Case report

INNOVATIVE APPROACHES FOR OPTIMIZING THE TREATMENT OF ARTHROSIS WITH AUTOLOGOUS ADIPOSE TISSUE STROMAL-VASCULAR FRACTION (SVF) TRANSPLANTATION

Shalva Gabadadze, Givi Chikobava, Davit Kochiashvili, Alexandre Tsalughelashvili, Irakli Nadiradze, Malkhaz Pirpilashvili, Tamaz Kerdzevadze

Georgia Israeli Joint Clinic "Gidmedi"

Contact person: Shalva Gabadadze, ga20ebuli@gmail.com

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Rezume

Aim: Non-operative arthrosis treatment via stem cell transplantation is a current medical priority. Standard stromal-vascular fraction (SVF) transplantation yielded unsatisfactory results in some patients, prompting development of a modified, more effective protocol.

Methods: 20 patients (18F, 2M; ages 42–72) with grade I–II hip arthrosis were divided equally into a study group (modified protocol) and control group (standard method). Outcomes were assessed via instrumental imaging (ultrasound, X-ray, CT, MRI), laboratory tests, the Lequesne algofunctional index, and modified Harris scale.

The modified method comprised three phases:

Phase I – Pre-transplant elimination of acute inflammation and pain relief;

Phase II – SVF preparation from autologous adipose tissue and joint injection;

Phase III – Post-transplant management via magnetotherapy, early rehabilitation, and infection prevention.

Adipose tissue (80–120 ml) was harvested by liposuction and processed using Arthrex technology, yielding 10–12 ml of injectable SVF.

Results: In the study group, 8/10 patients fully restored limb support and joint function within 6 months, exceeding 90 points on the Harris scale. The control group showed slow, unstable recovery; only 3/10 achieved a clinically good result.

Conclusion: The modified SVF transplantation method is significantly more effective than the standard approach. Key success factors include pre-transplant inflammation control, post-transplant magnetotherapy, and infection prevention. No reliable laboratory marker for regeneration dynamics was identified; CT and MRI remain the primary monitoring tools. The authors recommend broader clinical trials with larger patient cohorts and longer observation periods.

Key words: Arthrosis, Regeneration, Transplantation, Stromal-Vascular Fraction (SVF), Standard method, Innovative method, Early rehabilitation.

RELEVANCE

Conservative treatment (treatment with medications, injection therapy, physiotherapy, and others) of the spine and joints is mainly aimed at eliminating pathological symptoms and restoring and rehabilitating joint function. However, the issue of regeneration – restoration of the injured tissue system is not considered in this chain [27, 28, 29, 39], which is why long-standing, continuous treatment often ends with an endoprosthesis, and an endoprosthesis has both positive and negative side effects [38].

Treatment of arthrosis without surgery is a significant challenge in modern medicine and biomedical engineering. It is possible only with timely started regenerartive therapy, namely, with transplantation of stem cells in the injured joint [9, 12, 16, 20, 22, 35], however, transplantation conducted by us with standard method (taking adipose tissue from organism, preparation of the stromal-vascular fraction containing mesenchymal stem cells and injecting in target joint) showed a less effective result in the part of patients; Namely, the tempo of transformation of stem cells into collagen cells, accordingly, regeneration of tissues and restoration of joint were ongoing ineffectively and dully, and in single case, it ended up in failure. Since the treatment of arthrosis with stem cell transplantation is, in principle, the most correct and physiologically the most correct form [4, 5, 6, 14], we doubted not the method but its management.

Clinical practice has shown that not only restyling but also a completely new design of the standard stem cell transplantation method is necessary to increase treatment efficiency.

For this purpose, we studied and analyzed the management of standard treatment, in which several organizational and medical reasons for low efficiency were identified, namely:

1. underestimation of the stem cell resource in patients' bodies,
2. transplantation of non-autologous stem cell mass into the target joint (low concentration of stem cells in material to be transplanted, insufficient volume of material),
3. coexistence of an acute or chronic inflammatory process in the joint along with arthrosis,
4. systemic and infectious diseases of connective tissue (viral, bacterial and fungal).

