Original Article

Simple Decompression versus Anterior Transposition (Submuscular and Subcutaneous) of the Ulnar Nerve in Cubital Tunnel Syndrome: a Meta-Analysis

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Abstract: Cubital tunnel syndrome (CTS) is the second most common neuropathy of the upper extremity due to entrapment of ulnar nerve. Surgical management is the better intervention compared with conservative one. This study is to evaluate operative technique preferable for the treatment of cubital tunnel syndrome and compare between simple decompression versus anterior transposition, and subcutaneous anterior transposition versus sub muscular anterior transposition. Level III systematic review and network meta-analysis were performed to compare clinical improvement between subcutaneous anterior transposition and sub muscular anterior transposition, and simple decompression and anterior transposition. Two sub analysis was also performed: 1) comparing sub muscular anterior transposition to subcutaneous anterior transposition, 2) comparing Infection rate of Simple Decompression to Anterior transposition. We identified eighteen studies in which 5 studies were RCT and 13 were non RCT (8 Retrospective Case series and 5 Prospective study) which involved a total number of 491 simple decompressions, 307 sub muscular transpositions and 485 subcutaneous transposition patients. We also found evidence of publication bias or statistical study heterogeneity. Odds ratio of improvement with simple decompression versus anterior transposition were 0.781 with a 95% CI of [0.574, 1.063], I_2 = 0%, p value =0.117. The odds ratio of improvement of subcutaneous transposition versus sub muscular transposition was 1.208 with a 95% CI of [0.609, 2.397], I_2 = 0%, p value=0.588 and the odds ratio of post-op infection in simple decompression versus anterior transposition was 0.287 with 95% CI of [0.097, 0.845], I_2 = 0%, with p value=0.024. Sensitivity analyses with use of fixed-effects methodology confirmed these findings to be robust and no heterogeneity was found. The result in this study showed that there is no significant difference between the treatment of cubital tunnel syndrome while comparing the improvement parameter for simple decompression vs anterior transposition and sub muscular transposition vs subcutaneous transposition but while doing a sub-analysis comparing the post op-infection between simple decompression and anterior transposition significant difference was found, and also with subcutaneous transposition and sub muscular transposition.

Keywords: anterior transposition, cubital tunnel syndrome, simple decompression, ulnar neuropathy

1. INTRODUCTION

The term 'cubital tunnel' first appeared in the published literature in 1958 [1]. Cubital Tunnel Syndrome (CTS) is the second most common entrapment neuropathy of the upper extremity [2,3] which is associated with weakness of the hand and arm within the ulnar nerve distribution, pain and sensory abnormalities [4]. Out of the 5 possible sites responsible for nerve entrapment at the elbow, the cubital tunnel is the most common site for ulnar nerve compression [5]. It is undeniable that individuals who suffer from cubital tunnel syndrome experience significant health problems linked to their place of employment and the activities they engage in on a daily basis [6]. It is essential to locate the appropriate treatment that is necessary for the management of cubital tunnel syndrome, given the significance of this ailment. The majority of instances of cubital tunnel syndrome improve with non-surgical management, and the majority of these cases will improve with surgical intervention and treatment [7]. There are still a great deal of debates surrounding the optimal care of this diseased condition [8], despite the fact that there is a wide variety of clinical expertise in the management and treatment of this diseased condition. The diagnosis of this sick state is based on the clinical symptoms as well as the electrophysiological abnormalities that are present in the patient. It is possible to treat cubital tunnel syndrome using either an operational or non-operative approach. These are the two primary methods. Simple decompression, anterior transposition (submuscular and subcutaneous), and medial epicondyle Tomy are the three components that make up the surgical approach to the treatment of cubital tunnel syndrome [9]. The conventional surgical approach for simple decompression required a large incision of 6-8 centimeters above and below the elbow. However, in today's world, it is possible to execute the treatment with a little skin incision of approximately 2 centimeters or less and achieve successful outcomes [10]. When performing anterior nerve transposition surgery, it is frequently necessary to decompress the ulnar nerve for a distance of up to 10 centimeters or more. This decompression results in a significant reduction in the regional blood flow of the nerve [11]. On the other hand, the medial epicondyle Tomy technique is a technique that is rarely used for ulnar nerve entrapment [12]. A simple decompression method in conjunction with differing degrees of medial epicondyle Tomy and numerous different methods of anterior transposition are the distinguishing characteristics of the management of cubital tunnel syndrome. Nevertheless, there are a variety of procedures that are being utilized in the treatment of this condition. As a result of a survey that was carried out in the Netherlands, it was discovered that the most prevalent approach for operational therapy of cubital tunnel syndrome is anterior transposition of the ulnar nerve [13]. Undoubtedly, ulnar nerve entrapment at the elbow, sometimes referred to as cubital tunnel syndrome, necessitates surgical treatments that range from straightforward decompression to anterior transposition. Moreover, the choice of a surgical method for cubital tunnel syndrome should be related to the understanding of the etiology of the ulnar nerve entrapment of the patients, the pathophysiology of the compression of the ulnar nerve at the elbow, and the associated disadvantages of the various operative procedures [14]. The authors of a meta-analysis that was just recently published [15] and a systemic review came to the conclusion that simple decompression might be a better option for surgical intervention for cubital tunnel syndrome. On the other hand, another meta-analysis [16] came to the conclusion that anterior transposition would be a better clinical outcome. On the other hand, the authors have also mentioned that there is a possibility of bias in the research because of the preoperative severity assessment of the patients. The purpose of this research is to conduct a meta-analysis on the treatment of this disorder, with the sole focus being on comparative observational studies and randomized controlled trials. The analysis will compare anterior transposition and simple decompression, with the ultimate goal of determining which treatment option for cubital tunnel syndrome generates the most favorable outcomes.

