



Case report

Sporadic summer outbreak of SHAPU in even years: Does the pattern match with the usual autumn outbreak?

Haramaya Gurung^a, Ranju Kharel Sitaula^{b,*}, Pratap Karki^b, Anadi Khatri^c, Bhaiya Khanal^d, Sagun Narayan Joshi^e, Indraman Maharjan^a, Madan Prasad Upadhyay^f

^a Himalaya Eye Hospital, Pokhara, Nepal

^b Department of Ophthalmology, Maharajgunj Medical Campus, Institute of Medicine, Tribhuvan University, B. P. Koirala Lions Centre for Ophthalmic Studies, Maharajgunj, Kathmandu, Nepal

^c Birat Medical College and Teaching Hospital, Biratnagar, Nepal

^d Natural History Museum, Tribhuvan University, Kathmandu, Nepal

^e Dept of Ophthalmology, Maharajgunj Medical Campus, Tribhuvan University, Institute of Medicine, B.P. Koirala Lions Centre for Ophthalmic Studies, Maharajgunj, Kathmandu, Nepal

^f Tribhuvan University, Chair Emeritus BP Eye Foundation, Children Hospital for Eye ENT and Rehabilitation Services (CHEERS), Lokanthali, Bhaktapur, Nepal

ARTICLE INFO

Keywords:

SHAPU
White moth
Children
Odd year
Nepal

ABSTRACT

Purpose: Seasonal Hyperacute Panuveitis (SHAPU), is a mysterious blinding disease seen only in Nepal with a higher prevalence among children usually seen in autumn every alternate odd year since 1975. This report highlights the sporadic summer outbreak in the even years with atypical presentation.

Observations: Three patients were diagnosed as SHAPU in the summer (May) of 2020. All of them noted the presence of white moths (*Gazalina* species) in their environment with or without direct physical contact. The clinical patterns were severe in nature including corneal melting. Two out of three patients (66.6%) developed phthisis bulbi and lost their vision.

Conclusions and importance: White moth has been associated as a risk factor for SHAPU. Despite the known natural history of appearance after monsoon of every odd year, the few unhatched eggs of the moths may hatch under the favorable circumstances in the summer of the even years and may lead to the sporadic outbreak of SHAPU. Though less in numbers, the clinical presentation of such sporadic SHAPU cases may be atypical with less favorable outcome.

1. Introduction

Seasonal Hyperacute Panuveitis (SHAPU) is still an enigma, reported only from Nepal since 1975. Malla et al described it as endophthalmitis probably caused by Tussock moth in 1978.¹ Later it was studied in detail by Upadhyay et al. and named as Seasonal Hyperacute Panuveitis (SHAPU).^{2,3} The first outbreak was noted in 1975.⁴ Similar cases appeared again after two years in 1977 with identical presentation and outcome. Both outbreaks began in September and lasted until January of the next year.⁵ Since then, SHAPU has maintained a definitive cyclic and seasonal pattern of outbreak every odd year i.e. 1975,1977,1979,1981 and so on. Similarly, as expected, the last outbreak occurred during Aug–Dec 2019. Few sporadic cases of SHAPU have been reported during

even years-like those of 2008 and 2010.^{6,7} However, their pattern and clinical profile has not been described till date. The white moths have been proven as the potential risk factors for SHAPU causation⁸ and their population increases during autumn of odd years.

We present a case series of 3 SHAPU patients who presented in May of 2020 (a sporadic summer outbreak in even year) with unusual presentation pattern and less favorable outcome. The outbreak occurred after sudden unexpected increase in moth population in that particular geographical area. The written consent was obtained from all the cases and the manuscript adheres with the tenets of Declaration of Helsinki.

* Corresponding author.

E-mail addresses: harimaya32@gmail.com (H. Gurung), helloranju50@gmail.com (R. Kharel Sitaula), karkipratap@gmail.com (P. Karki), anadikc@gmail.com (A. Khatri), baya2000@live.com (B. Khanal), sagun.j3@gmail.com (S.N. Joshi), maharjanim@yahoo.com (I. Maharjan), madanupadhyay@hotmail.com (M.P. Upadhyay).

