CASE REPORT

Forensic investigation into a death: post-traumatic amnesia in a worker with a work-related head injury sustained in a coal-fired thermal power plant in India

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SUMMARY

This is the first reported case of a work-related head injury in a coal-fired thermal power plant in India. This case highlights the trend of not reporting work injuries due to fears of reprisal from the management team that may include the termination of employment. Post-traumatic amnesia in a worker presenting with head trauma must be recognised by coworkers, so the cause of injury can be elicited early and the victim gets timely medical help. There are few published studies on work-related traumatic brain injury, and they provide no information on either anatomical localisation or signs and symptoms. It is imperative that this under-researched area is studied, so detailed epidemiology and accurate national and global statistics are made available to address this dangerous yet preventable condition.

CASE PRESENTATION

A worker from a private coal-fired thermal plant in India reported of pain in the neck region on coming home via bicycle after a night shift. He massaged the area with oil and then went to sleep for 8 hours. At that time, he did not disclose an adverse incident at the factory to his family. He returned to work the next day for a second night shift, where he collapsed and died on the factory.

He had been working as a contract labourer for the company for the past 5 years. The police and his family were informed by the management staff that he had engaged in a fight for personal reasons outside the premises of the factory and that could have led to his subsequent demise. The deceased worker's brother found it difficult to believe his brother, a silent and calm person, would have engaged in a physical altercation. He requested help from the Occupational Health and Safety Centre (OHSC) of Mumbai to uncover the facts of the case. The OHSC has been helping workers and their families in acquiring diagnoses and appropriate compensation for victims of occupational diseases since the organisation's inception in 1988.^{1 2}

INVESTIGATION

One week after the worker's death, doctors from the OHSC interviewed the victim's family in detail and confirmed that the victim had indeed come home on his own after the night shift and had not informed his family about any adverse events in the factory. He did not allow his wife to examine his

neck after reporting of pain in that area. The victim was an otherwise healthy man with no diseases or addictions.

The postmortem report revealed a contused lacerated wound in the occipital region of the victim's skull and a cerebral contusion in the same region. The victim's entire brain was congested, indicating cerebral oedema. The report made no mention of the time of the injury. The remaining organs were reported normal, as were also the results of the biochemistry analyses on the victim's stomach contents and blood. The postmortem report and circumstantial evidence showed that the victim must have received a head injury the night before he died. The investigators concluded that the victim must have received a head injury at work with resultant post-traumatic amnesia (PTA). This, the investigation concluded, must have led to his inability to recall the accident or the cause of the neck pain, which he would have likely shared with his wife.

He was working as a helper at the coal rejection machine at the probable time of the incident, and the handle of the machine may have hit his head while discharging spent coal from the machine. Interviews with the factory workers revealed this particular mode of injury has occurred on multiple occasions in the past with other workers. The victim's colleague, who was present at the time of the incident, refused to provide additional information, stating that the management was correct: the victim must have had a fight and sustained an injury outside the factory as he was returning home from the night shift. The investigators' report was submitted to the police noting that a suspected head injury at work could be the cause of death, forcing the police to reopen the investigation.

Police reinvestigation revealed that the victim had indeed injured himself at work when the coal rejection machine handle had dropped onto his head. In fact, the accident made him unconscious briefly; his coworkers helped him return home. Given his amnesia of the event, he did not realise that an accident form had to be completed with witnesses as per the instructions in the Employees State Insurance Act (ESI) of 1948. The management staff maintained that since the accident form was not filled promptly at the time of the accident, the victim is not eligible for any benefits. However, given police suspicions of malicious or dishonest

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behaviour on the part of the management staff, the local ESI administrative body forced the management staff to complete the accident form, and the victim's family received all the benefits owed to a worker who suffered death during employment.

GLOBAL HEALTH PROBLEM LIST

1. There are many reasons for the under-reporting of occupational traumatic brain injuries, including fear of job loss or termination, doctors not taking proper occupational history and documenting authorities' callous attitudes, and, in some cases, pressure from owners on their workers.
2. Occupational traumatic brain injuries are under-researched with very few epidemiological studies. There are no Indian data on this subject.
3. Prevention and prompt treatment of work-related traumatic brain injury (WRTBI) are possible with proper engineering controls, training workers for awareness of head injury symptoms, use of personal protective equipment (PPE) (eg, helmets) and management-granted permission for workers to receive the provisions of welfare legislations relating to medical care after a workplace injury.

