

# Hospital Based Longitudinal Study on Artificial Snow Spray Induced Ocular Injuries and Its Correlation with the Awareness among the Study Population at Medical College Hospital, Bhubaneswar

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## ABSTRACT

### BACKGROUND

Artificial snow spray induced ocular injuries have become common in the past two decades throughout India. There is a paucity of studies in India as well as globally on such injuries. This study was undertaken to identify such types of ocular injuries and evaluate the awareness of artificial snow spray use in the present hospital settings.

### METHODS

This hospital based longitudinal study was carried out among 68 patients having artificial snow spray induced ocular injuries. The study period was from 01. 01. 2019 to 30. 12. 2019. A detailed history of patients was taken pertaining to the injury. A thorough ocular examination was carried out on a slit lamp biomicroscope. Visual acuity was recorded using Snellen's test type chart. Clinical grading was done by Roper Hall classification.

### RESULTS

The present study included 68 patients i.e. 124 eyes of which 64.7 % (44) were males, 35.3 % (24) were females. The mean age was 26.029 years. All the patients suffered from chemical conjunctivitis (100 %), superficial punctate keratitis (SPK) 82.3 %, corneal erosion (8.8 %), and corneal erosion involving limbal area (3.2 %). Most ocular injuries due to artificial foam were bilateral (82.3 %). Maximum number of patients (94.4 %) had grade I ocular injuries. 93.5 % of patients had BCVA (best corrected visual acuity) 6 / 6 within 1 week of ocular injuries. So far, no patients had any irreversible ophthalmic sequelae. Awareness among the study group was very less.

### CONCLUSIONS

Artificial snow spray used in parties, festival celebration can cause mild to severe ocular injuries. Public awareness will reduce the use of this chemical.

### KEYWORDS

Artificial Snow Spray, Corneal Erosion, Ocular Injury, Awareness

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*DOI: 10.18410/jebmh/2021/333*

*How to Cite This Article:*

*Panda L, Samal AK, Sarangi L, et al.  
Hospital based longitudinal study on  
artificial snow spray induced ocular  
injuries and its correlation with the  
awareness among the study population  
at medical college hospital,  
Bhubaneswar. J Evid Based Med Healthc  
2021;8(22):1764-1768. DOI:  
10.18410/jebmh/2021/333*

*Submission 13-01-2021,  
Peer Review 21-01-2021,  
Acceptance 09-04-2021,  
Published 31-05-2021.*

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**BACKGROUND**

Ocular chemical injuries are an emergency. Chemical exposure to eye results in trauma ranging from mild irritation to severe damage which ultimately leads to permanent vision loss. Chemical injuries of the eye cause damage to ocular surface epithelium, conjunctive, cornea and anterior segment which leads to permanent visual impairment. Ocular chemical injuries constitute 7.7 % to 18 % of all ocular trauma.<sup>1</sup>

The severity of injuries is directly related to the duration of exposure and property of causative agents.<sup>2</sup> At foam parties, soapy foam is sprayed onto the dance floor while participants dance. The foam is distributed from blowers on the ground or attached to the ceiling and several feet of foam accumulate. Foam parties can last for several hours while foam is disbursed intermittently throughout the night.<sup>3</sup>

Artificial snow spray induced ocular injuries is an ophthalmic emergency that mainly affects children and teenagers attending parties or festival celebrations.

Foam parties are increasingly becoming popular. Foam party attendees could potentially suffer eye irritation if foam particles get into the eye.<sup>3</sup> The chemical composition of artificial foam includes poly isobutyl methacrylate, sorbitan trioleate, and propellant which can cause chemical ocular injuries. These are mildly alkaline. Alkalies penetrate more readily into the eye than acids. Irreversible intraocular damage has been noted to occur at aqueous PH level of 11.5.<sup>1</sup> The sequel of chemical injuries may cause visual impairment and psychological effects on affected individuals. Proper management in acute condition and periodic follow up is crucial in limiting adverse effects of ocular tissue damage secondary to chemical injuries.

