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Exploring Echinococcus Infection in the Spinal Cord: Clinical Manifestations and Management Insight

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ABSTRACT

Echinococcus infection in the spinal cord can lead to various complications, including compression of the spinal cord. In some cases, Echinococcus infection can result in the formation of dumbbell structures within the spinal cord, extending into the paravertebral region. This type of infection is characterized by a high recurrence rate, ranging from 50% to 100%. This study used reliable and important scientific databases like PubMed, ScienceDirect, Google Scholar, as well as official databases from health organizations. Furthermore, studies have shown that individuals with preexisting conditions like pressure ulcers are at an elevated risk of postoperative infections following spinal cord surgery. Echinococcus infection in the spinal cord can have serious consequences such as compression and the formation of complex structures. Understanding the risk factors associated with postoperative infections and the persistence of viral infections in the spinal cord is crucial for effective management and treatment strategies in affected individuals.

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INTRODUCTION

Echinococcus infection, also known as echinococcosis, is a parasitic disease caused by the larval stages of taeniid cestodes belonging to the genus Echinococcus Moro & Schantz (2009). This zoonotic infection can affect various hosts, including humans, and is typically the result of exposure to Echinococcus larvae (Zhang & McManus, 2006). The most common species implicated in human infections are Echinococcus granulosus and Echinococcus multilocularis (Ulusoy et al., 2011). Echinococcus granulosus causes cystic echinococcosis (CE), while Echinococcus multilocularis is responsible for alveolar echinococcosis (Chong et al., 2022). The prevalence of Echinococcus infections varies across regions and hosts, with studies reporting prevalence rates in different populations. For example, a meta-analysis in China estimated a prevalence of 30.9% of Echinococcus in sheep (Gao et al., 2021). In Ethiopia, a pooled prevalence of Echinococcus infections in final hosts was calculated to be 33% (Shumuye et al., 2021). Additionally, studies have highlighted the co-endemicity of human cystic and alveolar echinococcosis in certain regions, emphasizing the importance of understanding the distribution and impact of these infections (Li et al., 2010).

The prevalence of Echinococcus infection specifically in the spinal cord is not directly addressed in the provided references. However, studies have highlighted the prevalence of Echinococcus infections in various hosts and regions. For instance, a meta-analysis in China estimated the combined prevalence of Echinococcus in sheep to be 30.9% Gao et al. (2021). Another study in Ethiopia calculated a pooled prevalence of Echinococcus infections in final hosts to be 33% (Shumuye et al., 2021). These findings

indicate a significant prevalence of Echinococcus infections in certain populations and regions, emphasizing the importance of understanding and addressing this parasitic infection. While the exact prevalence of Echinococcus infection in the spinal cord is not explicitly stated in the available references, the high recurrence rate of Echinococcus cysts in the spine, ranging from 50% to 100%, underscores the potential impact of this infection on spinal health (Thaler et al., 2010). Additionally, the risk of postoperative infections following spinal cord surgery, especially in individuals with preexisting conditions like pressure ulcers, further highlights the importance of infection prevention strategies in this vulnerable population (Yang et al., 2018).

Echinococcosis can present with various clinical manifestations, including unusual radiologic findings in the thorax and concurrent pulmonary sequestration with pulmonary hydatid cysts (Kılıç et al., 2006; Yusef et al., 2017). The disease can also lead to serious complications, such as miliary lung metastases in cases of Echinococcus multilocularis infection (Aydin et al., 2019). Diagnosis and treatment of echinococcosis are essential for managing the infection and preventing further complications (Mihmanli et al., 2016; Ulusoy et al., 2011). Understanding the prevalence, clinical manifestations, and management strategies for this infection is crucial for effective control and prevention measures.

METHODOLOGY

This research undertook the collection and analysis of pertinent literature from various sources concerning the clinical presentations and therapeutic strategies for echinococcus infection affecting the spinal cord, employing a methodological approach known as literature review. This method was selected for its capacity to systematically gather, consolidate, and scrutinize diverse research findings, thereby furnishing a comprehensive and detailed exposition of the subject matter under investigation. Notable and reputable scientific databases, such as PubMed, ScienceDirect, Google Scholar, alongside official repositories of health organizations, were utilized to ensure the integrity and accuracy of the information employed in this study.

