DOI: https://doi.org/10.17816/OV626409

The uveitis–glaucoma–hyphema syndrome. Part 2. Comparative analysis of existing treatment methods effectiveness

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ABSTRACT

BACKGROUND: The uveitis–glaucoma–hyphema syndrome is a disease caused by iris injury due to extracapsular fixation of intraocular lens (IOL). ES Treatment involves IOL fixation or exchange.

AIM: To compare the effectiveness of various surgical methods of uveitis–glaucoma–hyphema syndrome treatment.

MATERIALS AND METHODS: The study group included 95 patients (95 eyes), divided into six subgroups depending on surgical treatment methods used: hydrophobic IOL exchange on hydrophilic model (HYDRO) with its transscleral fixation (n = 20); transscleral fixation (TSF) of native IOL (n = 18); hydrophobic IOL exchange on polymethylmethacrylate iris-claw IOL (CLAW; n = 22); iris-fixated IOLs (IRIS; n = 8); IOL immobilization with scleral bandage sutures (BS; n = 4); conservative treatment (CT; n = 23). The methods were compared using a scoring system.

RESULTS: The final score of surgical methods effectiveness is presented in descending order: HYDRO — 5.36 ± 1.05, TSF — 5.21 ± 1.80, CLAW — 3.87 ± 3.34, IRIS — 1.26 ± 4.41, BS — –0.74 ± 3.66, CL — –3.26 ± 2.51 (p < 0.001).

CONCLUSIONS: Uveitis–glaucoma–hyphema syndrome surgical management is a complex problem due to necessity of several interventions performing directed to eliminate the cause factor of recurrent hemorrhages — mechanical traumatization of iris by IOL. The comparison of various surgical techniques demonstrated the greatest effectiveness of HYDRO, TSF, and CLAW. Suture fixation of the IOL to the iris showed slightly less effectiveness. Using of bandage sutures for UGH treatment is inappropriate due to the high risk of relapse.

Keywords: phacoemulsification; intraocular lens; complication; Ellingson syndrome; uveitis–glaucoma–hyphema syndrome; transscleral suture fixation; iris-claw IOL.

To cite this article
Belov DF, Nikolaenko VP, Shuvaev DA, Potemkin VV, Khripun KV. The uveitis–glaucoma–hyphema syndrome. Part 2. Comparative analysis of existing treatment methods effectiveness. *Ophthalmology Reports*. 2024;17(3):7–15. DOI: https://doi.org/10.17816/OV626409

Received: 02.02.2024 **Accepted:** 11.04.2024 **Published online:** 23.09.2024

DOI: https://doi.org/10.17816/OV626409

Синдром «увеит – глаукома – гифема». Часть 2. Сравнительный анализ эффективности существующих методов лечения

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АННОТАЦИЯ

Актуальность. Синдром «увеит – глаукома – гифема» — заболевание, обусловленное травмированием радужки, фиксированной вне капсульного мешка интраокулярной линзой (ИОЛ). Патогенетическое лечение синдрома предполагает репозицию либо эксплантацию ИОЛ.

Цель — сравнение эффективности различных методов хирургического лечения пациентов с синдромом «увеит – глаукома – гифема».

Материалы и методы. В исследовании приняли участие 95 человек (95 глаз) с синдромом «увеит – глаукома – гифема», которых распределили на шесть групп в зависимости от применявшегося метода хирургического лечения: замена искусственного хрусталика на гидрофильную ИОЛ (гИОЛ) с её транссклеральной шовной фиксацией (n = 20); репозиция и транссклеральная шовная фиксация (ТШФ) ИОЛ (n = 18); замена искусственного хрусталика на полиметилметакрилатную ирис-кло ИОЛ (КЛО) с бесшовной фиксацией к радужке (n = 22); шовная фиксация ИОЛ к радужке (РАД; n = 8); иммобилизация ИОЛ склеральными бандажными швами (БШ; n = 4); консервативное лечение (КЛ; n = 23). Сравнение методик производили по бальной системе.

Результаты. Итоговый балл эффективности методик представлен в порядке убывания: гИОЛ — 5,36 ± 1,05, ТШФ — 5,21 ± 1,80, КЛО — 3,87 ± 3,34, РАД — 1,26 ± 4,41, БШ — –0,74 ± 3,66, КЛ — –3,26 ± 2,51 (p < 0,001).

