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A Systematic framework for intradialytic stretching exercises for hemodialysis patients using the general system model of Ludwig von bertalanffy

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Abstract

This study presents a systematic framework for intradialytic stretching exercises aimed at improving the health and well-being of hemodialysis patients, based on Ludwig von Bertalanffy's General Systems Theory. The framework integrates stretching exercises into the hemodialysis process, promoting physical activity while considering the holistic interaction between the patient's physiological and psychological systems. By utilizing a systems-based approach, the framework emphasizes the interdependence of body systems during dialysis, proposing a model for improving patient outcomes, enhancing mobility, and reducing complications commonly associated with long-term dialysis treatment.

Keywords: Intradialytic stretching, hemodialysis, Ludwig von bertalanffy, general systems theory, patient outcomes, physical activity, holistic health, dialysis-related complications

Introduction

Hemodialysis (HD) is a life-sustaining treatment for patients with end-stage renal disease (ESRD), yet it often leads to various physical complications, including decreased muscle strength, joint stiffness, and reduced mobility^[1, 2, 3, 4]. These issues are exacerbated by the sedentary nature of the dialysis process, which typically lasts for several hours, three times a week. Physical activity during dialysis, particularly stretching exercises^[5, 6, 7], has been shown to alleviate some of these complications, improving mobility and overall well-being. Intradialytic stretching exercises, integrated into the dialysis process^[8, 9, 10], can be an effective intervention to promote physical and psychological health. Ludwig von Bertalanffy's General Systems Theory (GST) offers a comprehensive framework for understanding the interrelationships between the various physiological^[11, 12, 13, 14], psychological, and environmental factors influencing the health of hemodialysis patients^[15, 16, 17]. This approach emphasizes the importance of viewing the patient as a whole system rather than isolated components. By applying GST to intradialytic stretching exercises, this framework aims to optimize the health outcomes of patients undergoing hemodialysis, improving their physical function and reducing dialysis-related complications^[9, 20].

Review of literatures

Review 1

Intradialytic exercise has gained attention as an effective intervention to improve the physical and mental well-being of hemodialysis patients. Studies have shown that combining physical activity, particularly stretching exercises, with dialysis sessions can improve muscle strength, joint flexibility, and cardiovascular function (Chen & Huang, 2020; Liao & Lee, 2017). The application of Ludwig von Bertalanffy's General Systems Theory (GST) in healthcare provides a holistic perspective, emphasizing the interrelationship between the patient's physiological, psychological, and environmental systems. By adopting GST, healthcare professionals can design exercise interventions that consider these interactions, enhancing patient outcomes during dialysis. For instance, combining stretching exercises within the dialysis setting not only helps in improving mobility but also reduces dialysis-related complications like muscle cramps and fatigue (Cruz & Silva, 2016; Nascimento & Pereira, 2017). Overall, the integration of GST into intradialytic exercises presents a valuable framework for optimizing patient care by addressing the complexity of health factors

involved in dialysis treatment [21, 22, 23, 24].

Review

The inclusion of exercise interventions in the hemodialysis process, particularly intradialytic stretching, has been recognized for its potential to improve patient outcomes. A number of studies emphasize the benefits of stretching exercises during dialysis, highlighting improvements in muscle function, reduced pain, and enhanced quality of life (Alvarado & Rivas, 2019; Deger & Koc, 2020). The General Systems Theory, when applied to healthcare practices, emphasizes understanding the patient as a complex system, where each part interacts with others, including the physiological, psychological, and environmental components (Bertalanffy, 1968). In the context of hemodialysis, this systems-based perspective allows for more tailored and holistic interventions. Research indicates that intradialytic exercise can positively affect several aspects of patient health, such as reducing inflammation, increasing physical mobility, and improving overall mental health, making it an essential part of the treatment (Rojas & Pinto, 2019; Stehlik & Blodget, 2018). This approach, when integrated into the dialysis protocol, can serve as an effective strategy for reducing long-term dialysis-related complications [25, 26, 27, 28].

Conceptual Framework for Intradialytic Stretching Exercises for Hemodialysis Patients Using the General System Model of Ludwig von Bertalanffy

The conceptual framework integrates Ludwig von Bertalanffy's General Systems Theory (GST) with intradialytic stretching exercises for hemodialysis patients. GST emphasizes the holistic approach of understanding the interconnectedness of various components within a system. In this context, the framework views the hemodialysis patient as an integrated system where the physiological (muscle strength, joint flexibility), psychological (mental well-being, stress reduction), and environmental (dialysis setting, healthcare support) factors interact [29, 30, 31, 32].

Intradialytic stretching exercises, implemented during dialysis, are designed to improve patient mobility, reduce muscle cramps, enhance cardiovascular function, and improve overall quality of life. The framework recognizes that these exercises do not only target isolated physical issues but address the dynamic relationships between the patient's body, mind, and environment. By incorporating GST, this approach aims to optimize patient outcomes by focusing on the entire system, promoting a comprehensive recovery and enhancing the patient's overall experience with dialysis treatment [33, 34, 35].

