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Surgical Treatment of 40 Patients with *Pectoralis Major* Ruptures: Long-Term Outcomes

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Abstract

The aim of the study — to develop a system for evaluation of treatment outcomes important for patients with *pectoralis major* ruptures. The system should include the outcome criteria that meet the patients' expectations, and should allow the long-term outcomes evaluation. ***Materials and Methods.*** The paper presents the long-term results of surgical treatment of 40 consecutive patients with *pectoralis major* ruptures. The results were evaluated in 65.3±17.5 months after surgery. Since *pectoralis major* rupture occurs mainly in people going in for sports at a quite high level (37 out of 40 people in our study), a new questionnaire was created for the results evaluation. In our opinion, the new set of questions takes into account the specific expectations for such category of patients and covers the important for them areas of treatment results. The already existing scales and questionnaires have been focused on assessing joint functions in patients with upper limb pathology in daily living conditions. Among the main areas of important results we identified the following items: restoration of sports activities, recovery of strength, absence of pain and discomfort, aesthetic results. ***Results.*** All the patients reported a complete absence of strength deficiency during everyday living activities. In 33 cases out of 37 the patients continued to go in for sports: at the same level — 18, with reduced load — 6, with improved results — 9. A subjective strength assessment in the patients continued exercising was in total 8.21±0.96. The outcomes in the group "improved results" (8.8±0.78) were better than in the group "at the same level" (8.1±0.96, $p = 0.046$) and in the group "reduced load" (7, 5±0.54, $p = 0.0023$). There were no differences between "improved results" and "reduced load" groups ($p = 0.157$). The reasons for the dynamics of sports results, which could be caused not only by the consequences of injury, were analyzed separately. The complete symmetry of the pectoralis muscles was achieved in 10 patients (25%), including 3 bodybuilders. In other cases, there remained a some degree asymmetry. The patients could notice it or ignore. We do not exclude the latent dissatisfaction of the patients with asymmetry, even when they report that it does not matter to them. ***Conclusion.*** The surgical treatment of *pectoralis major* tendon rupture allows the compete restoration of daily living activities. Although to that matter, these activities are practically preserved after the conservative treatment as well. The significance of the surgical treatment is in its ability to bring some additional benefits satisfying the patient's other priorities: return to sport, maximum recovery of strength, aesthetic results. Our questionnaire don't have a final point gradation, but allows to reflect the patient's expectations, results and fears.

Key words: *pectoralis major* muscle rupture, reinsertion, rating scale.

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Introduction

Earlier, in 2015, we published the results of surgical treatment of 26 patients with *pectoralis major* rupture: the patients underwent surgery from 2010 to 2014 [1]. From 2014 to 2017, we operated another 14 patients with this infrequent injury. Thus, our total experience comprises 40 patients. This is relatively much: in most works, the authors reported one case or a small series of cases [2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13]. The largest series are represented by works of Fleury et al. (33 patients) [14], Aarimaa et al. (33 patients) [15], Cordasco et al. (40 patients) [16] and Bak et al. (72 patients) [17]. In this regard, we consider the treatment results of our 40 patients to be interesting. On the other hand, we are sure that this rare trauma turns out to be not that infrequent when the surgery department team begins to deal with this injury, attracting more and more patients. For example, Salazar et al. reported 9 cases of such kind of rupture they encountered in 4 months [18].

However, when we were going to evaluate the long-term results, we found the absence, in our opinion, of an adequate tool for the results assessment. General medical scales for assessing the quality of life (HRQoL) are very important for evaluating patients in general, and with shoulder pathology in particular, but they are not specific enough, or even not specific at all, for assessing the dysfunction of the shoulder [19]. Moreover, some patients, who had an objective improvement in shoulder function after some kind of injury or disease could, show poor results on the same general SF-36 scale [20].

There are more than 30 questionnaires and scales for the patients with the shoulder pathology. These scales can be conditionally divided into two groups: general, which evaluate the condition of the shoulder as a whole, and particular, created to assess a specific pathological condition.

The *general* scales include:

– Constant (The Constant-Murley score) [21],

– UCLA (University of California Los Angeles Shoulder score) [22],

– DASH (Disabilities of the Arm, Shoulder and Hand) [23],

– SST (Simple Shoulder Test) [24],

– ASES (American Shoulder and Elbow Surgeons Evaluation Form) [25],

– PENN (Pennsylvania Shoulder score) [26].

The particular (specific for certain pathological entities) scales include the following:

– WOSI (The Western Ontario Shoulder Instability Index) to assess instability [27],

– OSIS (The Oxford Shoulder Instability score) to assess instability [28],

– MIIS (The Melbourne Instability Shoulder scale) to assess instability [29],

– Rowe test to assess instability [30],

– WORC (The Western Ontario Rotator Cuff Index) to assess the rotational cuff [31],

– RCQoL (Rotator Cuff Quality-of-Life measure) to assess the rotational cuff [32].

We noted above that the division of scales into general and particular is conditional. For example, one of the UCLA scales (1981) was developed by the authors specifically for evaluating the results of anatomical approach to the shoulder arthroplasty [22]. Although, its set of questions and posture makes it possible to use it in other conditions. That is why we related it to the general scales.

