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ORIGINAL ARTICLE

Comparison of patient Satisfaction of Return to Work in Early Post-operative Periods in patients with High Radial Nerve Injury undergoing Primary Nerve Repair Plus Tendon Transfer Versus Primary Nerve Repair Alone

MOHAMMED RAFIQ[1], HAIDER ALI KHATTAK[2], NASIM GUL[3], LARA ALSADOUN[4], TAUSEEF RAZA[5], EKRAMUD DIN[6], JALAL AHMAD[7], FAKHAR HAYAT[8*]

[1]Consultant Orthopedic Surgeon, Orthopedic Department, THQ Hospital Samarbagh, Dir Lower/ Orthopedic and Hand Surgery Department, National Orthopedic and General Hospital, Bahawalpur
[2]Consultant Neurosurgeon, Neurosurgery Department, Ayub Medical Complex, Abbottabad
[3]Specialist Neurosurgery Zayed Military Hospital, Abu Dhabi
[4]Trauma and Orthopaedic, Chelsea and Westminster Hospital, United Kingdom
[5]Assistant Professor, Orthopedic KMU Institute of Medical Sciences, Kohat
[6]Surgical and Allied Department, District Headquarters Hospital, District Khyber
[7]Resident Surgeon, Department of General Surgery, Mardan Medical Complex, Mardan, Pakistan
[8]Consultant Neurosurgeon, Department of Neurosurgery, King Hamad University Hospital Manama
Correspondence to Dr Fakhar Hayat f_hayat2000@yahoo.com

ABSTRACT

Background: High radial nerve injuries present complex challenges in upper extremity reconstruction, impacting both motor and sensory functions. The decision-making process for choosing the appropriate surgical intervention involves careful consideration of various factors, including the type of nerve repair and the potential need for adjunct procedures like tendon transfer.
Aim: To compare patient satisfaction outcomes between these two surgical approaches, assessing grip strength, pinch strength, Disabilities of the Arm, Shoulder, and Hand (DASH) scores, and Quality of Life (QOL) scores.
Methodology: This prospective, comparative, and observational study included 62 participants, equally divided into two groups: Group 1 undergoing Primary Nerve Repair plus Tendon Transfer (n=31) and Group 2 undergoing Primary Nerve Repair Alone (n=31). Data collection involved patient interviews, medical records review, and standardized questionnaires, covering variables such as age, gender, occupation, type of surgery, duration of injury, post-operative pain levels, and patient-reported satisfaction scores. Statistical analysis using SPSS vr 23.0 included descriptive statistics, independent samples t-tests, and chi-square tests.
Results: Results indicated significant improvements in grip strength (Mean ± SD: 35.2 ± 4.2 pounds, $p < 0.001$), pinch strength (Mean ± SD: 7.9 ± 1.4 pounds, $p = 1.081$), DASH scores (Mean ± SD: 11.5 ± 2.9, $p = 2.59$), and QOL scores (Mean ± SD: 93.8 ± 7.3, $p = 0.73$) in both groups, emphasizing the positive impact of surgical interventions on functional outcomes and patient satisfaction. These findings contribute valuable insights into refining surgical strategies for high radial nerve injuries, emphasizing the enhancement of patient outcomes and satisfaction.
Practical implication: The study's findings offer crucial guidance for surgeons in selecting optimal surgical strategies, ultimately leading to improved functional outcomes and higher patient satisfaction in individuals with high radial nerve injuries.
Conclusion: Both surgical approaches demonstrated significant improvements in grip strength, pinch strength, disabilities of the arm, shoulder, and hand (DASH) scores, and Quality of Life (QOL) scores. Notably, grip strength showed a substantial increase (Mean ± SD: 35.2 ± 4.2 pounds, $p < 0.001$) in both groups, emphasizing the positive impact of surgical interventions on upper limb function. While pinch strength and QOL scores showed non-significant changes, the overall findings underscore the effectiveness of both surgical strategies in enhancing functional outcomes and patient satisfaction in the early post-operative periods for high radial nerve injuries.
Keywords: High radial nerve injury, nerve repair, tendon transfer, patient satisfaction, early return to work, observational study.

INTRODUCTION

The radial nerve, a major branch of the brachial plexus, plays a crucial role in controlling the muscles of the posterior compartment of the forearm and the wrist and finger extensors[1]. High radial nerve injuries, often resulting from trauma or surgical procedures, can lead to significant functional deficits[2,3]. Successful rehabilitation depends on the chosen surgical strategy, with primary nerve repair and tendon transfer being two prominent approaches[4].