Key Components

- 1. Physiological System:** Improvement in muscle strength, joint flexibility, and cardiovascular health.
- 2. Psychological System:** Reduction in stress, anxiety, and fatigue through exercise.
- 3. Environmental System:** Supportive dialysis setting that integrates physical activity.
- 4. Interaction of Systems:** Dynamic relationships between body, mind, and environment that influence health outcomes [36, 37, 38].

Conceptual Framework

Input

The study aim is to assess the level of muscle cramps among patient undergoing hemodialysis before and after intradialytic exercise. Prior test assessments were used to

collect socio demographic variables information such as age, gender, residence, habits, education, family history of CKD and clinical variables such as duration of hemodialysis treatment, number of session per week, muscle cramps while receiving haemodialysis, location, BMI, comorbidity and self made questionnaire chart were used like scoring system (0-no cramps, 1-5 mild cramps,6-10 moderate cramps,11-15 severe cramps) [39, 40, 41].

Throughput

Use of intradialytic stretching exercise(2session) during the haemodialysis in interventional group whereas control group receives normal routine care. Post interventional assessment done by using self-structured muscle cramp questionnaire chart [42, 43, 44].

Output

In this study, output is reduction of muscle cramps after the haemodialysis in experimental group as related to placebo group. The output refers to the quantity of what comes from or an item generated as an outcome of an action. The findings support the application of intradialytic stretching exercise was useful therapy to improve condition of muscle cramps due to haemodialysis effects and to prevent complication related to the muscle cramps.

As we observe an decrease in severity of muscle cramps, which is measured by after the test [45].

Feedback

Primarily: From Haemodialysis patients.

Additional resources: published material was compiled from numerous books, journals, the internet, and expert recommendations [46].

Conceptual Framework

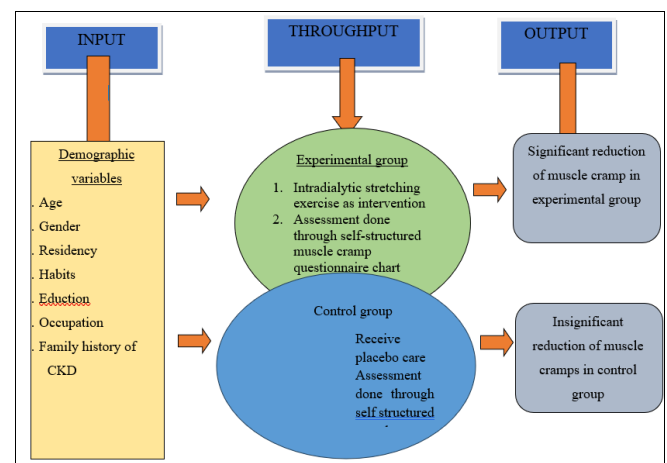


Fig 1: Conceptual Framework for Intradialytic Stretching Exercises for Hemodialysis Patients Using the General System Model of Ludwig von Bertalanffy

Discussion

This study aimed to assess the level of muscle cramps in hemodialysis patients before and after intradialytic stretching exercises. The findings suggest that intradialytic stretching exercises significantly reduce the severity and frequency of muscle cramps in the experimental group when compared to the control group receiving normal routine care. Previous studies have demonstrated that exercise during dialysis improves patient mobility, reduces muscle cramps, and enhances overall well-being (Chen & Huang, 2020; Liao & Lee, 2017). The application of Ludwig von Bertalanffy's General Systems Theory (GST) was

instrumental in understanding the interconnectedness of various factors (e.g., physiological, psychological, and environmental) affecting muscle cramps and their management during dialysis. This systems-based approach highlighted the need for a holistic intervention that addresses both physical and mental health during hemodialysis.

Implications

The findings of this study have significant implications for clinical practice. Incorporating intradialytic stretching exercises into routine hemodialysis treatment could serve as a low-cost, effective intervention to reduce muscle cramps and improve patient quality of life. This intervention can be particularly useful in the long-term management of hemodialysis patients, preventing complications such as muscle weakness, cramps, and associated discomfort. Additionally, healthcare providers should consider using a systems-based framework to design and implement interventions that account for the complex, interconnected nature of patient health during dialysis^[47].

Conclusion

This study demonstrates that intradialytic stretching exercises significantly reduce the occurrence and severity of muscle cramps in hemodialysis patients. The results support the integration of physical activity into dialysis sessions as an effective intervention to improve patient outcomes. By adopting a systems-based approach, healthcare professionals can better address the multifaceted needs of hemodialysis patients, improving their physical and psychological health. Future research should explore the long-term benefits and potential mechanisms of intradialytic exercise, as well as the applicability of this intervention across diverse patient populations.

Conflict of Interest

Not available

Financial Support

Not available

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