From an organizational perspective, standard treatment did not properly address patient preparation before transplantation, management of regeneration, or timely initiation of rehabilitation. Monitoring the patient's condition to prevent infectious and somatic diseases was overlooked, as was providing appropriate treatment when needed. Furthermore, in rare cases, necrotic–inflammatory processes caused by rough mechanical exposure of the joint's hard tissues during transplantation prevented regeneration, resulting in endoprosthesis placement.

Considering the fundamental shortcomings and incorrect approaches of the standard method for treating arthrosis with mesenchymal stem cell transplantation, we aimed to develop a modified and, most importantly, practically effective treatment method.

AIM OF THE STUDY

1. Investigation of the causes of the low effectiveness of the standard method for treating arthrosis with autologous adipose tissue stromal-vascular fraction (SVF) transplantation.
2. Creation of a new, modified, and effective method of treatment for arthrosis, taking into account the causes of the low effectiveness of stromal-vascular fraction transplantation treatment.
3. Comparison of the results of the modified and standard methods of treating arthrosis with stromal-vascular fraction transplantation.
4. Justification of the superiority of the modified treatment method compared to the standard one, based on the data from our own clinical studies, and its implementation in clinical practice.

MATERIAL AND METHODS

We studied 20 patients with I and II degrees of hip joint arthrosis. Of the patients, 18 were women, and 2 were men. Their ages were from 42 to 72. 10 patients underwent treatment with transplantation of autologous mesenchymal stem cells according to our protocol (the study group), and 10 patients underwent the same procedure using the standard method (the control group).

To monitor the degree of injury to the cartilage-ligament-bone tissues of the joint and the regeneration-restoration process, we used ultrasound, X-ray, densitometry (DEXA), computed tomography (CT), and magnetic resonance imaging (MRI) as needed.

During physical examinations, we evaluated joint shape, the condition of covering tissues, joint mobility, muscular power, and the support capacity of extremities by visual examination, using a dynamometer and a protractor. We assessed joint pain intensity using the Lequesne algofunctional scale [11] and qualitatively evaluated the treated joint using the Harris scale [7].

From laboratory tests, we studied complete blood count with a leukocyte formula, CRP, rheumatoid factor, uric acid content/level, calcium (total and ionized), alkaline phosphatase in the blood, seromucoid (alpha-1-acid glycoprotein), and synovial fluid.

Patients in both groups were examined before transplantation and after 3 and 6 months from transplantation.

Based on clinical, laboratory, and instrumental examinations, we compared innovative and standard stem cell transplantation methods for the treatment of arthrosis.

The treatment protocol in the study group consisted of 3 steps:

Before transplantation

I Stage

a) Resolution of the acute inflammatory process in the musculoskeletal system of the macroorganism (patient) (if present), and the transfer of the chronic inflammatory process into recession.

b) Pain relief (or pain control) in the target joint(s) (if present).

II Stage

Preparation of the stromal-vascular fraction of mesenchymal stem cells from autologous adipose tissue and transplantation into the target joint. Stimulation of stem cell generation in the body and an increase in their absolute number.

After transplantation

III Stage

Management of the regeneration-restoration process of damaged tissue(s) after transplantation, and provision of therapeutic and prophylactic services to the patient to prevent infectious diseases or provide timely treatment if necessary.

Photo 1.

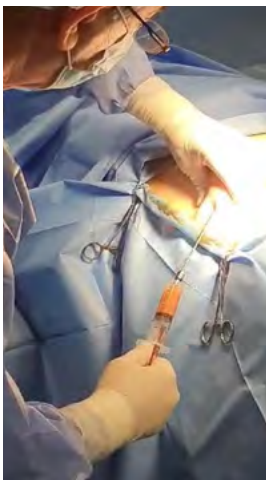

Photo 2.

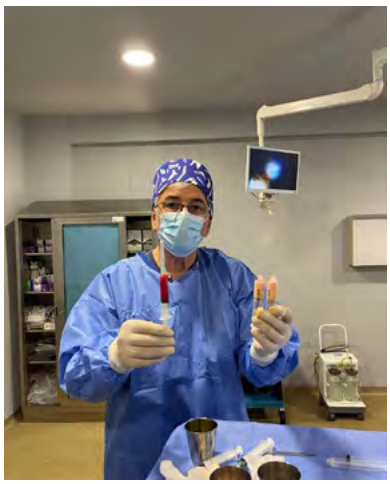

Photo 3.

