



Bioscientia Medicina: Journal of Biomedicine & Translational Research

Journal Homepage: www.bioscmed.com

Multilayered-Amniotic Membrane Transplantation in Gunshot Powder Injury: A Case Report

Nitia Amanda^{1*}, Havriza Vitresia¹

¹Department of Ophthalmology, Faculty of Medicine, Universitas Andalas/Dr. M. Djamil General Hospital, Padang, Indonesia

ARTICLE INFO

Keywords:

Amniotic membrane transplantation
Corneal defect
Foreign bodies
Gunshot powder injury

*Corresponding author:

Nitia Amanda

E-mail address:

ty.amanda13@gmail.com

All authors have reviewed and approved the final version of the manuscript.

<https://doi.org/10.37275/bsm.v8i3.948>

ABSTRACT

Background: Amniotic membrane transplantation has been widely used to repair various ocular surface conditions, including inflammatory, infectious, traumatic, and neoplastic conditions, with satisfactory results. a case of a 34-year-old male hit by a gunpowder explosion. **Case presentation:** We reported a case of a 34-year-old male hit by a gunpowder explosion. The right eye was hyperemic and felt blurry after the incident. On examination of the right eye, visual acuity was 20/150, and foreign bodies and erosion were found in the cornea. The patient planned to do foreign body extraction followed by a multilayered-amniotic membrane transplantation (ML-AMT) procedure. On the first and second day of follow-up, on the right eye, the visual acuity was 1/300, palpebral edema was decreased, and subconjunctival hemorrhage was found. On the cornea, there were ML-AMT and bandage contact lenses. **Conclusion:** Gunshot powder injury in the eyes is quite rare. The damage that can occur ranges from corneal epithelium abrasion to perforation and rupture of the eyeball. AMT has been successfully used in the management of eye trauma with defects on the ocular surface.

1. Introduction

Globally, there were 59,933.29 thousand cases of eye injuries in 2019, with a higher incidence rate in men in all age groups. Foreign bodies, exposure to mechanical forces, and falls are the leading causes of global eye injuries.^{1,2} Gunpowder has been used since a long time ago in firearms and explosives, which are made by mixing the elements sulfur, charcoal, and potassium nitrate or sometimes sodium nitrate. When activated, nitrogen and carbon dioxide gas expand and provide a propulsive action. Injuries can occur due to gunpowder. The remaining gunpowder after the explosion of a weapon with high kinetic energy can harm various parts of the human body, especially the eyes. Eye injuries that can occur include abrasion of the corneal epithelium to perforation and rupture of the eyeball.³

Ocular trauma caused by gunpowder alone has been rarely reported. A previous study reported a case in 2008 in which a 26-year-old man was injured by a shotgun loaded with a small caliber bullet. The patient then experiences decreased visual acuity and deep stromal-endothelial oedematous ring-like opacities in both cornea and gunpowder particles embedded in corneal epithelium. The patient was only managed by particle removal with a 20-gauge needle, and visual acuity after 6 weeks was improved in both eyes.⁴

Amniotic membrane (AM) has anti-inflammatory and anti-scarring effects and contains growth factors that promote epithelial wound healing on the surface of the eye. Therefore, it can be a good alternative for corneal and conjunctival reconstruction in many clinical situations and provides biochemical and mechanical support for corneal wound healing with

good visual outcomes.^{5,6} Amniotic membrane transplantation has been commonly used in the management of ocular surface disorders, ranging from inflammatory to infectious, traumatic to neoplastic, with satisfactory results.^{6,7} This study aimed to report a case of a corneal foreign body with erosion in the right eye after a gunpowder explosion. The patient was managed with foreign body extraction and multi-layered amniotic membrane transplantation.

2. Case Presentation

A 34-year-old male patient was admitted to Dr. M. Djamil General Hospital Padang after being hit by a gunpowder explosion on his right eye twelve hours before. The patient was previously hunting with a firearm, and the weapon exploded while shooting. His right eye was hyperemic and felt blurry since the incident.

On examination, visual acuity in the right eye was 20/150, and the left eye was 20/20. The right palpebra was oedema, hyperemic, and contained foreign bodies (Figure 1A). There were conjunctival injections, ciliary injections, and foreign bodies on conjunctiva examination. Foreign bodies and erosion were found

on the cornea of the right eye (Figure 1B). The pupil of the right eye was round with normal direct and indirect reflexes. The anterior chamber in the right eye was quite deep, the iris was brown, and the lens was clear with normal intraocular pressure on palpation (Figure 1C). Fundoscopy of the right eye was within normal limits. Other examinations on the left eye were found to be within normal limits. The patient was diagnosed with a corneal foreign body on oculi dextra due to a gunpowder injury. The patient then planned to do foreign body extraction on oculi dextra under local anesthesia in front of a slit lamp (Figure 1D).

