ANATOMICAL AND VISUAL OUTCOMES OF SURGICAL TREATMENT OF ADVANCED RETINOPATHY OF PREMATURITY

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Abstract*. According to the World Health Organization (WHO), there are currently 50 million blind people in the world, of which 2 million are children [1]. Blindness and low vision due to retinopathy of prematurity dominate in the structure of the causes of visual impairment since childhood in both developed and developing countries, despite all the achievements of science and practical medicine [2]. The proportion of 4B and 5 stages of ROP remaines high in the structure of this nosology. Although the anatomical success of surgical treatment of ROP in such stages, according to various sources, ranges from 38-60% of cases, long-term functional results are interrupted as insufficiently satisfactory [3]. An important achievement of the last decade is the further development of the methods of vitreoretinal surgery used to treat advanced stages of ROP [4]. Therefore, the surgical treatment of advanced stages of ROP and analysis of its results has particular relevance.*
Keywords*: retinopathy of prematurity, tractional detachment of the retina, treatment of advanced stages of ROP, lensvitrectomy, vitrectomy, reattachment of the retina.*

Introduction. Retinopathy of prematurity (ROP) is a vasoproliferative disorder. Threatened premature newborn, especially low birth weight infants with blinding. Despite on the screening programs that allowed early detection, the benefits of laser photocoagulation and cryotherapy for threshold ROP, there are many infants with advanced stages of ROP, according to foreign studies, 1 of 10 infants [5] needs surgical treatment of reattaching the retina and acquire whatsoever visual function.

Purpose: to evaluate the anatomical and visual outcomes of surgical treatment of advanced ROP.

Methods and materials. The study is retrospective and included 18 eyes of 14 infants with stages 4B and 5, who referred to the Kazakh Eye Research Institute and was treated surgically between 2012 to 2018 years. Females constituted a larger group (64.2% (9/5)) compared to males. No else of infants had received prior cryotherapy of laser photocoagulation because of late appeals. Preoperatively, infants were examined by indirect binocular ophthalmoscopy and ultrasonography. The mean gestational age of studying infants was 28.3±2.4 weeks (from 25 till 34 weeks), the mean birthweight was 1099.3±247.21 g (from 872 till 1640 g). The average age at the time of surgery was 24.3±19.07 months (range 6-84 months) (Table 1). The average anterior-posterior size of eyes was 16.9±2.05 mm (range 13.5-20.65 mm). And the data of ultrasonography consist of partial detachment involving macula 5 eyes (4B stage), and total detachment 13 eyes (5 stage). (Table 2). All premature babies were operated with total and subtotal detachment of retina in the scar stage. The type of surgical procedure was selected individually depending on the stage and the presence of concomitant eye pathology. (Table 3). In 17 eyes was performed lensvitrectomy and in 1 eye lens-sparing vitrectomy.

Table 1. Baseline Characteristics of infants, n=14

Characteristic	
Female gender, (%)	9(64.2%)
Male gender, (%)	5(35.8%)
Mean gestational age, weeks	28.3 weeks
Median (range)	28 (25-34)
Mean birthweight, g	1099.3 g
Median (range)	1000 (872-1640)

Table 2. Characteristics of eyes with 4 and 5 stages ROP, n=14

Characteristic	
Average age at time of surgery, weeks	24.3 weeks
Median (range)	15(6-84)
Average size of eye, mm (n=18)	16.9 mm
Median (range)	16.2 (13.5-20.65)
Stage of ROP, (n=18)	
Stage 4B	5 eyes
Stage 5	13 eyes

Table 3. Surgical procedures performed for eyes with advanced ROP

Surgical procedures (n=18)	
Lens-sparing vitrectomy	1
Lensvitrectomy	17

Follow-up examination

Postoperatively, the anatomical status of the retina was assessed clinically by indirect ophthalmoscopy and ultrasonography.

Anatomical outcomes of surgery were evaluated by determining a coefficient of reattachment (the area of reattaching/ the total area of retina) and was categorized as follows: “success” if the retina was reattached, “partial success” if the retina reattached in 2 and more quadrants, “failure” if the retina reattachment isn’t received.

Visual acuity was recorded as “no light perception”, “light perception”, “light perception with functions” if following the light at a distance of 1 m (0.001) and “pattern vision” if following toys at a distance of 3 m (0.05).

Results.