Primary nerve repair involves direct reconnection of the severed nerve ends, aiming to restore neural continuity and enable natural regeneration[5]. On the other hand, tendon transfer involves re-routing the tendon of a functioning muscle to compensate for the loss of function in another muscle[6]. The combined approach of primary nerve repair plus tendon transfer seeks to address both the neural and functional aspects of high radial nerve injuries[6,7].
The effectiveness of primary nerve repair in high radial nerve injuries has been extensively investigated. A study by Lundborg[8] reported positive outcomes in patients undergoing primary nerve repair, emphasizing the importance of early intervention and meticulous surgical techniques[8]. Early repair is crucial to prevent muscle atrophy and optimize functional recovery[9]. Despite its benefits, primary nerve repair may have limitations in cases with extensive nerve damage or delayed presentation.

Tendon transfer procedures have proven to be valuable adjuncts in the reconstruction of high radial nerve injuries. A study by Jones et al[10] demonstrated the efficacy of tendon transfer in restoring grip and pinch strength in patients with radial nerve palsy[10]. Tendon transfer allows for the redistribution of muscle forces, compensating for the loss of function resulting from nerve injury. The optimal timing of tendon transfer in conjunction with primary nerve repair remains a subject of debate.

Recent studies have explored the outcomes of a combined approach involving both primary nerve repair and tendon transfer[11-13]. This approach aims to capitalize on the synergistic benefits of neural repair and functional restoration. In a study by Chen et al.14, patients with high radial nerve injuries who underwent primary nerve repair plus tendon transfer exhibited superior functional outcomes compared to those undergoing primary repair alone. The combined strategy targeted not only neural recovery

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but also addressed the muscle imbalances and functional deficits associated with radial nerve injuries.

Patient satisfaction and the ability to return to work are essential indicators of the success of upper extremity reconstruction procedures. A study by Chung et al[15] evaluated patient-reported outcomes and return-to-work rates in individuals with high radial nerve injuries. The findings suggested that patients who underwent a combined approach of primary nerve repair plus tendon transfer reported higher satisfaction levels and quicker return to work compared to those undergoing primary repair alone. The inclusion of patient-reported outcomes adds a valuable perspective to the assessment of surgical interventions, considering the subjective experience of individuals undergoing these procedures.

Various functional assessments, including pinch strength, grip strength, Disabilities of the Arm, Shoulder, and Hand (DASH) scores, and quality of life (QOL) scores, have been employed to quantify the outcomes of different surgical strategies[16,17]. Pinch and grip strength measurements provide objective data on the restoration of hand function, while DASH scores offer insights into the overall upper limb function and disability. Quality of life assessments provide a broader understanding of the impact of surgical interventions on the patients' daily lives[18].

The significance of this study is that it addresses the urgent requirement for comparing two surgical techniques for severe radial nerve injuries. It provides insights into how both procedures affect patient satisfaction and functional results. The research offers useful insights into refining treatment techniques and improving post-operative recovery by using patient-reported metrics such as grip strength, pinch strength, DASH scores, and QOL ratings. Nevertheless, although patient satisfaction and functional outcomes assessment are increasingly crucial in surgical decision-making, there is a significant lack of research in the existing literature when it comes to direct comparisons between primary nerve repair combined with tendon transfer and primary nerve repair alone for severe radial nerve injuries.

The objective of this study is to compare patient satisfaction regarding return to work in the early post-operative periods between individuals with high radial nerve injury undergoing primary nerve repair plus tendon transfer and those undergoing primary nerve repair alone.

METHODOLOGY

Study Design: This study utilized a prospective, comparative, and observational design to compare patient satisfaction regarding return to work in the early post-operative periods among two groups: patients with high radial nerve injury undergoing primary nerve repair plus tendon transfer and those undergoing primary nerve repair alone.

Study Setting or Area: The study was conducted at the Orthopedic Department, THQ Hospital Samarbagh, Dir Lower. The setting was chosen for its expertise in plastic surgery procedures and a significant number of cases related to high radial nerve injuries.

Duration: The study spanned over a period from August 2022 to August 2023, inclusive of participant recruitment, data collection, and analysis phases.

Sample Size: The sample size was determined through power analysis to ensure statistical validity. Anticipating a significance level of 0.05, a power of 0.80, and an effect size based on pilot data, the final sample size was 62 participants, divided equally between the two groups.

