Transient visual acuity loss after spine surgery in prone position: A case report and literature review

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Case Study

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Abstract

Background: Visual loss after spine surgery in prone position is disastrous postoperative complication because it is almost irreversible. Meamwhile, there is no optimal treatments and recommended peofessional guidelines.

Case presentation: A 43 years old male patient complained visual loss after spine surgery in prone position. Immediate ophthalmic consultation undoubtedly considered central retinal artery occlusion, therefore combined therapies were administered including neurotrophy, anticoagulation, vasodilation and adequate fluid infusion, followed by hyperbaric oxygen treatment. After active treatment, his visual acuity recovered from postoperative 5 hours gradually.

Conclusion: Because there is shortage of efficacious treatment against visual loss after spine surgery in prone position, the best method avoiding this complication is to pay great attention and prevent it.

Background

Visual loss after spine surgery in prone position is a rare complication, this incidence is about 0.017 to 1% [1, 2]. Although rare, it is potentially disastrous postoperative complication, even irreversible. Visual loss after spine surgery is attributable to various risk factors, including excessive blood loss, long prone spine surgery, hypoxia, use of vasoconstrictors, hypotension, high venous pressure, high volume fluid replacement, and poor head positioning [3]. These risks might lead to ischemic optic neuropathy (ION), central retinal artery occlusion (CRAO) and retinal vein occlusion. It has been reported patients with carotid stenosis or occlusion is also more vulnerable to this complication than those without stenosis [4]. Although CRAO and ION might be the ordinal mechanisms of postoperative visual loss (POVL) [5], the exact pathophysiologic mechanism has not been revealed [6]. Now we presented a case suffering transient unilateral visual loss after spine surgery in prone position under general anesthesia (GA), although who was without these recognized perioperative risk factors. Because of timely diagnosis and therapy, his visual acuity (VA) mostly resolved soon. This was a lucky case because of very quick recovery, which different from the most reported cases. Meanwhile possible etiologies and effective treatments were analyzed for avoiding this complication in future.

Case Presentation

A 43-year-old man was admitted with complain of repeated numb and pain on left low limb and deteriorating recently. He was 78 kg weight and 170 cm height, the body mass index 26.99. His previous medical history was negative. Physical examination demonstrated L3-4-5-S1 left vertebral side tenderness and radiating to left hip. Except that, there was no positive sign, especially abnormalities of VA and cerebral infarction. The most results of laboratory examinations were within normal ranges. Magnetic resonance image (MRI) scan indicated L5-S1 lumbar disc herniation.

He was scheduled to undergo L5-S1 percutaneous endoscopic lumbar discectomy under GA. Anesthesia induction was with intravenous administration of 2 mg midazolam, 50 mg propofol, 20ug sulfentanyl and 10 mg cisatracurium. He was intubated with a 7.0 reinforced endotracheal tube and positioned in prone position. GA was maintained with propofol 4 mg/kg/h and oxygen 3L/min, in conjunction with administration of 10 mg cisatracurium and 30ug sulfentanyl during the operation. The mechanical ventilation protocol included inspiratory to expiratory ratio of 1:2 and inspired oxygen fraction of 1.0. Tidal volume and respiratory rate were regulated to maintain end tidal carbon dioxide partial pressure in normal range.

The total duration of anesthesia was 150 min. During anesthesia, the total fluid input was 1600 ml crystalloids, urine output 100 ml and estimated blood loss 10 ml. His noninvasive blood pressure and heart rate waved between 105 ~ 143/52 ~ 81 mmHg and 55 ~ 92 beat per minutes, respectively. He was extubated 5 min after end of operation without administration of medicines.

Twenty minutes postoperatively, on fully waking up from GA, he complained no vision and light perception in right eye without remarkable eye pain. The appearance and movement of both of his eyelids and bulbus oculis were normal, as well both of pupil were normal. He received further ophthalmic and neurologic examination at bedside by on-call team. Ophthalmic examination demonstrated his right eye had no perception of light. His left eyelid, bulbus oculi, and conjunctiva were normal, with clear cornea and clear lens bilaterally. The diameter of both pupil was 2.5 mm, right direct light pupillary reflex was absence, and indirect light reflex existed. Intraocular pressure was normal, hence intraocular pressure lowering medications were not administrated. Right fundus examination demonstrated attenuated retinal artery, pale optic disc and cherry-red macular without obvious exudation and vitreous bleeding. Optical coherence tomography revealed edematous retinal (Fig. 1A, B, C).

