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Original Research Article

Evaluation of radial nerve palsy treatment: tendon transfer with the flexor carpi radialis combination

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ABSTRACT

Introduction: Radial nerve palsy, a common peripheral nerve injury, significantly impacts the quality of life of affected individuals. The standard treatment is tendon transfer, but the optimal choice of tendon transfers remains a subject of ongoing debate. This study aimed to evaluate the treatment of radial nerve palsy through tendon transfer with the flexor carpi radialis combination in a Bangladeshi population.
Methods: This observational study was conducted over 18 weeks at the Department of Orthopedic Surgery of 3 medical college hospitals in Bangladesh. Forty adult patients with radial nerve palsy were selected based on specific inclusion criteria. Participants were evaluated preoperatively and postoperatively using the Disabilities of the Arm, Shoulder, and Hand (DASH) score. Complications were also recorded.
Results: The majority of participants were male (77.5%) and had right-sided injuries (72.5%). The most common cause of injury was humerus shaft injury (55.0%). The most common site of injury was middle third of the humerus shaft (67.50%). Postoperatively, 85.0% achieved an "Excellent" grade. Complications were minimal, with 90% of participants experiencing no complications.
Conclusions: Tendon transfer with the flexor carpi radialis combination appears to be an effective treatment for radial nerve palsy, with significant improvements in DASH scores postoperatively and minimal complications. Further research is needed to confirm these findings and compare the effectiveness of this treatment with other tendon transfer combinations.

Keywords: Tendon transfer, Flexor carpi radialis, Radial nerve palsy

INTRODUCTION

Radial nerve palsy, a condition characterized by the loss of radial nerve function, is a significant health concern that affects the quality of life of individuals worldwide. The radial nerve, a major peripheral nerve of the upper limb, plays a crucial role in extending the wrist and fingers.[1] Its impairment can lead to debilitating consequences, including a significant weakening of grip strength and substantial challenges to the affected individual's daily life and occupational activities.[2,3] The global incidence of radial nerve palsy is not well-documented, but it is known to be a common peripheral nerve injury, often resulting from fractures, penetrating injuries, or prolonged pressure on the nerve.[4,5] Certain conditions such as COVID-19 have also been associated with nerve dysfunctions, including ulnar nerve palsy, which may have implications for radial nerve palsy.[6-8] Furthermore, certain chronic inflammatory

diseases like rheumatoid arthritis can lead to extra-articular manifestations, potentially affecting peripheral nerves.[9] The impact of radial nerve palsy on daily life can be profound. The loss of motor function can lead to difficulties in performing everyday tasks, such as gripping objects or writing. In severe cases, the condition can lead to disability.[3] Moreover, complications such as chronic pain can significantly affect the quality of life of individuals with radial nerve palsy.[3,10] The standard treatment for radial nerve palsy is tendon transfer, a surgical procedure that restores function by rerouting tendons from their original attachments to new locations. However, the optimal choice of tendon transfers for radial nerve palsy remains a subject of ongoing debate among surgeons.[2] Various combinations of tendon transfers have been proposed, each with its own set of merits and demerits.[5] One of the most preferred combinations is the triple tendon transfer using flexor carpi radialis (FCR), pronator teres, and palmaris longus.[11] This combination, also known as the Brand transfer, has been widely used and has shown satisfactory results in a majority of patients.[11] However, recent studies have explored alternative approaches to tendon transfer. For instance, a study conducted by Sharma et al evaluated the results of a split flexor carpi ulnaris (FCU) as a single transfer in patients with persistent radial nerve palsy.[12] Their findings suggested that a single transfer using split FCU could be a preferred alternative in patients with low radial nerve palsy, and could also be considered for high radial nerve palsy patients in whom multiple donors are absent due to the nature of the injury.[12] In addition to the choice of tendon transfers, the method of surgery is also a critical factor. Abdullah et al described a surgical technique of triple tendon transfer with wide awake local anesthesia no tourniquet (WALANT).[13] This technique allows surgeons to judge the appropriate amount of transfer tension by observing awake patients actively extend their fingers, thumb, and wrist during the surgery. Despite these advancements, there is a need for further research to establish the most effective treatment for radial nerve palsy. This article aims to evaluate the treatment of radial nerve palsy through tendon transfer with the flexor carpi radialis combination in a Bangladeshi population.

