

Health Systems' Response Towards the Temple Fire Accident in Kollam District, Kerala: A Case Study

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Abstract

Objectives: The present study tries to describe the activities related to the rescue of injured, their management, and the rehabilitation activities conducted in relation to the incident and to understand the implications for disaster management preparedness in the future. **Materials and Methods:** Details about the incident were sourced through semistructured with health department officials, eyewitnesses, and local residents. Secondary data were collected from the data available from official records. **Results:** Ninety-four percent of the injured and 83.2% of the deceased were males. Seventy-six percent of the injuries constituted of fractures and soft tissue injuries and 9.2% constituted of burns. Nearly 67.5% of the injured were managed through private health care providers and 32.5% were managed at government hospitals. **Conclusion:** It is important to develop district level disaster preparedness and management plan involving private hospitals too for effective management of mass emergencies

Keywords: Disaster Kerala, Kerala temple disaster, Paravur disaster, Puttingal, temple fire

INTRODUCTION

Puttingal temple is located in Kollam district of Kerala, a coastal town in Southern part of India.^[1] The temple hosts a 10-day annual celebration during the months of March and April and concludes with a grand display of fireworks contest and other related cultural events since many decades.^[2] In 2016 April, though permission to conduct the fireworks contest was denied by officials, the temple authorities went ahead with the convention and conducted the event. Unfortunately, the show of fireworks took a tragic turn on 10th April at around 3.13 a.m., when a stray cracker fell on a fireworks stockpile inside a concrete structure resulting in huge fire and explosion. The incident claimed 108 casualties and around 411 were injured following the explosion.^[2]

Documentation of such incidents and subsequent management efforts is vital to assess the institutional capacity of the system to tackle disasters. It also helps identify the pitfalls and thus provides an opportunity to build on the experiences. Hence, the present study tries to describe the activities related to the rescue of injured, their management, and the rehabilitation activities conducted in relation to the incident.

MATERIALS AND METHODS

The present study employed a descriptive case study approach to document the health system response toward the disaster occurred during the Puttingal festival. Primary data were collected using qualitative methods and secondary data were sourced from data compiled by the Department of Health Services. First-hand information about the incident was sourced from government health officials involved in emergency care and management, eye witnesses, and local residents using semistructured interviews. Data regarding hospitalization as well as deaths and postmortems following the disaster were collected from secondary sources available from official records of government health authorities. The collected data were compiled and analyzed using Microsoft Excel software and proportions were used to report the results.

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RESULTS

Almost 80% of the cases belonged to 20–55 years age group, which reflected the age profile of the people who attended the festival. Relatively low proportion of women, children, and aged people among the injured may be attributed to the timing of the incident since the fireworks were performed during late night hours (9.5%). Children belonging to the age group 6–19 years constituted only 11% of the total cases. Although the incident was a firework mishap, majority of the victims suffered from injuries and fractures (76%) rather than burns. This occurred due to the explosion of the concrete structures containing the firecracker stockpile and from those situated near the site of explosion [Table 1].

Secondary care management

Majority of the accident cases (67.5%) were initially managed through nine private sector hospitals in Kollam district and the rest (32.5%) were managed by three public hospitals in the district. Almost 66% of the casualties were initially managed at four major hospitals located within 10–12 km radius from the site of accident. This included three private health facilities and one government health facility [Table 2].

Following the incident, a total of 108 deaths were recorded with a mean age of 40 years. Most of the deceased (83.2%) were males and 17 bodies remained unidentified. Since autopsy procedures are legally permitted only through public health facilities, District Hospital (DH) Kollam was the only facility in the district for conducting postmortems [Table 2]. Emergency arrangements were made at DH Kollam, to conduct the postmortems on war footing by ten teams of doctors with the technical support of a forensic surgeon from nearby district. Postmortem of 87 bodies was done at DH Kollam and remaining 20 at Medical College Hospital (MCH), Trivandrum. The 17 unidentified bodies were preserved in freezers at various public and private health facilities in Kollam district, of which 5 were later identified and released. Furthermore, 14 kits of unidentified body parts were collected and preserved. Samples from these were sent to Rajiv Gandhi Center for Biotechnology for DNA fingerprinting for later identification. A special counter was opened at DH Kollam, where blood samples were collected from the blood relatives for DNA fingerprinting.

Tertiary care management

During the emergency management efforts, MCH Trivandrum was the only government facility which provided high-end tertiary care like burns management and surgical care to the injured following the explosion. It also acted as the final referral center for all other hospitals involved in emergency management of injured. Preparation activities at MCH Trivandrum to receive the casualties commenced by 3.30 a.m. upon receiving the information of the incident. All the necessary facilities were arranged at the casualty and additional staff were deployed to meet the emergency. Two wards were reserved to admit the cases from the mishap and three operation theaters were kept reserved to perform the emergency surgery of the critically injured.

