

THERAPEUTIC PERSPECTIVES WITH STEM CELLS IN SPINAL CORD INJURIES: AN INTEGRATIVE REVIEW

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Abstract: Spinal cord injuries represent a devastating condition that affects patients' quality of life and challenges healthcare professionals and researchers. This article presents an integrative review on stem cell therapy as a promising approach for treating spinal cord injuries. The review was carried out through a systematic search in scientific databases, including studies published from 2007 to 2023. Studies that addressed the effectiveness and challenges of stem cell therapy in animal models and clinical trials related to spinal cord injuries were considered. spinal cord. The following descriptors were used: spinal cord injuries, stem cell transplantation, neuronal plasticity, nerve regeneration and efficacy. Analysis of studies revealed that stem cell therapy demonstrated efficacy in promoting regeneration and functional recovery after spinal cord injuries. Neural plasticity and long-lasting reorganization of the corticospinal tract have been identified as important mechanisms in recovery. Human clinical trials have demonstrated promising advances but highlighted the continued need for standardization of protocols and ethical considerations. Animal models have played a crucial role in understanding the underlying mechanisms, while the origin of stem cells has also affected cell outcomes and integration. Stem cell therapy in spinal cord injury surgery represents a promising approach, with encouraging results in both preclinical studies and clinical trials. However, significant challenges, such as standardizing therapeutic protocols and ensuring long-term safety, must still be overcome. Continued research, multidisciplinary collaboration, and adaptation to ever-evolving findings are essential to driving advancement in this field, which has the potential to substantially improve the quality of life for people with spinal cord injuries.

Keywords: spinal cord injuries, stem cell

transplantation, neuronal plasticity, nerve regeneration and efficacy.

INTRODUCTION

Spinal cord injuries represent a significant challenge to modern medicine due to their complexity and lack of effective and consistent treatments. However, in recent decades, substantial advances have been made in the search for therapeutic strategies that can improve the neurological function and quality of life of individuals affected by spinal cord injuries.

Stem cell therapy has emerged as a promising and dynamic area of research in addressing spinal cord injuries. This integrative review article aims to explore the current status of stem cell therapy in spinal cord injury surgery, focusing on its effectiveness and the challenges associated with this therapeutic approach.

Recently, Kwon et al. (2011) highlighted significant advances in the treatment of spinal cord injuries, highlighting the importance of continued research in this area. Their analysis emphasized the need for innovative strategies that promote neural tissue regeneration, offering hope for patients with spinal cord injuries.

Plasticity and regeneration in the spinal cord after stem cell therapy were examined by Nori et al. (2017). Their findings highlight the promising potential of stem cells to facilitate the repair of nervous tissue, with possible improvements in neurological function in patients with spinal cord injuries.

In this context, the lasting reorganization of the corticospinal tract after spinal cord injury, as discussed by Kumamaru et al. (2018), demonstrates the complexity of neurological recovery processes. These analyzes indicate that despite notable advances, there is still much to be understood in this rapidly evolving field.

Assinck et al. (2016) addressed the choice of

experimental models of spinal cord injury in rats, highlighting the importance of choosing the appropriate model for future research. The standardization and validation of these models are essential to guarantee consistent and reliable results.

The review of clinical trials on stem cell therapy for spinal cord injuries by Park et al. (2017), revealed promising advances in the clinical application of stem cells. However, it also pointed to the continued need for research and standardization of clinical protocols.

The clinical application of stem cells in spinal cord injuries, as discussed by Oh et al. (2018), offers a comprehensive overview of therapeutic approaches under development and their potential to improve patients' quality of life.

The reviews by Mothe et al. (2012) on the transplantation of progenitor/neural cells in spinal cord injuries and by Park et al. (2007) on stem cell transplantation in primates and humans complement this discussion, providing information on translational research and the integration of stem cells.

Furthermore, the long-term results of treating spinal cord injuries with bone marrow-derived mesenchymal stem cells in humans, as presented by Park et al. (2007), demonstrate the importance of long-term assessment of therapeutic efficacy.

The discussion ends with the review by Kwon et al. (2011) on the use of bone marrow-derived mesenchymal stromal cells in the treatment of central nervous system injuries, highlighting the promising application of these cells in translational research.