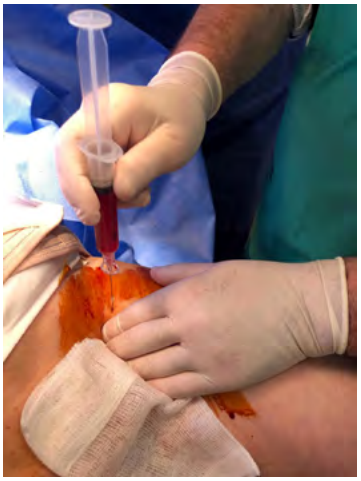

Photo 4.

TRANSPLANTATION TECHNIQUE

Transplantation place - surgical room.

Materials and tools required for transplantation: A toolkit from the South Korean firm "Adinizer" (Photo 1). Centrifuge SMART FUGE (Turkey).

We will mark the incision and liposuction sites on the front surface of the abdomen with a marker.

After aseptic processing of the surgical field and infiltration anesthesia of the adipose tissue (Sol. Lidocaine 1%, 120 ml + Sol. Adrenalinum 0.1%, 0.5 ml), we made two small cuts, each measuring 0.5 cm. Through the wounds, we insert a 20 cm-long titanium cannula fitted with a Luer-Lock syringe into the fatty tissue. (Photo 2) We perform liposuction by periodically moving the cannula back and forth and by constant aspiration (Photo 2). We inject the stem cell mass obtained by processing the fatty material (photo 3) into the target joint (Photo 4). We will place ice cubes in the liposuction area.

Technological assurance for the preparation of the stromal-vascular fraction containing mesenchymal stem cells from autologous adipose tissue.

Adipose tissue was harvested from the patient using the method described by Sydney R. Coleman [31]. The stromal-vascular fraction was prepared from adipose tissue using Arthrex technology [34] and a set of instruments from the South Korean company Adinizer. The processed adipose tissue was separated using the Turkish-manufactured centrifuge SMART FUGE.

COMPARATIVE CHARACTERIZATION OF STANDARD AND INNOVATIVE METHODS OF TREATING ARTHROSIS WITH STEM CELL TRANSPLANTATION

Joint mobility

As shown in Table 1, more than half of the patients in the study group had decreased flexion before transplantation. After 3 months, and especially after 6 months, joint mobility was notably improved; 7 patients flexed from 91° to 110°, and 3 patients flexed from 111° to 140°.

In the control group, the number of patients with flexion disability (5 patients) prevailed even 6 months after transplantation. 3 patients were able to extend the lower extremity at the hip from 91° to 110°, whereas only 2 extended it from 111° to 140°.

Before transplantation, only 5 patients in the study group could perform abduction from 16° to 30°, and only 1 could do so from 31° to 60°. After 6 months from transplantation, 6 and 4 patients were able to do it. Abduction was difficult for patients in the control group; only 2 patients were able to abduct the hip joint from 31° to 60°.

In the study group, 4 patients achieved adduction from 0° to 15° before transplantation, and 6 achieved adduction from 16° to 60°. After 6 months, all 10 patients achieved adduction from 16° to 60°! As for the control group, only 7 patients were able to do it.

In the study group, 7 patients performed external rotation from 0° to 30°, and only 3 performed it from 31° to 60° before transplantation. After 6 months of transplantation, 6 patients had already achieved external rotation from 31° to 60°, whereas only 3 patients in the control group had achieved the same.

Efficiency of pain cessation

Although 10 patients in the study group received anti-inflammatory, antispasmodic, and analgesic therapy before transplantation, only 4 patients did not experience night pain. In comparison, 5 and 1 patients experienced pain during movement and in a static position, respectively (Table 2).

After 6 months from transplantation, all patients of the study group completely recovered from night pain and discomfort.