GLOBAL HEALTH PROBLEM ANALYSIS

Phineas Gage, an American railroad construction foreman, had what was probably one of the first reported cases of occupational traumatic brain injury (TBI) in 1843 after a tamping rod was driven through his skull removing much of his left frontal lobe.³ At that time, the onus of medical treatment and compensation rested on the worker. In the early part of the 20th century, welfare legislations were passed in many countries enabling the worker to claim medical benefits and damages from the owner in the case of an accident.⁴ India was one of the first countries to pass such legislation in 1923.⁵ Nevertheless, the Act was subverted over time by a combination of factors including a decrease in worker unionisation and bargaining capacity, corruption of the notifying authorities and callousness of the owners in a rapidly evolving consumerist society.⁶ Moreover, doctors are either employed and paid by management and, hence, choose to not report an occupational injury, or they do not take occupational history due to ignorance or fear. This scenario is also seen among doctors in other parts of the world.⁷ A meagre 30 000 occupational injuries per year were reported to the ministry of labour in India in from 2010 to 2012.⁸ The number of reported cases of occupational injuries in India is likely an underestimation of the actual prevalence based on numerous investigations, interviews and surveys conducted over several years by the OHSC. Most of the injuries at work are not reported by the worker or by his colleagues as there is a fear of reprisal from the management that may include termination of employment. The management often pressures workers to not complete accident forms (which serve as the official record of the accident). Factory Inspectorates that are supposed to monitor work safety are often corrupt and deliberately ignores incidents when workplace injuries are not reported by the owners of factories. Owing to these factors, work-related diseases and injuries are grossly under-reported in India.^{6, 7, 9} As this case exemplifies, workers in these conditions prefer to avoid helping an injured coworker, given the atmosphere of fear that prevails on the shop floor. Since PTA is common after TBI,¹⁰ workers who are trained to recognise TBI should help the victim reach a medical facility without delay. The owners also take advantage of a section of the law mandating an injury be reported immediately in the presence of witnesses (usually coworkers) in order to receive medical benefits.

While there are some industry-based epidemiological studies on work-related injuries from India, these do not have any statistics for either organ-based or symptom-based information, and there are none on head injuries at work.^{11–14} There are anecdotal reports of WRTBI in India.¹⁵ There are no data or epidemiological reports of occupationally acquired TBI in India. Iverson and Lange¹⁶ provide a useful overview of TBI in the workplace including information on anatomical localisation and signs and symptoms. Global data on WRTBI are not available. According to the WHO, more than half the burden of occupational injuries is borne by people from South Asia and Asia-Pacific regions but has no information on the extent of WRTBI.¹⁷ At the national level, epidemiological data of WRTBI are sparse. For example, epidemiological studies of TBI from the USA, the Netherlands and the UK have sparse data on occupationally acquired TBI.^{18, 19} It is estimated that 18% of TBI is due to accidents at the workplace.²⁰ There is a paucity of published information on epidemiological aspects of WRTBI from the USA; there is a discordance of the data recorded by different agencies, and the data are not subclassified into anatomical locations or clinically relevant early symptoms like PTA.²¹ This is surprising since the majority of WRTBIs are acute injuries, according to a small study of WRTBI performed in the USA.²¹ Similarly, there are no epidemiological studies on WRTBI from Canada that provide country-wide authentic data and analyses of anatomical locations or symptoms of head injuries at work.²² The epidemiological studies on WRTBI from the USA, UK and Canada are either localised to counties, use data collected from major trauma referral hospitals, are retrospective autopsy-based or analyse data from potentially biased federal authorities (who are notified and/or compensated). None of these studies have data on anatomical localisation of injuries or the symptomatology of immediate events like PTA.^{22–26} One study, based on retrospective data, had the inherent problem of differentiating WRTBI from non-WRTBI based on hospital records and was not accurate in classifying mild and moderate WRTBI from secondary data.²⁴ These studies do not give us the overall country-wide data of all WRTBI since most incidences of WRTBIs are mild TBIs²¹ and would report to small community hospitals rather than report to federal authorities (notification/compensation). Studies from the UK and Canada classified WRTBI in industrial categories, but there is no classification for an injury sustained in a coal-fired thermal power plant.^{22, 27} These studies also showed contact injury with a heavy object varies from 15% in the Canadian study to 40% in the UK study to 43% in the US study.^{22, 23, 27}

The handle of the coal rejection machine is located above the level of the head for an average-height man. This needs to be corrected by proper engineering controls. Workers need to be trained on the early symptoms of head injury, including PTA. PPE should be provided, and workers should be encouraged to use it as the anecdotal evidence from this case shows that the injured worker was not wearing a helmet—a level of protection that may have saved his life. In a study from the UK, authors noted that wearing industrial-grade helmets is not guaranteed protection against sustaining a TBI, especially in the event of an off-centre strike by a heavy object or the helmet is dislodged during the incident.²⁷ An autopsy-based study of WRTBI from Canada reported that the majority of workers who were injured were not wearing PPEs at the time of the accident.²⁶ Moreover, in several cases, including this one, there is often the added complication of the worker suffering from PTA. For example, in our case, PTA and the resultant lack of awareness of the traumatic incident may have prevented the victim's wife from

examining him; if she had examined him, she might have found the gash in the back of his head and increased the likelihood of his seeking urgent medical help. PTA is common after head injuries, and doctors need to be vigilant to elicit this information as it is essential to identifying the cause of the injury and subsequent prognosis.^{10 28 29} The victim, in this case, should have been taken immediately to a medical centre for a check-up, an action that may have saved his life.

Learning points

- Post-traumatic amnesia (PTA) in a worker presenting with head trauma must be recognised by coworkers so that the cause of injury can be elicited early and the accident victim can get timely medical help.
- Coworkers and family need to be questioned in cases of probable work-related injury even if the management denies that the accident is not work-related because they may be able to provide valuable clues as to the cause of the accident.
- Reporting a work-related accident can be performed retrospectively in cases where the victim suffers from PTA and has failed to record the injury at the time of occurrence.
- There are few published studies on work-related traumatic brain injury, and they provide no information on either anatomical localisation or symptoms and signs. It is imperative that this under-researched area is studied, so detailed epidemiology and accurate national and global statistics are made available to address this dangerous yet preventable condition.
- It is critical that workers and doctors be empowered to help injured workers in an environment free of the fear of reprisal, and the provisions of welfare legislations in India must be enforced by the government.

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