Therefore, this integrative review addresses not only the effectiveness of stem cell therapy in spinal cord injury surgery, but also the challenges intrinsic to this approach. By examining the contributions of these studies, we hope to provide a comprehensive overview of the current state of stem cell therapy, as

well as highlight the continued importance of multidisciplinary research and collaboration in the search for effective solutions for spinal cord injuries.

METHODOLOGY

To carry out this integrative review, we implemented a systematic search strategy to identify relevant studies related to stem cell therapy in spinal cord injuries. The electronic databases PubMed and Scopus were consulted to cover studies published from 2007 to 2023. We used the following research descriptors: spinal cord injuries, stem cell transplantation, neuronal plasticity, nerve regeneration and efficacy. We adopt Boolean operators and term combinations to ensure broad search coverage.

We defined strict criteria for selecting studies. The following inclusion criteria were included: studies that addressed stem cell therapy in spinal cord injury surgery, including animal models or human clinical trials, studies published in peer-reviewed scientific journals, studies available in English. Studies that did not meet these inclusion criteria or that did not demonstrate direct relevance to the research topic were excluded.

The study selection process involved two distinct stages. First, we screened the titles and abstracts of articles identified in the initial search to determine their preliminary relevance. Then, the articles selected in the first stage underwent a detailed analysis of the full texts to determine final inclusion in the integrative review.

The extraction of relevant data from the included studies, such as information about authors, year of publication, methods, results and conclusions, was carried out systematically. We used a standardized spreadsheet to organize this data and conduct a rigorous synthesis of results, focusing on findings related to the efficacy and challenges

of stem cell therapy in spinal cord injury surgery.

We highlight that this integrative review was conducted in strict accordance with ethical principles and fully respected the copyright of the included studies. We also emphasize that there was no intervention in humans or animals during this study.

RESULTS

Our integrative review addressed studies and evidence related to stem cell therapy as a promising approach in the treatment of spinal cord injuries, based on the following references:

The work of Kwon et al. (2011) highlighted recent advances in the treatment of spinal cord injuries, emphasizing the growing understanding of spinal cord injuries and the progress made in stem cell therapy.

Nori et al (2017) explored plasticity and regeneration in injured spinal cord after stem cell therapy. They highlighted the importance of understanding the mechanisms underlying neural regeneration.

Kumamaru et al. (2018) analyzed the role of lasting reorganization of the corticospinal tract in functional recovery after spinal cord injury. Their results emphasized the complexity of this neurological recovery process.

Assinck et al. (2016) presented new experimental research models on spinal cord injuries in rats, comparing two of the most common approaches and offering valuable information for future studies.

Park et al. (2017) conducted a comprehensive review of clinical trials on stem cell therapy for spinal cord injuries. They highlighted promising advances in this area and the continued need to monitor and standardize clinical protocols.

Oh et al.'s (2018) comprehensive review addressed the clinical use of stem cells in

spinal cord injuries, highlighting the diversity of therapeutic approaches in development.

Maltman et al. (2011) carried out a review on the transplantation of progenitor/neural cells in spinal cord injuries, discussing challenges and perspectives of this approach.

Maltman et al. (2011) addressed stem cell transplantation in primates and humans, focusing on issues related to engraftment, homing and integration of stem cells.

Park et al. (2007) presented long-term results of treating spinal cord injuries with bone marrow-derived mesenchymal stem cells in humans. Their findings emphasized the importance of long-term assessment of therapeutic efficacy.

Parr et al. (2007) discussed the use of bone marrow-derived mesenchymal stromal cells in the treatment of central nervous system injuries, highlighting the promising application of these cells in translational research.

These studies have provided valuable insights into stem cell therapy in spinal cord injury surgery, emphasizing both efficacy and associated challenges, and highlighting the importance of continued multidisciplinary research to advance this ever-evolving field.

DISCUSSION

Stem cell therapy is emerging as a promising approach in the treatment of spinal cord injuries, and this integrative review addressed a number of studies that have contributed significantly to the current understanding of its effectiveness and associated challenges.

Recent advances in the treatment of spinal cord injuries, as discussed by Kwon et al. (2011), highlight the importance of continuous and innovative research in this area. Their contributions emphasize the need for approaches that promote neural tissue regeneration.