Among the control group patients, only 1 patient did not experience night pain before transplantation from 10 patients! 6 and 3 patients complained about pain during movement or in a static position, respectively, after 6 months from transplantation, 3 patients had night pain, 3

Table 1. Assessment of movement in the hip joint in the study and control groups

Form of movement in joint	Angle of movement in the joint in degrees	Study group N10			Control group N10		
		Patient's quantity with separate form of movement in joint			Patient's quantity with separate form of movement in joint		
		Before transplantation	After 3 months from transplantation	After 6 months from transplantation	Before transplantation	After 3 months from transplantation	After 6 months from transplantation
Flexion	0-45	4	0	0	6	1	0
	45-90	5	2	0	3	6	5
	91-110	1	6	7	1	2	3
	111-140	0	2	3	0	1	1
Abduction	0-15	4	0	0	6	3	2
	16-30	5	8	6	3	6	6
	31-60	1	2	4	1	1	2
Adduction	0-15	4	2	0	7	6	3
	16-60	6	8	10	3	4	7
External rotation	0-30	7	6	4	8	8	7
	31-60	3	4	6	2	2	3

Table 2. Pain assessment in the study and control groups according to the Lequesne scale

Parameters	Importance	Points	Study group N10			Points	Control group N10		
			Patients's quantity according to separate parameter				Patients's quantity according to separate parameter		
			Before transplantation	After 3 months from transplantation	After 6 months from transplantation		Before transplantation	After 3 months from transplantation	After 6 months from transplantation
Night pain and discomfort	No	0	4	8	10	0	1	5	1
	While moving or in a certain position	1	5	2	0	1	6	4	6
	At the time of immobility	2	1	0	0	2	3	1	3
Duration of morning stiffness or pain after getting up	No	0	6	8	10	0	4	5	7
	<15	1	4	2	0	1		3	3
	>=15	2	0	0	0	2	6	2	0
Pain increases after 30 minutes of standing	No	0	3	10	10	0	2	4	9
	Yes	1	7	0	0	1	8	3	1
Pain at the time of walking	No	0	0	9	10	0	0	4	8
	While passing a certain distance	1	3	1	0	1	4	4	2
	At the time of starting walk	2	7	0	0	2	6	2	0
At the time of sitting After 2 hours	No	0	2	7	10	0	4	6	8
	Yes	1	8	3	0	1	6	4	2

patients had pain at the time of movement, and all of them were recovered from pain in a static condition.

In the study group, 4 patients experienced morning stiffness syndrome characteristic of arthrosis; however, they mentioned that stiffness and discomfort lasted less than 15 minutes.

Morning stiffness was relieved in all patients after 6 months of transplantation.

In the control group, only 4 patients did not experience morning stiffness. 6 patients complained of pain upon waking. After 6 months of transplantation, morning stiffness resolved in 7 patients, and 3 patients still had mild pain upon waking.

In the study group, unlike the control group, pain on sitting, standing, and walking was significantly reduced before stem cell transplantation and was completely re-

Table 3. Assessment of the patients' condition in the study and control groups after 6 months from stem cells transplantation according to Harris scale

Type of complaint and physical activity	Intensity	Study group	Control group
Pain	Is not marked	10	7
	Insignificant		3
	Small at the time of activation		
	Strong at the time of activation		
	Permanent		
	Can't walk		
Movement in joint	Complete	10	8
	Insignificant restriction		2
	Moderate restriction		
	Important restriction		
	Strong restriction		
	Contracture		
Lameness	Is not marked	10	10
	Small		
	Moderate		
	Strong		
	Can't walk		
Assistive devices	Cane at long distance	10	7
	Cane always		3
	Two canes		
	Crutches		
Distance of walking	Unrestricted	10	7
	Up to 1 km		3
	Up to 200 m		
	Only at home		
	Can't walk		
Putting on socks and shoes	For 1 hour on any chair	10	7
	On low chair 0,5	2	3
	Can't		
Sitting	For 1 hour on any chair	10	7
	On low chair 0,5	2	3
	Can't		
Getting into transport	Can	10	10
	Can't		
Going up the stairs	Without railing	10	8
	With railing		
	Somehow		
	Can't		
Deformation	Is not marked	10	10
	Is marked		

Table 4. Qualitative assessment of results of treatment according to Harris scale (After 6 months)

Assessment	Point	Study group N10	Control group N10
Poor	<70	0	
Average	70-79	0	2
Good	80-90	2	5
Very good	>90	8	3
Good	80-90	2	5
Very good	>90	8	3

lieved after 6 months. During the same period, the degree of recovery in patients in the control group was noticeably lower than that of patients in the study group (see Table 2).

Types of patients' complaints and physical activities.