The use of the existing scales for assessing the results of treatment of pectoralis major rupture, in our opinion, is associated with three groups of problems. Firstly, the general scales make it possible to evaluate the shoulder function as a whole. But in the patients with pectoralis major rupture, according to our observations, it does not suffer even without treatment at all. Secondly, the specific scales, as you can easily see, are designed to assess the instability and pathology of the rotational cuff, the most common shoulder problems. However, it is obvious that the assessment of instability and rotational cuff is quite different from the assessment of the results of treatment of pectoralis major rup-

ture. Thus, the use of these scales in our patients will not give a real outcomes picture. Thirdly, many patients with pectoralis major rupture go in for sports. Although, the scales are more focused on assessing the household than real sports situation. For example, an athlete can show maximum points on any of the scales, or mark 0 points on VAS, but it does not matter for him, since he cannot move from the second podium place to the first. And this problem is relevant not only for the shoulder. Attempts to create specific sports scales have already been made, for example, the 2013 Hip Sports Activity Scale (HSAS) [33]. Although, this direction has been being at its infancy, and general scales are simply useless for assessing the athletes condition because they overlook too many delicate points. For example, professional gymnasts often refuse to take non-steroidal anti-inflammatory drugs, because this violates their coordination. Also, there exist a chilling memory of the trauma, fear of inability to reach the peak of masterhood, and many other features of professional sports.

Talking with some of our patients who underwent the surgery for pectoralis major rupture several years ago, we came to the conclusion that the existing questionnaires were not suitable for them. They told that they needed what was important just for them.

The expectations of patients with pectoralis major rupture could be divided into four directions: “Sport”, “Strength”, “Discomfort and pain” and “Aesthetics”. And it should be borne in mind that the life of each operated patient goes its own way. For example, someone continues to go in for sports, while someone stops, and not always due to injury. Some patients improve athletic performance, others worsen, and others do not improve because they do not consider it necessary for themselves, not because of the injury (Fig. 1).

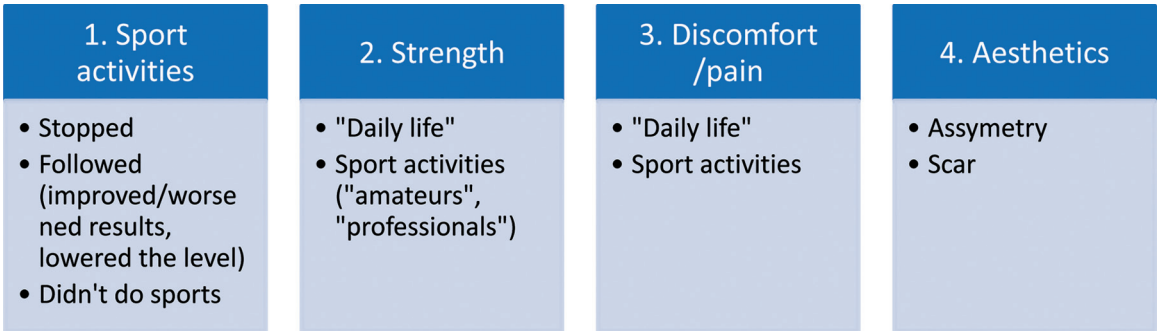

Fig. 1. Directions of patient expectations and areas of important treatment outcomes

The study purpose: to develop a system for evaluating treatment outcomes, that are important for patients with pectoralis major rupture, including outcome criteria that meet patients’ expectations, and to evaluate the long-term results.

Material and Methods

Inclusion criteria: the consecutive patients with complete rupture (separation) of the pectoralis major and/or its tendon of type III according to the Tietjen classification [34], undergone the surgery by the authors of the study from 2010 to 2017.

Among our 40 patients, the IIIB type according to R. Tietjen classification modified by Bak [17] occurred in 1 (2.5%) patient, the IIIC and IIID type — in 39 (97.5%). We could not calculate the specific number of patients with Tietjen IIIC and IIID ruptures, because, in our opinion, these subtypes could not be reliably distinguished after 2 to 3 weeks after the injury. On average, the period from injury to surgery was 128.4 weeks. (min 0, max 624, 95% CI 105.2–164.9). Excluding 1 patient with an extremely long gap (624 weeks), the average term was 14.6 weeks. (min 0, max 56, 95% CI 11.9–18.9). We observed one patient

with a separation of the pectoralis major tendon from the humerus with a bone block (fragment of the crest of greater tubercle). But we did not perform the surgery on this patient. Therefore, he was not included in this series of clinical cases. We also observed one patient with detachment of the sternum, but he refused treatment and was not included.

The surgeries were performed from 2010 to February 2015 at the Department of Traumatology, Orthopedics and Joint Pathology of the Sechenov University (Moscow), and from March 2015 to June 2017, at the Moscow departments of the Federal Medical Biological Agency (FMBA) of Russia.

All patients were males. The average age at the time of the injury was 30.1±8.4 years (min 19; max 53).

At the time of the injury, 36 (90%) patients were involved in sports at a professional or amateur level, of which 3 were members of the Russian national team (freestyle wrestling, boxing and triathlon).

The cause of the rupture in 24 (60%) cases was the bench press from a supine position, in 10 (25%) — the dumbbell flyes on a flat bench, in one (2.5%) — a knife wound, in 2 (5%) — sport game moments, in 3 (7.5%) — domestic injury (the patient crawled out of the well, lifted a heavy thing onto the mezzanine, etc.). All patients with a household injury did not go in for sports.

In 18 cases, the rupture occurred on the right, in 21 cases on the left, in 1 case there was a bilateral rupture (the patient was sequentially operated first on the right due to a more pronounced lack of strength, and after 14 months on the left).