Заключение. Хирургическое лечение пациентов с синдромом «увеит – глаукома – гифема» представляет комплексную проблему из-за необходимости выполнения, как правило, нескольких вмешательств, направленных на устранение причины рецидивирующих кровоизлияний — механического контакта ИОЛ с радужкой. Сравнение различных хирургических методик продемонстрировало наибольшую эффективность гИОЛ, ТШФ, а также КЛО. Несколько меньшую эффективность показала шовная фиксация ИОЛ к радужке. Применение бандажных швов для лечения пациентов с синдромом «увеит – глаукома – гифема» нецелесообразно из-за высокого риска рецидива.

Ключевые слова: факоэмульсификация; интраокулярная линза; осложнение; синдром Эллингсона; синдром «увеит – глаукома – гифема»; транссклеральная шовная фиксация; ирис-кло ИОЛ.

Как цитировать

Белов Д.Ф., Николаенко В.П., Шуваев Д.А., Потемкин В.В., Хрипун К.В. Синдром «увеит – глаукома – гифема». Часть 2. Сравнительный анализ эффективности существующих методов лечения // Офтальмологические ведомости. 2024. Т. 17. № 3. С. 7–15. DOI: https://doi.org/10.17816/OV626409

Рукопись получена: 02.02.2024 **Рукопись одобрена:** 11.04.2024 **Опубликована online:** 23.09.2024

BACKGROUND

Uveitis–glaucoma–hyphema (UGH) syndrome is a condition caused by iris and ciliary body injury [1] with a mobile intraocular lens (IOL) because of weak ligaments or extracapsular fixation [2, 3]. The main UGH syndrome manifestations (in descending order of frequency) are hyphema, iris transillumination, ocular hypertension, and anterior uveitis [4].

Medical therapy of UGH syndrome is based on local glucocorticoids, non-steroidal anti-inflammatory and hypotensive drugs. However, only surgical IOL repositioning or explantation can eliminate the root cause [3, 5].

Currently, there is no a generally accepted management algorithm for patients with UGH syndrome. Thus, the *study aimed* to compare the effectiveness of various surgical procedures to treat this condition.

MATERIALS AND METHODS

The study based in the Ophthalmology Center of Saint Petersburg City Multifield Hospital No. 2. Out of 100 patients (101 eyes) with UGH syndrome, 5 patients (6 eyes) who underwent IOL explantation were excluded because of a small sample challenging interpretation of the obtained data, as well as one patient who underwent enucleation of a blind eye with end-stage glaucoma and corneal dystrophy. The remaining 95 patients (95 eyes), including 37 women, aged 74.93 ± 8.30 years were divided into six groups by the surgical method used:

- One-step IOL exchange with a hydrophilic IOL (hIOL) with transscleral suture fixation (n = 20);
- IOL repositioning and transscleral suture fixation (TSF) (n = 18);
- One-step IOL exchange with a polymethyl methacrylate iris-claw IOL (CLAW) with sutureless iris fixation (n = 22);
- Iris suture fixation of the IOL (IRIS; n = 8);
- IOL immobilization with scleral bandage sutures (BS; n = 4);
- Drug therapy (DT; n = 23).

Since best corrected visual acuity (BCVA) provides limited information as an integrated parameter of the surgery effectiveness (low final visual acuity due to a concomitant optic nerve and/or macula condition or a significant but temporary vision improvement while on medical therapy for UGH syndrome), we have developed a formula to assess the effectiveness of a surgical method (Table 1):

$$\text{Final effectiveness score} = \text{VA} + \text{RS} + \text{SC} + \text{NSP} + \text{dBCVA} + \text{dIOP},$$

where VA = changes in visual acuity (increase/decrease); RS = relief of UGH syndrome symptoms (regression/persistence); SC = surgical complications (Table 1); NSP = number of surgical procedures; dBCVA = difference (delta) of BCVA obtained by subtracting $BCVA_1$

Table 1. Scoring system for assessing the surgical treatment effectiveness of uveitis–glaucoma–hyphema syndrome
Таблица 1. Балльная система оценки эффективности хирургического лечения пациентов с синдромом «увеит – глаукома – гифема»