<https://doi.org/10.1016/j.ajoc.2021.101198>

Received 15 October 2020; Received in revised form 26 May 2021; Accepted 30 August 2021

Available online 2 September 2021

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2. Case report

Three cases of SHAPU presented in May of 2020 at Himalaya Eye Hospital, Pokhara, Nepal. The last major SHAPU outbreak had affected around 50 eyes of 50 cases between August to December 2019. After the successful management of those cases, another outbreak was expected in 2021. But unexpectedly, we encountered 3 cases which fulfilled the definition criteria of SHAPU⁹ in the same geographical location with similar circumstantial risk factors. The occurrence of these cases matched with the sudden transient increase in the population of white moths with black striations (*Gazalina* species) in those areas (Fig. 1). However, they differed from the usual autumn presentation cases by occurring in mid-summer with different clinical picture and markedly poor prognosis in majority of cases.

2.1. Case 1

A 21 year immunocompetent female, from Pokhara –17 presented on May 2020 with sudden onset of redness, watering and diminution of vision of her right eye for two days. She had history of exposure to huge numbers of white moths outside her house without direct contact. On examination, vision in her right eye was Hand Movement (HM) with accurate projection of rays and 6/6,N6 in left eye. She had clear cornea with 4+ cells in the anterior chamber and 1mm height cream colored mobile hypopyon (Fig. 2A). The iris details and pupillary view was obscured by the thick exudates clumping over them. Fundus details could not be appreciated. However, the left eye was normal.

Intraocular pressure with air puff non-contact tonometer showed 8 and 11 mm Hg in right & left eye respectively. The ultrasound (USG) B-scan of the affected eye showed dense vitritis with flat retina (Fig. 2B). Her systemic examination was unremarkable and routine blood investigations were normal. With these findings, she was diagnosed as a case of right eye SHAPU. She was immediately treated with hourly topical antibiotics and steroids with cycloplegics agents. Her vitreous tap showed no bacterial growth. She received 2 doses of intravitreal injections (Vancomycin 1mg/0.1ml + Cefazidime 2.25mg/0.1ml + Dexamethasone 0.4mg/0.1ml) at 48 hours apart along with subconjunctival Gentamycin (40 mg/0.4 ml) and Dexamethasone (4 mg/0.4 ml). The vitreous aspirate showed no organism in Gram stain and KOH



Fig. 1. The white moth with black striations with brown tufts of hair at the end of the abdomen found at the house wall of the SHAPU case. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

stain. Oral steroid at the dose of 1mg/kg was also started but intraocular inflammation did not subside so she underwent pars plana vitrectomy. Her vitreous reactions decreased, fundus became visible and by the end of one month her vision improved to 6/6, N6 (Fig. 2C). She had good outcome with timely intervention.

2.2. Case 2

The second case was a 5 year old healthy boy from Pokhara-8 who was presented by his parents on May 2020 complaining of redness, photophobia and a smaller appearance of the right eye for 3 days (Fig. 3A). His presenting visual acuity was PL (Perception of Light) in the right eye and 6/6, N6 in the left eye. Slit lamp examination revealed edematous cornea, 4+ cells with 2 mm of creamy hypopyon in the right eye. The detail of lens, vitreous and retina was obscured but USG B scan revealed homogeneous hyperechogenicity in the vitreous cavity, suggestive of dense vitritis and attached retina (Fig. 3B). The left was normal. Intraocular pressure was 6 and 12 mmHg each. On specific inquiry, the parents mentioned the presence of white moths outside the house. However, there was no direct contact. The child was diagnosed to have SHAPU in his right eye.

He was immediately treated with vitreous tap for diagnostic purpose followed by intravitreal injections (Vancomycin (1 mg/0.1 ml) + Cefazidime (2.25 mg/0.1 ml), + Dexamethasone (0.4 mg/0.1 ml) and subconjunctival injections (Gentamicin 40 mg/0.4 ml + Dexamethasone 4 mg/0.4 ml) followed by hourly topical antibiotics (Tobramycin) and steroids with cycloplegics agent. The vitreous aspirates were negative for stain and culture but the conjunctival swab showed gram positive cocci. The ocular status did not improve. Rather his cornea gradually started melting from centre to periphery (Fig. 3C). The topical steroids were tapered and hourly topical antibiotics with lubricants were continued. His corneal status deteriorated and the vitreous status in ultrasound (USG) B Scan also did not show signs of improvement. Pars plana vitrectomy was planned but could not be performed due to media haziness secondary to corneal thinning and edema. A repeat vitreous aspirate and intravitreal injection was done after 72 hours. The repeat vitreous aspirate again showed no growth. The child denied perception of light and developed phthisis bulbi with corneal vascularization and scar (Fig. 3D) by the end of 1 month which has hitherto not been reported in SHAPU cases.