The diagnostic features we described earlier [1], and since then they have not undergone any changes. To restore the pectorales fixation point, we used a minimally invasive modified anterior axillary approach 5–8 cm long (except for a patient with type IIIB rupture), isolated a retracted muscle stump. If necessary, in old injuries, we isolated and prepared local scar tissue and a fascial-tendon complex for plastic surgery. The anchor fixation we performed with titanium anchors with the Mason-Allen suture, leaving the most distal part of the stump for 1.5–2.0 cm without threads to strengthen biological fixation. We did not use the distant autoplasty. In more detail, we described the surgery technique in previous works [1, 35, 36]. And the technique has not significantly changed after it* [1, 35, 36].

To evaluate the results in accordance with the patient expectations and important treatment results (Fig. 1), we developed a questionnaire in which subsequent question appeared depending on how the patient answered the previous one. The structure of the questions is presented below, in the "Results" section, simultaneously with the calculation of patient responses.

To interview the patients, we created a file in MS Excel with macro support (xlsm). The invitations to the patients to participate in the survey were sent through all the specified means of communication (by phone, SMS, e-mail, WhatsApp, Facebook), using the MS Excel file. Creating the questionnaire, we followed the principle "the patient sees only one question at a time". Response options were selected using buttons from the standard MS Excel set (Ribbon> Developer> Paste> Form control> Button). The button was given a macro, upon execution of which the cell on the hidden sheet was assigned a value in accordance with the selected answer. Then the question sheet was hidden and a new sheet opened with the next question.

To select a result in points from 0 to 10 (for example, when asking to assess pain), we used the Counter tool (Ribbon > Developer >

* RF patent for the invention 2585412. A method for the surgical treatment of chronic rupture of the pectoralis major tendon.

Insert > Form Control > Counter). The patient pressed the counter button up or down, choosing the desired value from 0 to 10. To go to the next question, the Next button was used with the macro attached (assign a value to the cell in accordance with the patient's value from 0 to 10, hide the sheet with the current question, open the sheet with a new question).

After completing the survey, the patient clicked the button "I have finished and agree to send data via the Internet", to which the macro of background file saving and sending via the SMTP protocol was attached, i.e. the patient did not even need to send the results by email. In this article we do not provide the questionnaire form, but if anyone wants to use it, we will be happy to share the file.

An invitation to fill out a questionnaire was sent to all 40 patients in August-September 2019. A response was received from all 40 patients. There were no technical errors in answering questions or sending files with answers.

At the stage of results analyzing, all questionnaires were depersonalized (Fig. 2).

The average period from the moment of surgery to the results evaluation was 65.3±17.5 months (min 27, max 106). Considering that a progressive return to sports loads in our patients occurred in 6 to 12 months after the surgery, it can be considered that the average period the results evaluation is consistent with the long-term results.

The patient was able to answer only once. We paid special attention to the wording of the questions to prevent a possible double interpretation. However, in practice, it is very difficult to achieve the ideal uniqueness of the question. For example, in the assessment of the level of professional sports mastery, there is a problem with the criteria of "amateurs" and "professionals". Among our patients, 3 (7.5%) were members of the sports teams of Russia. For these patients, we modified the questionnaire, excluding from it the question of whether they went in for sports (athletes underwent an in-depth medical examination in clinics of the FMBA of Russia twice a year with obtaining admission to sports). When we asked the other patients about their current sports activities, we clarified that those who played sports irregularly or without setting a goal to get maximum results belong to "amateurs". By "professional" we understood regular exercises, at least several times a week, in order to obtain maximum results. Although, strictly speaking, a professional in sports is a club player or member of a national team who receive the corresponding salary. However, among the players of the clubs (hockey, football, etc.), the pectoralis major ruptures were practically not found.