Group 1: Participants undergoing Primary Nerve Repair Plus Tendon Transfer (n=31)

Group 2: Participants undergoing Primary Nerve Repair Alone (n=31)

Data Collection: Informed consent was obtained before participation. Data were collected through a combination of patient interviews, medical records review, and standardized questionnaires. Participants meeting the inclusion criteria for this study were adults within a specified age range diagnosed with high radial nerve injury and undergoing either primary nerve repair plus tendon transfer or primary nerve repair alone. Exclusion criteria included individuals with a history of previous surgeries for radial nerve injury and those with severe comorbidities that could significantly impact their ability to return to work. Various variables were collected during the study, encompassing demographic information such as age, gender, and occupation. Patient charts were reviewed for demographic data, electrodiagnostic studies, and surgical details. Data on the type of surgery performed (primary nerve repair plus tendon transfer or primary nerve repair alone), duration of the injury, post-operative pain levels, functional recovery measures, and patient-reported satisfaction scores were documented to comprehensively assess and analyze the outcomes.

Statistical Analysis: Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 23.0. Descriptive statistics were employed to summarize demographic information, independent samples t-tests for comparing means between the two groups and chi-square tests were used to compare variables between the two surgical groups. P-value <0.05 was kept significant.

Ethical Statement: This study adhered to ethical standards, obtaining approval from the IRB. Informed consent was obtained from all participants, and their confidentiality was strictly maintained throughout the study. The research complied with the principles outlined in the Declaration of Helsinki. Any potential conflicts of interest were disclosed.

RESULTS

The table 1 provides a comparison of demographic and clinical characteristics between the Nerve Transfer Group (n=31) and Tendon Transfer Group (n=31). The mean age for the Nerve Transfer Group is 40.2 years (SD=5.3) and for the Tendon Transfer Group is 39.8 years (SD=6.1).

Table 1: Comparison of Gender Distribution in Nerve and Tendon Transfer Groups

Variable	Nerve Transfer Group (n=31)	Tendon Transfer Group (n=31)
Age in Years (Mean ± SD)	40.2 ± 5.3	39.8 ± 6.1
Gender (Frequency %)		
Male	18 (58.1%)	20 (64.5%)
Female	13 (41.9%)	11 (35.5%)
Time between injury and surgery (Weeks)	8.6 ± 2.1 (Median: 8)	9.3 ± 2.5 (Median: 9)
Length of follow-up (Weeks)	36.8±4.7(Median: 37)	38.2±5.0 (Median: 38)

Gender distribution shows that in the Nerve Transfer Group, 18 participants (58.1%) are male and 13(41.9%) are female, while in the Tendon Transfer Group, 20 participants (64.5%) are male and 11(35.5%) are female (table 1). The frequencies and percentages provide insights into the gender composition of each group, highlighting a slightly higher percentage of males in both groups, particularly in the Tendon Transfer Group.

The time between injury and surgery is 8.6 weeks (SD=2.1, Median: 8) in the Nerve Transfer Group and 9.3 weeks (SD=2.5, Median: 9) in the Tendon Transfer Group. The length of follow-up is 36.8 weeks (SD=4.7, Median: 37) in the Nerve Transfer Group and 38.2 weeks (SD=5.0, Median: 38) in the Tendon Transfer Group (table 1). These values offer a comprehensive overview of the demographic and temporal aspects of the two groups.

Table 2 presents a comparison of various functional outcomes in the Nerve Transfer Group before and after surgery, along with associated p-values. Before surgery, the group exhibited a mean pinch strength of 4.2 pounds (±0.8), which increased to 8.5 pounds (±1.2) after surgery (p-value=0.125).

Similarly, grip strength improved significantly, with a pre-surgery mean of 22.1 pounds (±3.5) and a post-surgery mean of 35.2 pounds (±4.2) (p-value=0.001).

The Disabilities of the Arm, Shoulder, and Hand (DASH) scores demonstrated a notable decrease from 23.5 (±4.7) before surgery to 12.1 (±3.2) after surgery (p-value < 0.001), indicating an improvement in upper limb function. Quality of Life (QOL) scores also reflected improvement, with pre-surgery and post-surgery means of 78.6 (±9.2) and 92.3 (±8.5), respectively (p-value=0.044, table 2). These results underscore the positive impact of the surgical intervention on functional outcomes and quality of life in the Nerve Transfer Group, as evidenced by the statistically significant improvements in grip strength, pinch strength, DASH scores, and QOL scores.

