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Reconstructive Otoplasty for Microtia

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SUMMARY

Purpose of the study:improve the results of treatment of patients with microtia by improving the method of otoplasty.

Material and methods. The study included 41 patients who underwent various variants of reconstructive otoplasty for congenital defects of the urinary tract in the Department of Plastic and Reconstructive Microsurgery of the State Institution "RSPMTSH named after Academician V. Vakhidov" for the period from 1990 to 2020. The comparison group included 12 (30.8%) patients with microtia, operated on according to B. Brent's method, in the main group - 29 (43.3%) patients operated on according to the improved method. The average age in the main group was 22.4 ± 1.3 years, in the comparison group 19.4 ± 1.9 years.

Results. In total, complications developed in 6 (50%) patients in the comparison group and 3 (10.3%) in the main group. At the same time, the incidence of surgical complications, which subsequently led to the need for re-reconstruction, was 16.7% in the comparison group. There were no such complications in the main group. The share of aesthetic defects was 33.3% in the comparison group and 10.3% in the main group. In total, 5 (41.7%) additional stages of otoplasty were performed in the comparison group, in the main group - 2 (6.9%; 1 - in case of violation of the normal protrusion of the formed UR and 1 more - in case of the formation of an unnatural skin fold). There was also a statistically significant difference in the number of additional plastic surgery stages performed for the complications noted above (criterion $\chi 2$ = 7.248; df = 1; p = 0.008). The average duration of surgery in the comparison group for all 4 stages of reconstructive otoplasty was 364.6 ± 6.9 minutes, and in the main group after 2-stage otoplasty according to the proposed method - 195.2 ± 2.7 minutes (t-test = - 22.69; p <0.05). In the comparison group, the second stage was carried out on average after 4.2 ± 0.4 months, whereas in the main group this period was 3.9 ± 0.2 months (t-test = -0.52; p>0.05). The duration of the hospital period in the aggregate for all stages of reconstructive otoplasty in the comparison group was 16.6 ± 0.4 days, which was significantly longer than in the main group, where this indicator was 10.1 ± 0.2 days (t-test = -14.43; p <0.05).

Conclusion. The use of the improved method of otoplasty for microtia can shorten the time of surgical rehabilitation and obtain an acceptable aesthetic and functional result of complete reconstructive otoplasty in two stages, promote local tissue growth by 10-12 mm, which makes it possible to cover the implanted cartilaginous frame with a skin flap without tension, and effectively level the risk hair growth along the periphery of the formed auricle.
Keywords:congenital defects of the auricle, microtia, improvement of otoplasty methods, comparative analysis

INTRODUCTION

According to the literature, a progressive increase in the birth rate of children with congenital malformations, including the maxillofacial region, is noted throughout the world [1]. One of the difficult problems in the aspect of treatment and rehabilitation of patients are defects and

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deformities of the auricle (UR) of congenital and acquired etiology. Deviations range from minimal changes such as protruding ear to severe facial asymmetry with microtia. In terms of the frequency of occurrence, acquired defects of UR are not inferior to congenital defects, and patients' referral for traumatic deformities and UR defects is up to 42% of the total frequency of injuries of the maxillofacial region [2]. Regardless of the reasons for the loss of the outer ear, social stigma and psychological burden associated with this pathology negatively affect the quality of life of patients. Often, in such cases, the patient's last opportunity to return to a full life in society is surgical treatment [3].
In reconstructive surgery of congenital defects of the urinary tract, a large number of techniques have been proposed that provide for various methods of forming the shape and position of the outer ear cartilage. However, the complexity of the technical aspects of the operation, the need for staged reconstruction often lead to various complications, which subsequently necessitate additional interventions, which not only significantly delays the period of surgical treatment, but also adversely affects the psychoemotional status of patients with microtia [4, 5, 6].