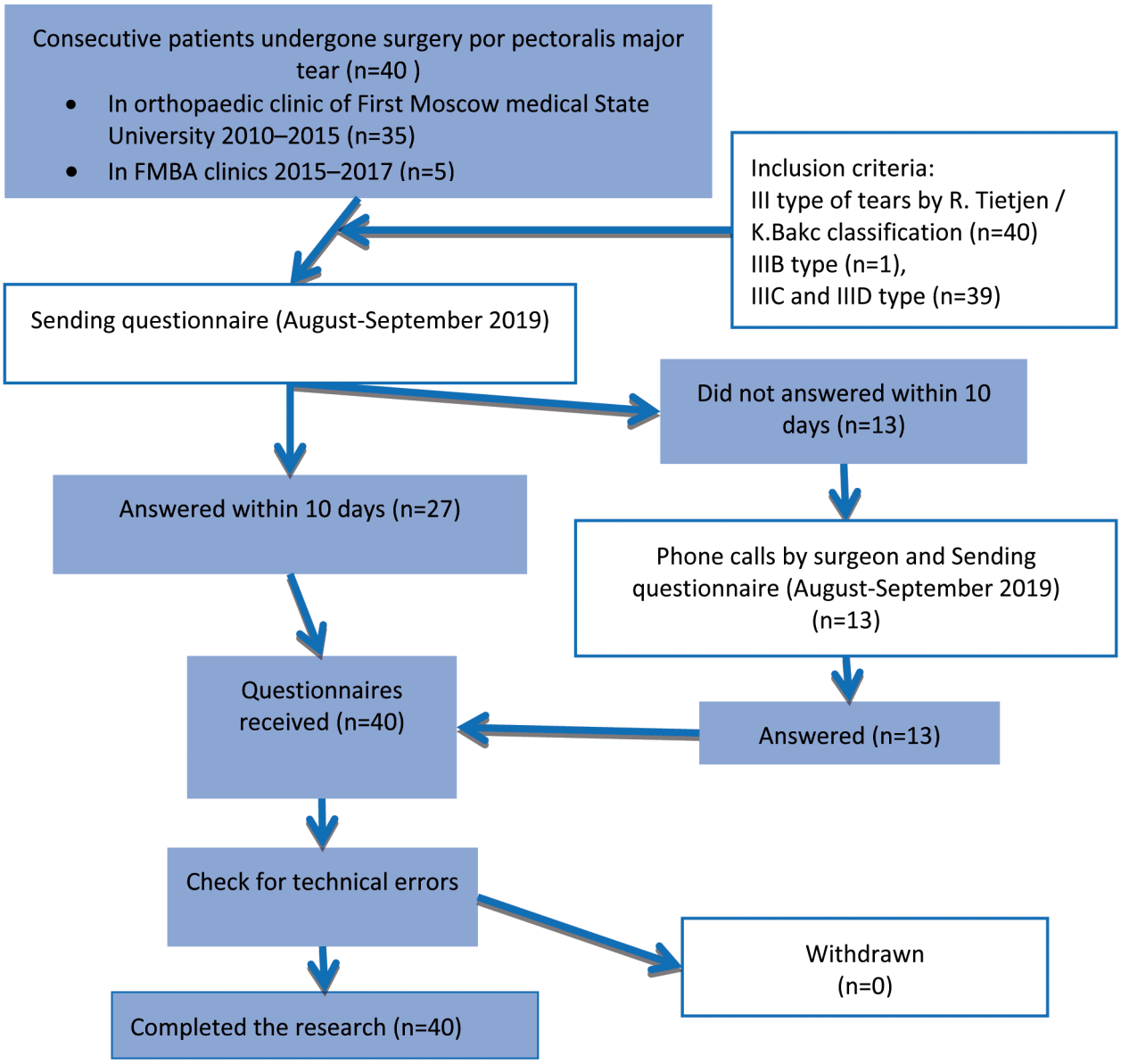

Fig. 2. Study design flowchart

Results

Among the patients studied, 3 out of 36 completely stopped going in for sports after an injury. These were relatively young patients (under 35 years old) who were involved in sports before an injury at an amateur level (Fig. 3). Analyzing the history immediately preceded the trauma in these 3 patients, we noted the same scenario — the patients decided to go in for sports "suddenly", and the trauma occurred when there was an unjustifiable sharp increase in the weightlifting load.

Theoretically, a situation is possible when a patient, who did not go in for sports and got a break due to domestic injury (4 patients), would start to play sports after an injury. But we did not ask such a question, since we considered that such an option was unlikely. In addition, these patients were already in adulthood, and it is unlikely that if they began to play sports, they would have gained any significant success in sports and they would hardly have needed it psychologically.