Because right CRAO was suspected, thus 0.5 mg atropine was peribulbar injected immediately. At the same time, 4100 IU low molecular weight heparin calcium was injected subcutaneously, as well intramuscular injection of 30 mg papaverine, following high flow oxygen inspiration and adequate fluid infusion. Five hours postoperatively, his VA of affected eye recovered to counting finger. Fundus examination revealed color of retina recovered normally with pink macula, retinal artery was mostly normal. Fluorescein fundus angiography (FFA) showed arteriovenous bloodstream was well, and little fluorescein leakage on margin of optic disc at later phase of FFA (Fig. 2). Therapy of anticoagulation, vasodilation and neurotrophy were keep on, followed by hyperbaric oxygen treatment.

On the first postoperative day, ophthalmic examination showed light perception on his affected eye without amaurosis. The diameter of right pupil was 6 mm with sluggish papillary reaction because of long-acting mydriatic. The ophthalmic consultation at bedside on the second postoperative day demonstrated VA of his right eye was 0.1 without visual field defect, left 0.5. Further fundus examination revealed normal retinal with pink optic disc and macular. The retinal artery was slim. On the fifth postoperative day, the diameter of affected eye pupil shrank to 4 mm with obtuse light reaction. On the eleventh postoperative day, he received ophthalmic consultation again. He reported slight blurring of

vision in right eye. VA was right 0.3 and left 0.6, respectively. Bilateral conjunctivas were no obvious hyperaemia and hydroncus. Bilateral corneas were clear, diameters of pupils were 3 mm, as well pupils equal and round, acute reactive to light. Both sides of keratic precipiate and aqueous flare were negative. Bilateral lens and vitreum were clear. Fundus examination revealed the margin of yellowish-orange optic disc was distinct without expansion and deepening, as well pink macula (Fig. 3). The ratio of retinal artery to vein was 1:3.

Conclusion And Literature Review

Although POVL in prone position following spinal surgery is rare, this complication is a disaster, which might be irreversible and seriously reduce quality of life. In 2016 Epstein and colleague [3] reviewed 20 cases of blindness with spine surgery, unexpectedly 8 patients were permanent visual loss postoperatively. Consequently it has to be paid more attention on this complication. In 2012, Quraishi [7] reported a patient lost bilateral eyesight following lumbar surgery in prone position, whose VA resolved within 48 hours. The case might be the shortest visual loss since recording. However the patient of this case resolved within 5 hours, and follow-up ophthalmic examination confirmed his VA recovered to 0.3 in the affected eye. So this was a luck case with the fastest recovery.

Visual loss after spine surgery under GA in prone position has gained more and more recognition recently. In American, this incidence was the second among the POVL of nonocular operations [8]. ION is the most frequently cited cause of POVL under GA [9]. No less than 89% of all POVL is attributed to ION, which including anterior ION and posterior ION depending on the location of lesion [3, 5]. Because of reduced light reflex and edematous retinal, CRAO was suspected firstly leading to ION.

There are multiple risk factors developing POVL in prone position. However, the patient in this case did not possess these recognized or suspected risk factors, for example, obesity, prolonged operative times, diabetes, and so on [3]. During the operation, his hemodynamic was tightly controlled and maintained stably without greater blood loss. Meanwhile, his head was secured without any pressure on the globe and positioned correctly in a neutral prone position without cervical rotation. And his head was maintained in a neutral forward position higher than the heart during the operation.

There might be other possible risk factors in this patient, for instance, he was a male. Male gender has been known as a risk factor relative to POVL [1, 8]. Meanwhile, he was positioned in prone position, which might increase direct pressure on the abdomen and obstructed venous return to heart. Obstruction of venous returning increases central venous pressure, further raises intraocular pressure. This is another recognized risk factor of POVL [2, 7]. The patient lost about 10 ml blood and 100 ml urine, fluid input was about 1600 ml crystalloid intraoperatively. Although the fluid volume was not large, there was lack of colloid. Intraoperative crystalloid overload contributes to the optic nerve perfusion pressure reduction, which is also considered to result in POVL [10]. The volume of 1600 ml crystalloid might not be overload for a 78 kg male patient, we merely speculated the shortage of colloid might be a criminal cause.