Some foreign bodies can be extracted, but for deeper foreign bodies, which have reached the depth of the endothelium, extraction was carried out in the operating room under general anesthesia followed by ML-AMT procedure (Figure 2). On the first and second day of follow-up, on the right eye, the visual acuity was 1/300, palpebral edema was decreased, and subconjunctival hemorrhage was found. On the cornea, there were ML-AMT and bandage contact lenses (Figure 3). The patient was given levofloxacin eye drop 1 gutta/ 4 hours, ciprofloxacin 500 mg/12 hours, and paracetamol 500 mg/8 hours.

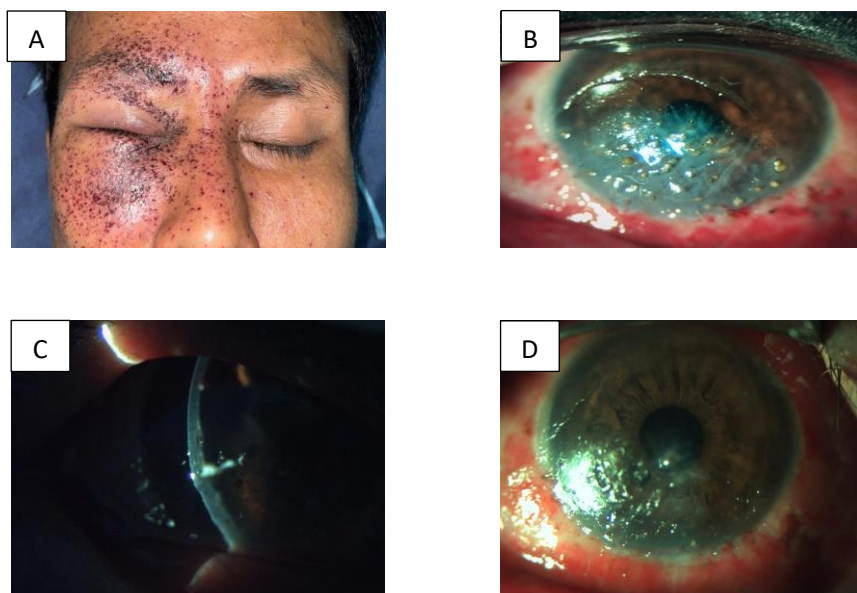


Figure 1. Ocular examination. (A) Oedema, hyperemic and foreign bodies on right palpebra; (B) Conjunctival injection, ciliary injection, and foreign bodies on conjunctiva with foreign bodies and erosion on the cornea in the right eye; (C) Slit lamp of the right eye; (D) Foreign bodies extraction under local anesthesia in front of a slit lamp.



Figure 2. Foreign bodies extraction and ML-AMT procedure.

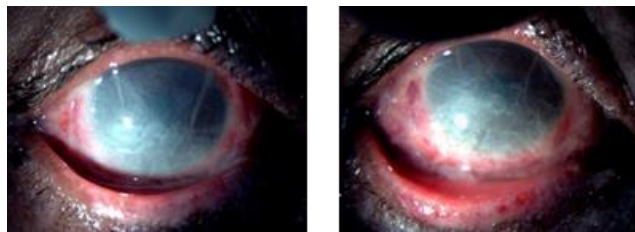


Figure 3. Follow-up day 1 (left) and day 2 (right).

3. Discussion

Gunshot powder injuries cover a broad range of severity, from a small corneal epithelial abrasion to more severe penetrating and globe rupture injuries.^{3,4} Akay et al. reported a case of a 30-year-old man who suffered from multiple particles of nonactivated gunpowder to his face and left eye with multiple black sphere-shaped gunpowder particles embedded in the lid margins, conjunctiva, and corneal epithelium of the left eye. The visual acuity was 20/32 in the affected eye. The patient was then managed by removal of multiple subconjunctival and superficial corneal gunpowder particles using a 28-gauge needle, and deep stromal particles were left in their place as there was a high risk of cornea perforation. At the end of the second month, the best corrected visual acuity in the left eye was 20/25. In this case, the patient had corneal abrasion with worst visual acuity (20/150).³

As previously mentioned, in some cases, the explosion of a gunshot could cause severe damage to the ocular surface due to high kinetic energy.⁴ In this

case, the patient had complaints of blurry eyes due to corneal abrasion and foreign bodies embedded in the deep stroma, so the patient was managed by foreign body extraction followed by an ML-AMT procedure to improve the visual acuity. The amniotic membrane (AM) is the innermost layer of the placental sac, synthesizing various biological factors, including growth factors, cytokines, and neurotrophins. AM enhances epithelialization by facilitating epithelial cell migration, strengthening basal epithelial cell adhesion, promoting epithelial differentiation to maintain the epithelial phenotype, and modulating normal corneal, conjunctival, and limbal fibroblast proliferation. In addition, AM also prevents apoptosis, has antimicrobial properties, and inhibits scarring, inflammation, and neovascularization.⁸ Previous studies prove that AMT had low or even no immunological rejection.^{5,6,9}

Amniotic membrane transplantation, if used for corneal perforation, can prevent urgent penetrating keratoplasty. Its application can restore stromal

thickness, and its advantage is that it can be stored in appropriate conditions for many months.^{10,11} Krysik et al. reported that 13,76% of patients underwent ML-AMT due to ocular trauma.⁹ In this case, this patient underwent ML-AMT after experiencing a gunpowder explosion. The patient had been follow up for 2 days and there was no further inflammation or rejection found. Longer follow-up is needed to know the long-term outcome of the patient.