Established criteria were delineated to ascertain the relevance of studies pertinent to the research focus. The inclusion criteria centered on the clinical manifestations and management of echinococcus infection in the spinal cord, encompassing research articles published in either Indonesian or English. Conversely, exclusion criteria were formulated to omit studies divergent from the research theme, those lacking sufficient data, or those addressing disparate risk factors. Employing specific search terms including "echinococcus infection in the spinal cord," "clinical manifestations of echinococcus infection," and "management of echinococcus infection," a meticulous and exhaustive search of the literature was conducted to encompass all requisite studies.

Following a preliminary screening based on title and abstract, a rigorous selection process was implemented to ensure adherence to predefined criteria. Subsequently, studies meeting the stipulated requirements underwent further scrutiny and analysis. Data synthesis involved the aggregation of pertinent information from seminal studies, which was subsequently presented in tabular formats or summarized using verbatim excerpts and conceptual insights derived from said studies.

This study endeavors to leverage the methodology of literature review to furnish precise and cogent insights into the nexus between clinical presentations and therapeutic management of echinococcus infection in the spinal cord. Its overarching aim is to elucidate the clinical manifestations and therapeutic modalities pertinent to echinococcus infection affecting the spinal cord.

RESULTS AND DISCUSSION

The spinal cord is a vital component of the central nervous system responsible for transmitting information between the brain and peripheral nerves. Spinal cord injuries can result in permanent functional impairment (Meletis et al., 2008). It is a complex and heterogeneous structure that performs multiple essential functions (Veshchitskii et al., 2022). The spinal cord acts as a carrier of information between the brain and peripheral nerves, underscoring its significance in neural communication ("Microsurgical Release of Spinal Cord and Nerve Root in Old Sports Spinal Cord Injury", 2022). Research has explored various aspects of spinal cord injuries and potential treatments. For example, studies have investigated the role of curcumin in mitigating depressive-like behavior following spinal cord injury through its interaction with the NLRP3 inflammasome (Yarahmadi et al., 2022). Additionally, interventions such as intrathecal transplantation of mesenchymal stem cells have been shown to activate signaling pathways in the spinal cord, leading to improved nerve function and inhibition of apoptosis (Wang et al., 2016).

Understanding spinal plasticity mechanisms is crucial for developing therapies for spinal cord injuries and other neuromotor disorders (Jindrich et al., 2009). Studies have indicated that functional responses in the human spinal cord during motor actions are side- and rate-dependent, highlighting the complexity of spinal cord function (Maieron et al., 2007). Furthermore, functional MRI studies have identified neuronal activity associated with sensory and motor functions in the spinal cord (Kornelsen et al., 2012). Spinal cord infections can be caused by various pathogens, including bacteria, viruses, fungi, and parasites. While bacterial and viral agents are the most common causes of spinal infections, fungal infections are more

prevalent in immunocompromised individuals, and parasitic infections are common in endemic regions (Bhattacharyya & Bradshaw, 2021).

These patterns are evolving due to factors like migration and climate change, impacting the distribution of infections affecting the spinal cord. Infections of the spinal cord can lead to serious complications, such as myelitis, which is characterized by inflammation of the spinal cord (Bhattacharyya & Bradshaw, 2021). Fungal infections, although less common, can occur in individuals with compromised immune systems and may result in significant morbidity and mortality (Bhattacharyya & Bradshaw, 2021). For instance, urinary tract infections (UTIs) are important causes of morbidity and mortality in patients with spinal cord injuries (Togan et al., 2014). Additionally, research has shown that factors like preoperative pressure ulcers may elevate the risk of infections after spinal cord surgery (Yang et al., 2018).

Parasitic infections affecting the spinal cord are a rare but significant medical concern. While bacterial and viral agents are the most common causes of spinal infections, parasitic infections can occur, especially in endemic regions. Parasites such as Echinococcus, Toxoplasma gondii, Plasmodium, Gnathostoma, and others have been reported to affect the spinal cord (Bradshaw & Venkatesan, 2019). These infections can lead to various clinical manifestations, including myelitis and myelopathy. Neurocysticercosis, caused by Taenia solium, is one of the most common parasitic infections of the central nervous system (CNS) and can involve the spinal cord. Spinal cysticercosis is rare but can result in severe neurological complications (Zheng et al., 2021). The involvement of the spinal cord by neurocysticercosis is relatively uncommon compared to brain parenchyma and subarachnoid spaces (Veiga et al., 2014). However, when present, it can mimic conditions like acute transverse myelitis (Kim et al., 2022). Infections like Gurltia paralysans can lead to myelopathy in domestic cats, causing symptoms such as paraparesis, paraplegia, and urinary or fecal incontinence (Gómez et al., 2021).