On the other hand, 1600 ml crystalloid was actually considered obvious shortage for a 78 kg male patient because of his preoperative fasting more than 10 hours. It might cause hypercoagulability which is a risk factor to develop CRAO [11]. Therefore, various treatments of anticoagulation, vasodilation and adequate fluid infusion were combined.

As well-known, although muscarinic agonist can produce intact blood vessels dilation in various species [12], this vasorelaxation only occurs in normal blood vessels. For abnormal blood vessels, muscarinic agonist might cause paradoxical vasoconstriction [13]. Thus based on the previous clinical experience, the patient was administered with atropine peribulbar injection which might relieve spasmodic retinal artery [14].

The patient was also treated with high flow oxygen inspiration and hyperbaric oxygen immediately after CRAO diagnosis. In patients with CRAO, oxygen therapy showed beneficial effects, especially when 100% oxygen and hyperbartic oxygen were administrated, which were proved to improve VA in CRAO patients significantly [15]. As an efficacious, well-tolerated and few-side-effects therapeutic method, hyperbaric oxygen can be used in treatment of acute and subacute CRAO patients, but also it is recommended as emergent therapeutic option [16–18]. We firmly believed these combined therapies to produce the benign clinical outcome.

There were no obvious risk factors in this patient, however, he did suffered transient unilateral POVL. There must be some etiologies we did not detect, which worked together to lead to POVL in prone position. Most cases of POVL were irreversible, this case was very lucky because his VA recovered beginning at postoperative 5 hours, and further ophthalmic consultation confirmed his VA of the affected eye was better and better. This is the fastest recovery of POVL in prone position after spine surgery in Pubmed and PMC recording. No doubt these immediate diagnosis and treatments were important to the benign clinical prognosis. However, it is critical to learn and recognize these etiologies and risk factors to avoid POVL in prone surgery. The best method avoiding POVL is to prevent it [19].

Therefore, POVL need to be considered as one of severe complications in prone spine surgery, which has to be emphasized. There are many perioperatve risk factors causing POVL, thus preoperative counseling, intraoperative strictly monitoring, correct position and stable hemodynamic, and postoperative follow up are essential.

Limitation

There were some limitations in the present case. Firstly, there was no preoperative cervical ultrasound examination to confirm whether there was carotid stenosis or plaque in this patient, because carotid stenosis is reported as a risk factor of POVL. Meanwhile, if MRI or computer tomography scan were implemented when the patient complained visual loss, the direct evidence of CRAO would be obtained. That the patient was not examined timely with FFA was another limitation, because he complained dizzy. Although late FFA revealed the normal blood flow, the best chance lost. If FFA was instantaneous, CRAO

might be observed directly. But combining the patient's complaint, ophthalmic signs, fundus examinations and OCT, the POVL diagnosis was exact, though lack of those above examinations.

Abbreviations

central retinal artery occlusion (CRAO)

fluorescein fundus angiography (FFA)

general anesthesia (GA)

magnetic resonance image (MRI)

ischemic optic neuropathy (ION)

postoperative visual loss (POVL)

visual acuity (VA)

Declarations

Ethics approval: We informed the ethics committee of Sanbo Brain Hospital, Capital Medical University, and got the approval.

Informed consent

Informed consent was obtained from the individual included in the study.

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Competing Interests

The authors declare no competing interest.

Authors' Contributions

Jun Xiong and Guiling Liang were the anesthesiologists who responsible for this patient's general anesthesia and also wrote the draft manuscript. Jun Xiong and Guiling Liang contributed equally to this manuscript and were regarded as co-first author. Liang Hu, Wei Chen, Jie Deng and Jun Gu gave suggestions for treatments for this patient. Guoyi Wang and Yushi Li were involved in literature search and revising the draft critically for content. Yongxing Sun was the correspondence author. All authors read and approved the final manuscript.

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No.