Parameter		Score
Visual acuity	increase	2
	no changes	0
	decrease	–2
	spatial vision loss	–4
Relief of symptoms	yes	2
	no	–3
Surgical complications	none	1
	vitreous hemorrhage	–1
	hemorrhagic choroidal detachment	–2
	uveitis–glaucoma–hyphema syndrome recurrence	–3
	epithelial-endothelial corneal dystrophy	–4
Number of surgical procedures	0 (drug therapy)	–2
	$n/4$	X
Delta BCVA	$BCVA_2 - BCVA_1$	Y
Delta IOP	$(IOP_1 - IOP_2)/100$	Z

DOI: https://doi.org/10.17816/OV626409

(visual acuity at Visit 1) from $BCVA_2$ (visual acuity at the last follow-up visit); dIOP = difference (delta) of intraocular pressure obtained by subtracting IOP_2 (eye pressure at the last follow-up visit) from IOP_1 (eye pressure at Visit 1) and divided by 100 (to prevent overestimation of the absolute final scores).

Statistical analysis

A database using a retrospective analysis of medical records of patients with UGH syndrome was created in Microsoft® Excel (version 16.72). Statistical analysis was carried out using Jamovi (version 2.2). Descriptive statistics techniques were used along with the mean (*M*), median (*Me*), and standard deviation (*SD*). Sample normal distribution was checked using the Shapiro–Wilk test. The nonparametric Kruskal–Wallis test was used to compare mean final scores and BCVA in the study groups. The adjusted determination coefficient R^2 was used for regression analysis. The differences were considered statistically significant at $p \leqslant 0.05$.

In statistical data processing, visual acuity of light perception (with and without light projection) and blindness were equated to 0.0001 and 0, respectively, in decimal notation.

Notably, the number of patients varied in the groups, which could affect the validity of statistical analysis.

RESULTS

Table 2 shows the total number of surgical procedures performed in patients with UGH syndrome.

Table 3 provides a comparison of the main surgical procedures by final score and achieved BCVA.

Fig. 1 shows the relationship between the final effectiveness score and surgical procedure, and Figure 2 demonstrates the relationship between BCVA and the type of performed surgery.

Table 4 presents complications of surgical procedures and medical treatment in the study groups.

Table 2. Number of surgical interventions performed on patients with uveitis–glaucoma–hyphema syndrome

Таблица 2. Общие сведения о количестве хирургических вмешательств, выполненных пациентам с синдромом «увеит – глаукома – гифема»

Surgical procedures	Total
Mean number of:	
• surgical procedures	1.34 ± 1.13
• hospitalizations	2,07 ± 1,03
To eliminate the IOL–iris contact	
Transscleral suture IOL fixation	24
Iris-claw IOL implantation	22
Secondary hydrophilic IOL implantation	20
Iris fixation of the IOL	16
Bandage sutures	6
IOL explantation	5
Haptics repositioning	1
To reduce intraocular pressure	
Trabeculectomy	18
Ahmed valve implantation	9
Hyphema washout	8
Laser iridotomy	4
Transscleral diode laser cyclophotocoagulations	3
Metal mini-shunt implantation	2
Bleb needling	2
Enucleation	1
Other procedures	
Laser removal of secondary cataract	3
Posterior scleral trephination	1
Anterior vitrectomy	1
Total vitrectomy	1
Total	147

Table 3. Comparison of study subgroups by final score and best-corrected visual acuity

Таблица 3. Сравнение исследуемых групп по итоговой оценке и максимальной корригированной остроте зрения

Main surgical procedure	Total score, *M* ± *SD* (*Me*)	*p*	BCVA at the last follow-up visit, *M* ± *SD* (*Me*)	*p*
Secondary hydrophilic IOL implantation	5.36 ± 1.05 (5.62)	<0.001	0.50 ± 0.33 (0.50)	0.146
IOL repositioning and transscleral suture fixation	5.21 ± 1.80 (5.68)		0.45 ± 0.31 (0.40)	
Iris-claw IOL implantation	3.87 ± 3.34 (5.50)		0.38 ± 0.30 (0.30)	
Iris fixation of the IOL	1.26 ± 4.41 (2.10)		0.37 ± 0.13 (0.40)	
Bandage sutures	–0.74 ± 3.66 (–0.76)		0.15 ± 0.17 (0.10)	
Drug therapy	–3.26 ± 2.51 (–4.48)		0.54 ± 0.31 (0.60)	

Table 4. Complications in the studied subgroups

Таблица 4. Осложнения хирургических вмешательств и консервативного лечения в исследуемых группах