The parasites can be found in the leptomeningeal veins and the parenchyma of the spinal cord, leading to progressive neurological deficits (Gómez et al., 2021). Additionally, parasitic migration within blood vessels and into the spinal cord parenchyma can cause direct tissue damage and local inflammation (Hartung et al., 2022). While much is known about the distribution of parasites during later stages of infection, the initial stages and how parasites reach immune-privileged sites like the spinal cord remain poorly understood (Sanders et al., 2014). Clinical manifestations of Echinococcus granulosus infection affecting the spinal cord can vary widely, ranging from asymptomatic infection to severe and potentially fatal disease (Grubor et al., 2017). Echinococcosis, caused by larval stages of cestode species of the genus Echinococcus, is a zoonotic infection that can manifest in humans with a spectrum of clinical features (Eckert & Deplazes, 2004).

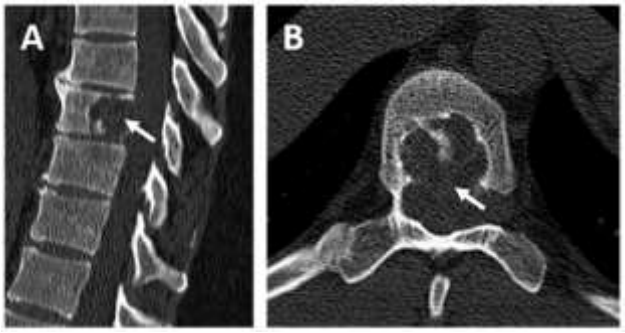

Figure 1. The magnetic resonance imaging (A) and the computed tomography scan (B) revealed a spinal lesion of the ninth dorsal vertebra with echinococcosis (Basmayican, 2018)

Spinal echinococcosis is an uncommon manifestation of E. granulosus infection and can present with pain as the most common clinical manifestation, followed by loss of leg strength (Zhang et al., 2021). The clinical presentation of spinal cystic echinococcosis may include pain, neurological deficits such as loss of leg strength, and potentially other symptoms related to spinal cord compression (Zhang et al., 2021). The manifestation of intramedullary parasitic infection, although extremely rare, can mimic conditions like acute transverse myelitis, presenting with symptoms such as Brown-Sequard syndrome (Kim et al., 2022). Understanding the clinical manifestations of spinal echinococcosis is crucial for accurate diagnosis and appropriate management. The nonspecific nature of symptoms and the rarity of spinal involvement by parasites like Echinococcus granulosus highlight the importance of considering parasitic infections in the differential diagnosis of spinal cord pathologies (Grubor et al., 2017). Treatment for Echinococcus spinal infection typically involves a combination of medical therapy and surgical intervention. Albendazole, a broad-spectrum anthelmintic drug, is commonly used in the treatment of echinococcosis, including spinal infections caused by Echinococcus granulosus (Ulusoy et al., 2011). Albendazole works by inhibiting the parasite's ability to absorb glucose, leading to its immobilization and eventual death (Ulusoy et al., 2011).

This drug is often used preoperatively to reduce the size of the cyst and postoperatively to prevent recurrence (Ulusoy et al., 2011). Surgical management plays a crucial role in the treatment of spinal echinococcosis, especially in cases where the cyst causes compression of the spinal cord or nerve roots (Thaler et al., 2010). Surgical procedures aim to remove the parasitic cyst while preserving neurological function and preventing recurrence (Thaler et al., 2010). In cases of severe kyphoscoliosis resulting from primary Echinococcus granulosus infection of the spine, surgical intervention may be necessary to correct the spinal deformity and alleviate symptoms (Thaler et al., 2010). In some instances, adjunctive therapies such as verapamil, a calcium channel blocker, have been investigated for their potential anti-echinococcal effects (Gao et al., 2021). Verapamil has been shown to regulate the calcium/calmodulin-dependent protein kinase II response, which may contribute to its efficacy against Echinococcus species (Gao et al., 2021). However, further research is needed to establish the full extent of verapamil's therapeutic benefits in the treatment of echinococcosis.

CONCLUSION

The spinal cord plays a critical role in the nervous system, and injuries to this structure can significantly impact motor and sensory functions. spinal cord infections pose significant challenges and can have severe consequences for affected individuals. Further research and clinical studies are needed to enhance our understanding of the clinical presentation, diagnosis, and treatment of spinal cord infections caused by E. granulosus. Overall, the treatment of Echinococcus spinal infection requires a multidisciplinary approach involving antiparasitic medications, surgical intervention, and potentially adjunctive therapies to ensure optimal outcomes for affected individuals.

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