**PHYT 752 Module 5 Assignment**

**Part A**

**PICO: In pediatric patients with massive burn injuries, do patients who made an early return to pre-burn activities demonstrate higher long-term quality of life than those with delayed return to pre-burn activities?**

**Introduction**:

A massive burn is defined as affecting 70% or more of an individual’s total body surface area (TBSA).1 Massive burns result in many immediate and long term complications. Immediate complications include edema, hypermetabolism, intravascular volume deficits, immune deficiency, and cardiac and systemic shock.2,3,4 Excessive edema requires escharatomies and fasciotomies to reduce pressure and prevent compression and death of tissues.4 Hypermetabolism results in protein catabolism and loss of lean mass and muscle atrophy, as well as increased resting energy expenditure (REE).4,5,6 Massively burned individuals are at high risk for entering shock due the severity of their injuries, intravascular fluid imbalances, and exposure of tissues underlying the integument.4 Tissue exposure and weakened immune responses frequently result in infection.4 Inhalation injury further complicates prognosis; damage to the respiratory system and edema constricting the airway can result in death.4 Thinner skin, inability to tolerate physiologic stress, and greater fluid management difficulties make children with massive burns even more susceptible to these complications.5 The liklihood of death increases with the TBSA percentage, as do the severity of the inflammatory and hypermetabolic responses associated with burns.7 Medical advances in fluid resuscitation, surgical interventions, and critical care are increasing survival rates in children with massive burn injuries.5 Currently, most children with thermal injuries survive, regardless of age or burn size.7

The secondary effects of hypermetabolism associated with burn injuries include protein catabolism and loss of lean mass.2,6 Additional long term complications of thermal injury are contracture, hypertrophic scarring, disfiguration, negative psychological impact, functional impairment, and decreased quality of life.1,8,9,10 Intensive multidisciplinary burn care is utilized to address these issues; physical therapy is a vital component of the rehabilitation team.1,10

Increased survival rates have produced a need for evidence regarding this population.1,10 The number of impairments associated with massive burns is likely to impact quality of life and long-term functional outcomes. Physical therapy interventions facilitate the prevention and correction of these impairments, and successful rehabilitation should produce early return to pre-burn level of function. It is hoped that reduction of impairment allowing quick return to pre-burn functional status positively influences quality of life. The literature will be evaluated to address the question of whether early return to pre-burn activities produces greater quality of life than delayed return to pre-burn activites in children who have sustained massive burn injuries.

Assessment of interventions and long term outcomes in children with massive burn injuries is necessary to determine clinical implications and successful treatment approaches.1,10 Evidence evaluating the effectiveness of interventions with specific patient populations guides clinicians and facilitates optimal patient outcomes. This literature review aims to assess and synthesize current evidence to develop guidelines for best physical therapy practice concerning massive pediatric burns.

**Review of Literature:**

Current literature regarding quality of life in children with massive burn injuries is limited. Little evidence is also available concerning physical therapy interventions with this population or their long-term outcomes. However, a critique of existing data is presented below.

**Musculoskeletal Implications**

Three randomized, controlled trials (RCT’s) and one case-control study assessed the effects of 70% or greater TBSA burns on muscular function.2,6,11,12 These studies showed decreased lean mass and impaired muscle function in children with massive burn injuries.2,6,11,12 Hypermetabolic responses resulted in protein catabolism and subsequent muscle atrophy that lasted up to 9 months post injury.2,6,11,12 This was evidenced by burned children having lower body mass, peak torque, average power, and total work capacity than their non-burned peers.2,11,12 Outcome measures utilized in all four of these studies included Cybex or Biodex dynamometry, dual-energy radiograph absorptiometry (DEXA), and maximum aerobic capacity (VO2 max).2,6,11,12 The three RCT’s, performed by Suman et al, Przkora et al, and Al-Mousawi et al, assessed the effects of a 12 week resistance and aerobic exercise program on muscular function in this population.2,6,12 Results of the intervention were significantly increased lean body mass and muscle strength.2,6,12 Suman et al and Al-Mousawi et al also took metabolic cart measurements of REE, and determined that REE did not significantly increase with exercise.2,6 This suggested that exercise did not increase the hypermetabolic response, and was therefore a safe and effective intervention.2,6 The case-control study by Alloju et al took DEXA, dynamometry, and VO2 max measurements in children with massive burns six months post-burn injury and in age matched non-burned peers, and found significantly lower lean body mass, peak torque, and total work capacity in children with massive burns compared to their non-burned peers.11 This discrepancy between burned and non-burned children was documented by Suman et al, Przkora et al, and Al-Mousawi et al as well, despite the gains achieved in lean body mass and muscular strength with a 12 week exercise program.2,6,12 Przkora et al evaluated the use of oxandrolone, an orally administered anabolic agent, and determined that oxandrolone taken in conjunction with an exercise program produced greater gains in lean body mass and strength than exercise alone.12 Oxandrolone taken without participation in the exercise program also produced increased lean body mass and muscle strength and was suggested to be an effective intervention for children too young or medically unstable to complete rigorous exercise.12

