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# Modern Principles of Medical Rehabilitation of Patients with Median Defects of the Abdominal Wall

## Współczesne zasady rehabilitacji medycznej pacjentów z wadami w linii pośrodkowej ścian jamy brzusznej

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### SUMMARY

**Aim:** To analyze rehabilitation and improvement of the quality of life of patients with median abdominal wall defects (MAWD) by increasing the efficiency of alloplasty by determining the general principles of planning and performing surgical interventions.

**Materials and methods:** We carried out an analysis of the treatment results of 346 patients with MAWD, who underwent surgery in the 1st Poltava City Hospital for the period 2005-2019. There were 269 women (77.8%), men – 77 (22.2%). 282 (81.5%) patients underwent reconstructive surgeries, 59 (17.1%) – reconstructive and corrective alloplasty techniques, and 5 (1.4%) – corrective ones. Patients underwent surgery: onlay – in 3 patients (0.9%), sublay – in 289 (83.5%), sublay-inlay – in 38 (11.0%), inlay – in 4 (1.2%), Ramirez modification – in 10 (2.9%), open IPOM – in 2 (0.6%).

**Results:** Local complications were in 25 (7.2%) cases: seroma in 12 (3.5%) patients, infiltrate in 5 (1.5%), necrosis of the edges in 4 (1.2%), hematoma – in 3 (0.9%), wound suppuration – in 1 (0.3%). In the remote period, 14 (4.1%) were registered: recurrence – 7 (2.0%); long-term deep seroma – 3 (0.9%); ligature fistulas with phlegmon – 2 (0.6%); abscess formation – 1 (0.3%), hernial sac infiltration – 1 (0.3%).

**Conclusions:** The results of MAWD alloplasty depend on the correct solution of the planning problem and the choice of the most rational treatment tactics. Adequate abdominoplasty leads to an improvement in the quality of life of patients, medical and social rehabilitation.

**Key words:** rehabilitation, planning, alloplasty, median defects, abdominal wall

**Słowa kluczowe:** rehabilitacja, planowanie, alloplastyka, wady linii pośrodkowej, ściana brzucha

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### INTRODUCTION

Despite the development of science, the problem of restorative treatment of patients after various diseases remains open. This is exactly what medical rehabilitation does – a set of measures for medical and therapeutic purposes that aimed at restoring the health of the patient and preventing disability. Nowadays, in conditions of a high level of morbidity among the population and hostilities in Ukraine, the development of medical rehabilitation has the particular relevance [1].

The relevance of the problem is emphasized by the increase in the number of patients requiring abdominoplasty not only for aesthetic reasons, but also for medical and social reasons in combination with the reconstruction of the abdominal wall (AW) for its defects, as well as to eliminate concomitant diseases from the abdominal organs, injuries. Although the restoration of AW functionality is the main goal of alloplasty in MAWD, cosmetic aspects deserve special attention, which are often more important for the patient.

Combined AW defects leave an imprint on the patient's character; affect his personal life, professional function, often lead to the development of a complex of physical, social, psycho-emotional inferiority. Elimination of the AW defects, normalization of the contours of the abdomen, reduction of its size, loss of excess weight due to abdominoplasty helps patients return to a full life.

Reconstruction of MAWD is often a unique, complex problem, since certain anatomical features take place in this localization, but especially with large defects, with loss of tissue resistance, recurrent, complicated, with a history of mesh use or wound infections, in patients with an infected surgical field, with combined defects that are rare [2-4]. The traditional approach to surgical treatment in these cases significantly limits the use of primary alloplasty and sometimes involves a staged treatment component [5-7].

Despite numerous methods of treatment, insufficient attention is paid to an individual, differentiated approach to the tactics

of treating this category of patients. Therefore, the search for new approaches to the planning and features of surgical interventions in patients with MAWD remains relevant.

### AIM

Rehabilitation and improvement of the quality of life of patients with median abdominal wall defects (MAWD), improvement of their ability to work by increasing the efficiency of alloplasty of MAWD by determining the general principles of planning and performing surgical interventions.