2.3. Case 3

Third case was a 2 year old healthy boy brought to hospital by his father from Tanahun, 45km away from Pokhara on May 29, 2020. He complained that the child developed sudden redness and watering of his right eye for 5 days. He was already on some antibiotic eye drops obtained from the local health post. The father revealed that few white moths were present inside their room and plenty outside the house prior to the disease onset and the history of direct contact of moth was present.

On presentation, the vision in the right eye was perception of light and in the left eye was 6/6. The right eye had hazy cornea, with an intense reaction in the anterior chamber along with whitish hypopyon of 1mm and leukocoria (Fig. 4A). The further details of that eye could not be evaluated. USG B scan showed homogeneous hyperechogenicity in the posterior vitreous cavity with shallow inferior retinal detachment (Fig. 4B). His left eye was normal. Amidst, the fear of SARS-CoV-2 in the country, the father refused the consent for vitreous tap with intravitreal injections and pars plana vitrectomy for the management. The child received hourly topical antibiotics, steroids and cycloplegics agent. The child lost to follow up for 2 months due to COVID-19 related lockdown in Nepal. They followed up in the first week of August 2020 but by that time, the child was found to have phthisical eye with no perception of light.

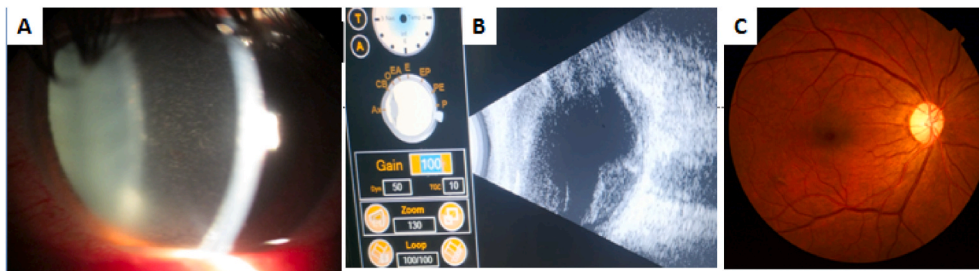


Fig. 2. Slit lamp view showing perlimbal congestion, 4+ anterior chamber cells with hypopyon at the bottom (A). USG B scan demonstrating hyperechoic shadows in the posterior vitreous with shallow exudative RD (B). The affected fundus became visible after treatment and the retina was normal (C).