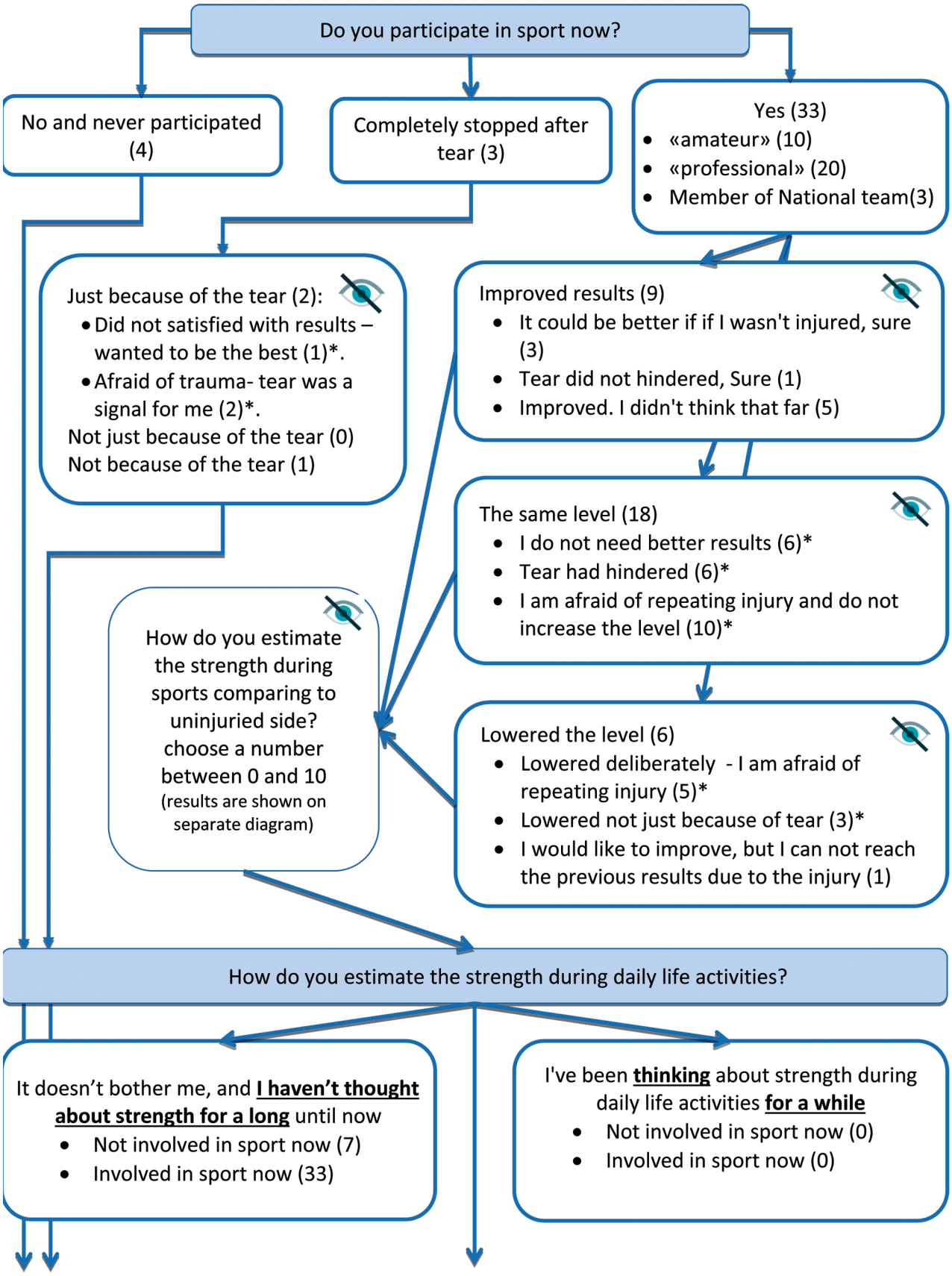

Fig. 3. Evaluation of athletic performance and strength. The number of patients chosen one or another answer is shown in parentheses.
* Hereinafter, it was possible to choose several options. Hereinafter, the "crossed-out eye" means that the patient did not see these options if he did not answer "yes" to the previous question

Not a single patient from the "professional" and "athlete of the national team" groups stoped playing sports after an injury.

Among those who continued to play sports, half of the "amateurs" reduced the load, fearing repeated injuries (5 out of 10 patients) and for other reasons (3 patients). The remaining 5 "amateurs" showed sports results at the same level (none improved), while 3 patients noted that they did not need better results, and 2 patients noted a fear of repeated injury.

There were fewer "professionals" who reduced the load than "amateurs": 1 out of 20 patients compared with 5 out of 10. As a reason, the patient noted that he wanted to return to the previous level, but could not do this because of the consequences of the injury. Most of the "professionals" (13 out of 20) returned to their previous level (better results were not needed — 3, injuries interfere — 6, fear of repeated injuries — 8). Six "professionals" improved their results. They chose only the answers "I'm sure the injury didn't hurt" (1) and "didn't think about it" (5).

Members of the teams (3 patients) improved the results, but noted that the injury prevented them from achieving even better results.

The average strength score on a 10-point scale with a sports load in 33 patients, who continued to play sports (Fig. 4), was 8.21±0.96 points (min 6, max 10, 95% CI 7.87–8, 55). The strength results in the group "Improved results" (8.80±0.78) were better than in the group "at the same level" (8.10±0.96, p = 0.046) and in the "reduced load" group (7.50±0.54, p = 0.0023). There were no differences between the "improving" and the "lowering" (p = 0.157).

None of the patients noted that he had a lack of strength in everyday life (see Fig. 4). In this regard, the question of assessing strength and pain in everyday life in points from 1 to 10 was not asked. We believe that exactly the pain is the main limiting factor in strength during domestic loads, since the phenomenon of loading "through pain" is important for sports. But for living conditions, the theoretically possible pain can be neglected if it does not decrease the personally significant patient's strength.

Assessment of pain and discomfort during sports showed that 31 patients noted a complete absence of pain (1 point), 2 patients rated the pain at 2 points (Fig. 5). Probably, the absence of pain can be explained by peculiarities of nociception of the cicatricial tissues at the site of surgical reconstruction. Although, the primary rupture, as a rule, occurs without previous pain, and the pain after the rupture is also not that much. As we noted earlier [1], the pain after rupture during sports before surgery was caused by an incorrect vector of the pectoralis major. The scar fascial apparatus of the muscle began to attach to the anterior bundle of the deltoid and/or passes into the subcutaneous fat of the arm.