METHODS

This prospective observational study was conducted with a combined sample size from the Department of Orthopedic Surgery, M Abdur Rahman Medical College Hospital, Dinajpur, Khagrachari District Sadar Hospital, and Moulvibazar 250 bed District Sadar Hospital in Bangladesh, over a period of 18 weeks. A total of 40 adult patients with radial nerve palsy were selected for the study based on the following inclusion criteria: age between 18-60 years, time between injury to admission less than 3 weeks, closed radial nerve palsy, and patient consent. Patients with neurovascular injury, pathological conditions other than radial nerve palsy, inability to answer the criteria question, and those affected by other chronic diseases were excluded from the study. The selected patients were treated with tendon transfer using the flexor carpi radialis combination. Both qualitative and quantitative data were collected using a structured questionnaire designed for the study. The outcome of the treatment was measured using the Disabilities of the Arm, Shoulder and Hand (DASH) score, which is a 30-item, self-report questionnaire designed to measure physical function and symptoms in people with any of several musculoskeletal disorders of the upper limb.[14] DASH scores range from 0 to 100 and provide an assessment of upper-extremity disability. A score of 61-100 indicates a poor outcome, 41-60 represents a fair outcome, 21-40 signifies a good outcome, and 0-20 reflects an excellent outcome. Informed written consent was obtained from all participants, and ethical approval was obtained from the ethical review committee of the study hospital. Data analysis was performed using manual formulas and SPSS software.

RESULTS

In (Table 1), we present the distribution of participants by their baseline characteristics. The sample size for this analysis is 40 individuals. Regarding the age of the participants, we observed a varied distribution across different age groups. The majority of participants fell within the age range of 30-39, accounting for 15 individuals or 37.50% of the sample. The second-largest age group was 40-49, comprising 11 participants, or 27.50% of the total.

Table 1: Distribution of the participants by baseline characteristics (n=40)

Characteristics	N	%
Age (in years)		
20-29	7	17.50
30-39	15	37.50
40-49	11	27.50
50-59	5	12.50
60+	2	5.00
Gender		
Male	31	77.50
Female	9	22.50
Side of injury		
Right	29	72.50
Left	11	27.50

A smaller proportion of participants belonged to the age groups of 20-29 (7 individuals, 17.50%), 50-59 (5 individuals, 12.50%), and those aged 60 and above (2 individuals, 5.00%). Analyzing the gender distribution, we found that the majority of participants were male, accounting for 31 individuals or 77.50% of the sample. On the other hand, the female participants constituted a smaller proportion, with 9 individuals representing 22.50% of the total. Examining the side of injury, we observed that the majority of participants experienced the injury on the right side, with 29 individuals accounting for 72.50% of the sample. The left side of injury was less

prevalent, with 11 participants representing 27.50% of the total.

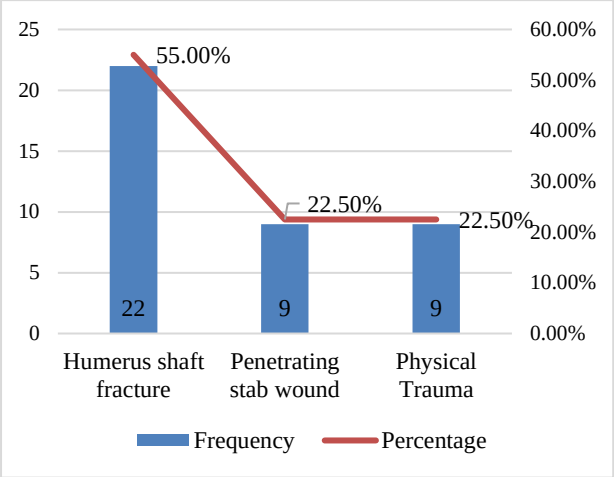

Figure 1: Distribution of participants by cause of injury (n=40).

Table 2: Distribution of participants by site of injury.

Site of Injury	N	%
Middle third of humerus shaft fracture	27	67.50
Distal third radius	13	32.50

Table 3: Distribution of participants by postoperative exam grade using DASH score.

