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Clinical case

Severe Occupational Traumatic Brain Injury: Case Study and Implications for Worker Health in Comoros

Traumatisme crânien professionnel sévère : étude de cas
et implications pour la santé des travailleurs aux Comores

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Résumé

Introduction : L'Organisation internationale du travail (OIT) indique qu'environ 270 millions de travailleurs dans le monde sont victimes d'accidents du travail chaque année, entraînant 2,2 millions de décès. Si ces statistiques mondiales sont bien documentées, les données relatives aux accidents du travail aux Comores restent limitées. Parmi les principaux facteurs contribuant aux accidents du travail figurent les défaillances d'équipement, les erreurs humaines, une sensibilisation insuffisante aux risques, une formation inadéquate et le non-respect des règles de sécurité. Cette étude présente le cas détaillé d'un traumatisme crânien grave d'origine professionnelle, admis et pris en charge au service des urgences du CHN El-Maarouf.

Cas clinique : Un homme de 34 ans, ingénieur en télécommunications spécialisé dans les systèmes de relais radio, a été victime d'un grave accident du travail en hauteur. Ses fonctions l'amenaient fréquemment

à intervenir sur des pylônes de transmission, et il avait suivi une formation à la sécurité, notamment sur l'utilisation des équipements de protection individuelle (EPI). L'accident s'est produit lors d'une opération de maintenance courante sur un pylône de transmission radio, lorsque le patient a fait une chute de plus de 15 mètres. Il a été transporté aux urgences du CHN El-Maarouf par ses propres moyens, présentant des signes de traumatisme crânien, dont une perte de conscience d'environ 15 minutes et de multiples vomissements. À son admission, le patient était pleinement conscient, avec un score de Glasgow (GCS) de 15/15. Un examen physique approfondi a révélé une importante plaie hémorragique du cuir chevelu frontal, suggérant un traumatisme crânien violent. Une tomodensitométrie (TDM) cérébrale en urgence a révélé une fracture frontale enfoncée comminutive avec fragments osseux intracérébraux, un œdème hémorragique contusionnel et un pneumocéphale. Compte tenu de la gravité de la

lésion, une intervention chirurgicale immédiate était indiquée. Le patient a bénéficié d'un débridement étendu de la plaie, de l'ablation des fragments osseux intracrâniens et d'une cranioplastie avec reconstruction osseuse par plaque métallique. La période postopératoire a été étroitement surveillée et l'évolution a été favorable, sans déficit neurologique observé. Le patient est sorti de l'hôpital le troisième jour postopératoire avec des instructions pour un suivi ambulatoire rapproché.

Conclusion : Les accidents du travail graves, en particulier ceux entraînant un traumatisme crânien, constituent un problème de santé publique croissant, notamment en milieu de travail en haute altitude. Une formation complète à la sécurité et des protocoles de préparation aux situations d'urgence sont essentiels pour atténuer les risques et améliorer les chances de survie. Ce cas souligne l'importance cruciale d'une intervention médicale rapide, de l'imagerie avancée et d'une prise en charge neurochirurgicale opportune pour optimiser le rétablissement et le pronostic du patient.

Mots-clés : Accidents du travail, traumatisme crânien, Comores, sécurité.

Abstract

Introduction: The International Labor Organization (ILO) reports that approximately 270 million workers worldwide experience occupational accidents each year, leading to 2.2 million fatalities. While these global statistics are well-documented, data on occupational accidents in Comoros remain limited. Key contributing factors to workplace injuries include equipment failures, human error, inadequate hazard awareness, insufficient training, and non-compliance with safety regulations. This study presents a detailed case of a severe occupational traumatic brain injury (TBI) admitted to and managed at the Emergency Department of CHN El-Maarouf.

