Online-ISSN 2623-2723
Print ISSN 2338-0373
Journal of Widya Medika Vol. 10 No. 2 Oktober 2024
https://doi.org/10.33508/jwm.v10i2.6023

SUCCESSFUL MANAGEMENT OF PENETRATING KERATOPLASTY IN PEDIATRIC PATIENTS WITH CORNEAL TRAUMA

Made Kusuma Wardani[1], Siska[2], I Made Agus Kusumadjaja[2]

Correspondent Email : madekusumawardani@gmail.com

ABSTRACT

Introduction: *Corneal perforation is an ophthalmic emergency and requires immediate medical and surgical treatment. The most common causes of corneal perforation are infection, inflammation, or trauma.*

Case Report: *A 9-year-old boy came with complaints of pain in his right eye for 2 days of BATH, he had a history of being hit by a sharp tip wire. Visual acuity on the right eye was 6/60 PH 6/30, revealed ciliary injection, corneal rupture with the avulsion, size 6x3x1mm, stromal oedema, iris prolapse, shallow anterior chamber, eye pressure was n-1/p. Patient was diagnosed with corneal rupture and iris prolapse. Patient was treated by penetrating keratoplasty. The last condition of the graft is quite good and the visual acuity was 6/15.*

Discussion: *Perforation caused by the trauma more than 3 mm can be treated by the penetrating keratoplasty as an emergency situation. Tissue adhesives, such as cyanoacrylate glue, amniotic membrane multilayer transplantation, conjunctival flap, or patch graft, can be used to treat small corneal defects. The success of keratoplasty is measured by corneal clarity and functional refractive outcomes.*

Conclusion: *The success rate of emergency keratoplasty in corneal perforations reported by various studies and one of these case reports reinforces the importance of eye banking in corneal graft supplies.*

Keywords: *Corneal Trauma, Penetrating Keratoplasty, Children*

---

1. Ophthalmology Study Program, Ophthalmology Department, Faculty of Medicine, Udayana University, Prof. Dr. I.G.N.G. Ngoerah General Hospital, Denpasar, Bali, Indonesia

2. Ophthalmology Department, Faculty of Medicine, Udayana University, Prof. Dr. I.G.N.G. Ngoerah General Hospital, Denpasar, Bali, Indonesia

INTRODUCTION

Around the world, about 12% of the population is known to be blind due to corneal disorders, a treatable visual impairment.[1] Dangerous corneal disorders such as ulcers or perforations often present difficult clinical situations, with threats to vision and eyeball integrity.[2] The most common causes of corneal perforation are infection, inflammation or trauma.[3]

Corneal perforation is an eye emergency and requires immediate medical and surgical treatment. Given the continuous advances in surgical techniques and instruments, the success rate of corneal transplantation has increased greatly.[3] Penetrating keratoplasty, which is an emergency, is a procedure to restore the structure of the eyeball and prevent severe infection and inflammation. The main goal of the surgery is the complete removal of the infected or damaged cornea and to restore the integrity of the eye.[2] Over the past few decades, transplantation indications and methods have changed. For a considerable amount of time, the most common surgical method has been penetrating keratoplasty, and it is still required in situations where full-thickness corneal biopsy is present, such as following trauma or serious infection.[4] As there is no medical cure for blindness caused by corneal disorders, ophthalmologists rely solely on the availability of corneal donors. Therefore, proper healthcare education and awareness regarding eye donation is essential.[1]

This case report was made to describe a case of corneal perforation caused by a sharp trauma to the cornea in a 9-year-old boy. The management performed on this patient was penetrating keratoplasty. The purpose of this case report is to increase knowledge about corneal perforation cases, understand how to handle them and also how follow-up care is related to penetrating keratoplasty and the importance of corneal donors.

