

Research Article

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The burden of neurological diseases in conflict settings: Narrative review Gaza situation

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ABSTRACT

Neurological disorders present formidable challenges, particularly in conflict zones, where access to healthcare is severely restricted. This review examines the profound impact of neurological diseases, including traumatic brain injury (TBI), Alzheimer's disease, epilepsy, Parkinson's disease, and post-traumatic stress disorder, on individuals in conflict zones, with a focus on the situation in Gaza. Amidst the ongoing conflict, Gaza faces significant health crises exacerbated by limited access to medication, rehabilitation, and healthcare services due to infrastructure destruction and resource constraints. Traumatic head injuries, a hallmark of conflict, impose immense strain on the healthcare system, and blast-related TBIs are prevalent. This review underscores the critical need for immediate action to address the healthcare crisis in Gaza, including prioritizing ceasefires, strengthening healthcare facilities, providing specialized training for healthcare professionals, and ensuring continued international aid and support. Failure to act promptly exacerbates suffering and increases the likelihood of permanent disabilities and psychological damage, emphasizing the urgency of the situation.

Keywords: Warzones, Gaza, neurological disorder, traumatic injuries

1. INTRODUCTION

Neurological disorders encompass conditions affecting both the central and peripheral nervous systems, and they are increasingly recognized as major causes of death (the second leading cause of mortality) and disability (the primary leading cause of disability) worldwide [1,2]. Neurological disorders have a marked economic impact on countries, including direct healthcare costs, indirect productivity losses, and the financial burden of disability support [3].

Traumatic brain injury (TBI) is a major category of neurological disorder with increasing incidence and burden on countries, with a profound impact on the populations'

lives [4]. Considering its impact on people's lives, it is a major concern in conflict areas and in the veterans. Amyotrophic lateral sclerosis appears to be elevated in Gulf War veterans compared to the general population [5]. Moreover, the incidence of paralysis and speech disturbances is significantly higher among World War I veterans [6]. Individuals with neurological disorders face increased challenges when struggling with their symptoms during war. The complex situation of the war exacerbates the demanding nature of managing neurological conditions, preventing individuals from effectively addressing their symptoms and accessing the essential support.

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The Gaza Strip, situated on the eastern coast of the Mediterranean Sea, is a densely populated land bordered by occupied Palestine and Egypt. Despite its small geographical size (365 km²), it is home to about 2.1 million people [7]. It has been under Israeli siege since 2007, hindering the development of the socioeconomic and healthcare facilities and leading to high rates of poverty and unemployment [7,8]. Additionally, Gaza has endured several devastating conflicts, including Israeli military operations in 2008–2009, 2012, 2014, and 2021, and the ongoing war now results in significant loss of life, widespread destruction of infrastructure, and immense trauma among its inhabitants. These repeated conflicts exacerbate the existing vulnerabilities, intensifying the challenges faced by individuals with neurological disorders living in the region [7,9].

In this review, we highlight the profound impact of the wars on neurological diseases. We aimed to identify the unique challenges faced by individuals with neurological disorders during times of conflict, emphasizing the crucial need to understand and provide support in demanding circumstances. Moreover, we emphasize the urgent need to promptly address the health crisis in Gaza and address the need for immediate ceasefire and action to hasten and prevent further health deterioration.

2. TRAUMATIC HEAD INJURIES IN GAZA

Amidst the devastating conflict in Gaza, the prevalence of injuries due to the ongoing bombardment by blasts and air strikes is evident. According to the Ministry of Health in Gaza, there have been 84,933 reported injuries [10,11]. A significant proportion of these injuries are presumed to be traumatic head injuries (THI). This assumption aligns with prior research on conflicts, such as those in Iraq and Afghanistan, where blast-induced THI has emerged as a hallmark injury [12]. THI is a type of acquired head injury that arises from a sudden trauma that affects the head and consequently the brain [13].

TBI can have short- and long-term consequences on individuals' lives. The impact of bomb blasts can result in varying degrees of TBI ranging from mild concussion to severe penetrating injury [13].