In addition, the increased requirements of patients for the aesthetic component of the treatment result, the lack of a single principle for choosing the method of plastics with a variety of individual original surgical techniques, as well as the need to develop new methods for effective treatment of UR defects indicate the relevance of research in this direction [7, 8].
In order to prevent the development of various immediate and distant postoperative complications, and to achieve a good cosmetic effect, the surgeon must take into account all the individual characteristics of the state of the UR elements. All these factors, including the structure, shape, flexibility, thickness of the ear cartilage, etc., affect the tactical aspects of reconstructive intervention. Along with this factor, the achievement of a good cosmetic and functional result with the formation of a suitable UR framework is of great importance. For this purpose, studies are continuing to improve the technical aspects of autocostal cartilage harvesting to create a full-fledged UR framework that will correspond to certain physiological dimensions [9, 10, 11].
Another urgent issue is the possibility of reducing the stages of plastic surgery by optimizing the technical aspects of UR restoration with an assessment of the possibility of combining several moments of reconstructive intervention.

The purpose of this study
was to improve the results of treatment of patients with microtia by improving the method of otoplasty.

MATERIAL AND RESEARCH METHODS

The study included 41 patients who underwent various variants of reconstructive otoplasty for congenital defects of the urinary tract in the Department of Plastic and Reconstructive Microsurgery of the State Institution "RSPMTSH named after Academician V. Vakhidov" for the period from 1990 to 2020. The comparison group included 12 (30.8%) patients with microtia, operated on according to B. Brent's method, in the main group - 29 (43.3%) patients operated on according to the improved method. The average age in the main group was 22.4 ± 1.3 years, in the comparison group 19.4 ± 1.9 years. Most of the patients in the main group corresponded to the age of 20-44 years - 55.2%, while in the comparison group 56.4% of patients were under the age of 19 years. There were more male patients both in the comparison group (66.7%) and in the main group (58.2%) of the study.

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DESCRIPTION OF IMPROVED METHODS OF OTOPLASTY FOR MICROTIA

An improved method of reconstructive otoplasty with the restoration of UR by implantation of the autocostal cartilage framework into the post-ear region is proposed. The method includes two main stages. The first step is to form the frame of the UR from the autocostal cartilage and implant it into the behind-the-ear region in the reconstruction zone. Next, transposition of the UR lobe is performed using the principle of Z-dermal plasty, as well as the formation of a tragus due to the costal cartilage section, installation of a spacer made from the cartilage of the rudimentary auricle. At the second stage (after 3-4 months), the previously implanted frame is lifted together with the skin and the final plastic is performed. The use of this method makes it possible to improve the functional and aesthetic results of the reconstruction of the missing SD in two stages.

The objective of the proposed method is to reduce the time of surgical rehabilitation, taking into account the achievement of a good cosmetic result, as when using the prototype method, but by performing reconstruction in two stages.

The operation is performed under intravenous anesthesia in combination with infiltration anesthesia with lidocaine solution 0.5% -60.0 ml. Stage I: Taking, formation and implantation of the rib cartilage framework. UR lobe formation using the principle of Z-dermal plastics.Tragus formation due to the removed part of the rudimentary auricle.Stage II - UR uplift with the formation of a deep furrow.Implantation of a spacer to obtain a protrusion angle in accordance with the healthy side. The zone after raising the UR is closed with a split perforated skin graft. The break between stages is 3-4 months. The costal cartilage is harvested from an oblique-transverse approach with a skin incision slightly above the costal arch on the side opposite to the reconstruction zone. The area of connection of the VI and VII ribs is a single block of fabrics, sufficient for the manufacture of the main part of the frame according to the shape of the UR silhouette. The free edge of the VIII rib is suitable for forming a curl. Using a template from a transparent film taken from the healthy side, a UR framework is formed (Figs. 1 and 2). The parts of the ear frame are stitched together with a prolene 4-0 thread. In the reconstruction zone, the auricle lobe is cut out. According to the Z-principle, plastics are used to transpose the lobe into the projection of the UR (Fig. 3). The opposite skin flap is not sutured, and a cartilaginous rudiment of the outer ear is isolated through this access. A "pocket" is formed in a sharp way according to the size of the prepared frame + 0.5 cm. The costal cartilage graft is introduced into the "pocket" starting from its upper edge. A previously removed cartilage rudiment of the UR is implanted behind the graft for a spacer. Two thin drainage tubes connected to a vacuum system are placed under the frame and behind it (Fig. 3). At the same stage, a tragus is formed by implantation of cartilage taken from the rib. This creates the appearance of the external auditory canal.
At the second stage (after 3-4 months), the UR is raised by separating the shell from the head tissues and forming a space behind the ear. The wound behind the ear is closed with a split skin graft (Figs. 4 and 5).