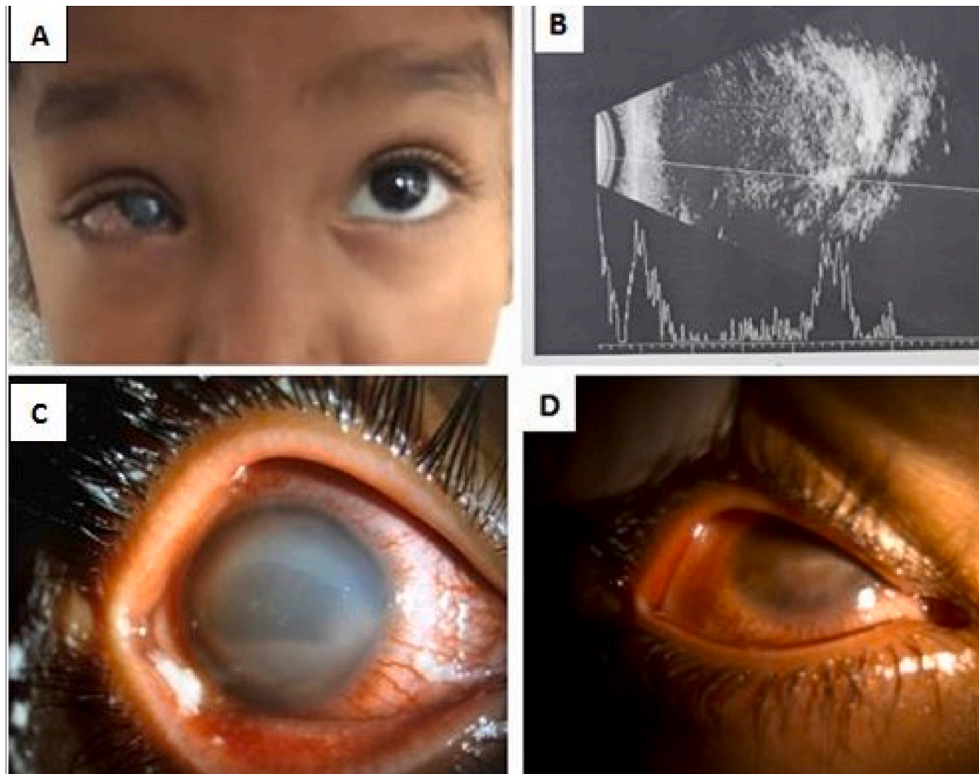


Fig. 3. Right eye appeared congested and smaller than the left eye (A). The USG (A + B scan) showed diffuse hyper echogenic shadows throughout the vitreous with thickened choroid and attached retina (B). The cornea gradually developed central corneal defect with edema (C). The affected right eye went into phthisis with central corneal vascularized scar (D).

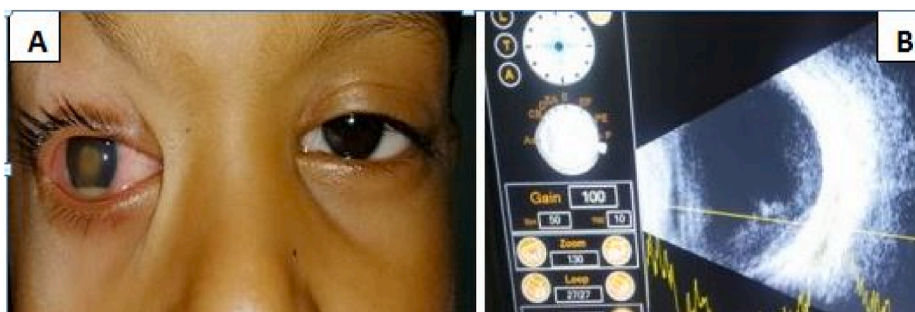


Fig. 4. Unilateral Red eye with White pupil and hypopyon (A) and USG (A + B scan) showing hyperechoic shadow in the posterior vitreous with shallow retinal detachment and thickened choroid (B). (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

3. Discussion

SHAPU, is known to be the most destructive form of intraocular

inflammation among children reported mainly from Nepal till date.^{2,4} SHAPU outbreaks have seasonal preferences and majority of the cases have been reported to occur during the period of the end of monsoon

(August–September) and beginning of the severe winter (December–January) of odd years.⁴ Very few sporadic outbreaks in the summer of the even years have been reported. The first report on sporadic outbreak of 10 SHAPU cases was published in 1982.³ Later, Manandhar et al. reported few cases of SHAPU during the summer of 2008 and 2010, following 2007 and 2009 SHAPU outbreak respectively.^{6,7}

However, earlier publications have not described the differences in the clinical presentation of even year SHAPU, nor were attempts made to explain the cause of unusual summer outbreak. This time the even year SHAPU outbreak happened again in the Pokhara region in the middle of COVID-19 pandemic.

Sudden spike up in the population of white moths in the surrounding environment and their presence in and around the house was the common history in all 3 cases. Prior studies also have reported association of SHAPU with white moths (*Gazalina* species) with or without physical contact.⁸ It can be considered that the moth's abdominal hair tufts are easily detachable even with slight disturbances of air or other causes and becomes air born which may fall into contact to the human eyes so no direct physical contact to moth species may also be necessary.⁸ There seem to be a similarity in the background climatic scenario in that particular geographical location of Nepal just prior to autumn and summer SHAPU outbreak. The integrated meteorological conditions like humidity, temperature and rainfall are known to influence significantly on the abundance of moth in a certain area.¹⁰

Moths and butterflies (Order: Lepidoptera) are holometabolous i.e. they have complete life cycles with four distinct stages like egg, caterpillar, pupa or chrysalis, and adult.¹¹ After mating, females lay eggs from which the caterpillars hatch under favorable condition. Hatching of moth's eggs takes place in mid August to September and caterpillars in a processionary behavior live for 11–11.5 months i.e. mid August to June end next year. The caterpillar transforms itself into the pupal stage in mid June to July end before the adult moth emerges.¹²

At the end of the growing phase, caterpillars enter a dormant phase called a pupa or chrysalis. Inside the pupa or chrysalis, the moth or butterfly caterpillar undergoes metamorphosis and eventually under optimum environmental condition the pupal case is broken up for the emergence of adult moth or butterfly to the outer environment thus completing the life cycle.^{13,14} However, some of the un-hatched eggs remain in a dormant stage for a longer period if not parasitized or predated.