To assess the effectiveness of the innovative protocol, we compared the study and control groups, as well as the patients, on key criteria, including the type of complaint and physical activities.

As shown in Table 3, after 6 months of stem cell transplantation, walking distance and self-care ability are limited in the control group. Patients have difficulty climbing stairs, putting on socks, and putting on shoes. It should be noted that there is no difference between the groups in terms of lameness and joint deformity.

In the study group, in contrast to the control group, pain was relieved in all patients, and full joint movement was restored, indicating a significant advantage of the innovative treatment method over the standard one.

Qualitative assessment of the results of treatment according to the Harris scale (After 6 months).

As it can be seen from Table 4, after 6 months from transplantation in the control group, average result (70-79 points) was observed in 2 patients, good result (80-90 points) in 5 patients, very good result (more than 90 points) in only 3 patients, while in the study group, poor and average result was not observed in any patient. A good result was observed in 2 patients and a very good result in 8, demonstrating the clear advantage of the innovative treatment protocol we provide for arthrosis compared to the standard approach.

Discussion about the obtained results

Years of practical experience have shown us that treating arthrosis with medication, injection therapy, physiotherapy, and other routine methods is ineffective and often ends in surgery.

Modern medicine and bioengineering have shown that effective regeneration and restoration of the joint's degenerated hard and soft tissues are possible with mesenchymal stem cell transplantation. However, the standard transplantation we performed did not yield the desired result. Given that the treatment of arthrosis with stem cell transplantation is a fundamentally correct and physiologically most justified approach, we did not doubt the method itself, but rather its management. We aimed to identify shortcomings of standard stem cell transplantation through clinical studies and to develop a modified stem cell transplantation method for treating arthrosis.

The conducted studies revealed several medical and organizational shortcomings of the standard method of transplantation of the stromal-vascular fraction (SVF) containing mesenchymal stem cells of arthrosis.

Because stromal-vascular fraction (SVF) transplantation is often performed in one session, sufficient attention is not paid to the coexistence of infectious (viral, bacterial, fungal), non-infectious (contact with toxins, allergic reac-

tions, metabolic disorders), or mixed genesis inflammatory process in the target joint, along with arthrosis, which requires complete treatment before stem cell transplantation. Against the background of the inflammatory process, the rate of stem cell transformation into collagen cells, and, accordingly, tissue regeneration and joint restoration, is reduced.

Another disadvantage of the standard method of treating arthrosis with stromal-vascular fraction (SVF) is the neglect of periodic oxygenation of periarticular tissues after transplantation, early initiation of premature rehabilitation, and preventive measures for infectious diseases for the patient. The regenerative process stops against the background of prolonged febrile diseases with chills.

Our modified method of treating arthrosis with stromal-vascular fraction (SVF) transplantation significantly accelerated tissue regeneration, the restoration process, and the degree of recovery. namely: prior to transplantation, the inflammatory process in the target joints of patients in the study group had resolved, pain had been alleviated, and there was a marked reduction in soft-tissue edema. After 2 months of transplantation, the supportive capacity of the extremity began to improve, and it was corrected over 6 months; joint movement function was restored, and the patient regained the ability to perform physical activity. According to the Harris Scale, in 8 out of 10 cases, a very good result was obtained (>90 points)!

During the same observation period, the recovery process with standard treatment was slow; patients had difficulty with self-care, e.g., putting on socks, walking short and medium distances, and climbing and descending stairs, and, in most cases, used assistive devices (e.g., a cane). Good results were achieved in only 3 of 10 patients, demonstrating the clear advantage of our innovative stem cell transplantation method over the standard method for treating arthrosis.

It is noteworthy that no clinically valuable test reflecting the dynamics of the regenerative process has been found in laboratory studies. Also, instrumental examinations such as CT, MRI, ultrasound, and X-ray, especially during the first six months after transplantation, cannot accurately reflect the true state of regeneration and restoration of the damaged hard and soft tissues of the joint.

PRACTICAL RECOMMENDATIONS

1. Our innovative method of treating arthrosis with stem cell transplantation is much more effective than the standard one.
2. For successful treatment of arthrosis with transplantation of the stromal-vascular fraction (SVF) containing mesenchymal stem cells, it is advisable to follow the 3-stage protocol provided by us, namely consistently:

Before transplantation,

a) Creating favorable conditions for stem cell proliferation and tissue regeneration in the target joint (reducing the inflammatory process, relieving pain).