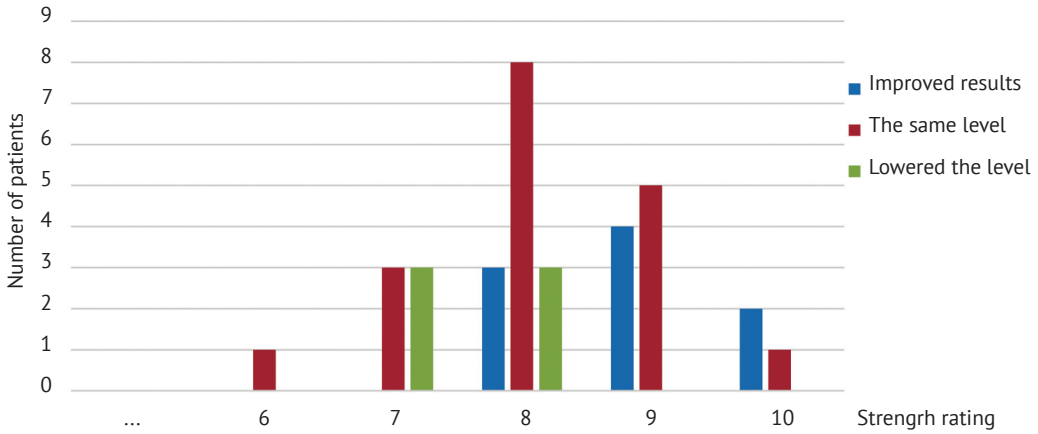

Fig. 4. Subjective assessment of strength in sports

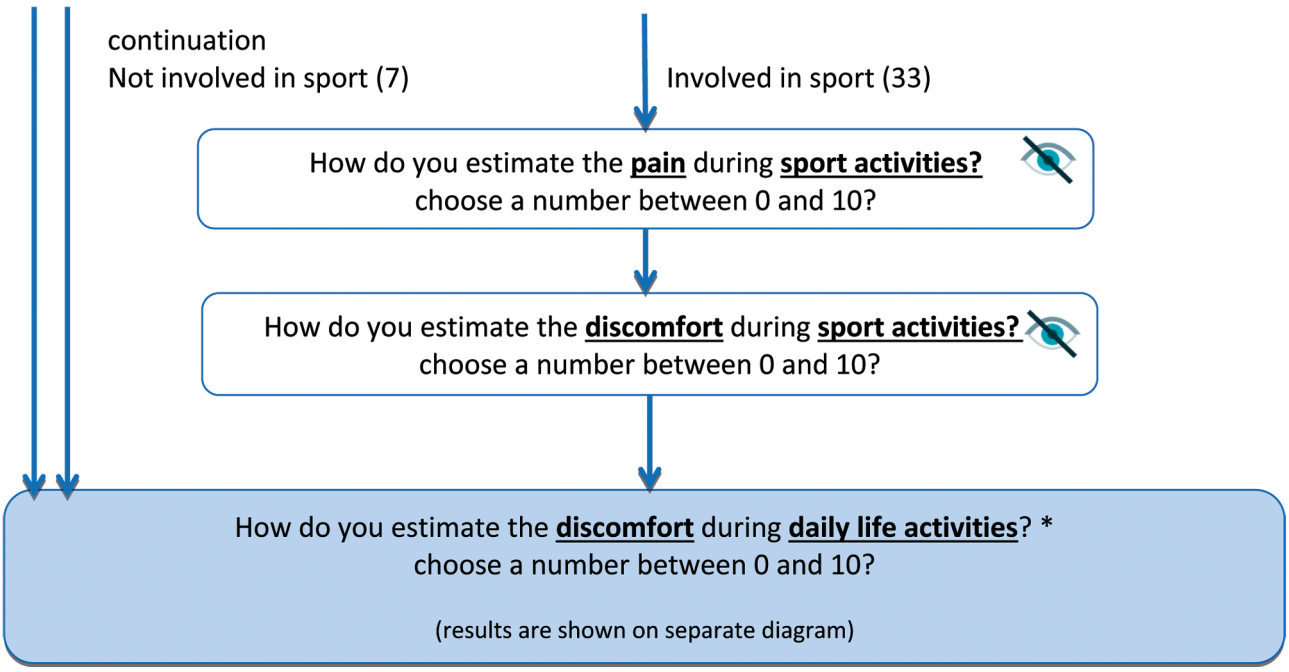

Fig. 5. Assessment of pain and discomfort during sports and in daily living conditions.
* Not a single patient noted that he/she had a lack of strength in daily living activities. In this regard, the question about the assessment of pain in points from 1 to 10 with loads in daily living activities was not asked (explanation in the text)

Assessing discomfort during sports, 25 patients noted its complete absence (1 point), 8 patients rated it 2 points. The complete absence of discomfort in everyday life (1 point) was noted by all 33 patients who continued to exercise, 2 points were selected by 6 patients who were not involved in sports at the time of the survey, and 4 points were selected by 1 patient from the group of had never gone in for sports (Fig. 6).

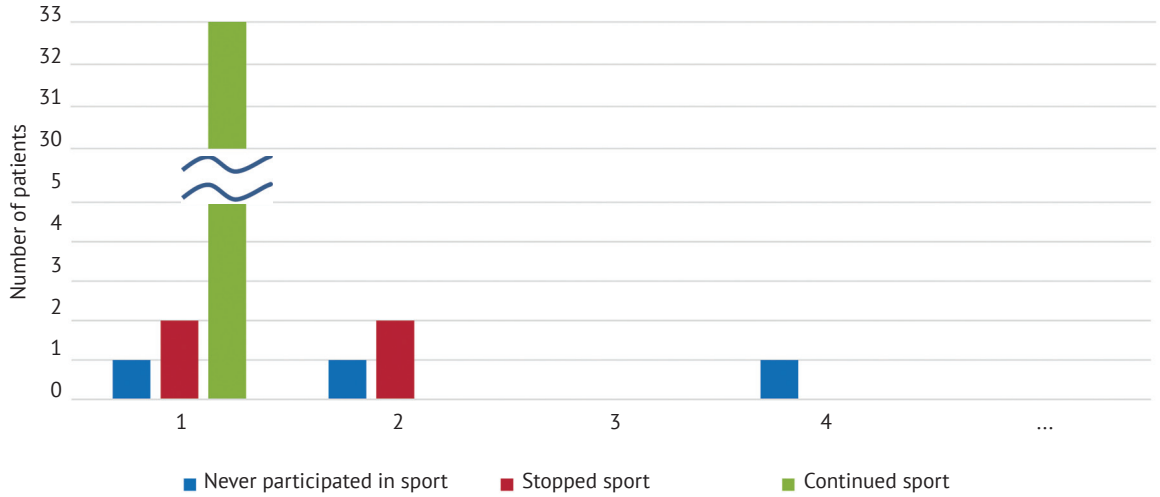

Fig. 6. Subjective assessment of discomfort in daily living activities of non-athletic patients who discontinued physical exercises and who continued them

Assessment of aesthetic results was preceded by a block of questions about why the patient was involved in sports (Fig. 7). The members of the national teams of Russia were not asked about the purpose of their going in for sports.

Of the previously identified group of "professionals" (*n* = 20), three were engaged in bodybuilding at the national and international levels, three noted that they did for themselves to be in shape ("fitnessers"), and the majority (15) identified themselves as a group of "strengtheners". The loads level among those who were fond of the barbell was very high, and reached 280 kg in the bench press from the chest in the shirt.

The previously allocated group of "amateurs" (n = 10) according to the purpose of playing sports was distributed as follows: "gamers" — 2, "fitnessers" — 7, "strengtheners" — 1.