Visual outcomes

Before surgery in 4 eyes, BCVA (Best-corrected visual acuity) was “light perception” and in 14 eyes “no light perception”

After the surgical treatment, BCVA was in 4 eye “pattern vision”, in 7 eyes “light perception with functions”, and in 7 eyes “light perception”. (Diagram 1)

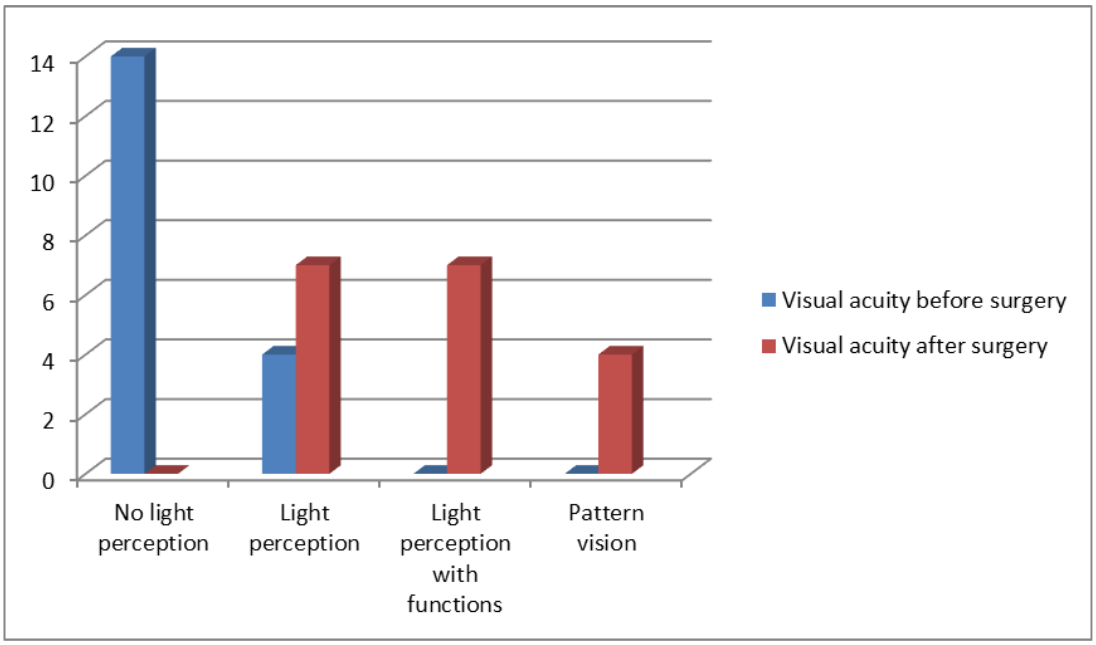


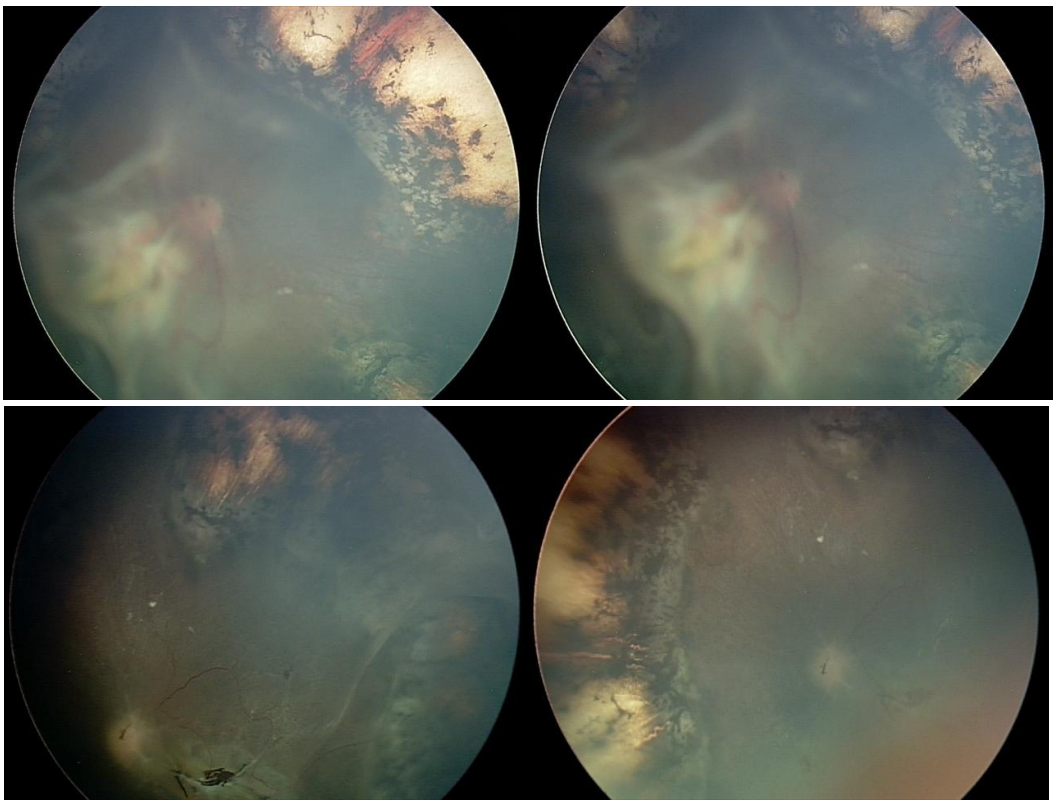
Diagram 1. Visual acuity of babies before and after surgery