During transplantation,

a) Ensuring that a sufficient number of stem cells are introduced into the target joint.

After transplantation,

a) Managing the process of regeneration-restoration of the degenerated tissues of the target joint (oxygenation of the joint, improvement of blood and lymph microcirculation in the hard and soft tissues of the joint.
b) Prevention of infectious diseases and, if necessary, immediate referral of the patient to a medical institution of the appropriate profile.
c) Timely activation of early rehabilitation.

3. It is recommended that the patient be at rest for 1 week after transplantation.
4. Treatment of arthrosis with stromal-vascular fraction transplantation is recommended to be repeated 8-12 months after the first transplantation - especially in elderly patients (60-74).
5. Since X-ray and ultrasound examinations, CT, and MRI (especially in the first six months after transplantation) do not reflect the real picture of regeneration-restoration, we can use the Lequesne and Harris algofunctional index to assess the result of treatment.
6. In order to increase the validity of the innovative treatment method we provide, we consider it appropriate to expand further studies to preliminarily identify stem cells to be injected into the target joint and determine the optimal number of stem cells in the transplantation material. In addition, to fully reflect the process of tissue regeneration and restoration, it is necessary to create optimal laboratory and instrumental research methods.
7. The study was conducted in a small group of patients, and the treatment outcomes were observed over a short period. Therefore, we also consider it advisable to broadly evaluate the presented treatment method and its conclusions in interested clinics, with the extensive involvement of specialists in the relevant fields.

CONCLUSION:

Treating arthrosis by transplanting adipose tissue stromal-vascular fraction is fundamentally correct and physiologically justified. Standard transplantation with a stromal-vascular fraction is relatively easy to implement, but the modified, complex treatment we present is much more effective.

The effectiveness of the treatment depends on a) accelerating the regeneration of damaged tissues by eliminating the inflammatory process in the target joint before transplantation; b) managing the regeneration-restoration process in the joint after transplantation, by timely initiation of early rehabilitation with magnetotherapy for oxygenation of hard and soft tissues. Practice has shown that providing prophylactic services in the post-transplantation period is essential to protect treated patients from infectious diseases. (The regenerative process stops against the

background of infectious diseases with fever and chills, and renewal becomes impossible!).

No clinically valuable test reflecting the dynamics of the regenerative process has been identified in the laboratory. We can assess the arrangement of articular cartilage, tendons, and bone tissues using CT and magnetic resonance imaging. The clinical course of the disease objectively reflects the patient's recovery.

Given the growing evidence supporting the modified method of treating osteoarthritis with transplantation of the stromal-vascular fraction of autologous adipose tissue, we consider it appropriate to expand further studies to identify stem cells in the transplant material to be injected into the target joint and determine their optimal number.

The study was conducted in a small group of patients, and the evaluation of treatment results was carried out over a short period; therefore, we also consider it advisable to widely test the modified method and the conclusions presented by us in interested clinics, with broad involvement of relevant specialists.

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ინოვაციური მიდგომები ართროზის აუტოლოგიური ცხიმოვანი ქსოვილის სტრომულ-ვასკულური ფრაქციის (SVF) ტრანსპლანტაციით მკურნალობის ოპტიმიზაციისთვის

შალვა გაბადაძე, გივი ჩიქობავა, დავით ქოჩიაშვილი, ალექსანდრე ცალულელაშვილი, ირაკლი ნადირაძე, მალხაზ ფირფილაშვილი, თამაზ კერძევაძე

საქართველო-ისრაელის ერთობლივი კლინიკა „გიდმედი“

პასუხისმგებელი პირი: შალვა გაბადაძე, ga20ebuli@gmail.com

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რეზიუმე

ართროზის უოპერაციოდ მკურნალობა თანამედროვე მედიცინის და ბიოსამედიცინო ინჟინერიის უაღრესად აქტუალური გამოწვევაა და დროულად დაწყებული რეგენერაციული თერაპიით, კერძოდ, დაზიანებულ სახსარში ღეროვანი უჯრედების ტრანსპლანტაციითაა შესაძლებელი [20,29,34].