References

1. Nickels TJ, Manlapaz MR, Farag E. Perioperative visual loss after spine surgery. World J Orthop. 2014; 5(2): 100-106. DOI:10.5312/wjo.v5.i2.100.
2. Kamming D, Clarke S. Postoperative visual loss following prone spine surgery. Br J A. 2005; 95(2): 257-260. DOI: 10.1093/bja/aei173.
3. Epstein NE. Perioperative visual loss following prone spine surgery: A review. Surg Neurol Int. 2016; 7: S347-360. DOI: 10.4103/2152-7806.182550.
4. Lee SH, Chung I, Choi DS, Shin IW, Kim S, Kang S, Kim JY, Chung YK, SohnJT. Visual loss due to optic nerve infarction and central retinal artery occlusion after spine surgery in the prone position. Medicine (Baltimore). 2017; 96(31): e7379. DOI: 10.1097/MD.0000000000007379
5. Nakra D, Bala I, Pratap M. Unilateral postoperative visual loss due to central retinal artery occlusion following cervical spine surgery in prone position. Paediatr Anaesth. 2007; 17(8): 805-808. DOI: 10.1111/j.1460-9592.2007.02222.x.
6. Hassani V, Homaei MM, Shahbazi A, Zamani MM, Safari S, Nadi S, Rahimizadeh A, Lashkari MH, Zendehrood SA. Human erythropoietin effect in postoperative visual loss following spine surgery: A case report. Anesth Pain Med. 2014; 4(2): e7291-7294. DOI: 10.5812/aapm.7291.
7. Quraishi NA, Wolinsky JP, Gokaslan ZL. Transient bilateral post-operative visual loss in spine surgery. Eur Spine J. 2012; 21(Suppl 4): S495-S498. DOI: 10.1007/s00586-011-2117-7.
8. Shen Y, Drum M, Roth S. The prevalence of perioperative visual loss in the United States: A 10-year study from 1996 to 2005 of spine, orthopedic, cardiac, and general surgery. Anesth Analg. 2009; 109(5):1534-1545. DOI: 10.1213/ane.0b013e3181b0500b.
9. Myers MA, Hamilton SR, Bogosian AJ, Smith CH, Wagner TA. Visual loss as a complication of spine surgery. A review of 37 cases. Spine (Phila Pa 1976). 1997; 22(12):1325-1329. DOI: 10.1097/00007632-199706150-00009.
10. Shifa J, Abebe W, Bekele N, Habte D. A case of bilateral visual loss after spinal cord surgery. Pan Afr Med J. 2016; 23: 119. DOI: 10.11604/pamj.2016.23.119.8443.
11. Mac Grory B, Lavin P, Kirshner H, Schrag M. Thrombolytic therapy for acute central retinal artery occlusion. Stroke. 2020; 51(2): 687-695. DOI: 10.1161/STROKEAHA.119.027478.
12. Chen N, Lv J, Bo L, Li N, Wu C, Yin X, Li J, Tao J, Chen J, He Y, Huang S, Xiao J, Mao C, Xu Z. Muscarinic-mediated vasoconstriction in human, rat and sheep umbilical cords and related vasoconstriction mechanisms. BJOG. 2015; 122(12):1630-1639. DOI: 10.1111/1471-0528.13144.

13. Qipshidze N, Metreveli N, Lominadze D, Tyagi SC. Folic Acid Improves Acetylcholine-induced Vasoconstriction of Coronary Vessels Isolated from hyperhomocysteinemic mice: An Implication to Coronary Vasospasm. J Cell Physiol. 2011; 226(10): 2712–2720. DOI: 10.1002/jcp.22621.
14. Lin FY, Fu MS. Central retinal artery occlusion after uneventful glaucoma valve implantation surgery with retrobulbar anesthesia: a case report. Int J Ophthalmol. 2019; 12(8): 1362-1365. DOI: 10.18240/ijo.2019.08.22.
15. Wu X, Chen S, Li S, Zhang J, Luan D, Zhao S, Chu Z, Xu Y. Oxygen therapy in patients with retinal artery occlusion: A meta-analysis. PLoS One. 2018; 13(8):e0202154. DOI: 10.1371/journal.pone.0202154.
16. Baqli BS, Cevik SG, Cevik MT. Effect of hyperbaric opxygen treatment in central retinal artery occlusion. Undersea Hyperb Med. 2018; 45(4): 421-425. PMID: 30241121.
17. Masters TC, Westgard BC, Hendriksen SM, Decanini A, Abel AS, Logue CJ, Walter JW, Linduska J, Engel KC. Case series of hyperbaric oxygen therapy for central retinal artery occlusion. Retin Cases Brief Rep. 2019. DOI: 10.1097/ICB.0000000000000895.
18. Youn TS, Lavin P, Patrylo M, Schindler J, Kirshner H, Greer DM, Schrag M. Current treatment of central retinal artery occlusion: a national survey.J Neurol. 2018; 265(2):330-335. DOI: 10.1007/s00415-017-8702-x.
19. Epstein NE. How to avoid perioperative visual loss following prone spine surgery. Surg Neurol Int. 2016; 7 (Suppl 13): S328-S330. DOI: 10.4103/2152-7806.182543.