All 40 patients was asked the question about muscle symmetry. In the group of athletes of the national teams, all three chose the answers "have not thought for a long time" and the option "there is a difference". The residual asymmetry for professional athletes turned out to be personally insignificant, since they did not think about it. The very fact that it was persisted could be explained by the absence of need to correct it with exercises, since it did not affect the sports results.

In a group of 7 people who were not involved in sports, 5 chose the option "I have not thought about it for a long time" or "there is a difference" and another 2 chose the option "there is a difference" or "I don't care". This option also seems quite logical for those who do not play sports or those who have stopped playing sports. They have quite different priorities, expectations and needs. Similarly, two "gamers" did not pay attention to the asymmetry, although they still had it.

All three bodybuilders chose the option "symmetrical." Obviously, they did not choose the option "did not think for a long time" due to the obvious features of bodybuilding. We can explain the absence of asymmetry in bodybuilders by the fact that they perform specialized exercises, correcting residual asymmetries, and they succeed. One of our three athletes won medals at major international bodybuilding events after surgery.

Other groups of athletes ("fitnessers", "strengtheners") more often chose the answers "I don't care", "I understand that this is inevitable", etc. This was really difficult to interpret, since all these options can only show hidden dissatisfaction with the external demonstrative denial of the problem not only by the "fitnessers", but also by the "strengtheners". Our assumption is also supported by the way the patients assessed the appearance of the postoperative scar (see Fig. 7).

In the end, we asked the patients to write a free comment. None of the patients interviewed noted that he had a rerupturing. Previously, we reported 2 patients undergone early rerupturing. In one case it occurred due to a postoperative abscess (the patient did not play sports). In the other case it occurred in a patient with a rupture in 14 months after surgery. Although, in the latter case, the result was good with improving function and reducing pain. We believe that, despite the rerupturing in this patient, there was the reorientation of the force application vector of the pectoralis major, which served as the basis for a positive outcome.

Not a single patient reported progression of asymmetry, which could be considered a sign of "gradual" rerupturing. Thus, the total rate of reruptures in our series of cases was 5% (2 out of 40), and all cases of reruptur were early with possible defects in operations as the cause of rerupturing.

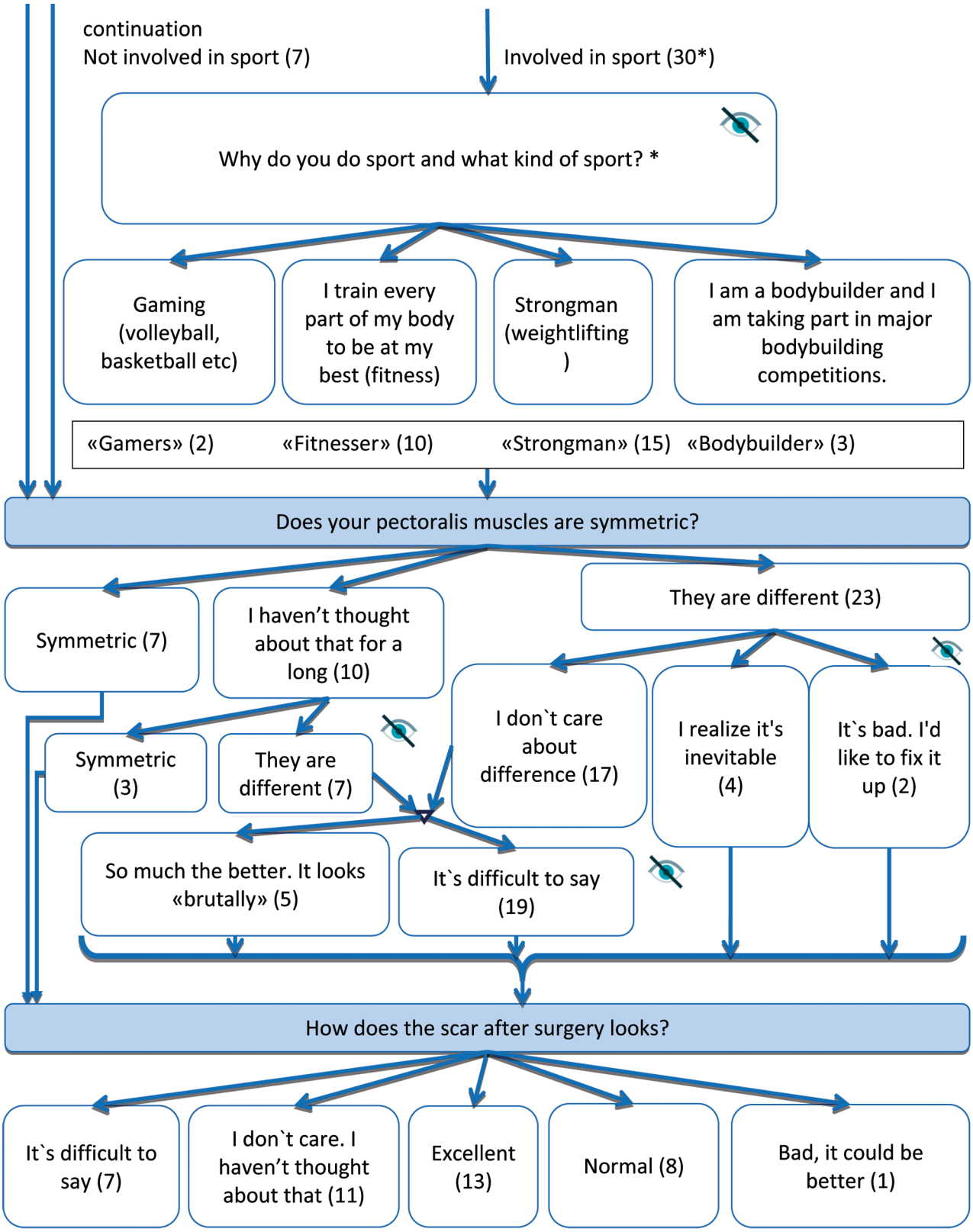

Fig. 7. Aesthetic effects.
* The athletes of the Russian national teams were not asked the question "Why do you go in for sports?"