Nori et al (2017) shed light on plasticity

and regeneration in injured spinal cord after stem cell therapy. These findings highlight the promising ability of stem cells to promote nerve tissue repair and improve neurological function in patients with spinal cord injuries.

However, the complexity of neurological recovery processes after spinal cord injuries was emphasized by Kumamaru et al. (2018). His studies on the lasting reorganization of the corticospinal tract demonstrated that there is still much to be understood despite remarkable advances.

Assinck et al. (2016) addressed the choice of experimental models in spinal cord injuries in rats. Their review highlights the importance of standardized and validated models to ensure the consistency and reliability of future studies.

The review of clinical trials on stem cell therapy for spinal cord injuries by Park et al. (2017), revealed promising progress in the clinical application of stem cells. However, it also highlighted the continued need for research and standardization of clinical protocols.

Furthermore, the overview provided by Oh et al. (2018) on the clinical use of stem cells in spinal cord injuries highlights the diversity of therapeutic approaches in development. This diversity indicates the significant therapeutic potential of these therapies for patients with spinal cord injuries.

The reviews by Mothe et al. (2012) on the transplantation of progenitor/neural cells in spinal cord injuries and by Maltman et al. (2011) on stem cell transplantation in primates and humans complement this discussion, providing information on translational research and the integration of stem cells.

Furthermore, the long-term results of treating spinal cord injuries with bone marrow-derived mesenchymal stem cells in humans, as presented by Park et al. (2007), demonstrate the importance of long-term

assessment of therapeutic efficacy.

The discussion ends with the review by Parr et al. (2007) on the use of bone marrow-derived mesenchymal stromal cells in the treatment of central nervous system injuries, highlighting the promising application of these cells in translational research.

In summary, the studies reviewed in this integrative review have provided a comprehensive understanding of the field of stem cell therapy in spinal cord injuries. Despite notable progress, significant challenges remain, and continued research and interdisciplinary collaboration are crucial to advancing the treatment of spinal cord injuries. Successful clinical application of stem cell therapy requires a holistic approach, considering factors such as animal model choice, standardization of clinical protocols, and long-term monitoring. As we continue to advance this area, it is imperative that clinical and experimental research remain aligned, providing a solid foundation for future therapeutic advances.

FINAL CONSIDERATIONS

The integrative review conducted in this article provides a comprehensive overview of the use of stem cell therapy in spinal cord injury surgery, highlighting recent discoveries and significant challenges that permeate this constantly evolving field.

The effectiveness of stem cell therapies in promoting regeneration and functional recovery after spinal cord injuries was a central theme in this analysis. Studies, such as those by Kwon, Okon and Tetzlaff, Nori and Okano, and Park, Shim and Kim, have consistently demonstrated that stem cell therapy offers a promising treatment prospect, allowing for notable improvements in neurological

function and quality of life. patients' lives.

Another crucial aspect explored was neural plasticity and the ability of the spinal cord to regenerate after stem cell therapy, as illustrated by Kumamaru and Okano. This phenomenon is essential for long-term functional recovery and should be the target of future investigations.

The human clinical trials reviewed by Park, Lee, and Oh provide a valuable perspective on the clinical application of stem cell therapy. They highlight promising advances, but also underscore the continued need for monitoring, protocol standardization, and ethical considerations to ensure treatment safety and effectiveness.

It is important to mention that research in animal models, as discussed by Assinck and Tetzlaff, is critical to elucidating the mechanisms underlying the effectiveness of stem cell therapies and developing new therapeutic strategies. Likewise, the origin of the stem cells, whether from the bone marrow or other sources, as discussed by Maltman, Parr and Tator, can significantly influence the results and integration of the cells into the spinal cord tissue.

In summary, stem cell therapy in spinal cord injury surgery represents a promising and growing area in regenerative medicine. Although the results to date are encouraging, it is essential to recognize that there are still challenges to be overcome, such as optimizing therapeutic protocols, maximizing safety and ensuring long-term efficacy. Continued research, multidisciplinary collaboration, and adaptation to constantly evolving discoveries are critical to driving advancement in this field, which has the potential to substantially improve the quality of life for people with spinal cord injuries.

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