Figures

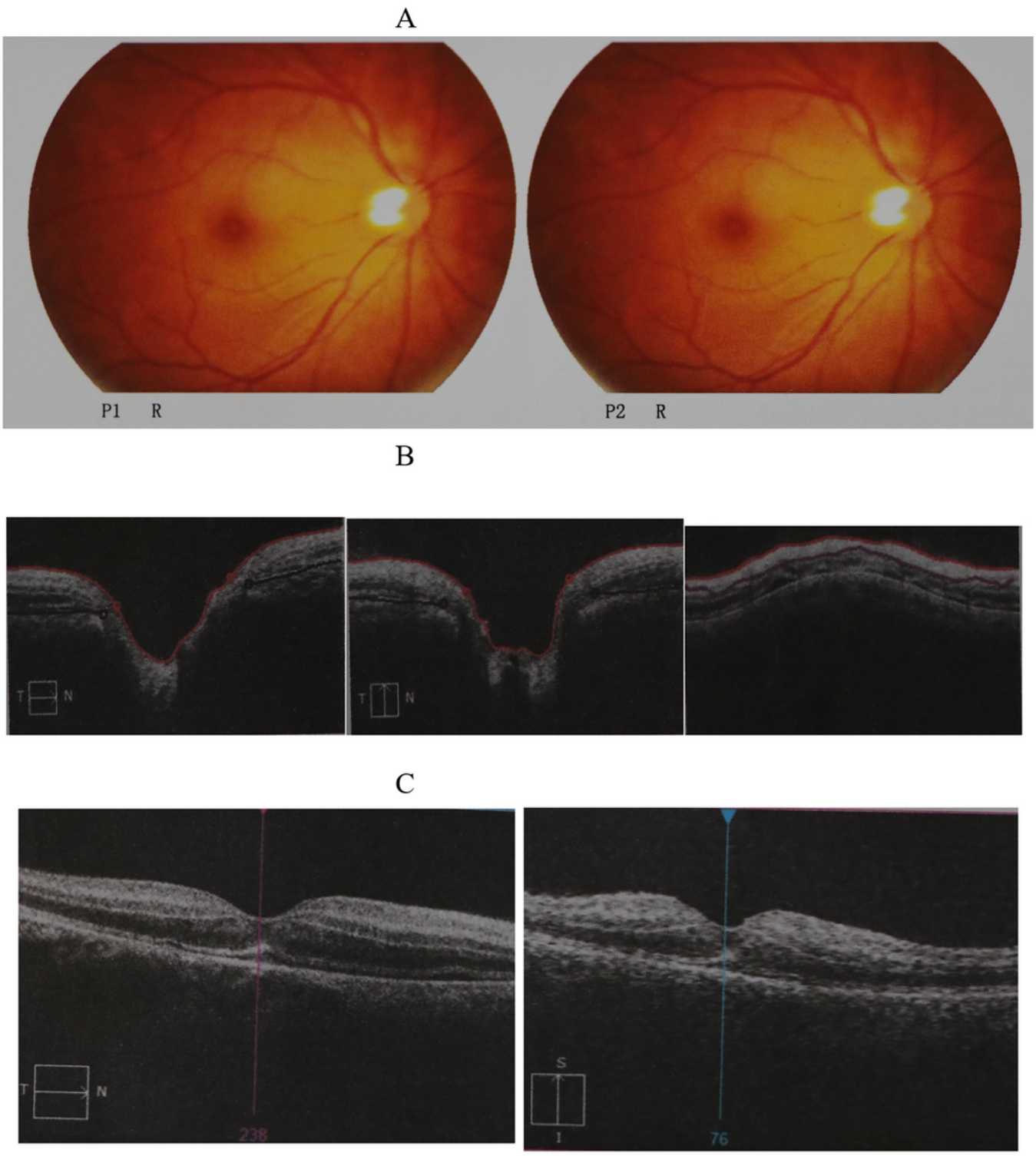

Figure 1

Fundus photography of right eye. Fundus photography (P1 R and P2 R) showed thinning retinal artery with pale optic disc and cherry-red macular (A). Optical coherence tomography of right eye revealed edematous retinal (B and C).