Around 139 critical cases associated with the accident were brought and treated at MCH Trivandrum. Out of this, 132 cases were brought on the day of accident and the remaining cases during the subsequent days. Sixty-two cases were admitted as inpatients for further care and treatment [Table 3]. Eleven cases were brought dead and 2 deaths occurred at surgical Intensive Care Unit (ICU) of MCH, Trivandrum. Among the 13 dead, postmortem of 8 was performed and released to the relatives on the same day of the accident.

Table 1: Demographic distribution of inpatient cases and injury types

Age category (years)	Number of cases (%)		Total (n=369) (%)
	Males	Females	
<5	1	1	2 (0.5)
6-19	48	4	52 (11.3)
20-55	265	8	273 (79.2)
>55	33	2	35 (9.0)
Total	347 (94.0)	15 (4.0)	362*

Type of injury	Frequency (n=398) (%)
Fractures	94 (23.6)
Head injury	91 (22.8)
Burns <40%	31 (7.7)
Abdominal injury	10 (2.5)
Chest injury	9 (2.2)
>60% burns	3 (0.7)
>40%-60% burns	3 (0.7)
Others	99 (24.8)

*7 missing

Table 2: Proportion of cases managed during the day of accident at different hospitals in Kollam district and gender distribution of deceased

	Number of cases (%)	Distance from accident site (km)
Public hospitals		
DH Kollam	53 (14.4)	15
TH Nedungolam	51 (13.8)	4
ESI Parippally	16 (4.3)	11
Private hospitals		
Kollam Medicity Hospital	69 (18.7)	10
Holy Cross Kottiyam	59 (16.0)	11.5
KIMS Kollam	51 (13.8)	11.5
Meditrina	25 (6.8)	15
Azeezia hospital	22 (6.0)	15
N.S Palathara	11 (3.0)	16
Upasana Kollam	6 (1.6)	16
SIMS Kollam	4 (1.1)	15
Nairs Kollam	2 (0.5)	16

Gender of deceased	Frequency (%)
Males	89 (83.2)
Females	2 (1.9)
Unknown	17 (15.0)
Total	108

Table 3: Demographic distribution of inpatient cases in Trivandrum Medical College Hospital

Age category (years)	Number of cases		Total (n=62) (%)
	Males	Females	
6-19	7	1	8 (12.9)
20-55	45	5	50 (80.6)
>55	3	0	3 (4.8)

A group of doctors from All India Institute of Medical Science (AIIMS), New Delhi, was brought on an emergency basis to support the patient management activities at MCH Trivandrum. A second group of expert doctors including plastic surgeons from Safdarjung Hospital, New Delhi, also arrived at the facility for further support. The situation of the patients admitted in the wards and ICUs were thoroughly evaluated by these experts and needed support was provided for the patient care activities.

To manage the care of eight severely ill cases at MCH Trivandrum, a high-level team under the leadership of Head of the Department, Plastic Surgery, was constituted in the hospital. The team met every 2 h and reviewed the situation in coordination with the experts from AIIMS. Measures were also taken to appoint more anesthetists and nursing staff for the special care of critical cases. Arrangements were also made to provide high quality diet required for burns victims and critically injured patients. Services of additional psychiatrists were also made available to provide support for patients with posttraumatic stress disorder.

DISCUSSION

The explosion occurred after a fire which broke out in the storeroom stockpiling pyrotechnic chemicals. This was soon followed by a power disruption and this made the rescue activities challenging. Local people in and around the accident site were the first to reach the accident site and initiate the rescue activities. In the initial period, injured and the people trapped among the debris were rescued and transferred to hospitals using locally available means such as transport buses and private vehicles available in the vicinity. By 3.20 a.m., district health officials were alerted about the accident by local Police Department officials. Subsequently, in-house ambulances from the health department and support from private ambulances were immediately sought by the officials to transfer injured to hospitals. Health facilities in the area were alerted immediately regarding the accident and beds were blocked to accommodate the incoming cases.

Enabling factors for immediate rescue and management

Puttingal temple is located only 10 km from the nearest national highway and is well connected to both Trivandrum – the capital city of state – and Kollam, another main city. The fact that the accident site is located within 1 h reach to 3 major MCHs and 12 tertiary care facilities also facilitated quick transfer and management of the injured. The time of the

incident was early morning which also meant that the roads were deserted and free of traffic. This was evident from the fact that the first patient reached DH Kollam within 30 min and MCH Trivandrum –60 km from the accident site –within 1 h following the incident.