**Objectives**

- To evaluate clinical profiles, demographic spread, time for resolution, visual outcome of an artificial snow spray induced ocular injuries.
- To identify the vulnerable age group.
- To find out its correlation to the awareness among study groups.

**METHODS**

This was a hospital based longitudinal study on the patients having ocular injuries due to artificial snow spray attending to OPD and emergency ward of Department of Ophthalmology, Hi-Tech Medical College, Bhubaneswar, Odisha. The study period was for a year from January 2019 to December 2019. Total 74 participants, both males and females presented to OPD during the study period with the above said injuries. Out of these, 68 patients participated in study.

During the study period using universal sampling method all 74 patients presented to Ophthalmology OPD of the Medical college and Hospital, Bhubaneswar were enrolled in

the study. Out of these 2 patients denied to be part of the study, 3 patients were admitted in the Inpatient Department (meeting exclusion criteria), and 1 patient could not be followed up. After excluding 6 patients the final sample size was 68, both male and female i.e. 124 eyes.

**Inclusion Criteria**

All cases of ocular injuries due to artificial snow spray, who gave consent to be part of the study.

**Exclusion Criteria**

Ocular chemical injuries other than artificial foam spray or other form of trauma.

**Ethical clearance**

This study was approved by the ethical committee of a medical institution in Bhubaneswar, Odisha. Subjects were ensured confidentiality and they were explained the purpose and ethical issues involved in the study. Written informed consent was obtained from each subject participating in the study.

**Data Collection Procedure**

A pretested, pre designed semi structured questionnaire administered by a trained research assistant was used for data collection of participants' demographic characteristics, location, mechanism of injuries. Study participants mostly presented with sudden onset of severe pain, epiphora and blepharospasm following artificial foam getting in their face and eye. As soon as a case of ocular injury due to artificial foam was presented to the emergency, first aid was given in the form of thorough irrigation of conjunctival fornices with ringer lactate or normal saline. The PH of conjunctival fornix was measured before irrigation and it was continued until PH had been neutralized. Superior and inferior fornix was examined for presence of any retained or embedded particulate matter and was removed carefully.

Detailed history of the patients and history of presenting complaints were taken. Visual acuity was recorded by using Snellen's test type chart. A thorough ocular examination was done on a slit lamp. Clinical grading was done by Roper Hall Classification. All patients were treated with steroid (Dexamethasone) and antibiotics (Moxifloxacin) eye drops. For patients with extensive corneal erosion, eye patch was given for 8 hrs. Average time to resolution of injuries was 5 days. As far as we know, no patient had any irreversible ophthalmic sequela.

**Statistical Analysis**

Data was collected and entered into MS Excel 2019. Data analysis was done using percentage, Fischer's exact test and Likert scale. P value less than 0.05 was considered as statistically significant.

## RESULTS

Altogether 68 patients (134 eyes) had suffered from foam induced ocular injuries. Sex distributed evenly in study population.

| Age          | Male      | %            | Female    | %            | Total     | %            |
|--------------|-----------|--------------|-----------|--------------|-----------|--------------|
| 5 - 15       | 5         | 7.3 %        | 5         | 7.3 %        | 10        | 14.7         |
| 15 - 25      | 16        | 23.5 %       | 8         | 11.7 %       | 24        | 35.2         |
| 25 - 35      | 12        | 17.6 %       | 9         | 13.2 %       | 21        | 30.8         |
| 35 - 45      | 8         | 11.7 %       | 1         | 1.4 %        | 9         | 13.2         |
| > 45         | 3         | 4.4 %        | 1         | 1.4 %        | 4         | 5.8          |
| <b>Total</b> | <b>44</b> | <b>100 %</b> | <b>24</b> | <b>100 %</b> | <b>68</b> | <b>100 %</b> |

**Table 1. Age & Sex Distribution of Patients Presenting with Artificial Snow Spray Induced Ocular Injury**

Mean age - 26.029 years, Unilateral involvement % - 17.6 %, Bilateral involvement % - 82.3 %. Pearson; 4.004 (P = 0.40551) LRX; 4.4222 (P = 0.35185) (LRX is likelihood ratio chi square) Mean age = 26.029 years S. D =  $\pm$  10.8.