Anatomical outcomes

After the surgical treatment in 3 eyes we achieved “success”, with a coefficient of reattachment K=0.25, in 5 eyes “partial success” and in 10 eyes “Failure” reattachment wasn’t received.

A.

B.



Pre (A) and post- lens-sparing vitrectomy (B) fundus photographs in a patient with stage 5 retinopathy of prematurity.

Discussion. The success of surgical treatment in terms of anatomical results depends mainly on many factors.as surgical technique, stage of detachment, the age of premature babies at the time of surgery and the presence of concomitant diseases. One of the top-priority issues of qualitative treatment of advanced ROP is the definition of the optimal time for surgery [4, 5, 6, 7]. In the second place are the presence and degree of activity of the proliferous process. According to several researches on this topic, optimal time to surgical interventions on advanced stages of ROP is no earlier than 5-6 months of age [8]. The active vascular phase of ROP extends an average for 3-6 months. [8], then the process transfers to the scar phase. These are the two criteria that determine the possibility of performing vitreoretinal surgery. So, vitrectomy during the active vascular phase for severe ROP is not recommended because it is often associated with sustained bleeding during surgery, increased risk of iatrogenic damage and poor retinal reattachment. Improved results have been reported in some articles describing vitrectomy performed in combination with pharmacologic adjuncts, as anti-VEGF agents [9]. The surgical goal for 4B detachments should be to minimize retinal distortion and prevent total detachment. Residual retinal detachment is common in these eyes and attempts should not be made to try to flatten the retina completely [8]. Despite all these combined and improved surgical procedures for late-stage ROP, anatomical and visual functions remain low. However, low visual acuity in patients with stage 4B and 5 retinopathy of prematurity is often associated not only with morphological changes in the retina, but also with prolonged inactivity of the visual analyzer during the development of an activity pathological process [10]. However, the techniques and methods of vitreoretinal surgery for ROP are improved every year.

Conclusions. Improvement of vitreoretinal technique interventions and optimization of its timing at advanced stages or ROP allow to obtain satisfactory results, consisting in completely or partial retinal reattachment. This anatomical state of intraocular structures is not only a good cosmetic effect, but also creates a fertile ground for the development of visual functions in the future.

