers in Veterinary Science*, 4, 205.
 9. Hu Y, Liu K, Yan M, Zhang Y, Wang Y, Ren L. Effects and mechanisms of icariin on atherosclerosis. Int J Clin Exp Med. 2015 Mar 15;8(3):3585-9.
 10. Notarnicola A, Tamma R, Moretti L, Panella A, Dell'endice S, Zallone A, Moretti B. Effect of shock wave treatment on platelet-rich plasma added to osteoblast cultures. Ultrasound Med Biol. 2011 Jan;37(1): 160-8.
 11. Wu YN, Wu CC, Sheu MT, Chen KC, Ho HO, Chiang HS. Optimization of platelet-rich plasma and its effects on the recovery of erectile function after bilateral cavernous nerve injury in a rat model. J Tissue Eng Regen Med. 2016 Oct;10(10): E294-E304.
 12. Wu CC, Wu YN, Ho HO, Chen KC, Sheu MT, Chiang HS. The neuroprotective effect of platelet-rich plasma on erectile function in bilateral cavernous nerve injury rat model. J Sex Med. 2012 Nov;9(11):2838-48.
 13. Retraction. *Medicine (Baltimore)*. 2018 Mar;97(12):e0262.
-

АВТОРСКАЯ СПРАВКА

- Заседа Юрий Игоревич, д.мед.н. Главный врач клиники «Мужское Здоровье» г. Киев. Телефон: +390976500444. E-mail: zasieda@gmail.com.
- Заседа Юрий Игоревич, д.мед.н. Головний лікар клініки «Мужское Здоровье» м. Київ. Телефон: +390976500444. E-mail: zasieda@gmail.com.
- Zasieda Yuri Igorevich. MD, Urologist, Andrologist, PhD, Doctor of Science, CMO of Men's Health Clinic, Kiev. Contact number: +390976500444. E-mail: zasieda@gmail.com.

Стаття надійшла до редакції 05.01.2018

У разі виникнення питань до автора статті, звертайтеся до редакції журналу ceomenshealth@gmail.com