Table - I show that out of 68 patients 44 (64.7 %) are males and rest females. Out of males, most of the patients that present with ocular injuries belong to 15 - 25 years i.e. 23.5 % and least were above 45 years (4.4 %).

In comparison, 25 - 35 years' females presented more with ocular injury i.e. 13.2 %, Whereas people above 35 years had less occurrence of injuries (1.4 %). Applying Fisher's Exact test, age sex distribution was found to be statistically not significant.

| Laterality | No. of Patients | Total (%) |
|------------|-----------------|-----------|
| Unilateral | 12              | 17.6 %    |
| Bilateral  | 56              | 82.3 %    |

**Table 2. Incidence of Laterality in Foam Induced Injuries of Eye**

| Grade of Injured | No. of Eyes | %            |
|------------------|-------------|--------------|
| I                | 117         | 94.4 %       |
| II               | 7           | 5.6 %        |
| III              | 0           | 0            |
| IV               | 0           | 0            |
| <b>Total</b>     | <b>124</b>  | <b>100 %</b> |

**Table 3. Grade Wise Distribution of Ocular Injuries (N = 124)**

| Clinical Presentation                | Number | %      |
|--------------------------------------|--------|--------|
| Chemical Conjunctivitis              | 124    | 100 %  |
| Superficial punctate Keratitis       | 102    | 82.3 % |
| Cornea erosion                       | 11     | 8.8 %  |
| Cornea erosion involving Limbal area | 4      | 3.2 %  |

**Table 4. Clinical Presentation among Study Groups**

| BCVA                | At Presentation No. | %      | 1 Week No. | %      | 2 Week No. | %       |
|---------------------|---------------------|--------|------------|--------|------------|---------|
| 6 / 6 $\leq$ 6 / 12 | 82                  | 66.1 % | 116        | 93.5 % | 123        | 99.11 % |
| 6 / 18 - 6 / 60     | 20                  | 16.1 % | 6          | 48 %   | 1          | 0.9 %   |
| 6 / 60 - 1 / 60     | 15                  | 12 %   | 2          | 1.6 %  | 0          | 0       |
| HM                  | 7                   | 5.6 %  | 0          | 0 %    | 0          | 0       |

**Table 5. Visual Outcome among Study Participants**

Majority presented with bilateral involvement (82.3 %). So total no. of eyes in the study group (124 no.). Ninety-four percent presented with grade - I type of injuries and rest with grade - II. No patients were among grade - III & IV. Table - 4 shows most of the patients presented with chemical conjunctivitis (100 %). The second common presentation was Superficial punctate keratitis (SPK). Limbal area involvement was seen in 3.2 % which signifies delayed

recovery though our study participants have not presented with Grade - III & Grade - IV injuries.

Table 5 shows best corrected visual acuity (BCVA) at presentation, after one week and after two weeks of treatment. 66.1 % of the study population had BCVA less than 6 / 12 at presentation but 5.6 % had BCVA hand movement (HM). After one week of treatment 93.5 % had good vision, only 1.6 % of patients had BCVA less than 6 / 60. After two weeks of treatment 99.11 % had good vision.

| Question                                    | 0           | 1           | 2           | 3          | 4          | Total |
|---------------------------------------------|-------------|-------------|-------------|------------|------------|-------|
| 1. Can the spray injure your eyes           | 3 (4.4 %)   | 30 (44.1 %) | 23 (33.8 %) | 8 (11.7 %) | 4 (5.8 %)  | 68    |
| 2. Can you permanently become blind         | 45 (66.1 %) | 15 (22 %)   | 8 (11.7 %)  | 0          | 0          | 68    |
| 3. Should you rub your eyes                 | 56 (82 %)   | 5 (7.3 %)   | 7 (10.2 %)  | 0          | 0          | 68    |
| 4. Should you wash your eyes immediately    | 0           | 0           | 0           | 0          | 68 (100 %) | 68    |
| 5. Should you visit your doctor immediately | 18 (26.4 %) | 13 (19.1 %) | 16 (23.5 %) | 15 (22 %)  | 6 (8.8 %)  | 68    |