### MATERIALS AND METHODS

We carried out a clinical analysis of the consequences of surgical treatment of 346 patients with MAWD who were operated on in an open way in the surgical department of the 1st Poltava city clinical hospital for the period from 2005 to 2019. There were 269 women (77.8%), men – 77 (22.2%). The patients' age ranged from 21 to 85 years (average age was  $62 \pm 3.2$  years). The duration of the disease ranged from 2 months to 47 years. Postoperative MAWD prevailed – 294 (80.8%). Recurrent MAWD was detected in 75 (21.7%) patients. According to the size of the largest defect, they were divided into: W1 – 11 (3.2%), W2 – 226 (65.3%), W3 – 109 (31.5%) episodes.

Accompanying diastases of the rectus abdominis was found in 317 (91.6%) patients. Concomitant diseases were observed in 267 patients (77.2%). Obesity of varying degrees was diagnosed in 218 (63.0%) patients. AW deformity of various origins requiring surgical correction was detected in 253 patients (73.1%).

All patients were examined according to the same scheme, anamnesic, clinical, laboratory, instrumental, intraoperative, morphological factors were determined.

When performing a surgical intervention for MAWD, the following procedures were performed: surgical access to the AW defect with obligatory dermatolipectomy; wide mobilization of the defect edges, handling of the hernial sac (if any); herniolaparotomy (if necessary) for revision, elimination of adhesions, performing simultaneous intra-abdominal operations; alloplasty of the AW; active drainage of the implantation zone; layer-by-layer suturing of the wound and its possible drainage (if necessary).

Types of dermatolipectomies used in patients with MAWD were: according to Bebbcock – 127 (36.7%), longitudinal – 110 (31.8%), according to Fernandez – 69 (19.9%), Fernandez modification – 17 (4.9%), according to Kelly – 11 (3.2%), according to Torek – 6 (1.7%), according to Burson – 4 (1.2%), according to Grazer – 2 (0.6%). 282 (81.5%) patients underwent other types of reconstructive surgeries, 59 (17.1%) patients – reconstructive-corrective alloplasty techniques, and 5 (1.4%) – corrective ones.

Patients with MAWD underwent the following types of alloplasty: onlay – in 3 patients (0.9%), sublay – in 289 (83.5%), sublay-inlay – in 38 (11.0%), "inlay" – in 4 (1.2%), Ramirez modification – in 10 (2.9%), open IPOM – in 2 (0.6%).

To estimate the effectiveness of treatment of patients, first of all, such criteria as postoperative complications, postoperative mortality, and the number of relapses were used.

### RESULTS

In the early postoperative period, local complications were observed in 25 (7.2%) episodes: seroma in 12 (3.5%) patients, inflammatory infiltrate in 5 (1.5%), necrosis of the wound edges in 4 (1, 2%), hematoma – in 3 (0.9%), wound suppuration – in 1 (0.3%). General postoperative complications were noted in 12 (3.5%) episodes: ACS – in 3 (0.9%), PE – in 3 (0.9%), pneumonia – in 2 (0.6%), acute thrombophlebitis of superficial veins of the lower extremities – in 1 (0.3%), parotitis – in 1 (0.3%), acute myocardial infarction – in 1 (0.3%), gastrointestinal bleeding – in 1 (0.3%). 4 (1.2%) patients died. Mortality was mainly associated with the clinical features of comorbidity; only in 1 incident we observed a connection with the method of primary surgery.

In the remote period, 14 (4.1%) local complications were registered: recurrence – 7 (2.0%); long-term deep seroma of the implantation zone – 3 (0.9%); ligature fistulas with recurrent AW phlegmon – 2 (0.6%); abscess formation in the implantation zone – 1 (0.3%), hernial sac infiltration – 1 (0.3%).

### DISCUSSION

At present, in the case of surgical closure of the MAWD, alloplasty of the AW has convincingly become the main operation [6-8]. Improved alloplasty techniques using surgical meshes can successfully eliminate the most AW defects and expand the limits of their operability [4-6, 9]. But, unfortunately, there are significant differences in indications for implantation, in the choice of alloplasty technique, surgical access, mesh formats, methods of their fixation, and prediction of consequences. Considering the imperfection of surgical methods, alloplasty materials, and patients, the success of the operation for the closure of MAWD may be questionable. Favorable results of surgery for MAWD also depend on the type of implanted material, its location, fixation [2, 9, 10].