CASE ILLUSTRATION

A nine-year-old boy came to the emergency room of Prof. Dr. I. G. N. G Ngoerah General Hospital accompanied by his mother with complaints of pain in his right eye since 2 days of BATH. He had a history of being hit by a sharp tip wire. Visual acuity on the RE was 6/60 PH 6/30, revealed ciliary injection, corneal rupture with the avulsion, size 6x3x1mm, stromal oedema, iris prolapse, shallow anterior chamber, eye pressure was n-1/p. Patient was diagnosed with corneal rupture and iris prolapse. The patient received Moxifloxacin ed 1 drop every hour RE, Artificial tears ed 6x1 RE, Paracetamol syrup, Vitamin C tablet, and plans for Penetrating Keratoplasty.

Figure 1. Photo of the patient when he first came to the emergency room of Prof. Dr. I.G.N.G Ngoerah General Hospital

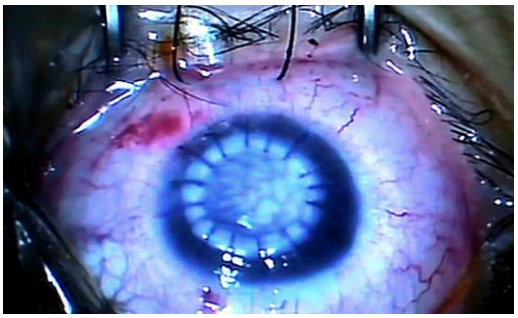

Figure 2. Eye condition post surgery

At 1 month postoperatively his vision was better than before. On examination, the visual acuity was 2/60. The corneal suture was found to be 16 intact sutures, clear central cornea, anterior chamber shallow at 5 o'clock, peripheral iridectomy at 1 o'clock, round pupil, intraocular pressure was 19. The patient received Moxifloxacin ed 4x1 RE for 1 week, Prednisolone Acetate ed 6x1 RE and followed by 3x1, 3x1, 2x1, Artificial Tears ed 6x1 RE, Sodium Chloride ed 3x1 RE (for 2 weeks).

Figure 3. Eye condition 1 month after surgery

At 6 months postoperatively, no complaints were reported. Visual acuity was 6/30 PH 6/9.5. For examination, there were 13 intact sutures, shallow anterior chamber at 5 o'clock, anterior iris synechiae at 5 o'clock, peripheral iridectomy at 1 o'clock, pupil twitching at 5 o'clock, intraocular pressure 12 mmHg. The patient was treated with Flumetholone ed 2x1 RE, Artificial tears ed 4x1 RE.

Figure 4. Eye condition 6 months after surgery

The patient came for control after 1 year postoperatively with no complaints. The visual acuity was 6/48, then corrected with S-3.00, C-1.50 X 20 to 6/15. The cornea suture was loose at 1,3,7 o'clock, intraocular pressure was 10 mmHg. The patient received Flumetholone ed 1x1 RE (2 days apart), Artificial tears ed 4x1 RE, education about eye hygiene and the patient was scheduled for control if there were complaints.

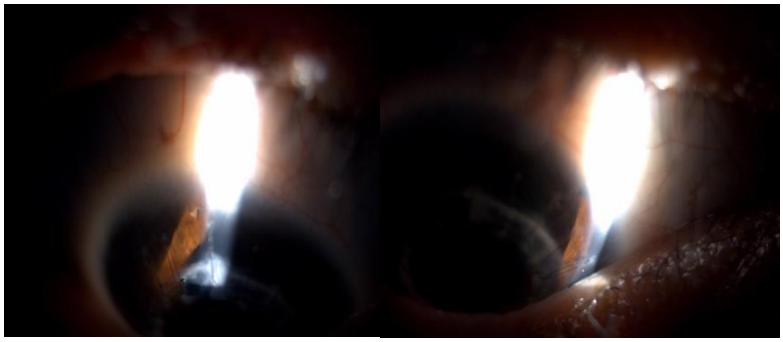

Figure 5. Eye condition 1 year after surgery

The patient came after 1 year and 5 months postoperatively with no complaints. The visual acuity was 6/48 PH 6/24. The cornea suture was loose at 12,1,5 o'clock, neovascularization at 1,3,7 o'clock, intraocular pressure 12 mmHg. The patient was diagnosed with Right Eye Post Penetrating Keratoplasty with rejection and was planned intrastromal anti VEGF injection with release suture cornea.