Clinical case: A 34-year-old male, employed as a telecommunication engineer specializing in radio relay systems, sustained a severe occupational injury while working at an elevated height. His duties

frequently required him to operate on transmission towers, and he had undergone formal safety training, including the use of personal protective equipment (PPE). The incident occurred during routine maintenance on a radio transmission tower, when the patient fell from a height exceeding 15 meters. He was transported to CHN El-Maarouf's emergency department in a private vehicle, exhibiting signs of traumatic brain injury, including a temporary loss of consciousness lasting approximately 15 minutes and multiple episodes of vomiting. Upon admission, the patient was fully conscious with a Glasgow Coma Scale (GCS) score of 15/15. A thorough physical examination revealed a significant hemorrhagic frontal scalp wound, suggesting a high-impact cranial injury. Urgent cranial computed tomography (CT) imaging was performed, revealing a comminuted depressed frontal skull fracture with intracerebral bone fragments, a contusional hemorrhagic edema, and the presence of pneumocephalus. Given the severity of the injury, immediate surgical intervention was indicated. The patient underwent extensive wound debridement, removal of intracerebral bone fragments, and cranioplasty with bone reconstruction using a metallic plate. The postoperative period was closely monitored, and the patient demonstrated a favorable recovery trajectory, with no observed neurological deficits. He was discharged on the third postoperative day with instructions for close outpatient follow-up.

Conclusion: Severe occupational accidents, particularly those involving traumatic brain injuries, pose a growing public health challenge, especially in high-altitude work environments. Comprehensive safety training and emergency preparedness protocols are essential for mitigating risks and improving survival outcomes. This case highlights the critical importance of rapid medical intervention, advanced imaging, and timely neurosurgical management in optimizing patient recovery and prognosis.

Keywords: Occupational accidents, traumatic brain injury, Comoros, Safety.

Introduction

The International Labor Organization (ILO) and the World Health Organization (WHO) estimate that approximately 2 million people die each year from work-related causes¹. Non-communicable diseases, such as respiratory and cardiovascular diseases, account for the majority of these deaths, while occupational accidents are responsible for 19% of fatalities (around 360,000 annually)¹. These figures underscore the critical importance of occupational safety and health on a global scale. In Comoros, data on occupational accidents are limited, but the challenges are significant. Contributing factors to workplace injuries include equipment failures, human error, inadequate hazard awareness, insufficient training, and non-compliance with safety regulations². Comorian legislation on occupational health and safety is governed by the Constitution of Comoros and the Labor Code, which require employers to take measures to protect workers' health and safety². However, enforcement of these laws remains a challenge due to limited resources and the need for better worker awareness and training².

Recent global statistics indicate that work-related diseases and injuries were responsible for the deaths of 1.9 million people in 2016¹. The greatest causes of deaths were chronic obstructive pulmonary disease (450,000 deaths), stroke (400,000 deaths), and ischemic heart disease (350,000 deaths)¹. Occupational injuries caused 19% of deaths (360,000 deaths)¹. The key risk was exposure to long working hours, linked to approximately 750,000 deaths¹. Workplace exposure to air pollution (particulate matter, gases, and fumes) was responsible for 450,000 deaths¹.

This report presents a detailed case of a severe occupational traumatic brain injury (TBI) managed at CHN El-Maarouf in Moroni, Comoros. It highlights the specific challenges faced by Comorian workers and the importance of rapid medical intervention and rigorous safety protocols in improving survival and recovery outcomes.

Clinical case

A 34-year-old male, employed as a telecommunication engineer specializing in radio relay systems, sustained a severe occupational injury while working at an elevated height. His duties frequently required him to operate on transmission towers, and he had undergone formal safety training, including the use of personal protective equipment (PPE). The incident occurred during routine maintenance on a radio transmission tower, when the patient fell from a height exceeding 15 meters. He was transported to CHN El-Maarouf's emergency department in a private vehicle, exhibiting signs of traumatic brain injury, including a temporary loss of consciousness lasting approximately 15 minutes and multiple episodes of vomiting. Upon admission, the patient was fully conscious with a Glasgow Coma Scale (GCS) score of 15/15. A thorough physical examination revealed a significant hemorrhagic frontal scalp wound, suggesting a high-impact cranial injury (figure 1). Urgent cranial computed tomography (CT) imaging was performed, revealing a comminuted depressed frontal skull fracture with intracerebral bone fragments, a contusional hemorrhagic edema, and the presence of pneumocephalus (figure 2). Given the severity of the injury, immediate surgical intervention was indicated. The patient underwent extensive wound debridement, removal of intracerebral bone fragments, and cranioplasty with bone reconstruction using a metallic plate (figure 3). The postoperative period was closely monitored, and the patient demonstrated a favorable recovery trajectory, with no observed neurological deficits. He was discharged on the third postoperative day with instructions for close outpatient follow-up.