With a substantial number of injuries, the healthcare sector in Gaza struggles under immense strain, making the treatment of THI and other injuries challenging [14]. The overwhelming influx of casualties not only highlights the prevalence of these injuries but also emphasizes the severe limitations of the healthcare system [14,15]. The shortage of medical supplies, compounded by a large number of patients, creates a situation in which adequate treatment of injuries is becoming increasingly elusive [16].

In recent decades, significant advancements have been made in modern weaponry, greatly amplifying the potential for craniospinal injuries and disabilities. Concurrently, there have been advances in scientific knowledge and neurosurgical management to treat these injuries [17]. However, despite these advancements, considerable barriers persist, particularly in Gaza due to the long siege preceding this conflict, crowdedness, poverty, and low socioeconomic status [18].

In conflict zones, TBIs can result from direct exposure to explosive blasts caused by bombs or missiles, leading to concussive waves impacting the head or collapsing buildings after residential bombardment. Another common cause is

forceful detention, which results in a direct blow to the head. Moreover, THI may stem from vehicular accidents in chaotic war environments, gunshot wounds, shrapnel from explosive devices, or even falls while seeking shelter or navigating unstable terrains.

Primary blast injuries are caused by blast overpressure waves, creating extreme pressure changes that notably impact organs with air-fluid interfaces [19]. While they tend to prioritize treating visible injuries, this focus might inadvertently lead to missing equally critical yet less apparent injuries, such as damage to internal organs or traumatic brain injuries. This often occurs due to the high number of injured patients in Gaza, many of whom have multiple injuries. In addition, staff shortages and limited supply have contributed to this challenge [20]. On the contrary, secondary brain injury is the primary cause of in-hospital mortality following TBI [12]. Severe TBIs can lead to loss of consciousness, neurological deficits, seizures, and unequal pupil size. In extreme cases, TBIs can result in coma or death due to immediate brain damage to vital centers or secondary complications such as increased intracranial pressure or intracerebral hemorrhage [21].

Epilepsy, a prevalent long-term complication, has emerged in 7% of patients with TBI over a 10-year period, emphasizing the need for establishing long-term follow-up to mitigate such effects. Despite a slight decrease in balance, which persisted in over 60% of individuals, enduring alterations in memory, concentration, cognitive fatigue, irritability, impulsivity, inappropriate social behavior, anxiety, and depression remained significantly prevalent over the same period [22]. This underscores the profound and substantial impact of TBI on various aspects of well-being and quality of life during and after wars [22].

Experiencing mild-to-moderate head injuries significantly increases the likelihood of developing Parkinson's disease [23]. Moreover, mild TBI not only increases the risk of developing Alzheimer's disease but also increases susceptibility to post-traumatic stress disorder (PTSD) and other mental health disorders [24,25]. Additionally, the risk of epilepsy escalates following both mild and severe brain injuries, including skull fractures, and can persist for more than a decade post-injury [26]. These findings underscore the complex and enduring impact of head injuries on neurological and psychological health and highlight the importance of preventive measures and comprehensive care strategies for at-risk individuals.

3. ALZHEIMER'S DISEASE

Alzheimer's disease (AD) is the leading cause of dementia and is rapidly becoming one of the most costly, deadliest, and burdensome diseases [27]. AD is a progressive degenerative brain disorder that worsens over time. The early signs of the disease include forgetting about recent events or conversations, and over time, it progresses to serious memory problems and loss of ability to perform everyday tasks [28].

In Gaza, where access to medication, rehabilitation, and healthcare services is severely limited due to ongoing conflict, this will severely impact the quality of life for patients with Alzheimer's disease.

Withdrawing essential medications exacerbates the natural progression of the disease, causing increased

cognitive impairment, behavioral and psychological symptoms, and functional decline. Literature indicates that individuals experiencing depression later in life are at an increased risk of developing dementia and Alzheimer's disease at a younger age [29], as most Gazan people are expected to be psychologically traumatized after the war has stopped. Moreover, caregivers who are already burdened face heightened stress, which prevents them from providing optimal care for these patients, resulting in an overall reduction in the quality of life of individuals with Alzheimer's disease.

The conflict intensifies these difficulties by disrupting regular care, elevating stress levels, and constraining access to specialized services. Displacement exacerbates the issue by diminishing access to community support networks, with approximately 75% of Gaza's total population being displaced due to ongoing conflict. The absence of rehabilitation services makes it difficult for individuals to access essential interventions to maintain cognitive function and manage behavioral symptoms [30,31].