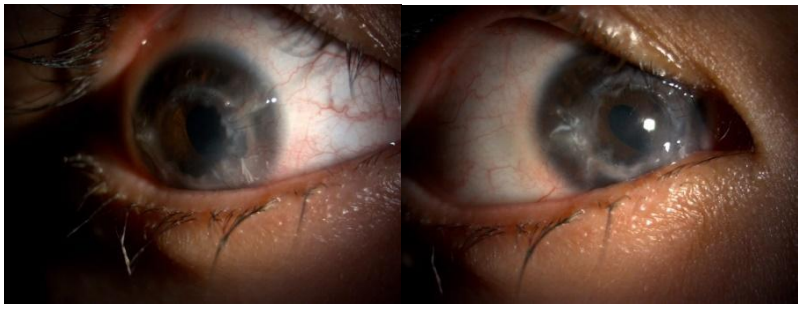

Figure 6. Patient photo 1 year and 5 months after surgery

At the last control, 1 year and 10 months, the patient came with no complaints. The visual acuity was 6/30 PH 6/15 with correction S-4.00, C-3.00 X 145 = 6/15. For other examinations, it was found that the corneal suture was stable, anterior chamber was deep, anterior synechiae at 5 o'clock, peripheral iridectomy at 1 o'clock, the pupil was twitching at 5 o'clock, the intraocular pressure was 14 mmHg. The patient was diagnosed with Right Eye Post Penetrating Keratoplasty 1 Year 10 months + Post Intrastromal Anti VEGF Injection + Rejection Decreased and received Flumetholon ed 2x1 RE, Artificial tears ed 4x1 RE and another 6 months control.

Figure 7. Eye condition 1 years 10 months after surgery

DISCUSSION

Serious corneal disorders such as ulcers or perforations often present a difficult clinical situation, with threats to vision and the integrity of the eyeball. Despite recent advances in pharmacological and surgical treatments, severe corneal infections, injuries, or systemic diseases can lead to corneal perforation, which often requires surgery. [2] The most common causes of corneal perforation are infection, inflammation, or trauma. Bacterial infections are the most prevalent type of infections, followed by viral and fungal infections. Another important cause is trauma, which has an adverse effect on the cornea, initially through direct injury, and then causing corneal melting and eventual necrosis. [3] In this case, a boy who experienced sharp trauma to the cornea of his eye. However, due to accidentally being exposed to the sharp tip of the cable, a perforation of the cornea occurred and caused iris prolapse, posing a threat to vision and eyeball integrity.

The clinical picture of patients with corneal perforation can vary greatly, depending on whether the perforation occurs in a healthy eye, in which case the patient will notice the symptoms immediately, or in a previously diseased eye, in which case the patient may not notice the symptoms. The main symptoms of corneal perforation are a sudden decrease in visual acuity, pain, and watery. Pain may be caused by ocular surface disease or may be caused by spasm of the iris or ciliary body. The most common signs of corneal perforation are a shallow front chamber, a positive seidel test, uveal tissue prolapse and hypotony. [3] The patient in this case report with complaints of right eye pain, red eye, watery. On examination, the visual acuity of the right eye is 6/60 PH 6/30, revealed ciliary injection, corneal wound with avulsion, size 6x3x1mm, stromal edema, iris prolapse, anterior chamber shallow impression, intraocular pressure was n-1/p.

Corneal perforation is an eye emergency with consequences that can damage the eye and requires immediate medical and surgical treatment. The primary goal of treatment is to preserve the anatomical structure of the eyeball and restoration of vision is a secondary goal. [3] Urgent reconstructive surgical intervention may be required to avoid the complications of endophthalmitis and the formation of anterior and posterior synechiae and secondary glaucoma and to prevent the spread of pathogens to the posterior of the eyeball or to avoid other complications. [2] If the corneal defect is small, tissue adhesives, such as cyanoacrylate glue, amniotic membrane multilayer transplantation, conjunctival flap or patch graft can be used, but in case of failure of previous treatments or larger perforations, with a diameter of more than 3 mm, penetrating keratoplasty should be performed. [3] Therapeutic penetrating keratoplasty can be performed to restore the structural integrity of the eye or to address infectious or inflammatory keratitis that is difficult to cure with conventional medical therapy. [5] The patient in this case report received Moxifloxacin ed 1 drop every hour RE, Artificial tears ed 6x1 RE, Paracetamol syrup, Vitamin C, and planned Penetrating Keratoplasty surgery.