2. MATERIALS & METHOD

Using search terms such as "ulnar nerve compression, cubital tunnel syndrome, ulnar nerve, submuscular transposition, anterior transposition, and subcutaneous transposition," two writers conducted independent searches for different articles in the databases of OVID MEDLINE, PubMed MEDLINE, and EMBASE between the years 1979 and 2019. Additionally, the Cochrane Central Register of Controlled Trials was searched for additional information. In a similar manner, the archives of abstracts offered by medical organizations such as the American Association of Hand Surgeons (AAHS), the Canadian Society of Plastic Surgeons (CSPS), and the American Society for Surgery of the Hand (ASSH), as well as the Canadian Orthopedic Association (COA), were searched. The titles of the abstracts were checked to ensure that they were correct, and a reference check was carried out in order to ascertain whether or not the articles satisfied the specifications for inclusion. There were a total of 389 articles recovered from the search. Following an examination of the titles, 363 were disqualified due to the absence of titles that were relevant or comparisons that were not present. There were a total of 26 papers chosen for full text evaluation, three of which contained cadaver and animal investigations [17,18], while five articles that did not compare were not included. Last but not least, for the purpose of this meta-analysis, a total of 18 publications were incorporated [19,20]. Two authors carefully extracted relevant data for the intervention groups from each study. Details such as the name of the first author, the number of cases and controls, gender, age, loss of follow-up, country, severity and duration of preoperative outcome, postoperative outcome (as measured by improvement of symptoms or grading of excellent and good), infection (both superficial and deep), intervention protocol, and duration of the study were among the data that were extracted. The statistical analysis was carried out with the assistance of CMA, which stands for Comprehensive Meta-Analysis Software Version 2.2.064. Comparative observational studies and randomized controlled trials were the only types of research that qualified for analysis. We evaluated the heterogeneity of the included papers as well as the publication bias that existed. Within the same category as transposition, subcutaneous and submuscular transposition were categorized as "transposition." In the case of dichotomous outcomes, the treatment effects were reported as odds ratios (OR) with confidence intervals (CI) of 95%. Each of the studies had their odds ratio determined. For example, the odds ratio compared the likelihood of improvement following transposition to the likelihood of improvement following basic decompression. An anterior transposition (submuscular or subcutaneous) and a simple decompression were both subjected to the determination of odds ratios for post-operative infections. In addition to that, the calculation for odds ratios of clinical improvement was carried out by contrasting submuscular anterior transposition with submuscular anterior transposition.

3. RESULTS & DISCUSSION

As can be seen in table 01, this meta-analysis included a total of 18 investigations with a total of 1283 participants. Of these studies, 5 were randomized studies, and 13 were comparative observational studies. The inclusion criteria were met by all of these research. The individuals in the simple decompression procedure had a mean age of 52 years old, whereas the subcutaneous transposition participants had a mean age of 46 and the submuscular transposition participants had a mean age of 51. There were a total of 994 patients involved in 12 different investigations that compared simple decompression to anterior transposition. There were also two sub-analyses that were carried out, which compared post-operative infections in simple decompression and anterior transposition. These sub-analyses contained three trials with a total of 226 individuals. Moreover, a further sub-analysis was carried out on the subject of improved versus unimproved clinical outcomes. This particular sub-analysis comprised seven trials and a total of 292 participants.