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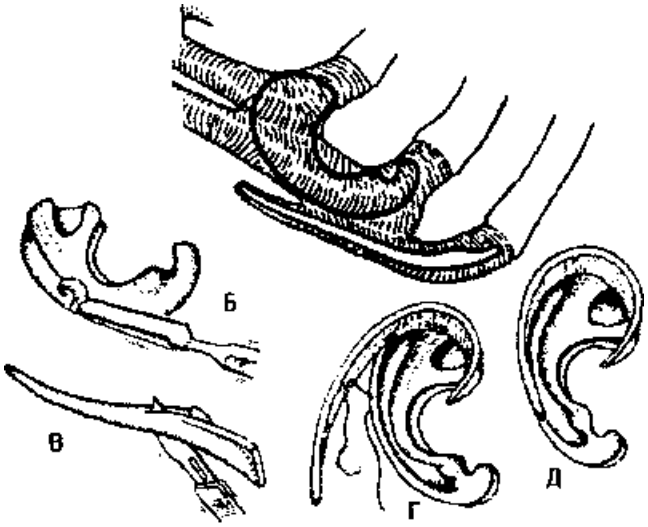

Fig. 1. Scheme of the collection of autocostal cartilage and the manufacture of the frame of the auricle

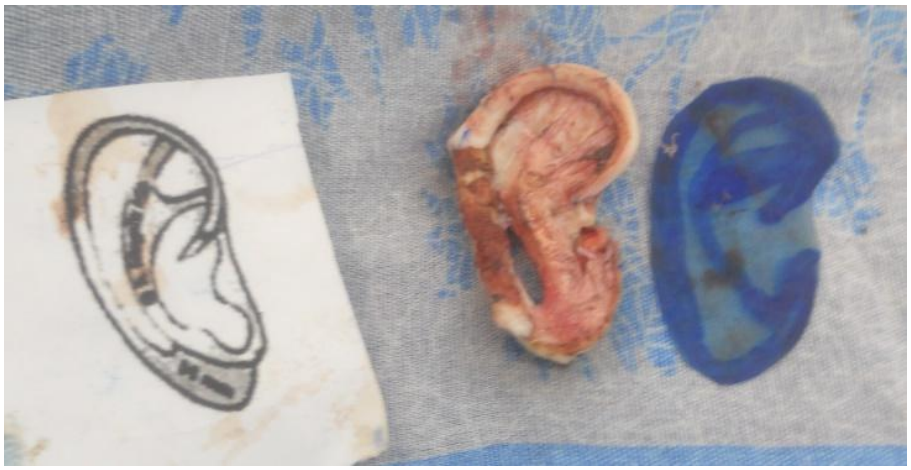

Fig. 2. Manufactured frame of the auricle

Fig. 3. Stage I otoplasty: implantation of the ear frame, transposition of the lobe, formation of a tragus, installation of a spacer, vacuum drainage.

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Fig. 4. Local status in microtia

Fig. 5. Local status after the second stage of plastic surgery

It should be noted that in order to reduce the time (the first stage), the surgical intervention was performed simultaneously by two teams. One team harvested cartilage and fabricated the framework using a clear film scoop to form a curl, antihelix and a bowl. The second team simultaneously carried out the formation of a "pocket" in the reconstruction zone, transposition of the lobe, and the formation of a tragus.