REFERENCES

1. Gilbert C., Kong I., Fry M. “An update on progress and changing epidemiology of causes of childhood worldwide” 2012.
2. Baranov A.V., Troyansky R.L Surgical treatment of 4B and 5 stages of retinopathy of prematurity (PH).Modern technologies of treatment of vitreoretinal pathology-2008:Collection of scientific. articles. FSI MNTK “Eye Microsurgery”, M., 2008; 23-26
3. Katargina L. A with coauthors, 2002. “ROP, current state of the problem and tasks of organizing ophtalmological care of premature babies in the RF.
4. Diskalenko O.V. Early vitrectomy in stage IVa retinopathy of prematurity/ O.V. Diskalenko, O.A. Konikova// Ros.pediatrician.ophtalmology.- 2016. -T.11, №3. p.133-137
5. P.K. Shah, V. Narendran
6. Баранов А.В., Трояновский Р.Л Хирургическое лечение 4В и 5 стадий ретинопатии недоношенных (РН). Современные технологии лечения витреоретинальной патологии-2008: Сборник науч. статей ФГУ “МНТК “Микрохирургия глаза” М 2008;23-26.
7. Баранов А.В.., Трояновский Р.Л. Лечение и предупреждение поздних стадий ретонопатии недоношенных. Современные технологии лечения витреоретинальной патологии-2009: Сборник науч. статей. ФГУ “МНТК”Микрохирургия глаза”М 2009;26-28/
8. Azuma N., Ishikawa K., Hama Y., Hiraoka M., Suzuki Y., Nishina S. Early vitreous surgery for aggressive posterior retinopathy of prematurity.Am J Ophtalmology 2006;142:4:636-643.
9. Hirose T. Discussion. Ophtalmology 1998;105:6:997.
10. Хирургическое лечение поздних стадий ретинопатии недоношенных-последний шанс видеть. Сообщение 1. Анализ анатомических результатов А.В, Баранов, Р.Л. Трояновский
11. Lensectomy and virectomy with and without intravitreal triamcinolone acetonide for vascularly active stage 5 retinal detachments in retinopathy of prematurity.
12. Functional outcomes of stage IV b and V retinopathy of prematurity Konikova O.A., Diskalenko O.V.
13. Gilbert C, Fielder A, Gordillo L, Quinn G, Semiglia R, Visintin P, et al. (International NO-ROP Group). Characteristics of infants with severe retinopathy of prematurity in countries with low, moderate, and high levels of development: implications for screening programs. Pediatrics. 2005; 115:e518-525.
14. Karkhaneh R, Riazi-Esfahani M, Lashay A, Chams H. A survey on visual impairment and blindness in children from retinopathy of prematurity. Iranian J Ophthalmol. 2003; 15:101-105
15. Mousavi SZ, Karkhaneh R, Riazi-Esfahani M, Mansouri MR, Roohipoor R, Galichi L, et al. Retinopathy of prematurity in infants with late retinal examination. J Ophthalmic Vis Res. 2009; 4:24-28.
16. Karkhaneh R, Mousavi SZ, Riazi-Esfahani M, Ebrahimzadeh SA, Roohipoor R, Kadivar M, et al. Incidence and risk factors of retinopathy of prematurity in a tertiary eye hospital in Tehran. Br J Ophthalmol. 2008; 92:1446-1449.
17. Gibson DL, Sheps SB, Uh SH, Schechter MT, McCormick AQ. Retinopathy of prematurity induced blindness: birth weight-specific survival and the new epidemic. Pediatrics. 1990; 86:405-412.
18. Lakhanpal RR, Sun RL, Albini TA, Holz ER. Anatomical success rate after primary three-port lens-sparing vitrectomy in stage 5 retinopathy of prematurity. Retina. 2006; 26:724-728.
19. Hubbard GB 3rd. Surgical management of retinopathy of prematurity. Curr Opin Ophthalmol. 2008; 19:384-390.
20. Cats RP, Tan KF. Premature infants with and without regressed retinopathy of prematurity: comparison of long-term (6-10 years) ophthalmological morbidity. J Pediatr Ophthalmol Strabismus. 1989; 26:271-275.
21. Hubbard GB 3rd, Cherwick DH, Burian G. Lenssparing vitrectomy for stage 4 retinopathy of prematurity. Ophthalmology. 2004; 111:2274-2277.
22. Ertzbischoff LM. A systematic review of anatomical and visual function outcomes in preterm infants after scleral buckle and vitrectomy for retinal detachment. Adv Neonatal Care. 2004; 4:10–19.
23. Greven C, Tasman W. Scleral buckling in stages 4B and 5 retinopathy of prematurity. Ophthalmology. 1990; 97:817-820.
24. Noorily SW, Small K, de Juan E Jr, Machemer R. Scleral buckling surgery for stage 4B retinopathy of prematurity. Ophthalmology. 1992; 99:263-268.
25. Maguire AM, Trese MT. Lens-sparing vitreoretinal surgery in infants. Arch Ophthalmol. 1992; 110:284–286.
26. Maguire AM, Trese MT. Visual results of lenssparing vitreoretinal surgery in infants. Pediatr Ophthalmol Strabismus. 1993;30:28-32
27. Trese MT, Droste PJ. Long-term postoperative results of a consecutive series of stages 4 and 5 retinopathy of prematurity. Ophthalmology. 1998;105:992–997.
28. Trese MT. Scleral buckling for retinopathy of prematurity. Ophthalmology. 1994;101:23–26.
29. Hinz BJ, de Juan E Jr, Repka MX. Scleral buckling surgery for active stage 4A retinopathy of prematurity. Ophthalmology. 1998;105:1827–1830.
30. Capone A Jr, Trese MT. Lens-sparing vitreous surgery for tractional stage 4A retinopathy of prematurity retinal detachments. Ophthalmology. 2001;108:2068–2070.
31. Sears JE, Sonnie C. Anatomic success of lenssparing vitrectomy with and without scleral buckle for stage 4 retinopathy of prematurity. Am J Ophthalmol. 2007;143:810–813.