Complication	Main surgical procedure						Total, *n*
	hIOL (*n* = 20)	TSF (*n* = 18)	CLAW (*n* = 22)	IRIS (*n* = 8)	BS (*n* = 4)	DT (*n* = 23)	
Hemorrhagic choroidal detachment	0	0	2	0	0	0	2
Uveitis–glaucoma–hyphema syndrome recurrence	1	0	0	2	1	11	15
Epithelial-endothelial corneal dystrophy	1	0	1	0	0	0	2
Vitreous hemorrhage	0	1	1	0	0	0	2
No	2	1	4	2	1	11	21

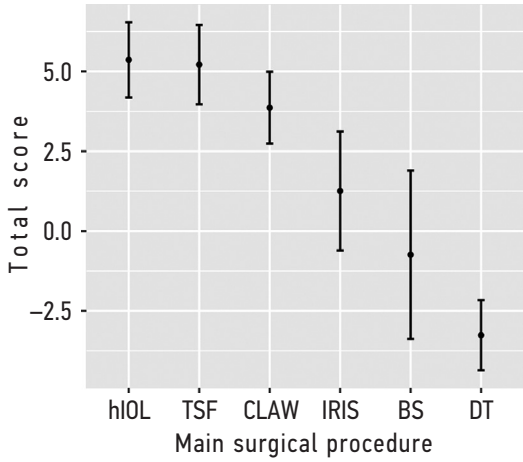


Fig. 1. Dependence of final score due to surgical approach; R^2 = 0.648; p < 0.001. гИОЛ — hydrophobic IOL exchange on hydrophilic model with its transscleral fixation; ТШФ — transscleral fixation of native IOL; КЛО — hydrophobic IOL exchange on polymethylmethacrylate iris-claw IOL; РАД — iris-fixated IOLs; БШ — immobilization with scleral bandage sutures; КЛ — conservative treatment

Рис. 1. Зависимость итоговой оценки эффективности хирургического лечения от типа основного хирургического вмешательства; R^2 = 0,648; p < 0,001. гИОЛ — вторичная имплантация гидрофильной ИОЛ; ТШФ — транссклеральная шовная фиксация ИОЛ; КЛО — вторичная имплантация ирис-кло ИОЛ; РАД — шовная фиксация ИОЛ к радужке; БШ — фиксация ИОЛ бандажными швами; КЛ — консервативное лечение

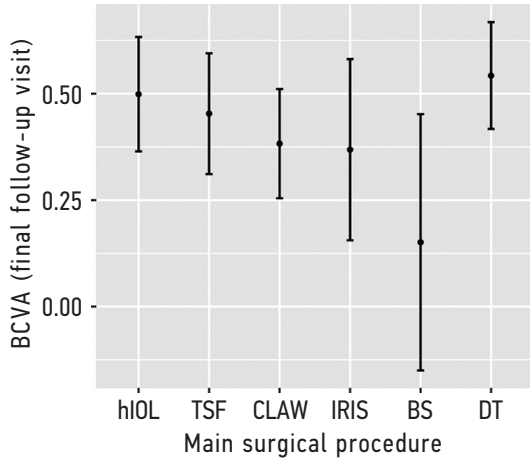


Fig. 2. Dependence of best-corrected visual acuity due to surgical approach; R^2 = 0.085; p < 0.001. гИОЛ — hydrophobic IOL exchange on hydrophilic model with its transscleral fixation; ТШФ — transscleral fixation of native IOL; КЛО — hydrophobic IOL exchange on polymethylmethacrylate iris-claw IOL; РАД — iris-fixated IOLs; БШ — immobilization with scleral bandage sutures; КЛ — conservative treatment

Рис. 2. Зависимость максимальной корригированной остроты зрения от типа основного хирургического вмешательства; R^2 = 0,085; p < 0,001. гИОЛ — вторичная имплантация гидрофильной ИОЛ; ТШФ — транссклеральная шовная фиксация ИОЛ; КЛО — вторичная имплантация ирис-кло ИОЛ; РАД — шовная фиксация ИОЛ к радужке; БШ — фиксация ИОЛ бандажными швами; КЛ — консервативное лечение

DISCUSSION

Our findings are consistent with the published data on challenging surgical treatment of patients with UGH syndrome [6, 7]. A total of 147 procedures were performed in 100 patients (including IOL explantations and enucleations), with an average of 1.34 ± 1.13 procedures per patient, each was hospitalized for an average of 2.07 ± 1.03 times (Table 2). The maximum number of procedures per patient was 7, the last of which was enucleation due to persistent pain syndrome secondary to epithelial-endothelial corneal dystrophy and end-stage glaucoma.