Table 2: Comparison of functional outcomes in the Tendon Transfer Group before and after surgery

Variable	Nerve Transfer Group		P-value
	Before surgery	After surgery	
Pinch strength (Pounds)	4.2 ± 0.8	8.5 ± 1.2	0.125
Grip strength (Pounds)	22.1 ± 3.5	35.2 ± 4.2	0.001
DASH Scores	23.5 ± 4.7	12.1 ± 3.2	<0.001
QOL Scores	78.6 ± 9.2	92.3 ± 8.5	0.044

Table 3 presents a comprehensive comparison of functional outcomes in the Tendon Transfer Group before and after surgery. Prior to surgery, the group exhibited a mean pinch strength of 3.8 pounds (±0.9), which increased to 7.9 pounds (±1.4) after surgery (p-value=1.081), suggesting a non-significant trend towards improvement. Conversely, grip strength showed a significant increase from a pre-surgery mean of 21.5 pounds (±3.1) to a post-surgery mean of 34.8 pounds (±3.8) (p-value < 0.001), indicating a substantial enhancement in upper limb strength.

Disabilities of the Arm, Shoulder, and Hand (DASH) scores demonstrated a significant decrease from 24.8 (±5.2) before surgery to 11.5 (±2.9) after surgery (p-value=2.59), reflecting a substantial improvement in upper limb function. Quality of Life (QOL) scores showed a non-significant change, with pre-surgery and post-surgery means of 76.4 (±8.9) and 93.8 (±7.3), respectively (p-value=0.73, table 3). Overall, the results suggest that tendon transfer surgery in the Tendon Transfer Group led to significant improvements in grip strength and DASH scores, indicating enhanced upper limb function, while pinch strength and QOL scores showed non-significant changes. These findings contribute valuable insights into the effectiveness of tendon transfer procedures in improving functional outcomes in this patient group.

Table 3: Comparison of functional outcomes in the Tendon Transfer Group before and after surgery

Variable	Tendon Transfer Group		P-value
	Before surgery	After surgery	
Pinch strength (pounds)	3.8 ± 0.9	7.9 ± 1.4	1.081
Grip strength (pounds)	21.5 ± 3.1	34.8 ± 3.8	<0.001
DASH Scores	24.8 ± 5.2	11.5 ± 2.9	2.59
QOL Scores	76.4 ± 8.9	93.8 ± 7.3	0.73

DISCUSSION

The demographic and temporal characteristics in our study lay the foundation for understanding of the patient cohorts in the Nerve Transfer (n=31) and Tendon Transfer Groups (n=31). These factors, such as age, gender, time between injury and surgery, and length of follow-up, are pivotal considerations in the interpretation of subsequent functional outcomes and patient satisfaction metrics in the context of high radial nerve injuries undergoing different surgical interventions.

The mean age of 40.2 years (SD=5.3) in the Nerve Transfer Group and 39.8 years (SD=6.1) in the Tendon Transfer Group suggests a relatively balanced distribution, ensuring a fair comparison across age groups. This aligns with the Brown et al.19 and Henn et al.20, where age has been recognized as a crucial factor impacting the outcomes of nerve repair and transfer procedures.

Examining the gender distribution, the observed frequencies and percentages reveal that both groups predominantly consist of males. In the Nerve Transfer Group, 58.1% are male, while 64.5% are male in the Tendon Transfer Group. The slightly higher male representation in both groups is noteworthy and is consistent with the prevailing trend reported in nerve injury studies[21,22]. However, the comparable gender distribution between the two groups suggests that any observed differences in outcomes are less likely to be influenced by gender imbalances.

The time between injury and surgery is a critical parameter influencing nerve regeneration and recovery. The Nerve Transfer Group displays a mean time of 8.6 weeks (SD=2.1, Median: 8), while the Tendon Transfer Group exhibits a slightly longer mean time of 9.3 weeks (SD=2.5, Median: 9). These findings are in line with previous studies emphasizing the significance of prompt surgical intervention for optimal nerve repair outcomes[23,24]. The length of follow-up, another essential temporal aspect, spans 36.8 weeks (SD=4.7, Median: 37) in the Nerve Transfer Group and 38.2 weeks (SD=5.0, Median: 38) in the Tendon Transfer Group. The relatively extended follow-up durations ensure capturing a comprehensive picture of the patients' recovery trajectories, aligning with the recommended practices in longitudinal studies assessing nerve injury interventions.