Figure 1: Hemorrhagic Frontal Scalp Wound Indicating High-Impact Cranial Injury

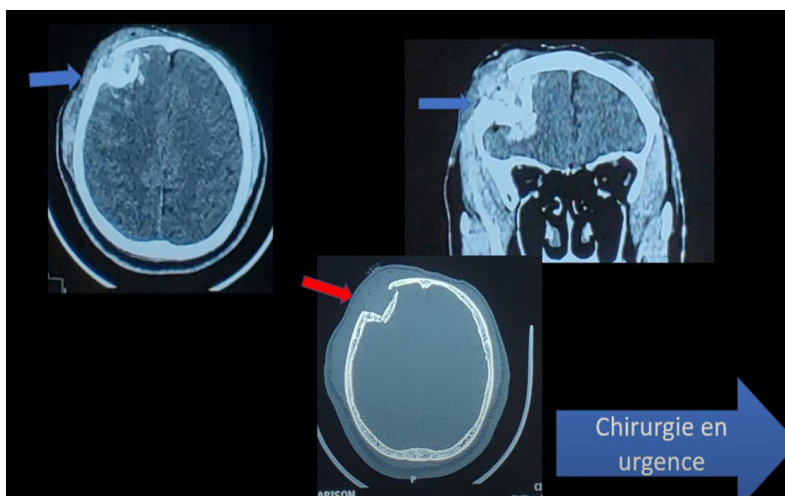


Figure 2: Cranial CT Imaging Showing Comminuted Depressed Frontal Skull Fracture with Intracerebral Bone Fragments, Contusional Hemorrhagic Edema, and Pneumocephalus

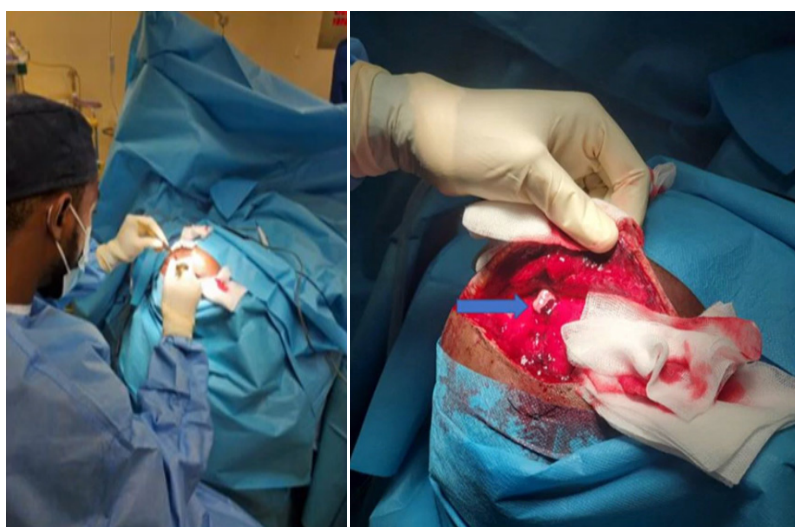


Figure 3: Post-Surgical Intervention: Extensive Wound Debridement, Removal of Intracerebral Bone Fragments, and Cranioplasty with Metallic Plate Reconstruction

Discussion

This case of severe occupational traumatic brain injury (TBI) highlights several critical aspects of workplace safety and emergency medical response in Comoros. The incident underscores the importance of comprehensive safety training, proper use of personal protective equipment (PPE), and the need for rapid medical intervention in improving patient outcomes.