Research findings indicate that a significant proportion of adolescents in Gaza suffer from mental health challenges: 69% experience symptoms associated with PTSD (some PTSD patients develop Alzheimer's disease later), 40% display signs of depression, 95% exhibit symptoms of anxiety, and 70% resort to harmful coping mechanisms, including cognitive avoidance and emotional discharge [32]. These alarming statistics are undoubtedly worsened by the conflict, stressing the urgent necessity for targeted interventions and support to address the escalating mental health issues affecting this population during ongoing crises.

4. EPILEPSY

Epilepsy, a chronic non-communicable brain disorder, affects approximately 65 million individuals worldwide. In Palestine, the prevalence of epilepsy is recorded at a rate of 10.4 per 100,000 individuals [33].

It is characterized by recurring seizures involving brief involuntary movements that affect either a specific body part (partial) or the entire body (generalized). In some instances, seizures may be associated with the loss of consciousness and control of bowel or bladder function [34].

Previous studies have shown a heightened incidence of epileptic seizures in children with pre-existing epilepsy residing in war-inflicted areas [35]. Furthermore, a strong correlation persists between stress and epilepsy, even in the post-war period. Interestingly, following the cessation of war, there was a notable decline in the frequency of seizures, attributable to the alleviation of stressors associated with the wartime environment [35,36]. Despite the difficult situation general Gazan people are living in, patients with epilepsy are living a far more difficult time.

Failure to stick with the medication regimen can induce seizures in individuals with well-controlled or poorly controlled epilepsy. Status epilepticus, acknowledged as a medical emergency, is a serious threat and can lead to death if seizures are not promptly addressed [37].

Abrupt drug discontinuation may worsen the patient's overall condition, affect daily functioning, and exacerbate psychosocial challenges. People at high risk of head injuries are also at high risk of developing epilepsy; approximately 5% of new cases and 20% of existing cases may be attributed

to prior traumatic brain injuries [38]. Many patients have shown that psychological and emotional stress can trigger seizures or increase their likelihood of experiencing them. Specifically, fear, anxiety, frustration, and anger are commonly reported to have adverse effects on the occurrence of seizures [39].

Limited access to healthcare during wartime exacerbates disease status by delaying patients from seeking prompt medical attention or obtaining essential medications. Stress and vulnerability in conflict zones worsen physical and mental health, whereas disruptions in healthcare infrastructure increase mortality.

5. PARKINSON'S DISEASE

Parkinson's disease is a progressive nervous system disorder with motor symptoms, cognitive alterations, behavioral/neuropsychiatric changes, and symptoms associated with autonomic nervous system failure, with a regional prevalence of 82.6 per hundred thousand, making it a major concern [40,41].

In the context of the war in Gaza, individuals with Parkinson's disease face significant challenges, including a lack of medical supplies and essential healthcare services due to infrastructure destruction. Although the disease cannot be cured, medications are crucial for enhancing the patient's quality of life and slowing the disease's progression. Abrupt discontinuation of medication during conflict exacerbates motor symptoms, intensifies rigidity and tremors, prolongs hospitalization time, and worsens prognosis [42,43].

A rehabilitation program that encompasses motor function, swallowing difficulty, and speech disorder is crucial for managing patients with PD and has clear evidence of improved quality of life. Therefore, lack of access to these services adds challenge to a set of challenges. Malnutrition and dehydration are particularly detrimental to patients with Parkinson's and further worsen their health [44].

The dependency of individuals with Parkinson's places an extra burden on caregivers, who struggle with limited resources, heightened stress, and challenges in providing optimal care for patients in Gaza.

6. POST-TRAUMATIC STRESS DISORDER

The profound and enduring impact of multiple wars has significantly contributed to escalating mental health crises, particularly PTSD, among the youth population in the conflict zones, as 53.5% of Gazan children had PTSD even prior to the ongoing conflict [45]. After the current conflict, it is estimated that 91% of children and adolescents have PTSD [46]. Notably, PTSD was 34.5% in Ethiopia [47]. Each conflict has added layers of trauma and stress, further straining the already limited mental health resources available in Gaza. As a result, PTSD rates among youths have skyrocketed, with many experiencing persistent emotional distress. The constant fear of violence and loss of loved ones has created a pervasive sense of anxiety and hopelessness, making it challenging for young people to envision a future free from conflict and suffering [1,32,45].