**Table 6. Likert Scale on Awareness of Artificial Snow Induced Ocular Injuries**

0 - Strongly disagree, 2 - Neutral, 4 - Strongly agree, 1 - Disagree, 3 - Agree

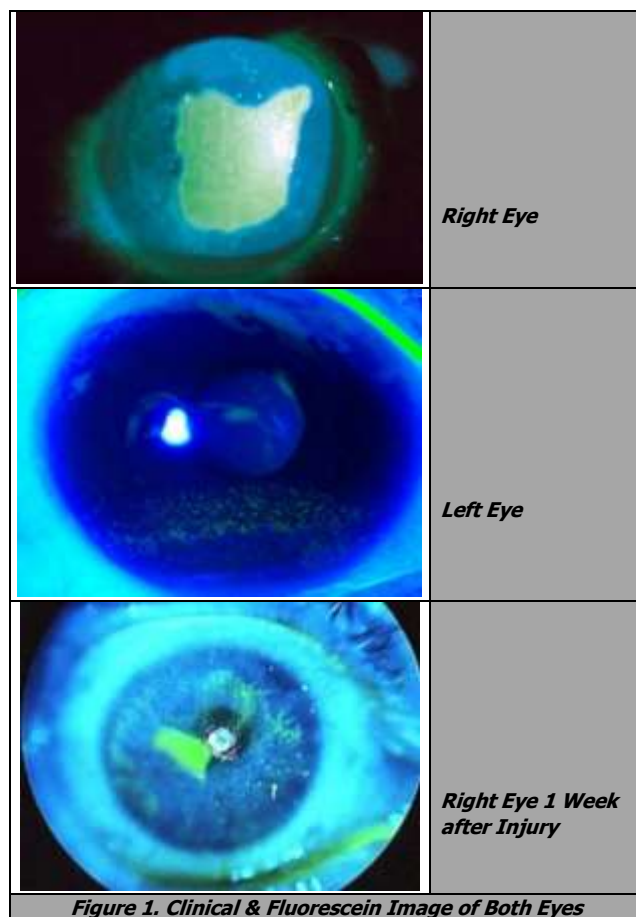
From this study, awareness about washing their eyes immediately i.e. 68 (100 %) which was a very good sign and also they strongly agreed that they should not rub their eyes after injury. While only 6 % strongly agreed to visit a doctor immediately. The study participants were not aware about the injury that can be caused by artificial snow spray as 44. 1 % disagreed that spray can injure their eyes and 66.1 % strongly disagreed to the fact that they can become blind because of artificial snow spray.

## Representative Case Report

A 27-year Male presented with pain, burning and photophobia in both eyes following artificial foam sprayed into his face in a party 3 hours before. He was under alcohol & also rubbed his eyes. His medical history was unremarkable. The eyes underwent copious irrigation with normal saline until PH level had been normalized. His visual acuity was RE - CF 3 meter LE - 6 / 36. Slit lamp biomicroscopic examination revealed both eyelids mildly swollen, conjunctivitis in both eyes.

Subtotal corneal erosion with a diffuse stromal haze in right eyes and Superficial punctate keratitis (SPK) in left eyes. No sign of limbal ischemia. The injury was grade II in the right eye and grade 1 in the left eye. He was treated with combination antibiotics and steroid eye drops 6 times for left eyes. Patching had been done on the right eye after putting antibiotics and steroid drops as joint combination. Cycloplegic drops were put in both eyes and oral analgesics given for pain control.

Artificial eye drops were used in both eyes. On day 3 the right eye had a big corneal epithelial defect but no stromal haze. Left eye had mild SPK. On 2<sup>nd</sup> week post injuries conjunctivae were quiet and mild SPK on right eye cornea BCVA in both eyes was 6 / 6. Artificial tears were advised for another 2 weeks.