კლინიკური კვლევის მიზანი იყო სტანდარტული ტრანსპლანტაციის დადებითი და უარყოფითი შედეგების გათვალისწინებით ართროზის სტრომულ-ვასკულური ფრაქციით (SVF) მკურნალობის მოდიფიცირებული, კომპლექსური და კლინიკურად ეფექტური მეთოდის შექმნა.

მასალა და მეთოდები: შესწავლილი იყო 20 პაციენტის (18 ქალი, 2 მამაკაცი, ასაკი - 42-72 წელი) მენჯ-ბარძაყის სახსრის I და II ხარისხის ართროზის მკურნალობის შედეგები. 10 პაციენტს (საკონტროლო ჯგუფი) აუტოლოგიური ცხიმოვანი ქსოვილის SVF-ით მკურნალობა ჩაუტარდა სტანდარტული, 10-ს (საკვლევი ჯგუფი) - კი მოდიფიცირებული მეთოდით.

სახსრის ქსოვილების დაზიანების ხარისხის და რეგენერაცია-რესტავრაციის პროცესის მონიტორინგისთვის გამოყენებული იყო ინსტრუმენტული და ლაბორატორიული კვლევები. მკურნალობის ეფექტურობა შეფასდა ლეკვესნეს ალგოფუნქციური ინდექსით [11] და ჰარისის მოდიფიცირებული სკალით (Harris HS) [7].

ართროზის SVF-ით მკურნალობის, ჩვენს მიერ მოდიფიცირებული, მეთოდი შედგებოდა 3 ეტაპისაგან: **I ეტაპი - ტრანსპლანტაციამდე,** დაზიანებულ სახსარში მწვავე ანთებით პროცესის ალაგება, ქრონიკული ანთებით პროცესის რემისიაში გადაყვანა, ტკივილის კუპირება. **II ეტაპი** - აუტოლოგიური ცხიმოვანი ქსოვილისაგან მეზენქიმური ღეროვანი უჯრედების შემცველი SVF-ის მომზადება და სამიზნე სახსარში ტრანსპლანტაცია. **III ეტაპი - ტრანსპლანტაციის შემდეგ** სახსრის დაზიანებულ ქსოვილებში რეგენერაცია-რესტავრაციის პროცესის მართვა.

ტექნოლოგიური უზრუნველყოფა: პაციენტისაგან ცხიმოვანი ქსოვილის აღება წარმოებდა S. R. Coleman-ის მიხედვით [31], ცხიმოვანი ქსოვილისაგან SVF-ის მომზადება - ფირმა Arthrex-ის ტექნოლოგიით [34] და სამხრეთ კორეული ფირმა Adinizer-ის ინსტრუმენტთა ნაკრებით. გადამუშავებული ცხიმოვანი მასალისაგან SVF-ის სეპარაცია თურქული წარმოების ცენტრიფუგით SMART FUGE. ლიპოსაქციით მიღებული აუტოლოგიური ცხიმოვანი ქსოვილის რაოდენობა საშუალოდ 80-120 მლ-ს შეადგენდა სატრანსპლანტაციო SVF - 10-12 მლ-ს [39].

სტრომულ-ვასკულური ფრაქციის მომზადების და სამიზნე სახსარში ტრანსპლანტაციის პროტოკოლი.

პროცედურის ჩატარების ადგილი - საოპერაციო დარბაზი. მუცლის წინა კედლის ქვედა ნაწილის ასეპტიკური დამუშავების და ცხიმოვანი ქსოვილის ინფილტრაციული ანესთეზიის შემდეგ (Sol. Lidocaini 1%,120ml+Sol. Adrenalinum 0.1% +0.5ml) საოპერაციო ველის მარჯვენა და მარცხენა ლატერალურ მიდამოებში ვატარებთ მცირე ზომის (0.5სმ) 2 განაკვეთს. ჭრილობებიდან ცხიმოვან ქსოვილში შეგვყავს ლუერ-ლოკის შპრიცზე მორგებული ტიტანის კანიულა სიგრძით 20 სმ. კანიულის წინ და უკან გადაადგილებით, მუდმივი ასპირაციით ვაწარმოებთ ლიპოსაქციას, მიღებული ცხიმოვანი ქსოვილი იქვე გადამუშავდება სპეციალური ტექნოლოგიით და მეზენქიმური ღეროვანი უჯრედებით მდიდარი SVF (10-12 მლ-ის ოდენობით) შეგვყავს მენჯ-ბარძაყის სახსარში.