DASH score grade	N	%
Excellent	34	85.00
Good	4	10.00
Poor	2	5.00

The (Figure 1) presents the distribution of participants based on the cause of their injury. A total of 40 participants were included in this analysis. The most common cause of injury among the participants was a humerus shaft injury, accounting for 22 cases or 55.00% of the sample. Penetrating stab wounds were the second most prevalent cause, with 9 cases representing 22.50% of the total. The remaining 9 cases had direct physical trauma as their cause of injury. (Table 2) provides the distribution of participants based on their site of injury. The majority of participants, 27 individuals or 67.50% of the sample, had injury in the middle-third of the humerus shaft region, while the remaining 32.50% had injury in the distal third radius. (Table 3) illustrates the distribution of participants based on their postoperative exam grade using the DASH score. The table includes data from a total of 40 participants. Among the participants, the majority, 34 individuals or 85.00% of the sample, achieved an "Excellent" postoperative exam grade. A smaller proportion of participants, 4 individuals or 10.00% of the sample, received a "Good" grade. Finally, only 2 participants, or 5.00% of the sample, were classified as having a "Poor" postoperative exam grade. (Table 4) displays the distribution of participants based on the presence of complications. The data includes information from a total of 40 participants. The majority of participants, 36 individuals or 90.00% of the sample, did not experience any complications following their treatment. Among those who did experience complications, 3 participants (7.50%) experienced inadequate wrist flexion as a complication, and 1 participant (2.50%) had inadequate thumb abduction.

Table 4: Distribution of participants by complications.

Complications	N	%
No complications	36	90.00
Inadequate thumb abduction	1	2.50
Inadequate wrist flexion	3	7.50

DISCUSSION

The age distribution observed in our study reveals a notable skew towards the younger age groups, particularly within the 30-39 years range. This trend aligns with a study conducted by Agarwal et al where they reported a mean age of 35.27 years among patients with radial nerve palsy.[15] The predominance of males in our study (77.50%) is also consistent with the gender distribution reported in the aforementioned study.[15] It is important to note that the gender composition of our sample may be influenced by various factors, such as the type of injury or the demographic characteristics of the population studied. Examining the distribution of participants by the side of injury, we found that right-side injuries were more prevalent, accounting for 72.50% of the cases. This observation might be attributed to the fact that the majority of individuals in the general population are right-handed, leading to a higher likelihood of right-hand involvement in activities that could result in injury. However, further research is necessary to substantiate this hypothesis and explore potential contributing factors to the side of injury. Regarding the cause of injury, our study identified humerus shaft injuries as the most common cause (55.00%), followed by penetrating stab wounds (22.50%), and physical trauma (22.05%). These findings are consistent with a study by Ljungquist et al which reported humerus fractures and penetrating injuries as prominent causes of radial nerve injuries.[16] Understanding the leading causes of injury can inform preventive measures and aid in the development of targeted interventions to reduce the incidence of radial nerve palsy. According to DASH score, there was a significant improvement in postoperative exam grades, with 85.00% of participants achieving an excellent grade. These results suggest that the tendon transfer procedure involving the flexor carpi radialis combination was effective in enhancing functional outcomes for patients with radial nerve palsy. Our findings align with a study by Abdullah et al where satisfactory results were reported for the same procedure.[13] The positive outcomes indicate the potential benefits of this surgical intervention

in improving the quality of life and functional capabilities of individuals with radial nerve palsy. In terms of complications, our study observed a relatively low complication rate, with 90% of participants experiencing no complications. This rate is comparable to the findings of Sharma et al who reported a low complication rate in their study of a single transfer using split flexor carpi ulnaris.[12] The low occurrence of complications suggests that the tendon transfer procedure, as performed in our study, is generally safe and well-tolerated by patients. However, it is crucial to continue monitoring and evaluating complications in larger and more diverse patient populations to obtain a comprehensive understanding of potential risks and develop strategies to minimize them.

Limitations

The study was conducted in a very short period with a small sample size. So, the results may not represent the whole community.

CONCLUSION

In conclusion, our study provides valuable insights into the baseline characteristics, causes of injury, preoperative and postoperative exam grades, and complications among patients with radial nerve palsy. The findings highlight the predominance of younger individuals in the study sample, with a higher incidence of right-side injuries and a notable prevalence of humerus shaft injuries. The surgical intervention involving tendon transfer with the flexor carpi radialis combination demonstrated positive outcomes, as reflected by the significant improvement in postoperative exam grades. Moreover, the low complication rate observed indicates the overall safety and effectiveness of the procedure. These findings contribute to the existing body of knowledge and can guide healthcare professionals in the management and treatment of radial nerve palsy.

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