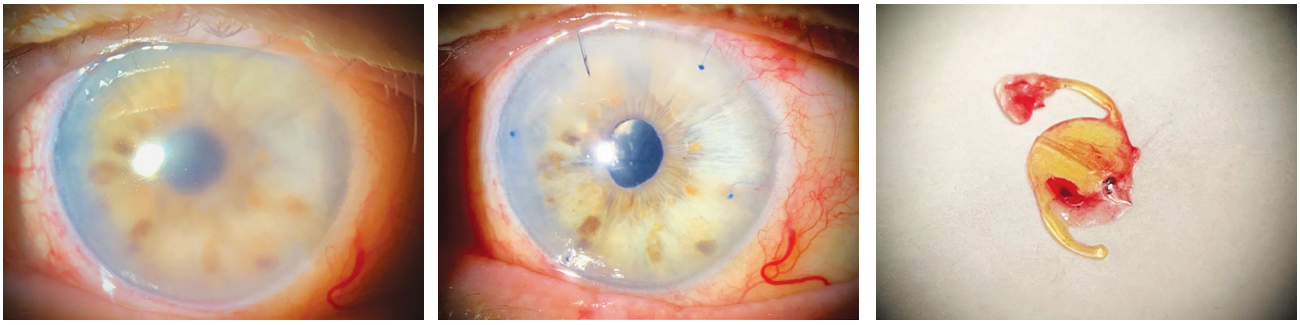
Additional surgeries in patients with UGH syndrome also aimed to stabilize glaucoma. Thus, 34 different procedures were required to reduce IOP. They included 18 trabeculectomies, 2 implantations of a metal mini-shunt, 9 implantations of the Ahmed valve, 2 bleb needlings, and 3 transscleral diode laser cyclophotocoagulations (TDL-CPC). Excessive scarring of the filtration site caused by chronic inflammation and recurrent anterior chamber hemorrhages [8] makes glaucoma in UGH syndrome a secondary one. Therefore, it requires treatment methods other than trabeculectomy, the gold standard of surgical IOP normalization in primary open-angle glaucoma [9], such as implantation of drainage devices [10] or TDL-CPC [11].

Compared with laser iridoplasty, which has demonstrated its effectiveness in the treatment of UGH syndrome [12], laser iridotomy (n = 4) did not eliminate the IOL–iris contact as the root cause of UGH syndrome and was insufficient to prevent additional surgeries.

The main procedures aimed to correct the malpositioned IOL included suture fixation of the IOL to the sclera or iris, secondary implantation of the hydrophilic or iris-claw IOL, and immobilization of the IOL with scleral bandage sutures. Transscleral fixation of the pre-implanted IOL was performed using flange [13] or interrupted sutures with the formation of scleral pockets [14]. The S-loop IOL haptics were fixed to the iris with 10-0 polypropylene interrupted sutures per the McCannel technique [15] modified by Condon [16]. Secondary implantation of the hydrophilic IOL with suture scleral fixation included explantation of the lens which caused UGH syndrome (Fig. 3). Retropupillary iris-claw IOL implantation also involved the removal of the previously placed IOL. This technique is described in detail in published articles [17]. U-shaped bandage sutures were placed behind the IOL to reduce pseudo-phacodonesis and, thus, eliminate the intermittent IOL–iris contact.

A comparison of the effectiveness of different surgical techniques showed that the hydrophilic IOL secondary implantation group had the best results. However, in one out of 20 cases, UGH syndrome re-occurred, which reduced the final score of this technique. Transscleral suture IOL fixation demonstrated almost similar effectiveness as the above technique. Its advantage is a more rapid VA increase as no large corneal incision was made, which is an integral step of polymethyl methacrylate IOL implantation, and no complications of IOL explantation occurred [18]. The TSF disadvantages include the risk of intraoperative vitreous hemorrhage [19] and UGH syndrome recurrence because the inducing IOL is not removed.