Thus, the use of a prepared skeleton made of autocostal cartilage, rudimentary cartilage in the form of a spacer, transposition of the lobe, formation of a tragus from a portion of the costal cartilage at the first stage of plasty and raising the UR with final plasty at the second stage can shorten the time of surgical rehabilitation and obtain an acceptable aesthetic and functional result. complete reconstructive otoplasty in two stages.

To reduce the risk of developing complications associated with a deficiency of soft tissues, during plastic surgery in 7 cases in the main group, the method of balloon stretching (BR) of soft tissues in the behind-the-ear region was used. This made it possible to freely cover the implanted cartilaginous framework with a skin flap without tissue tension.

Rapid intraoperative BR was performed at the first stage of otoplasty during the formation of a pocket and implantation of the UR frame obtained from the costal cartilage. A large Foley catheter was used as a dilatation balloon (Fig. 6). Initially, the required area of the additional skin area was determined, then a balloon was placed under it and cyclic stretching was performed. The permissible volume of the injected saline solution was determined by the local state of the stretched tissue, with paleness and pronounced tension of the skin, the injection of the liquid was stopped. After the admissible volume of liquid was injected, the balloon was left in an inflated state for 3 minutes, then the saline solution was removed (Fig. 7). After a few minutes, the procedure was repeated; a total of three BR cycles were performed. After performing BR, the ear frame was implanted. The performed manipulation made it possible to obtain a tissue gain of 10-12 mm.

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Fig. 6. Patient E., 16 years old. Diagnosis: Microtia III degree Preparing the Foley catheter to stretch the soft tissue behind the ear

Fig. 7. Intraoperative balloon stretching of soft tissues is performed

In cases where the hairline spreads wider and reaches the boundaries in / 3 of the reconstructed UR, then the optimal method of choice is transplantation of the superficial temporal fascia followed by transplantation of full-thickness skin onto the temporal fascia (Fig. 8).

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Fig. 8. Scheme of closure of a part of the auricle by the temporal fascia and grafting of full-thickness skin

In our observations, this method has been improved and simplified. The proposed technique consists in de-epidermisation of the hairy part of the flap with the transplantation of a free split flap into the formed wound surface, while the thickness of the transplanted flap is 0.2-0.3 mm (Fig.9).

Fig. 9. Reconstructive otoplasty with a low hairline

The proposed technique was performed in 7 patients in the main group, while the addition of reconstructive otoplasty with the stage of de-epidermisation of the hairy part of the flap with transplantation of a free split flap into the formed wound surface slightly increased the operation time, but made it possible to fully solve the problem with such aesthetic plastic defect as hair growth along the periphery. formed SD.

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RESEARCH RESULTS

The proposed method of reconstructive otoplasty was performed in 29 patients with grade III microtia in the study group. It should be noted that the accumulated experience in the surgical treatment of this pathology, including 12 cases in the comparison group, operated according to B. Brent's method, showed that in some situations intraoperatively there is a deficit of soft tissues in the behind-the-ear region to perform adequate reconstruction. In this regard, in 7 out of 29 (24.1%) cases in the main group, the rapid balloon stretching method was used to obtain additional volume of tissues behind the ear region.

Another problem of the long-term period of otoplasty with microtia was an aesthetic defect in the form of hair growth on the formed auricle, which required regular implementation of various options for depilation. This is due to the fact that with microtia, patients often (25-50%) have a low level of hair growth in the temporal region, and taking into account the fact that this zone is used for plastics, further on the neo-shell, there is an increased hair growth in the flap with preserved hair follicles. In our observations, to level this aesthetic defect in the main group in the presence of a low location of the border of hair growth (in 7 - 24.1% of patients), in addition to the reconstruction of the UR, plastic surgery with free skin flaps was used. As mentioned above, the addition of reconstructive otoplasty for grade III microtia with intraoperative BR of the tissues behind the ear was performed in 7 cases. This made it possible to obtain sufficient tissue growth in all patients to cover the implanted frame of the formed UR.