Previous studies have reported good final functional results following the use of multilayered amniotic membrane transplantation in long-term follow-up. Peraka et al. reported a case of a 19-year-old man with a peripheral corneal scar in his left eye who underwent an ML-AMT procedure. After 6 months, the amniotic membrane became integrated within the stroma, but the patient experienced complicated cataracts 10 months after the multilayered amniotic membrane graft. Six months after cataract surgery, best-corrected visual acuity was 20/20p.¹¹

Eslami et al. reported peripheral corneal ulceration and perforation cases managed by multilayered amniotic membrane (AM) transplantation with successful outcomes. Both patients did not experience further episodes of ulceration, melt, or inflammation. In the first case, the AM patch integrated well into the corneal stroma in the 1-month, and visual acuity improved to 6/9 at 3- months post-op. In the second case, Snellen's visual acuity at the 1-month and 4-month postoperative visit was 6/90 in RE (with cataract) and 6/9 in LE with normal intraocular pressures and a quiet ocular surface.¹²

The relative ease of availability of AM compared to donor cornea makes this an attractive choice for the management of corneal defects. it may be an appropriate temporizing measure to allow for an uninflamed and quiet eye prior to donor corneal graft transplantation, thereby increasing success for visual rehabilitation.¹² There is no absolute perforation size cut-off for the use of AM transplantation. It may be difficult to pack and close large perforation defects and restore the globe's integrity. Another limitation of

using AMG is that it is an opaque tissue. Thus, in patients with perforation involving the centre of the cornea, visual acuity may not improve in spite of adequate healing.^{11,12}

4. Conclusion

Gunshot powder injury in the eyes is quite rare. The damage that can occur ranges from corneal epithelium abrasion to perforation and rupture of the eyeball. AMT has been successfully used in the management of eye trauma with defects on the ocular surface. Application of amniotic membrane to a corneal defect can speed healing, reduce the risk of further corneal thinning or perforation, and achieve better final visual acuity with minimal inflammation and rejection reaction.

5. References

1. Li C, Fu Y, Liu S, Yu H, Zhang M, Liu L. The global incidence and disability of eye injury: an analysis from the global burden of disease study 2019. *eClin Med.* 2023; 62: 102134.
2. Shah FQ, Asif J, Syed TQ. Perforating ocular trauma due to shotgun pellet - Clinical profile and visual outcome. *Indian J Ophthalmol.* 2021; 69: 1224-9.
3. Akay F, Yıldırım Y. Gunpowder injury to the cornea and the lens. *J Exp Clin Med.* 2012; 29: 249-51.
4. Kotagiri AK, Sundaram V, Khandwala M, Teimory M. Gunpowder injury to the eye. *Clin Exp Ophthalmol.* 2008; 36: 190-9.
5. Meller D, Pauklin M, Thomasen H, Westekemper H, Steuhl KP. Amniotic membrane transplantation in the human eye. *Dtsch Arztebl Int.* 2011; 108(14): 243-8.
6. Baig IF, Le NT, Al-Mohtaseb Z. Amniotic membrane transplantation: an updated clinical review for the ophthalmologist. *Ann Eye Sci.* 2023; 8: 5.
7. Casalita V, Nora RLD, Edwar L, Susiyanti M, Sitompul R. Amniotic membrane transplantation for infectious corneal ulcer

treatment: a cohort retrospective study. *Med J Indones.* 2020; 29: 379–85.

8. Walkden A. Amniotic membrane transplantation in ophthalmology: an updated perspective. *Clin Ophthalmology.* 2020; 14: 2057-72
9. Krysik K, Dobrowolski D, Wylegala E, Lyssek-Boron A. Amniotic membrane as a main component in treatments supporting healing and patch grafts in corneal melting and perforations. *J Ophthalmol.* 2020; 2020: 4238919.
10. Acar U. Amniotic membrane transplantation for spontaneous corneal perforation in a case of rheumatoid arthritis. *Beyoglu Eye J.* 2020; 5(3): 238-41.
11. Peraka RP, Kalra P. Multilayered amniotic membrane transplantation in a case of chronic corneal fistula. *BMJ Case Rep.* 2020; 13(9): e237369.
12. Eslami M, Benito-Pascual B, Goolam S, Trinh T, Moloney G. Case report: use of amniotic membrane for tectonic repair of peripheral ulcerative keratitis with corneal perforation. *Front Med (Lausanne).* 2022; 9: 836873.