**Figure 1. Clinical & Fluorescein Image of Both Eyes**

## DISCUSSION

Chemical Ocular injuries are true ophthalmic emergencies. Artificial snow that was the reason of injuries in our study is composed of sodium polyacrylate granules which are converted to snow like semi-sticky matter when exposed to water causes damage to corneal epithelium due to its acidic nature.<sup>4</sup> In present study the mean age presentation was 26.029 years emphasizing the vulnerability of young adults. Kuckelkorn R et al.<sup>5</sup> in a retrospective study on the incidence and prevalence of ocular chemical injuries reported that 70 % were adult males, 23 % were adult females and 7 % were children. Singh P et al.<sup>6</sup> found that chemical injuries of the eyes occur most often among the age group of 20 - 40 years. Haring RS et al.<sup>7</sup> report a median age of 22 years in their study done in the United States in a sample of 900 patients.

In the present study, males were 64.7 % females 35.2 %. Almost 90 % of study groups had a history of rubbing their eyes after exposure to foam. In the study, 12 % of people were under alcohol during exposure to foam. A study from England showed normal PH in five of six patients; the other had a PH of 8.5 in his right eye, 8.0 in his left eye.<sup>8</sup>

In our study, chemical conjunctivitis accounted for (100 %), SPK 82.3 %, Corneal erosion 8.8 % and Corneal erosion involving limbal area 3.2 %. A study done at Florida, 2010 had eye irritation (94.6 %), severe eye pain (91.7 %) decreased visual acuity (81.3 %) conjunctivitis (76.8 %).<sup>9</sup> A study done at Israeli, showed chemical conjunctivitis (100 %) SPK (79 %) Corneal erosion (21 %). In our study visual

acuity of 63.5% improved to 6 / 6 within 1 week of ocular injuries. Only 6.8 % study group VA 6 / 18 – 6 / 6 after 1 week of ocular injury. After 2 weeks of ocular injuries 99. 1 % of study group vision improved to 6 / 6. But study from Israeli average time to resolution of injuries was 6 days and average time to pain resolution was 2 days.<sup>2</sup> In our study 94.4 % of ocular injuries were grade 1. Awareness among the study group was very less. Only 4. 4 % of the study group agreed to the fact that artificial snow spray can injure their eyes.

One study from Vienna shows that chemical foam used in dance parties should be considered as an alkali substance which can have very toxic effect on eyes. It is important to specify toxicity of these substances and warn that such foam can have harmful ophthalmic effect. Topical corticosteroid plays a critical role in controlling acute inflammation after chemical injuries. They reduce inflammatory cell infiltration and stabilize neutrophil cytoplasmic and lysosomal membranes. They also help resolving anterior chamber as well as conjunctival inflammation.<sup>6</sup> The downside is that they also inhibit epithelization and collagen synthesis. The conventional belief is that topical steroids should not be used beyond 10 to 14 days, as they increase the risk of inhibition of collagenesis, worsening corneal thinning, and possible corneal perforation in alkali burns.<sup>10</sup> The involvement of the eyes should be graded according to a prognostic classification to make a precise prognosis that will help in choosing the right treatment strategy.<sup>11</sup> Foam is a deceptive chemical hazardous agent that can cause serious injuries. It affects mainly children and young adults who participate in foam parties and parades.<sup>2</sup>

Conjunctival inflammation and loss of goblet cells can leave the ocular surface prone to dryness, scarring and contracture of fornices.<sup>12</sup> Preservative free tear substitutes and lubricating ointment can ameliorate persistent epitheliopathy, reduce the risk of recurrent erosion, and accelerate rehabilitation.<sup>13</sup> So, to all cases in our study we advised lubricating eye drops for two weeks. A study from Egypt shows a rare clinical profile of corneal endothelitis due to artificial snow foam.<sup>12</sup> In that case no epithelial defect was found. But in our study, we did not find any corneal endothelitis. Dubey A, Kubery et al.<sup>4</sup> early presentations with good presenting visual acuity carries a good structural and visual prognosis and lesser complication. Recovery rates in lower grades were higher than the more severe grades. Mounir A et al.<sup>9</sup> study found that corneal endothelitis can be triggered by chemical ocular trauma. The scheimpflug densitometry examination may be a useful non-invasive method for reaching a clinical diagnosis of corneal endothelitis and monitoring treatment effectiveness. A study from Israel shows that in 2007 during Israel Independence Day celebration 85 patients got treated at two medical centres for artificial snow spray induced ocular injuries. That event received extensive coverage by national radio, TV, and newspapers. In the following year only 11 patients presented to the same medical centres, representing a decline of 85 %. That decline was likely because of increased public awareness.<sup>2</sup> Eye irritation from foam parties was recently a topic of local television news in Houston. Such foam parties are a current fad. We believe