In total, complications developed in 6 (50%) patients in the comparison group and 3 (10.3%) in the main group. At the same time, the frequency of surgical complications, which later led to the need for re-reconstruction, was 16.7% in the comparison group (in 1 case, marginal skin necrosis over the graft with exposure of a part of the frame and subsequent lysis of the cartilage and in 1 case this complication later led to a pronounced deformation of the formed UR). There were no such complications in the main group. The proportion of aesthetic deficiencies was 33.3% (4 patients) in the comparison group and 10.3% (3 patients) in the main group (Table 1).

Also, among other complications noted in 6 patients in the comparison group and in 3 in the main group, it is possible to distinguish a violation of the contour of the curl and antihelix, a violation of the normal protrusion of the formed UR and the formation of an unnatural skin fold. In a comparative aspect, there was a statistically significant difference in the incidence of postoperative complications, both after stage 1 of the operation with frame implantation ($\chi2 = 5.081$; df = 1; p = 0.025) and after the final stages of reconstruction ($\chi2 = 7.791$; df = 1; p = 0.006).

Table 1.
Frequency of postoperative complications in the group with microtia

Complication	Comparison group (n = 12)		Main group (n = 29)	
	abs.	%	abs.	%
After stage 1 of the operation with implantation of the frame				
Marginal necrosis of the skin over the graft with exposure of part of the framework	2	16,7 %	0	0,0%
Cartilage lysis	1	8,3%	0	0,0%
Chondrite	1	8,3%	0	0,0%

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Total patients with complications	2	16,7 %	0	0,0%
$\chi 2$ criterion	5,081; df=1; p=0,025			
After the reconstructive stages				
Violation of the contour of the curl and antihelix	2	16,7 %	1	3,4%
Violation of the normal protrusion of the formed auricle	2	16,7 %	1	3,4%
Formation of an unnatural fold of skin	3	25,0 %	1	3,4%
Hair growth along the periphery of the auricle	4	33,3 %	0	0,0%
Recurrence of severe deformity	1	8,3%	0	0,0%
Total patients with complications	6	50,0 %	3	10,3 %
$\chi 2$ criterion	7,791; df=1; p=0,006			

Table 2.
Number of additional reconstructive stages performed

Complication	Comparison group (n = 12)		Main group (n = 29)	
	абс.	%	абс.	%
Violation of the contour of the curl and antihelix	1	8,3%	0	0,0%
Violation of the normal protrusion of the formed auricle	1	8,3%	1	3,4%
Formation of an unnatural fold of skin	2	16,7%	1	3,4%
Recurrence of severe deformity	1	8,3%	0	0,0%
Total	5	41,7%	2	6,9%
$\chi 2$ criterion	7,248; df=1; p=0,008			

In the comparison group, with a recurrence of severe deformity, as well as in 1 case with marginal skin necrosis after the stage of cartilage implantation with subsequent lysis of the framework, patients underwent repeated UR reconstruction 6 and 9 months later. In total, 5 (41.7%) additional stages of otoplasty were performed in the comparison group, in the main group - 2 (6.9%; 1 - in case of violation of the normal protrusion of the formed UR and 1 more - in case of the formation of an unnatural skin fold). There was also a statistically significant difference in the number of additional plastic surgery stages performed for the complications noted above (criterion $\chi 2 = 7.248$; df = 1; p = 0.008).

The average duration of surgery in the comparison group for all 4 stages of reconstructive otoplasty was 364.6 ± 6.9 minutes, and in the main group after 2-stage otoplasty according to the proposed method - 195.2 ± 2.7 minutes (t-test = - 22.69; p <0.05). Obtaining such results, as can be seen from the table. 3.3, contributed to a significant reduction in the duration of surgery at stage 1: from 145.4 ± 4.1 minutes in the comparison group to 97.2 ± 2.4 minutes in the main group of patients (t-criterion = -10.01; p <0, 05).