To avoid the occurrence of glaucoma, all patients underwent peripheral iridectomy, unless iridotomy or iridectomy had been performed during a previous surgical intervention. [2]. In the patient in this case report, peripheral iridectomy was performed to prevent an increase in eyeball pressure.

Restoring visual function via penetrating keratoplasty was the first method to be done so safely.[6] The most common indications for penetrating keratoplasty are keratoconus (although DALK is often a better option), combined stromal and endothelial damage, graft failure, corneal opacities with intraocular lens replacement, implantation or manipulation and/or anterior segment reconstruction.[5] The patient in this case report experienced corneal perforation which caused iris prolapse. This is one of the indications for penetrating keratoplasty.

Patching, therapeutic contact lenses, and the use of aqueous fluid suppressants that can preserve the tear film. Re-suturing is recommended for leaks associated with shallow anterior chambers and low IOP lasting more than 3 days. It is important to appropriately manage ocular surface disease that contributes to irreversible epithelial damage (e.g., dry eye, exposure, acne rosacea, blepharitis, or abnormal eyelid position). Lubrication, punctal occlusion with plugs or cautery, patching, or therapeutic bandage soft lenses are first-line treatments. [5] The patient in this case report, bandage contact lenses were

placed to prevent leakage and also to prevent ocular surface disease that can cause non-healing epithelial defects.

Routine intraocular pressure measurement is an important part of postoperative care. High intraocular pressure can occur at any time after penetrating keratoplasty. Elevated intraocular pressure in the early postoperative period may be caused by pupillary block, aqueous misdirection, bleeding or pigment clogging the trabecular meshwork, or excessively tight sutures. Elevated intraocular pressure occurring within 1 month postoperatively may be due to a corticosteroid response. The onset of high intraocular pressure may occur months or even years after uncomplicated topical corticosteroid use. If glaucoma occurs, aggressive treatment with appropriate topical medications, laser or other surgical intervention is indicated. [5] In this case report, there was an increase in intraocular pressure of 24 mmHg in the second month. This may be due to blocking of the trabecular meshwork caused by iris pigment or may be caused by the use of corticosteroids. Then the patient was given Timolol maleate 0.25% ed 2x1 RE. After receiving Timolol maleate therapy for 2 weeks, the patient's intraocular pressure became 8 mmHg. Until there was an increase in intraocular pressure again to 29 mmHg when the patient returned to control 1 year and 7 months after penetrating keratoplasty. Then given therapy Timolol maleate 0.25% ed 2x1 RE for 2 weeks and there was a decrease in intraocular pressure to 11 mmHg and the patient's intraocular pressure remained within normal limits until the last control.

Corneal transplantation refers to the surgical replacement of the host cornea with full-thickness (penetrating keratoplasty) or partial-thickness (lamellar keratoplasty) donor corneal tissue. A complete ophthalmic evaluation, including history and examination, is required before considering corneal transplantation. Risk factors for rejection include young age, previous rejection, multiple grafts required, stromal vascularization, large diameter grafts. [5] The patient in this case report is a 9-year-old boy. In his treatment this patient experienced graft rejection, in this case neovascularization was found on the cornea. Where one of the risk factors for graft rejection in penetrating keratoplasty is young age. But after being given further treatment intrastromal anti-VEGF injection, rejection is reduced.