The choice of alloplasty was obviously dependent on the area of the defect, its size, shape, morphological state of the AW tissues, the possibility of suturing them without significant tension, creating the optimal volume of the abdominal cavity, and the likelihood of postoperative complications. The following were also taken into account: the severity of diastases of the rectus abdominis muscles, the degree of tissue deficiency of the anterior abdominal wall (DTDAAW), the degree of intra-abdominal pressure (DIAP) before and after the operation, the characteristics of the personal clinical situation [6].

Taking into account the size of the defect, DTDAAW, in patients with MAWD, allowed the differential use of the AW reconstructions or corrections depending on the technical conditions and the level of DIAP, which was measured under conditions of modeling the state of the abdominal cavity, as after alloplasty. With the growth of DIAP, after the erection of the edges of the defect, up to 15-30% of the original, it was considered possible to perform alloplasty using the "sublay" method, up to 45% – "sublay-inlay", and with more than 45% – special methods of AW alloplasty without reduction volume of the abdominal cavity.

When planning apoplectic reconstructive operations associated with extensive mobilization of tissue flaps to close adjacent AW defects, the limits of the anatomical and



physiological possibilities of plastic deformation of all tissue structures in this zone were taken into account. To reduce tissue tension in MAWD alloplasty, wider surgical approaches, stratification, separation of anatomical components, and mobilization of tissue flaps of different thicknesses within their anatomical and physiological capabilities were used. Maximum attention was paid to the state of regional hemo- and lymphatic circulation, preservation of peripheral nerves, elastic-deformation and strength properties of the AW tissues.

The goal of every plastic surgery is to renew the form and function of this area. Considering that in certain parts of the AW there is a complex anatomical structure, during the reconstruction, their structure should, if possible, approach the primary one. Only under such conditions can one hope for an approach to the ideal restoration of the form and function of the destroyed parts of the AW. Therefore, we believe that a complete closure of the MAWD is best done by separating the anatomical components and extensive mobilization of the AW tissues.

When planning a reconstructive operation for MAWD in each specific case, these points were adhered to: 1) used the division of tissue components of the AW into predominantly dynamic and supporting ones; 2) the dynamic function is performed by skin-subcutaneous-fascial flaps and muscles; 3) the main supporting tissue structures are fascial (aponeurotic) nodes and periosteum of the pelvic bones, ribs; 4) AW alloplasty was performed according to the principle of minimum deformation of sliding tissue complexes with fixation of the alloplasty material to the supporting structures; 5) all surgical interventions should be performed within the physiological capabilities of maximum plastic deformation of sliding tissue complexes, taking into account the depth, limits of their detachment and mobilization, and the strength properties of supporting structures, depending on the characteristics of various topographic and anatomical areas of the AW.

Assessing the possibilities of the most optimal location of the implant in the thicknesses of the AW, it was necessary to take into account its physical and mechanical properties, the degree of tension, that is, tissue tension. In MAWD alloplasty, attempts were made to position the mesh implant (MI) so that its greatest rigidity approached the characteristics of the musculoaponeurotic structures of the AW in patients in the defect area that needed to be strengthened. The main criteria for the choice of the AW that affect the effectiveness of alloplasty were considered: type, specific gravity of the polymer, cell size, anisotropy level, which made it possible to maximally individualize the choice of implant and to plan the type of alloplasty taking into account the characteristics of the patient.

Also, the main features of alloplasty in the mobilization of dynamic structures of soft tissues of the AW were developed, what came down to: 1) determining the strategy for updating the AW for each individual incident should depend on the existing anatomical features of the alloplasty zone, the size and shape of the defect, its location, morphological changes in the AW tissues, gender, age, degree of obesity of the patient, clinical features; 2) the formation of a "base" for the implant by separating the anatomical structures and their stratification within the limits of plastic deformation; 3) the separation of anatomical

components and the limits of their mobilization are established in relation to the biomechanical properties of one or another topographic anatomical site and individual morphological changes in tissue complexes; 4) the use of component separation of the AW tissues is performed for better approximation of the edges of the defect without tension and increase in DIAP; 5) adherence to the principle of the AW augmentation, that is, "bridging" – bridge-like overlapping of the defect - depending on the clinical situation, the operation can be reconstructive, reconstructive-corrective or corrective; 6) the method of MI fixation depends on the boundaries of detachment, mobilization of tissue complexes, method of alloplasty, type and size of the implant; 7) taking into account the topographic anatomical site of localization and prevalence of the AW defect, the selected appropriate the AW is fixed to suitable supporting tissues (fascial node or periosteum); 8) when the skin-subcutaneous flap is not mobilized, the AW fixation is performed transfascially using interrupted submersible sutures, taking into account the maximum allowable deformation of the implant, and modeling an adequate DIAP; 9) the number of fixing seams that hold the maximum static stress may vary depending on the size, shape and location of the measuring instrument; 10) suturing of the mobilized fasciocutaneous flap together with subcutaneous adipose tissue is carried out with thick interrupted sutures with fixation to the aponeurosis to minimize residual cavities (using PTS-technic).