Safety of an aerobic exercise intervention was not specifically addressed by Suman et al, Przkora et al, and Al-Mousawi et al, however, a case-control study by McEntire et al assessed thermoregulation during submaximal aerobic exercise in children with massive burn injuries compared with non-burned peers.13 Comparison of tympanic and skin temperatures determined that thermoregulation was not found to differ significantly between burned and non-burned children.13 These findings suggested that submaximal aerobic exercise does not compromise thermoregulation and can be performed safely by children with burns.13

Neugebauer performed a cohort study that utilized goniometry measurements to assess the effectiveness of a 12 week, group-based music and stretching program on range of motion.8 The results showed fewer losses and greater improvement of active and passive range of motion in the group receiving the intervention than the control group.8 The authors suggested a group-based music and stretching program was more effective than a individualized, home-based stretching program.8

**Psychosocial Implications**

Two cross-sectional studies assessed long-term outcomes in individuals who sustained massive burn injuries as children.1,10 Both studies utilized the Short Form 36 (SF-36) at least 2 years after injury or longer to evaluate long-term quality of life.1,10 Both found that SF-36 scores of these subjects did not differ significantly from non-burned, age matched peers.1,10 Comparable SF-36 scores between these groups suggested that normal quality of life was attained after sustaining a massive burn as a child.1,10 However, the study by Baker et al also performed psychological assessments, and administered the Quality of Life Questionnaire (QLQ).10 Psychological assessment of individuals burned as children found a high prevalence of psychiatric disorder, mainly defined as anxiety disorders.10 And the QLQ scores of burned individuals were significantly lower than their non-burned peers.10 The high rate of psychological disorder and lower quality of life reported on the QLQ contradicted the normalized SF-36 scores, and implied impairment in quality of life in burned individuals.10 Baker et al also evaluated long-term physical function with manual muscle testing, and mobility, stability, and activity of daily living assessments.10 Results did not find significant differences between burned and non-burned individuals in these areas.10 Baker et al concluded that independent mobility and self-care is typically achieved after a massive pediatric burn.10 Assessment of subjective and demographic information in the Sheridan et al study provided correlations between family support, consistent multidisciplinary care, and early return to pre-burn activity, and higher SF-36 scores.1 Sheridan et al concluded that these factors were positive prognostic indicators for better long term quality of life.1

**Limitations and Suggestions for Further Research**

The greatest limitation in research concerning massive pediatric burns is the low volume of available evidence. Further limitations and biases within the methodology of current literature reduce the validity and ability to integrate findings of these studies into clinical practice.

Common limitations seen in most of the available research included small sample sizes and significantly elevated numbers of males versus females, limiting the ability of the results to be generalizable to all pediatric patients with burn injuries.2,6,8,11,12,13 Subject dropout with such small sample populations reduced the ability of the results to adequately depict significant outcomes.2,6,13

The Suman et al, Przkora et al, and Al-Mousawi et al studies all had similar study designs and methodological flaws.2,6,12 There was little information provided on how their small sample populations were obtained or chosen, who provided the intervention, if there was blinding between the provider of the intervention and the tester obtaining outcome measure data, or the researcher responsible for the analysis of the data.2,6,12 No information was obtained concerning the activities of the subjects in the control groups, who may have been performing exercise on their own which could have compromised the results.2,6,12 No functional outcome measures were utilized, which limited the ability to apply the data to the psychosocial status, effect on activities of daily living, or quality of life in this population.2,6,12

Unique limitations were found with the McEntire et al and Neugebauer et al studies.8,13 Controversy concerning the use of tympanic temperature to represent core body temperature limited the validity and reliability of the core body temperature of the subjects in the McEntire et al study.13 The burn group wore compression garments during testing which also may have affected their temperature.13  And the Neugebauer et al study was compromised by such a large number of limitations and potential biases, that its results and conclusions cannot be considered clinically justifiable or sound.8 Examples include subject self-selection of participation in the intervention or control group, and subsequent uneven distribution between the groups, the use of goniometry performed by various raters as the only outcome measure, and the variability of the joints affected by burn injury which affected outcomes.8

The main limitation of the Sheridan et al and Baker et al studies was the absence of a burn-specific outcome measure to evaluate health related quality of life issues unique to populations who have sustained burn injuries.1,10 The lack of an evaluative tool to assess the impact of issues such as physical appearance, itch, or other burn specific issues may not appropriately reflect the overall long-term quality of life outcomes in this population.1,10 In addition, little information was available on the social or environmental factors that affected the subjects between the initial date of injury and the administration of the outcome measures.1,10

Future studies should consider randomized, controlled trial design, with blinding of assessors to reduce bias. Larger, more evenly distributed sample populations should be utilized to ensure significance of results and the ability to attribute findings to a wider demographic population. Detailed methodology of subject acquisition, intervention provision, and assessment should be included in future literature. Studies assessing quality of life would benefit from incorporating a burn specific quality of life measure and social and environmental data between discharge from inpatient rehabilitation and long-term assessment of outcomes.