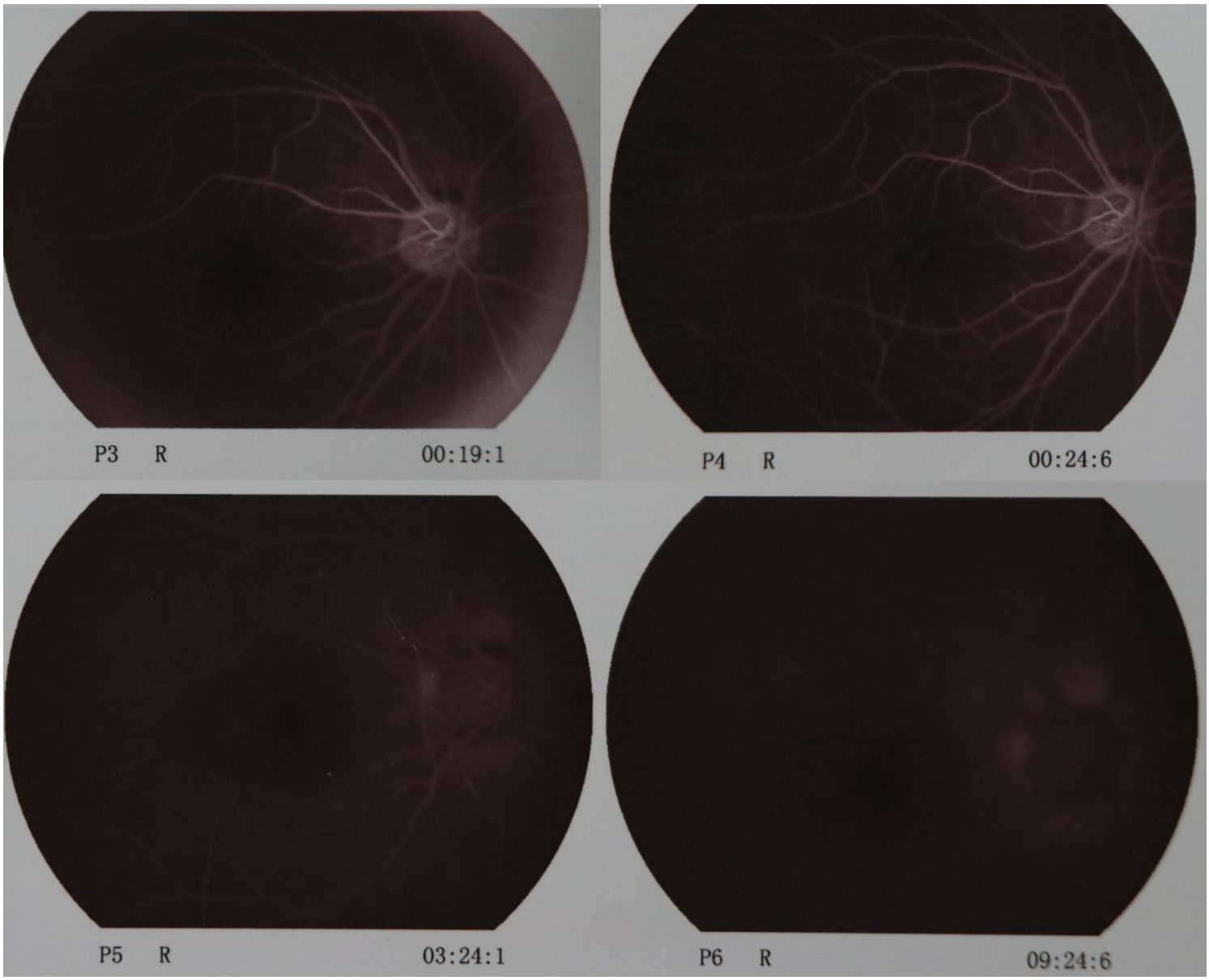

Figure 2

Seven hours after treatment, fundus fluorescein angiography of right eye. Arteriovenous bloodstream was well and little fluorescein leakage on margin of optic disc at later phase.