Moths may suffer from diseases as a result of parasitization due to fungi and hymenopterons.¹⁵ Eggs which have survived predation may hatch in favorable environmental condition later which after completing their larval stage is changed into the pupal stage and finally emerge as adult moths which are the potential risk factors for SHAPU causation. Mainly caterpillars are parasitized by the hymenopterons (wasps) besides few caterpillars which may also be attacked by the fungus disease. No information is available about this moth being a predator's preference or palatable species due to the toxin present in them.

The 2/3 of the SHAPU cases of even years had unusual corneal involvement in the form of edema followed by corneal melting with or without vascularization within a week. This has not been ever documented in SHAPU cases of odd year autumn outbreaks previously. The anterior chamber reactions were also found to be more profound with dense hypopyon in all three cases. Conventional treatment also failed to produce desired outcomes that would have otherwise normally expected owing to the experience from management of cases from previous outbreaks. Two of the 3 cases had complete compromise in both anatomical and functional aspect and progressed to phthisis. The burden this loss imparts to the victim and the family is beyond measure.

The most plausible unifying hypothesis for SHAPU pathogenesis is driven by ocular micro trauma induced by moth particles such as setae which have been observed in some cases^{16,17} with introduction of any or some of the following: such as microbes, toxins and allergens. Microbial invasion is unproven with inconsistent reports of isolation of organisms.^{4,6,18} In few cases where organisms have been isolated, these could

be secondary invaders in a compromised eye.

The speed with which the disease manifests itself suggests more of a toxin or an allergen. It still remains unresolved which of them is the primary offender. The immediate and dramatic reaction seen is suggestive of a type 1 allergic causing a cytokine storm. Whether, the white moths (*Gazalina* sp.) act as the vector for transfer of microbes or toxins, or allergens into the ocular surface, resulting in inflammatory cascades is still a mystery. However, the summer SHAPU outbreak during even year raises a serious concern. They were found to be more challenging and “non –responsive” to treatment. They also had the tendency to deteriorate quickly leaving very few options on the table for treating physicians to decide on. Vitrectomy did yield a good outcome but it had its limitations. Patients who present with corneal complications or start developing one may form a unique cluster are at risk of rapid deterioration and deprivation from vitrectomy. Findings from these cases mandate a more robust treatment strategies must be thought of immediately so we are better prepared for the next outbreak.

4. Conclusion

The unusual outbreak of SHAPU can occur in summer season of the even years if the warmer temperature, increased rainfall and increase in humidity provide favorable condition for hatching of the surviving un-hatched eggs of the white moths. The clinical pattern of SHAPU cases during such outbreaks may be lower in numbers but the clinical outcome can be more severe alerting clinicians to offer guarded prognosis to the patients or their parents.

Patient consent statement

Written consent to publish case details was obtained from the patient/legal guardian.

Funding

No funding was received for this work.

Intellectual property

We confirm that we have given due consideration to the protection of intellectual property associated with this work and that there are no impediments to publication, including the timing of publication, with respect to intellectual property. In so doing we confirm that we have followed the regulations of our institutions concerning intellectual property.

Research ethics

We further confirm that any aspect of the work covered in this manuscript that has involved human patients has been conducted with the ethical approval of all relevant bodies and that such approvals are acknowledged within the manuscript.

IRB approval was obtained (required for studies and series of 3 or more cases).

Written consent to publish potentially identifying information, such as details or the case and photographs, was obtained from the patient(s) or their legal guardian(s).

Authorship

All listed authors meet the ICMJE criteria.

We attest that all authors contributed significantly to the creation of this manuscript, each having fulfilled criteria as established by the ICMJE.

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Declaration of competing interest

No conflict of interest exists.

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