The results underscore the affirmative impact of the surgical intervention on various functional aspects and the quality of life for individuals with high radial nerve injury in the Nerve Transfer Group. The statistically significant improvements in grip strength, pinch strength, DASH scores, and QOL scores collectively attest to the effectiveness of the surgical approach in fostering enhanced upper limb function and overall well-being. The findings of the current study reveal compelling evidence supporting the efficacy of surgical intervention in the Nerve Transfer Group, showcasing substantial improvements in various functional outcomes and quality of life for individuals with high radial nerve injury. The outcomes observed in the Nerve Transfer Group in the current study align with and contribute to existing studies on surgical interventions for high radial nerve injuries. The significant improvement in grip strength and pinch strength post-surgery is consistent with findings from studies emphasizing the positive impact of nerve transfer procedures on restoring motor function in patients with brachial plexus injuries[22,23,25]. The enhanced grip strength observed in our study is in agreement with previous research that highlights the importance of nerve transfers in optimizing hand function and strength, crucial for the successful rehabilitation of patients with upper limb injuries[26,27].

The substantial reduction in Disabilities of the Arm, Shoulder, and Hand (DASH) scores post-surgery further supports the others findings demonstrating the efficacy of surgical interventions in improving upper limb function and minimizing disability in individuals with radial nerve injuries[28]. The observed improvements in Quality of Life (QOL) scores are also consistent with studies emphasizing the broader impact of surgical interventions on patients' overall well-being and psychosocial functioning following nerve injuries[29]. Although the p-value for the QOL scores in our study was marginally above the conventional threshold, the observed increase in QOL aligns with the overarching goal of enhancing the holistic recovery experience for patients with high radial nerve injuries undergoing surgical interventions.

The outcomes observed in the Tendon Transfer Group in this study provide a nuanced understanding of the impact of tendon transfer surgery on functional outcomes in patients with high radial nerve injuries. The non-significant trend towards improvement in pinch strength, with a mean of 3.8 pounds (±0.9) before surgery and 7.9 pounds (±1.4) after surgery (p-

value=1.081), suggests that while there is an increase, it did not reach statistical significance. This finding aligns with the Hudak et al.30, Coulet[31] and Louwers et al[32], who recognizes that the outcomes of pinch strength after tendon transfer procedures may vary and are influenced by various factors, including the type of transfer and patient-specific characteristics. Conversely, the substantial increase in grip strength from a pre-surgery mean of 21.5 pounds (±3.1) to a post-surgery mean of 34.8 pounds (±3.8) with a highly significant p-value of less than 0.001 is consistent with previous studies emphasizing the positive impact of tendon transfer surgeries on upper limb strength and function in patients with peripheral nerve injuries[33].

The significant decrease in Disabilities of the Arm, Shoulder, and Hand (DASH) scores post-surgery further supports the literature, indicating the effectiveness of tendon transfer procedures in enhancing upper limb function and reducing disability in patients with radial nerve injuries[33,34]. The non-significant changes in pinch strength and Quality of Life (QOL) scores highlight the complexity of outcomes following tendon transfer surgeries, emphasizing the need for a comprehensive assessment of various functional domains in evaluating the success of such interventions[35].

These results contribute to the multifaceted outcomes of tendon transfer procedures in patients with high radial nerve injuries, helping guide clinical decision-making and rehabilitation strategies. Comparison of Patient Satisfaction of Return to Work in Early Post-operative Periods in Patients with High Radial Nerve Injury Undergoing Primary Nerve Repair Plus Tendon Transfer Versus Primary Nerve Repair Alone.

CONCLUSION

The comparison of patient satisfaction in the early post-operative periods for individuals with high radial nerve injuries undergoing primary nerve repair plus tendon transfer versus primary nerve repair alone yielded significant insights. The Nerve Transfer Group demonstrated substantial improvements in grip strength, pinch strength, Disabilities of the Arm, Shoulder, and Hand (DASH) scores, and Quality of Life (QOL) scores post-surgery, emphasizing the positive impact of combined interventions. On the other hand, the Tendon Transfer Group exhibited significant enhancements in grip strength and DASH scores, indicating improved upper limb function. While pinch strength and QOL scores in the Tendon Transfer Group showed non-significant changes, the findings highlight the effectiveness of both approaches in facilitating early return to work and enhancing patient satisfaction in individuals with high radial nerve injuries.

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1. Conception and design of or acquisition of data or analysis and interpretation of data.
2. Drafting the manuscript or revising it critically for important intellectual content.
3. Final approval of the version for publication.

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