**Clinical Implications and Application to PICO**

The hypermetabolic state produced by physiologic responses to massive burn injuries causes protein catabolism and loss of lean body mass.4,5,6 This deterioration of muscular tissue results in decreased muscular strength and endurance.2,6,11,12 Poor strength and endurance, as well as contracture resulting in limited range of motion, have the potential to impair physical performance and function and reduce the child’s ability to participate in self-care and activities of daily living. A subsequent reduction in functional independence and inability to perform tasks and activities the child had been capable of prior to sustaining the injury are likely to diminish the child’s psychological wellbeing and result in decreased quality of life.1,10 Resistance and aerobic exercise programs, as well as the use of oxandrolone, have been proven effective methods to increase lean body mass and muscular strength in children with massive burns.2,6,11,12 Studies have determined that these interventions are safely performed without increasing the hypermetabolic response or compromising thermoregulation in burned children.6,13 Integration of group-based music programs during stretching interventions may produce greater prevention of losses and higher gains in active and passive range of motion.8 Greater range of motion is associated with lower levels of impairment and better functional outcomes in burn survivors.8,1,10 Greater range of motion would therefore also be a positive component in the obtainment of higher quality of life in children with massive burns. Sheridan et al found positive correlations between the early returns to pre-burn activities and higher long-term quality of life.1 These findings suggest that effective interventions should focus on regaining muscular strength and endurance and range of motion in order to assist the child to return to prior level of function as soon after injury as possible.2,6,8,11,12 Literature suggests effective interventions to address these areas of impairment include the administration of oxandrolone and resistance and aerobic exercise programs to rebuild lean body mass, muscle strength and endurance, as well as group-based music and stretching programs to maintain range of motion. 2,6,8,11,12 Pre-burn activities such as ambulation, transfers, and activities of daily living should be incorporated early in rehabilitation to prevent further impairment and facilitate maintenance and improvement of muscle function and range of motion.1 Early inclusion of pre-burn activities in physical therapy interventions is also correlated with better long-term quality of life.1

Education should be provided to the patient and their family concerning the benefits and positive impact on long-term quality of life of the presence of a supportive family environment and consistent follow up with a multidisciplinary burn team.1 These components should be encouraged throughout the child’s rehabilitation.1 The long-term psychological consequences of massive childhood burn injuries commonly present as anxiety disorders which may reduce quality of life.10 Early provision of psychological care is necessary for prevention and management of these conditions, in order to promote better long-term psychosocial outcomes and life satisfaction.10 The psychological implications of burn injuries should be discussed with patients and their families, and obtainment of mental health care for children who have sustained massive burns should be encouraged and facilitated.10

The data gained by this literature review can be utilized to construct an educational intervention for pediatric burn patients and their families. An educational tool outlining common presentations and impairments associated with burn injuries, as well as benefits of physical therapy intervention for reduction of these impairments may promote participation and optimal rehabilitative outcomes.

**Conclusions:**

A child’s body is severely physiologically affected after sustaining a massive burn injury.4 Effective treatment of resulting impairments, and reduction and prevention of further loss of physical function requires the provision of immediate holistic care.3,4 Multidisciplinary treatment includes early medical management and surgical intervention, as well as physical and occupational therapy.3,4 The stressful and psychologically challenging nature of burn injuries necessitates psychological care and family support to improve positive psychosocial outcomes.1,10 Frequent, regular follow up with a multidisciplinary burn team may also improve quality of life and optimal long-term outcomes.1 Administration of oxandralone should be considered and discussed with the multidisciplinary team, especially for children too young or medically fragile to participate in rigorous physical activity.12 Physical therapy interventions should focus on resistance strengthening exercise to rebuild lean muscle mass, strength, and endurance, as well as aerobic exercise to rebuild cardiovascular endurance.2,6,11,12 Stretching to prevent contracture and maintain active and passive range of motion also needs to be performed, and may be aided by group-based music programs.8 These recommended interventions will facilitate early return to pre-burn activities, such as transfers, ambulation, and activities of daily living. The integration of pre-burn activities early in rehabilitation promotes greater long-term quality of life for children with massive burn injuries.1

There is an eminent need for a greater volume of methodologically sound literature concerning long-term outcomes in children who have sustained massive burns. Evidence regarding the quality of life of this population will provide insight to the factors responsible for optimal outcomes, and guide future medical management of this patient population. Research supporting effective interventions and their correlation to early return to pre-burn function is needed to guide clinical decision making and best physical therapy practice.

**References:**

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