Discussion

The long-term results of the surgical treatment of the patients with ruptured pectoralis major lead to a complete restoration of everyday functions, which, in our opinion, makes a pointless assessment on general scales of quality of life. Retrospectively reflecting the patient motivation, when he agrees for the surgery, we tend to think that the patients most likely want to be operated on, not because they have real dysfunction, but because they have a "fear of dysfunction", supported by logic: if there is a rupture and asymmetry, that means it definitely will not work as it should.

Although this is not the goal of our work, we can note that, even without surgery, everyday functions after pectoralis major rupture are fully restored. Thus, the reason for surgery may be just increased functional request, the want to play sports, the desire to get rid of asymmetry. Planning an operation, the surgeon should also keep in mind the sensitive topic of the patient's psychological satisfaction with his/her appearance.

In our previous work and in this updated series of observations, the patients underwent surgery many weeks, months, and even years after the rupture. And we could note that the long time from rupture was not a contraindication for surgery. It is only necessary to keep in mind the various technical features and methods that we described earlier [1].

Many of our patients, undergone the surgery due to the pectoralis major rupture, continue to play sports, they are concerned about issues of maximum strength and athletic performance. The patients nicety in terms of aesthetic results should not be underestimated. Although, all of them were men and almost none of them reported any obvious dissatisfaction.

Overall, 25% of patients (10 out of 40) reported that they did not see any asymmetry. Earlier, we reported that after 12.4±9.2 months (min 6; max 32) after surgery, none of the 26 patients managed to achieve complete symmetry of the axillary fossa anterior walls (although the asymmetry was significantly reduced compared with the state before surgery) [1]. Thus, the asymmetry, that persisted 1.5 years after surgery, completely disappeared in 25% of cases after 65.3±17.5 months due to sports activities. It is important to note that all 3 bodybuilders completely eliminated the asymmetry.

In other cases, probably due to the absence of specific exercises, patients did not correct the asymmetry. Although, it should be kept in mind that when the patients are uninvolved in the work to restore symmetry it does not mean that they completely satisfied with their appearance. The patients can hide their dissatisfaction or be guided by the principle: "I understand that this is inevitable ". Some patients even managed to improve their athletic performance, although there is a difference between "professionals" and athletes of national teams: 6 "professionals" improved their results, while they chose only the answer options "I am sure the injury did not interfere" (1) and "did not think about it" (5). All 3 members of the national teams improved the results. But they noted that without injury their results would have been even better. Perhaps, the professional growth of the national teams athletes was really limited by athletes injury. However, it cannot be excluded that the athletes just try to explain the no-growth by their injuries, although in fact there may be other reasons. To find out this point is almost impossible, but we believe that it should be borne in mind when you deal with a "professional" or a member of the national team.

Pain and discomfort in no way limited our patients in their everyday activities and practically did not limit them in sports. Very high results were obtained for a subjective assessment of strength on a 10-point scale: 8.21±0.96 points in general for those who continued to go in for sports. The indicators in the group of "improved results" (8.80±0.78) were better than in the group of "at the same level" (8.10±0.96; $p = 0.046$) and in the group

of "reduced load" (7.50±0.54; p = 0.0023). There were no differences between the "improving" and the "lowering" (p = 0.157).

Of the 33 patients, 17 who continued to go in for sports, reported fears of re-injury, which, one way or another, limited their sports engagement. The absence of long-term reruptures in our series of observations was probably due to such a protecting yourself approach. On the other hand, we ourselves informed our patients about a possible risk of rerupturing. It is also possible that the risk of rerupturing is overestimated.

The questionnaire, that we created, does not have a final point gradation, but rather allows us to describe the range of patient expectations, outcomes and concerns.

Study limitations

Despite the fact that at the stage of analyzing the results, all questionnaires were depersonalized, the analysis was performed by the operating surgeons, who in some cases were well acquainted with the patients athletic results after surgery. The analysis of 3 patients, who were athletes of the national teams of Russia, was carried out without blinding. Our group of consecutive patients was uneven. It comprised cases of fresh, old, and very old ruptures. A separate analysis by the rupture duration would result in very small subgroups. In addition, we assumed that long-term results would not depend on rupture duration.

We did not use any control group of the patients which were treated conservatively. In fact, we had a retrospective cohort. The questions were formulated in April–July, 2019, although the patients underwent surgery in 2010-2017. The patient responses could be influenced by the information they received from the surgeon during informed consent before surgery and during postoperative consultations.

In our questionnaire, only the questions of subjective assessment of pain, discomfort, and strength were categorized from 1 to 10 in points. For other types of questions (cosmetic result, asymmetry), we did not set any quantitative criteria.

Publication ethics

The patients gave an informed consent for participation in this clinical study.

Conflict of interest: The authors declare no conflict of interest.

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Authors' contributions

A.P. Sereda — research concept, research questionnaire, inviting patients by phone, data analysis.

S.M. Smetanin — research concept, routing and coordination of patients after a job change by the first author, questionnaires distribution, data analysis.

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