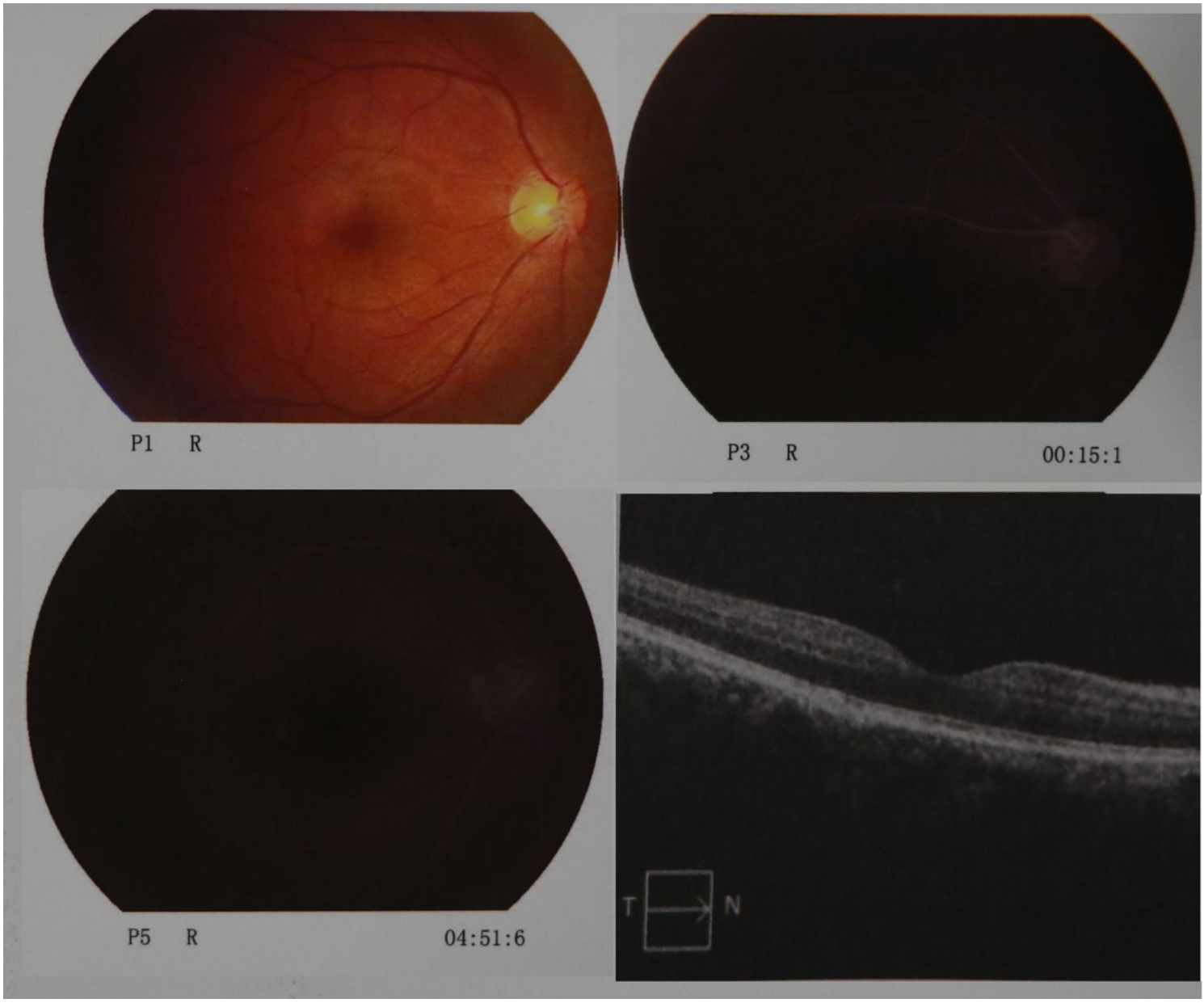

Figure 3

16-days after treatment, fundus photography showed normal retina color with pink macula, retina artery was mostly normal (P1 R). Fundus fluorescein angiography (P3 R and P5 R). Macular region OCT scan showed retina edema faded (Lower right).