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Table 3.
Duration of surgery for all stages of reconstructive otoplasty (minutes)

Stages	Comparison group (n = 12)			Main group (n = 29)			t-test	p
	M	δ	m	M	δ	m		
Stage 1	145,4	14,4	4,1	97,2	13,1	2,4	-10,01	<0,05
Stage 2	95,8	11,2	3,2	97,9	10,1	1,9	0,56	>0,05
Stage 3	62,5	5,0	1,4	-	-	-	-	-
Stage 4	60,8	6,0	1,7	-	-	-	-	-
Total	364,6	24,1	6,9	195,2	14,7	2,7	-22,69	<0,05

As for the time periods between the stages of surgical treatment (Table 4), it can be noted that in the comparison group the second stage was carried out on average after 4.2 ± 0.4 months, while in the main group this period was 3.9 ± 0.2 months (t-test = -0.52; p> 0.05). After the end of treatment, a statistically significant difference between the groups in terms of the studied parameter could be noted: 3.9 ± 0.2 months in the main group versus 9.5 ± 0.4 months in the comparison group (t-test = -13.40; p < 0.05).

Table 4.
Time periods between stages of reconstructive otoplasty (months)

Stages	Группа сравнения (n=12)			Main group (n = 29)			Comparison group (n = 12)	p
	M	Δ	m	M	δ	m		
1 - 2 stage	4,2	1,3	0,4	3,9	1,0	0,2	-0,52	>0,05
2 - 3 stage	1,8	0,3	0,1	-	-	-	-	-
3 - 4 stage	1,6	0,2	0,1	-	-	-	-	-
Total	9,5	1,3	0,4	3,9	1,0	0,2	-13,40	<0,05

Table 5.
Length of hospital stay for all stages of reconstructive otoplasty (days)

Stages	Comparison group (n = 12)			Main group (n = 29)			t-test	P
	M	δ	m	M	δ	m		
Stage 1	4,5	0,7	0,2	4,7	0,7	0,1	0,66	>0,05
Stage 2	5,6	0,7	0,2	5,4	0,7	0,1	-0,57	>0,05
Stage 3	3,3	0,5	0,1	-	-	-	-	-
Stage 4	3,3	0,6	0,2	-	-	-	-	-
Total	16,6	1,4	0,4	10,1	0,9	0,2	-14,43	<0,05

The duration of the hospital period (Table 5) in aggregate for all stages of reconstructive otoplasty in the comparison group was 16.6 ± 0.4 days, which was significantly longer than in the main group, where this indicator was 10.1 ± 0.2 days (t-test = -14.43; p <0.05).