Occupational Safety and Health in Comoros

This observation highlights several key issues concerning workplace safety in the telecommunications sector in the Comoros. Falls from height remain one of the main risks in this field, despite training and the use of personal protective equipment (PPE). This case underscores the potential limitations of these measures when they are not accompanied by rigorous supervision, equipment condition checks, and work organization that minimizes time pressures. The limited data on occupational accidents in Comoros presents a significant challenge for policymakers and health professionals. The lack of comprehensive reporting and monitoring systems makes it difficult to develop targeted interventions and policies to improve workplace safety. According to the International Labour Organization (ILO), effective occupational safety and health (OSH) systems are vital for preventing workplace injuries and fatalities³.

Global Context and Recent Statistics

Globally, work-related diseases and injuries were responsible for the deaths of 1.9 million people in 2016². The greatest causes of these deaths were chronic obstructive pulmonary disease (450,000 deaths), stroke (400,000 deaths), and ischemic heart disease (350,000 deaths)^{1,3}. Occupational injuries accounted for 19% of these deaths (360,000 deaths)². The key risk factors included exposure to long working hours, which was linked to approximately 750,000 deaths, and workplace exposure to air pollution, responsible for 450,000 deaths². Recent data from the ILO indicates that the rate of fatal occupational injuries varies significantly across countries, with some countries experiencing rates as high as 116.8

fatalities per 100,000 workers^{3,4,5}. This variation underscores the importance of tailored interventions that address the specific risks and challenges faced by workers in different regions.

Importance of Safety Training and PPE

The case report emphasizes the critical role of safety training and the use of PPE in preventing severe injuries. The patient had undergone formal safety training and was using PPE at the time of the accident. However, the incident still occurred, highlighting the need for continuous improvement in safety protocols and equipment. Regular safety drills and updated training programs can help workers better understand and mitigate the risks associated with their tasks. Although the patient had received adequate training and used PPE, the accident suggests the existence of deeper contributing factors. Equipment failure, human error, a failure to follow procedures, or organizational constraints—such as the time pressure associated with maintenance operations—could have played a role. The lack of a structured national system for reporting and analyzing workplace accidents further limits our understanding of these factors. Implementing such a system would help identify recurring causes and strengthen preventive strategies.

Rapid Medical Intervention and Advanced Imaging

The patient's favorable recovery was largely due to the rapid medical intervention and the use of advanced imaging techniques. The immediate surgical intervention, including wound debridement and cranioplasty, was crucial in managing the severe TBI. This case underscores the importance of having well-equipped medical facilities and trained personnel capable of handling complex trauma cases.

Conclusion

This case report highlights the critical importance of occupational safety and health measures in preventing severe workplace injuries. The global statistics and the specific challenges faced in Comoros underscore the need for continuous improvement in safety

protocols, training, and medical response systems. By addressing these issues, we can significantly reduce the incidence of occupational injuries and improve the overall health and safety of workers.

The patient's favorable recovery in this case was largely due to the rapid medical intervention and the use of advanced imaging techniques. The immediate surgical intervention, including wound debridement and cranioplasty, was crucial in managing the severe TBI. This case underscores the importance of having well-equipped medical facilities and trained personnel capable of handling complex trauma cases.

To improve occupational safety and health in Comoros, several measures can be recommended:

- *Enhanced Reporting and Monitoring*: Establishing comprehensive reporting and monitoring systems for occupational accidents and diseases.
- *Strengthening Legislation and Enforcement*: Ensuring strict enforcement of existing safety regulations and updating them as necessary.
- *Improved Safety Training*: Regular and updated safety training programs for workers, especially those in high-risk occupations.
- *Access to Medical Facilities*: Improving access to well-equipped medical facilities and ensuring the availability of trained medical personnel.

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