Endothelial decompensation, graft rejection, postoperative synechiae, recurrent graft infection, and secondary glaucoma were among the hazards linked to penetrating keratoplasty. [7] After ocular damage, penetrating keratoplasty had a high initial graft survival rate with 1-year

graft survival rates ranging from 42% to 84%. [8] Graft rejection, on the other hand, is a pertinent complication that may arise from endothelial rejection or from increasing dysfunction and endothelial function failure. [6] Corneal allograft rejection rarely occurs within the first month; however, it may occur years after penetrating keratoplasty. Prompt recognition and treatment of rejection is essential as sustained endothelial rejection leads to irreversible endothelial cell loss. At each visit, it is important to check the patient's condition for symptoms of graft rejection such as pain, redness, photophobia and decreased vision. Other healthcare professionals can also be trained on how to respond if the patient contacts them with these symptoms. Most episodes of graft rejection will not become irreversible if recognized early and treated aggressively with corticosteroids. Routine administration of corticosteroid eye drops is the primary therapy for corneal allograft rejection. Eye drops of Prednisolone Acetate 1%, Dexamethasone 0.1%, or Difluprednate ophthalmic emulsion 0.05% can be used, hourly, depending on severity. [5] In the patient in this case report, the corneal sutures were loosened at 10 months post penetrating keratoplasty and also accompanied by neovascularization on the cornea at 1,3,7 o'clock. After that the patient is planned to do Intrastromal anti VEGF injection and release suture. Then the patient received prednisolone acetate therapy ed 6x1 RE and an additional combination of Tobramycin and Dexamethasone ed 6x1 RE for 2 weeks. After receiving this therapy, there was an improvement in graft rejection. After that the corneal condition began to improve and signs of graft rejection decreased. Prednisolone acetate therapy was again given for 1 month and continued with Flumetholone.

The long-term success of penetrating keratoplasty procedures depends on proper postoperative management and patient compliance. Routine post-surgical care includes short-term topical antibiotics and long-term topical corticosteroids (Prednisolone, Difluprednate ophthalmic emulsion 0.05%, or Fluorometholone 0.25% or 0.1%). Regular visits to the doctor are necessary to facilitate rapid visual rehabilitation and early recognition of complications that may occur postoperatively. To prevent graft rejection, according to a Cornea Society survey, prednisolone acetate 1% is the topical corticosteroid of choice for prophylaxis against graft rejection, with dexamethasone as another option. Loteprednol or Fluorometholone may be better for steroid responders or phakic eyes. In low risk cases, the dose is usually 4 times a day for 3 months; then reduced by 1 drop

every month until it is reduced to once per day. If no rejection episodes occur in the first 6 to 12 months, therapy may be switched from Prednisolone 1% to Fluorometholone 0.1% or Loteprednol 0.2%, which may reduce the risk of corticosteroid-related complications. In patients with phakia, corticosteroid use will be reduced or the lowest concentration maintained to minimize the risk of cataracts. Pseudophakia or aphakia patients are usually given a once-daily steroid regimen. Patients on steroids should be continuously monitored for elevated intraocular pressure.[5] The patient in this case report received Prednisolone acetate therapy for 2 months after penetrating keratoplasty, then continued with Fluorometholone for 7 months. Then the patient experienced signs of graft rejection and intrastromal anti VEGF injection was performed. After that, the corneal condition began to improve and signs of graft rejection decreased. Prednisolone acetate therapy was again given for 1 month and continued with Fluorometholone.

The integrity of the wound site both early and late affects the surgical results of penetrating keratoplasty. When the recipient cornea is fully dissected 360 degrees in penetrating keratoplasty, a number of factors can have a significant impact on how quickly the wound heals. In keratoplasty surgery, sutures are the first and most crucial step in ensuring wound integrity. [9] It has been reported that graft transparency is an indicator of the success of keratoplasty. Although donor related factors may affect the transparency of the graft, the indication for penetrating keratoplasty and the additional pathologies found in the patient are the main factors in maintaining the transparency of the graft.[10] The success of keratoplasty is measured by corneal clarity and functional refractive outcomes. Severe astigmatism may be associated with decreased visual acuity, anisometropia, aniseikonia, distortion and monocular diplopia, causing the graft to malfunction. In children, significant visual complications or astigmatism may lead to amblyopia. In the postoperative period, the main method of reducing astigmatism is to readjust or remove the sutures. However, in addition to suture manipulation, it is also important to optimize the condition of the ocular surface. If the patient's sutures are only interrupted sutures, suture removal should be started at a later stage (e.g., ≥3 months) to avoid wound damage. Before suture removal, the most important step is to identify steep axis astigmatism. Sutures that are tight and cause focal flattening will cause a central tilt in the suture axis. The use of corneal topography, tomography, photokeratoscopy or manual keratometry is essential to evaluate the corneal contour. The power map may show an asymmetric