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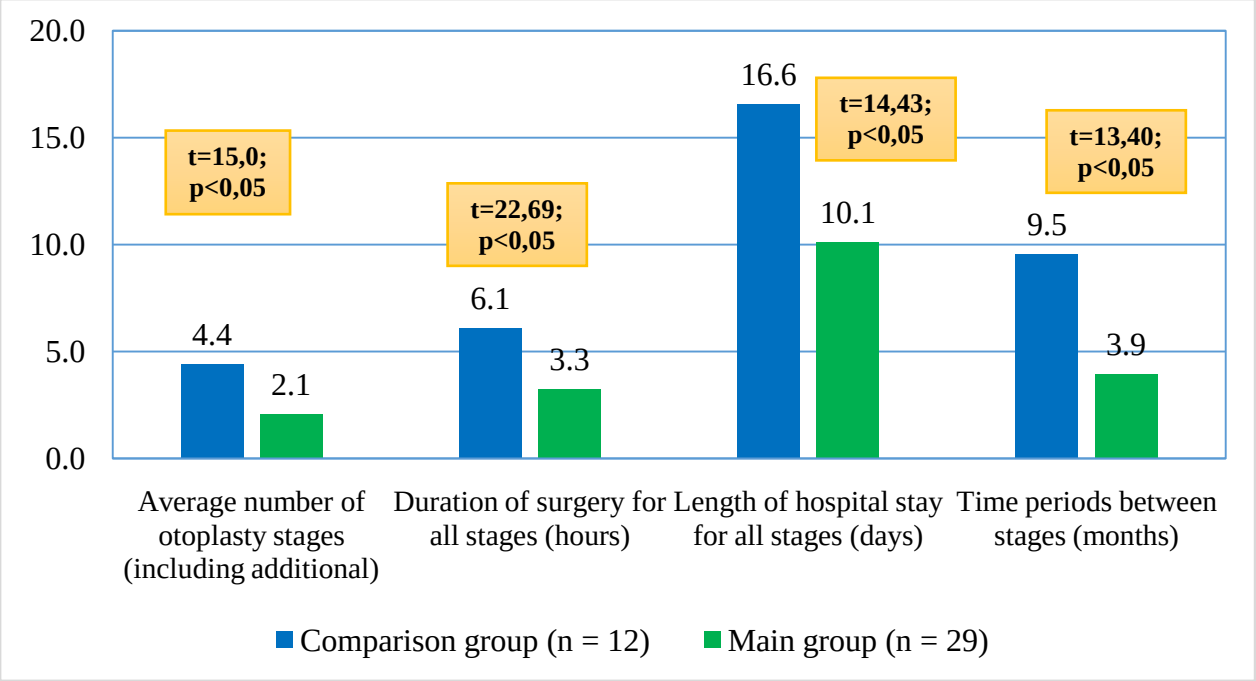

Fig. 10. Summary data on the duration of all stages of reconstructive otoplasty for microtia

Summary data on the duration of all stages of reconstructive otoplasty for microtia are shown in Fig. 10. Thus, it can be concluded that the proposed two-stage method of otoplasty for microtia allows reducing the average number of otoplasty stages (including additional ones) from 4.4 in the comparison group to 2.1 in the main group (t = 15.0; p <0, 05), the duration of the operation at all stages - from 6.1 hours to 3.3 hours (t = 22.69; p <0.05), the duration of the hospital period at all stages - from 16.6 to 10.1 days (t = 14.43; p <0.05) and time periods between stages - from 9.5 to 3.9 months (t = 13.40; p <0.05).

CONCLUSIONS.

The use of a prepared skeleton made of autocostal cartilage, rudimentary cartilage in the form of a spacer, transposition of the lobe, formation of a tragus from a portion of the costal cartilage at the first stage of plasty and raising the UR with final plasty at the second stage allows to shorten the time of surgical rehabilitation and obtain an acceptable aesthetic and functional result of complete reconstructive otoplasty. in two steps.

When performing the proposed variant of reconstructive otoplasty, the use of intraoperative balloon stretching with a deficiency of soft tissues behind the ear region promotes local tissue growth by 10-12 mm, which makes it possible to cover the implanted cartilaginous frame with a skin flap without tension.

The addition of reconstructive otoplasty with the stage of de-epidermisation of the hairy part of the flap, designed to close the wound surface formed after cartilage implantation, can effectively neutralize the risk of hair growth along the periphery of the formed auricle.

The proposed two-stage method of otoplasty for microtia made it possible to completely neutralize the likelihood of developing surgical complications that led to the need for re-reconstruction (16.7% in the comparison group; $\chi 2 = 5.081$; df = 1; p = 0.025), as well as to reduce the proportion of patients with complications in general. from 50% to 10.3% ($\chi 2 = 7.791$; df = 1; p = 0.006), to reduce the likelihood of performing additional aesthetic stages of

plasty from 41.7% to 6.9% ($\chi 2 = 7.248$; df = 1; p = 0.008) and thereby reduce the time period for complete reconstruction of the UR from 9.5 ± 0.4 to 3.9 ± 0.2 months (t = 13.40; p <0.05).

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