Since the day of accident was a Sunday morning, it facilitated better triaging and management of casualties at the hospitals owing to lesser patient crowd. Furthermore, the facilities were alerted in time by the authorities enabling additional staff to be made available on an immediate basis. The proximity of the blast site to administrative capital of the state also facilitated better monitoring of the rescue activities by higher authorities in the government, mobilizing needed resources, and take swift actions as necessary. Deputy collectors and other officials were immediately positioned at all hospitals to manage the incoming crowd. DH Kollam upon the instructions of Director of Health Services and District Medical Officer arranged teams of doctors and paramedical staff from within and outside the district to manage the incoming casualties.

The event was flagged as a Level 2 disaster^[3] by 5.00 a.m., which required the help from all state machineries to mitigate the disaster. By 7.00 a.m., the event was further raised as Level 3 disaster^[3] by the state authorities which warranted national support for medical care and management was sought through State Emergency Operations Centre. To move critically ill cases, aircraft support was provided by Indian Air force and two Indian Navy ships sailed to Kollam, to provide needed medical aid. The navy also moved in medical support team with the help of helicopters as per the orders of Ministry of Home affairs.^[4]

Rehabilitation

24 × 7 medical camps were opened at the site of accident to provide support and follow-up care. ENT surgeons were posted at the camp site to provide care to the patients with hearing difficulties. Psychiatrist and a team of district mental health program also provided needed care through the medical camps at the accident site. Staffs from the periphery health institutions, under the Department of Health, were deputed to help and support the duties at the affected hospitals.

Twenty teams of health functionaries, involving Accredited Social Health Activists (ASHA) and Junior Health Inspectors, were formed to perform field surveys. These teams performed house-to-house visits, checked injured cases, and assessed their health status and also assessed the water quality of nearby wells and water sources. Steps were also taken to document missing individuals list and thereby help identify deceased.

Unavailability of safe drinking water and improper disposal of waste are often causes of epidemics postdisasters.^[5] Around 200 wells and other water sources in and around the accident site were either contaminated or destroyed following the accident. To prevent the instance of an epidemic, water samples from the wells and other sources were collected by the health teams and sent to State Public Health laboratory

for quality check. Water availability in the region was scarce, as the event coincided with the summer season in the state, measures were taken to provide drinking water with the help of around 15 tankers of 10,000 L capacity each to the households. Intersectorial meetings were conducted and instructions were given to clean the food and plastic waste from the premises, so that the chances of epidemics can be mitigated.

As part of long-term rehabilitation, a road map was developed by the Department of Health to provide long-term psychosocial support to the people in the affected areas with the help of ASHA and other professional volunteers. Steps were also taken to identify hearing impaired cases and provide them with hearing aids. A seed fund was also allocated to establish a new burns unit at DH Kollam to future proof the facility for burns care as MCH Trivandrum was the only facility which was able to provide proper care for burns cases during the Puttingal disaster.

LESSONS LEARNED AND CONCLUSION

Display of pyrotechnics and fireworks competition has long remained an integral part of Kerala temple culture. Such events often attract large gatherings of people and can escalate to a lethal event in the absence of adequate safety measures. Ignorance and negligence in the safe handling of pyrotechnic chemicals have often resulted in fire accidents in Kerala, from as early as 1952 at Sabarimala temple including 68 casualties and till this latest event at Puttingal temple. The main reasons for such accidents have often been unscientific storage, manufacturing, and usage of the chemicals involved in fireworks.^[6] Despite the historical evidences regarding the safety issues in such events, the current Puttingal disaster has been the deadliest in the history of Kerala till date.^[7]

The accident points out to negligence from the part of authorities as well as from the event organizers in handling such mass events. Despite having no permission from District officials for the fireworks contest, the organizers went ahead with the event without following the guidelines laid out by Petroleum and Explosives Safety Organisation. No adherence was also observed on the guidelines regarding usage of banned chemicals for the event. A big proportion of the casualties could also have been averted if adequate distance was maintained from the explosive area and the gathered crowd during the event.^[7]

Readiness of health system in anticipating such events and prompt management of emergencies are vital for the management of casualties. The adverse effects on human

lives and the impacts on socioeconomic fronts could have been significantly reduced, had there been a proper disaster preparedness plans and protocols in place.^[8] Civil authorities as well as health system shall prepare in advance strategies for quick response in case of emergencies which includes various healthcare providers, police force, firefighting departments, ambulances, emergency drugs, and equipment.^[9] A state like Kerala, where there is a burgeoning private health care sector,^[10] it is important to develop district level disaster preparedness and management plan, which also include private hospitals too, for effective management of similar mass emergencies.

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Conflicts of interest

There are no conflicts of interest.

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