შედეგები: ართროზის SVF-ით მკურნალობამ დააჩქარა დაზიანებულ ქსოვილთა რეგენერაცია-რესტავრაციის პროცესი. კერძოდ: ტრანსპლანტაციამდე საკვლევი ჯგუფის პაციენტების დაზიანებულ სახსრებში განსხვავებით საკონტროლო ჯგუფისაგან, ალაგდა ანთებითი პროცესი, მოიხსნა ტკივილი, შემცირდა პერიარტიკულური რბილი ქსოვილების შეშუპება. ტრანსპლანტაციიდან მე-2 თვეს, 10-დან 8 პაციენტში დაიწყო და 6 თვის განმავლობაში სრულიად აღდგა კიდურების საყრდენუნარიანობა, სახსრის მოძრაობის ფუნქცია და ფიზიკური აქტივობის უნარი. ჰარისის სკალით გამოჯანმრთელების ინდექსმა 90 ქულას გადაჭარბა.

დაკვირვების იგივე პერიოდში სტანდარტული მეთოდით მკურნალობისას საკონტროლო ჯგუფის პაციენტებში გამოჯანმრთელების პროცესი მიმდინარეობდა შედარებით ნელა და არასტაბილურად. კლინიკურად კარგი შედეგი მიღებული იქნა 10-დან მხოლოდ 3 პაციენტში.

დასკვნა: ცხიმოვანი ქსოვილის SVF-ის ტრანსპლანტაციით ართროზის მკურნალობა პრინციპულად სწორი და ფიზიოლოგიურად გამართლებულია. SVF სტრანდარტული ტრანსპლანტაცია პრაქტიკულად ადვილი განსახორციელებელია, მაგრამ ჩვენ მიერ წარმოდგენილი მკურნალობის მოდიფიცირებული, კომპლექსური მეთოდი გაცილებით ეფექტურია.

მკურნალობის ეფექტურობას განაპირობებს: ა) ტრანსპლანტაციამდე სამიზნე სახსარში ანთებითი პროცესის ალაგებით დაზიანებული ქსოვილების რეგენერაციის დაჩქარება, ბ) ტრანსპლანტაციის შემდეგ სახსარში რეგენერაცია-რესტავრაციის პროცესის მართვა (მაგარი და რბილი ქსოვილების ოქსიგენაცია, მაგნიტოთერაპია და ადრეული რეაბილიტაციის დროული დაწყება), გ) ტრანსპლანტაციის შემდგომ პერიოდში პროფილაქტიკური ხასიათის სერვისების მიწოდებით პაციენტების ინფექციური დაავადებებისგან დაცვა..

რეგენერაციული პროცესის დინამიკის ამსახველი კლინიკურად ღირებული ტესტი ვერ იქნა ნაპოვნი. სახსრის ხრტილოვანი, მყესოვანი და ძვლოვანი ქსოვილების განახლებაზე შეგვიძლია, ვიმსჯელოთ კტ და მაგნიტურ-რეზონანსული გამოკვლევებით. პაციენტის გამოჯანმრთელებას ობიექტურად ასახავს დაავადების მიმდინრეობის კლინიკური სურათი.

ჩვენი აზრით, მეთოდის ვალიდურობის გაზრდის მიზნით მიზანშეწონილია: 1) სამიზნე სახსარში შესაყვანი ღეროვანი უჯრედების წინასწარი იდენტიფიკაცია და მათი ოპტიმალური რაოდენობის განსაზღვრა; 2) კვლევის გაფართოვება უფრო დიდ პაციენტთა ჯგუფში და უფრო ხანგრძლივი დაკვირვების პერიოდით; 3) მეთოდის ფართო აპრობაცია დაინტერესებულ კლინიკებში შესაბამისი პროფილის ექიმ-სპეციალისტთა ჩართულობით.

საკვანძო სიტყვები: ართროზი, რეგენერაცია, ტრანსპლანტაცია, სტრომულ-ვასკულური ფრაქცია (SVF), სტანდარტული მეთოდი, ინოვაციური მეთოდი, ადრეული რეაბილიტაცია.