Iris-claw IOL implantation was at the third place. Notably, intra-operative and early postoperative complications such as hemorrhagic choroidal detachment (2 cases per 22 procedures) and vitreous hemorrhage (1 case per 22 procedures) were more common for this technique. Moreover, both secondary hydrophilic and iris-claw IOL implantations have a risk of epithelial-endothelial corneal dystrophy, clearly due to prolonged manipulations in the anterior chamber [20]. In our study, one complication was reported in each group.



a *b* *c*

Fig. 3. Clinical case of a hydrophobic S-shaped IOL explantation with exchange on hydrophilic model with transscleral suture fixation: *a* — before surgery (hyphema); *b* — biomicroscopy on the third day after the surgery; *c* — explanted hydrophilic IOL

Рис. 3. Клинический случай эксплантации гидрофобной S-образной ИОЛ с заменой на гидрофильную модель с транссклеральной шовной фиксацией: *a* — биомикроскопическая картина до операции (микрогифема); *b* — биомикроскопическая картина на третьи сутки после вмешательства; *c* — эксплантированная ИОЛ

DOI: https://doi.org/10.17816/OV626409

The highest effectiveness (final score above 3) of the three listed methods determines their feasibility in clinical practice, and a surgical technique should be selected based on the surgeon preferences [17].

Iris suture fixation of the IOL was at the fourth place, because it led to UGH syndrome recurrence in 2 out of 8 patients, which required IOL explantation. However, if no postoperative complications occur, the technique provides BCVA almost similar to that in the iris-claw IOL implantation group.

Bandage sutures for the treatment of patients with UGH syndrome is less efficient because of the risk of recurrent anterior chamber hemorrhages caused by IOL contact with the iris (1 case out of 4). Possible complications of this technique also include fluid backflow [21], which, however, was not reported in the study group.

Drug therapy ranked last due to high UGH syndrome recurrence rate (11 cases out of 23), although this subgroup had the best between-recurrence BCVA, which was not associated with the long-term visual outcomes of UGH syndrome.

CONCLUSION

Surgical treatment of UGH syndrome is a comprehensive challenge, as it usually requires several procedures to eliminate the root cause of recurrent anterior chamber and/or vitreous hemorrhages, i.e., mechanical IOL–iris contact, and surgically normalize IOP using valve devices in every third patient.

A comparison of different surgical techniques demonstrated superiority of secondary hydrophilic IOL implantation, transscleral suture IOL fixation, and iris-claw IOL placement. Iris suture fixation of the IOL was slightly less effective. Bandage sutures are inappropriate for the treatment of patients with UGH syndrome due to the high risk of recurrence.

ADDITIONAL INFO

Authors' contribution. All authors made a substantial contribution to the conception of the study, acquisition, analysis, interpretation of data for the work, drafting and revising the article, final approval of the version to be published and agree to be accountable for all aspects of the study. Personal contribution of each author: D.F. Belov — study concept and design, writing, statistical data processing, literature review; V.P. Nikolaenko — writing, literature review; D.A. Shuvaev — data collection and processing, literature review; V.V. Potemkin — study concept and design, text writing, literature review, surgical interventions; K.V. Khripun — text writing, surgical interventions.

Funding source. The study was not supported by any external sources of funding.

Competing interests. The authors declare that they have no competing interests.

Ethics approval. Not applicable.

Consent for publication. Written consent was obtained from the patients for publication of relevant medical information and within the manuscript.

ДОПОЛНИТЕЛЬНАЯ ИНФОРМАЦИЯ

Вклад авторов. Все авторы внесли существенный вклад в разработку концепции, проведение исследования и подготовку статьи, прочли и одобрили финальную версию перед публикацией. Вклад каждого автора: Д.Ф. Белов — концепция и дизайн исследования, написание текста, статистическая обработка данных, обзор литературы; В.П. Николаенко — написание текста, обзор литературы; Д.А. Шуваев — сбор и обработка данных, обзор литературы; В.В. Потемкин — концепция и дизайн исследования, написание текста, обзор литературы, проведение хирургических вмешательств; К.В. Хрипун — написание текста, проведение хирургических вмешательств.

Конфликт интересов. Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с публикацией настоящей статьи.

Источник финансирования. Авторы заявляют об отсутствии внешнего финансирования при проведении исследования.

Этический комитет. Не применимо.

Информированное согласие на публикацию. Авторы получили письменное согласие пациентов на публикацию медицинских данных.

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