such cases should be considered alkali chemical injuries and referred to an ophthalmologist immediately for treatment.<sup>16</sup> We propose strict government supervision of the use of these foam products to increase public awareness in schools by the media, especially close in time to holidays and other days of celebration.<sup>2</sup>

## CONCLUSIONS

Artificial foam is a seemingly harmless chemical that has the potential to cause serious ocular injuries. Many people of the younger age group are exposed to artificial foam in parties and celebrations. The injuries caused by artificial foam are often shrugged off as harmless and cause severe damage down the line. Since early treatment is one of the best ways to manage ocular injuries, ignoring the injury can be disastrous. The authors propose the regulation of the use of artificial foam products and increasing awareness among the public, especially youngsters.

## Limitations

It is unclear if there are terms that are truncated, overlooked, lost in speech or abbreviated by those reporting the problem. The strength of this study is that it involves a relatively large number of analytical cases.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.

Financial or other competing interests: None.

Disclosure forms provided by the authors are available with the full text of this article at jebmh.com.

## REFERENCES

- [1] Roper-Hall MJ. Thermal and chemical burns. *Trans Ophthalm Soc UK* 1965;85:631-653.
- [2] Abulafia A, Segev F, Platner E, et al. Party foam-induced eye injuries and power of media intervention. *Cornea* 2013;32(6):826-829.
- [3] Cavicchia PP, Watkins S, Blackmore C, et al. Eye injuries sustained at a foam party--Collier County, Florida 2012. *Morbidity Mortality Weekly Report* 2013;62(33):667-668.
- [4] Dubey A, Kubrey SS, Kumar K. Clinical profile and visual outcome in ocular chemical injury. *Trop J Ophthalmol Otolaryngol* 2019;4(2):137-142.
- [5] Kuckelkorn R, Luft I, Kottek AA, et al. Chemical and thermal eye burns in the residential area of RWTH Aachen. Analysis of accidents in 1 year using automated documentation of findings. *Klin Monbl Augenheilkd* 1993;203(1):34-42.
- [6] Sing P, Tyagi M, Kumar Y, et al. Ocular chemical injuries and their management. *Oman Journal of Ophthalmology* 2013;6(2):83-86.
- [7] Haring RS, Sheffield ID, Channa R, et al. Epidemiologic trends of chemical ocular burns in the United States. *Jama Ophthalmol* 2016;134(10):1119-1124.
- [8] Cather JC, Yee RW, Kilimanjaro Davis H. Chemical keratoconjunctivitis from a foam party. *N Engl J Med* 1996;334(7):474.
- [9] Mounir A, Zidan OF, Awany I, et al. A case of artificial snow foam induced corneal endotheliitis followed up by Scheimpflug densitometry. *Med Hypothesis Discov Innov Ophthalmol* 2019;8(2):64-68.
- [10] Saud EE, Morales HV Jr, Marculino LGC, et al. Clinical and histopathological outcome of subconjunctival triamcinolone injection treatment of acute ocular burn alkali burn in rabbit. *Cornea* 2012;31(2):181-187.
- [11] Gicquel JJ. Management of ocular surface chemical burns. *Br J Ophthalmol* 2011;95(2):159-161.
- [12] Eslani M, Baradaran-Rafil A, Movahedan A, et al. The ocular surface chemical burns. *Journal Ophthalmology* 2014;2014:196827.
- [13] AL-Amry M, Al-Ghadeer HA. Corneal epitheliopathy after trauma by fake snow powder in a 7-year-old child. *Middle East Afr J Ophthalmol* 2016;23(3):274-276.