PTSD is a mental health condition that persists beyond the initial traumatic occurrence and arises in response to

traumatic, threatening, or distressing events, such as severe emotional situations and sexual assault [48].

The study by Altawil et al. highlighted the deep-seated consequences of conflict-induced trauma, specifically PTSD, in affected communities. They found that the prevalence of mental disorders in conflict-affected areas, including depression, anxiety, PTSD, bipolar disorder, and schizophrenia, was alarmingly high, reaching 22.1% [49].

Studies focusing on Gaza have elucidated the chronic impact of war trauma on PTSD in adolescents and adults. Wimalawansa et al. revealed a concerning trend, showing a substantial rise in PTSD prevalence over time, exemplified by a surge from 61.8% in 2006 to 86.5% in 2021 [50].

The crucial situation in Gaza highlights the pressing need for intervention and support systems. With prolonged conflict and its far-reaching effects on the mental health of people, particularly young people, it is imperative that immediate action be taken to address the lasting effects of trauma. The importance of implementing strong mental health initiatives in Gaza cannot be overstated, as unrelenting conflict continues to take a heavy toll on psychological well-being, with the potential for an even higher prevalence of PTSD in the aftermath of the current conflict.

Recognized causes of PTSD in wartime situations, including various traumatic experiences such as abuse, assault, accidents, and disasters, underscore its significant impact. One study has indicated that approximately 25% of exposed children develop acute or delayed-onset PTSD [51].

Gaza's post-war context poses challenging obstacles to delivering effective mental health support. The administration of effective treatments for PTSD is challenging. Limited resources and a persistent state of conflict create significant challenges in providing specialized therapies necessary for PTSD care [52]. The scarcity of trained mental health professionals and inadequate infrastructure further impede the delivery of these essential interventions.

Francisković and his colleagues conducted research on healthcare and community-based interventions for war-traumatized individuals in Croatia, and they evaluated the mental health status of participants and their utilization of healthcare and community-based services since the onset of the war. They highlighted a wide range of services utilized, with primary healthcare and specialist physical healthcare being the most frequently accessed. Mental healthcare

services are less utilized, primarily in outpatient settings, and often involve psychopharmacological treatment. Accommodation support emerged as crucial for facilitating PTSD recovery, indicating the significance of improving living conditions for trauma recovery [53].

Drawing insights from Frančišković's research, a tailored plan for mitigating PTSD and other mental health concerns in Gaza can be developed [53]. This plan would integrate successful services and methodologies utilized in conflict zones while adapting to the distinct cultural, social, and psychological dynamics specific to Gaza. By considering local infrastructure and community-specific factors, such as the availability of healthcare resources and the unique experiences of the population, this strategy holds promise for effectively addressing mental health needs in Gaza.

7. RECOMMENDATION AND CALL FOR ACTION

Each second without basic care increases the likelihood of permanent disabilities and psychological damage, not only for patients but also for the entire family and population. This emphasizes the need for an immediate ceasefire. Medical care services should be prioritized to reduce the backlog of cases. In addition, it is vital to strengthen healthcare facilities in Gaza to manage these crises more efficiently. In addition to the need for specialized training and resources for healthcare professionals, their ability to handle critical cases should be improved. Furthermore, international cooperation is essential to guarantee the provision of continued assistance and aid from the healthcare sector in Gaza. Of such organizations, UNRWA stands at the top of the pyramid [54]. Another initiative called the Gaza Health Initiative emerged in the current situation to help gather medical personnel to provide Gazan people with available treatment [55]. The need for a quick response is obvious: every minute of delay causes misery for those in need.

AUTHORS' CONTRIBUTIONS

JJ—Conceptualization, Revision, and Editing. BA—Writing the first draft and editing. SJ—Writing the first draft and editing.

CONFLICTS OF INTEREST

Authors declare no conflict of interest.

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