bow tie shape oriented towards the steep axis, while the anterior elevation map usually shows focal depression in the area of tight sutures. [5] Examination of this case report patient obtained a clear cornea in the central part until the last control. Visual acuity also improved with glasses until the patient's best visual acuity until the last control was 6/15. So that, penetrating keratoplasty was considered successful in this patient.

CONCLUSION

Penetrating keratoplasty is a corneal transplant procedure that refers to the surgical replacement of the host cornea with full-thickness donor corneal tissue, with the aim of restoring the structure of the eyeball and preventing severe infection and inflammation. The long-term success of penetrating keratoplasty procedures depends on proper postoperative management and patient compliance. This case report was prepared to describe a case of corneal perforation caused by sharp trauma in a 9-year-old boy. The management performed on this patient was penetrating keratoplasty. During his treatment the patient had experienced graft rejection, but the condition improved after receiving anti-VEGF and corticosteroid. Until the end of his control, the graft condition was quite good and there was an improvement in the patient's visual acuity.

Several studies have shown that outcomes are better when surgery is performed sooner. The success rate of emergency keratoplasty in corneal perforation has been reported by various studies and one of these case reports reinforces the importance of eye banking in providing corneal graft supplies in these conditions.

REFERENCES

1. Dahiya M, Chugh JP, Chauhan RS, Rathi A. Clinical indications of penetrating keratoplasty in a tertiary care centre of North India. *Int J Community Med Public Health*. 2020;7(9):3439. doi:10.18203/2394-6040.ijcmph20203904
2. Krysik K, Wroblewska-Czajka E, Lyssek-Boron A, Wylegala EA, Dobrowolski D. Total penetrating keratoplasty: Indications, therapeutic approach, and long-term follow-up. *J Ophthalmol*. 2018;2018. doi:10.1155/2018/9580292
3. Stamate AC, Tătaru CP, Zemba M. Emergency penetrating keratoplasty in corneal perforations. *Rom J Ophthalmol*. 2018;62(4):253-259. doi:10.22336/rjo.2018.39

4. Dohse N, Wibbelsman TD, Rapuano SB, et al. Microbial keratitis and clinical outcomes following penetrating and endothelial keratoplasty. *Acta Ophthalmol*. 2020;98(7):e895-e900. doi:10.1111/aos.14404
5. American Academy of Ophthalmology. Clinical Approach to Corneal Transplantation. In: *Basic and Clinical Science Course*. Vol 8. European Board of Ophthalmology; 2022.
6. Nuzzi R, Tripoli F, Rossi A, Ghilardi A. A Combined Procedure of Intrastromal Corneal Rings Explantation and Penetrating Keratoplasty in a Patient With Keratoconus: A Case Report. *Front Med (Lausanne)*. 2022;9. doi:10.3389/fmed.2022.853702
7. Mousa R. *Therapeutic Penetrating Keratoplasty For Treatment Of Active Resistant Corneal Infection*.; 2023.
8. Li KX, Durrani AF, Zhou Y, et al. *Outcomes of Penetrating Keratoplasty After Open Globe Injury*.; 2021. www.corneajrnl.com
9. Singar E, Burcu A, Tamer-Kaderli S, Yalnız-Akkaya Z, Ozbek-Uzman S, Ornek F. Resuturing after penetrating keratoplasty without trauma: Indications and results. *J Fr Ophtalmol*. 2020;43(1):18-24. doi:10.1016/j.jfo.2019.07.004
10. Demir MS, Muhafiz E, Evcimen Y. Evaluation of Penetrating Keratoplasty Results: Initial Experiences. *Kafkas Journal of Medical Sciences*. 2022;12(3):185-191. doi:10.5505/kjms.2022.97752