During alloplasty of MAWD, in order to achieve a verified result and minimize complications, the following principles were observed during the operation: 1) in case of cicatricial defects, a revision with alloplasty of the zone of the entire postoperative scar was performed; 2) the posterior sheets of the rectus muscles were widely mobilized along the linea alba on both sides along the upper and lower edges of the AW defect; 3) in the presence of diastases of the rectus abdominis muscles, the aponeurotic sheaths were cut from the xiphoid process almost to the pubic fusion; 4) with multiple AW defects, they were combined, forming one common defect in the longitudinal direction, corresponding in shape to an ellipse; 5) after opening the sheaths of the rectus abdominis muscles from the edges of the defect, the maximum possible mobilization of the retromuscular space was performed in the lateral direction to the Spigelian lines; 6) when mobilizing tissue complexes of the abdomen to the lateral sides of the defect, we tried to preserve the nerves and vessels of the AW as much as possible; 7) when choosing the method of AW alloplasty, DIAP was measured when modeling the closure of the abdominal cavity, as after alloplasty; 8) with defects W3, expressive cicatricial changes in the site of alloplasty, dissociation of the lateral anatomical structures of the AW was performed; 9) in the presence of cicatricial changes or with atrophic changes in the muscular- aponeurotic tissues of the AW, not capable of performing the technology with dissociation of the anatomical components of the abdomen, the IPOM technique was used; 10) after measuring the dimensions of the implantation site, cut out the required shape and size of the MI; 11) sufficiently covered with the implant (at least 6-8 cm) the AW tissues along the perimeter of the defect in all directions; 12) the area of the implant must exceed the area of the AW defect by at least 1.6 times (factor 0.7

- compliance with the Fibonacci principle); 13) when applying alloplasty of the AW using the “sublay-inlay” technique, the AW with average cell sizes and moderate anisotropic properties were used; 14) when performing AW alloplasty using the “inlay” technique, they tried to use the AW with small cell sizes and orthotropic qualities; 15) in standard AW alloplasty with a distinct anisotropy, the MI must have greater vertical strength, or use implants which strength in the vertical direction corresponds to that in the horizontal; 16) in corrective AW alloplasty the AW must have greater strength in the vertical direction; 17) maximally prevented contact of the AW with the intestines; 18) the implant was necessarily fixed along the perimeter to the supporting AW tissues; 19) performed the maximum possible reconstruction of the linea alba as a medial fulcrum for all musculoaponeurotic structures of the AW.

So, analyzing the features of the modified methods of surgical interventions and their consequences, it can be argued that the principle of maximum mobilization of sliding shells has been developed, taking into account the biomechanical features of soft tissues and their topographic anatomical, histological structure, which makes it possible to expand the reserves of alloplasty operations with the slightest complications, scars, optimal functional and aesthetic result.

In our opinion, the term abdominoplasty has a broader meaning than it has been thought. Correction of abdominal deformities of various origins is an urgent medical and social problem. The use of the technique developed by us made it possible to achieve not only the maximum aesthetic effect, but also significantly reduce the number of postoperative complications.

An analysis of the quality of life of patients after surgery found an improvement in vitality, role-playing emotional functioning and psychological health in the study groups ( $p < 0.05$ ).

## CONCLUSIONS

The consequences of MAWD alloplasty depend on the correct solution of planning issues and the choice of the most rational treatment tactics. To improve the results of treatment, one should focus on a personal assessment of the patient's condition and the choice of rational surgical tactics during the operation. The individuality of each patient requires a differentiated approach to the selection of the optimal treatment technology. Elimination of the AW defects, normalization of the contours of the abdomen, reduction of its size due to adequate abdominoplasty leads to an improvement in the quality of life of patients, their professional function, medical and social rehabilitation.

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