Table 01: Study Characteristics

Author	Country	Design	Total no of patient included (N)	% Men	Mean Age (year)	Follow up (month)	Evaluation of Procedure
Zhou, Y., et al (2012) [23]	China	Prospective study	39 19(SMT) 20(SCT)	N/A	N/A	24-36	Improved vs not improved/DASH Score
Zare zadeh, A., et al. (2012) [37]	Iran	Prospective randomized trial	38 24(SMT) 24(SCT)	58(SMT) 54(SCT)	47.4 (SMT) 47.58 (SCT)	12	Clinical rating score (pain, sensation, muscle strength and atrophy)
Luo, S., et al. (2010) [36]	China	Prospective study	66 42(SMT) 24(SCT)	N/A	N/A	12-36	Bishop Score
Keiner et al., (2009) [24]	Germany	Prospective study	33 17 (SD) 16(SMT)	50 (SD) 25 (SMT)	52 (SD) 46 (SMT)	52(SD) 63.1 (SMT)	Clinical McGowan
Charles, Y.P., et al (2009) [25]	France	Retrospective Case series	49 25(SMT) 24(SCT)	72(SMT) 79(SCT)	53(SMT) 46(SCT)	84(SMT) 36(SCT)	Modified MC Gowan
Jad due, D.A(2009)[38]	Iraq	Prospective study	26 13(SMT) 13(SCT)	78(SMT) 78(SCT)	34 34(SMT) 34(SCT)	12	Bishop Score
Köse et al., (2007)[3]	Turkey	Retrospective case series	49 18 (SMT) 16 (SCT)	N/A	47.9 (SMT) 43.3 (SCT)	7 – 49	Improved vs not improved
Biggs & Curtis [26](2006)	Australia	Prospective randomized study	44 23 (SD) 21(SMT)	69 (SD) 81 (SMT)	56 (SD) 61 (SMT)	38.8 (SD) 42 (SMT)	Clinical (McGowan, LSUMC)
Gervasio et al., (2005) [10]	Italy	Prospective randomized study	70 35 (SD) 35 (SMT)	50 (SD) 50 (SMT)	53.1 (SD) 52.2 (SMT)	47 (SD) 46.94 (SMT)	Clinical rating score (NCS, atrophy, weakness

Bartels et al., (2005)[27]	The Netherlands	Prospective randomized study	152 75 (SD) 77 (SCT)	61(SD) 62 (SCT)	47 (SD) 47 (SCT)	12	Improved vs not improved
Nabhan et al., (2005)[28]	Germany	Prospective randomized study	65 32 (SD) 33 (SCT)	57 (SD) 43 (SCT)	52 (SD) 48 (SCT)	3 – 9	Clinical rating score (NCS, atrophy, weakness)
Taha et al., (2004)[29]	USA	Retrospective case series	38 21 (SD) 17 (SCT)	71	63	48	Clinical (Gabel)
Bimmler et al., (1996)[31]	Switzerland	Retrospective case series	79 31 (SD) 48 (SMT)	64	45	76	McGowan scores
Davies et al., (1991)[33]	Australia	Retrospective case series	130 76 (SCT) 54 (SD)	70	N/A	0.45–60	Improved vs not improved
Adelaar et al., (1984)[30]	United States	Prospective study	37 7 (SD) 22 (SCT) 8 (SMT)	N/A	51	11.7 – 14.25	Clinical rating score (NCS, atrophy, weakness)
Foster et al., (1981)[34]	Sweden	Retrospective case series	48 29 (SD) 19 (SCT)	56	N/A	50	Clinical rating scale (Sensation, pain, weakness)
Chan et al., (1980)[32]	Canada	Retrospective case series	235 120 (SCT) 115 (SD)	75	54	0.45–60	Improved vs not improved
MacNicol (1979)[35]	United Kingdom	Retrospective case series	80 42 (SD) 38 (SMT)	N/A	50	172.8	Clinical rating scale (sensation, motor)

SCT: Subcutaneous transposition; **SD**: Simple decompression; **SMT**: Sub muscular transposition; **NCS**: Nerve conduction study; **N/A**: Not available; **LSUMC:** Louisiana State University Medical Center system for grading of ulnar nerve entrapment. Bold numbers are the total number of patients in each study.

Table 02: Summary of Patients

Surgical Procedure	Number of Patients	Mean Age (y)
Simple decompression	491	52
Subcutaneous transposition	485	46
Sub muscular transposition	307	51

By comparing the standard error of the effect estimate of the study against the long odds ratio, we were able to evaluate the possibility of publication bias. The funnel plot was symmetrical, with seven studies that were located on the left side of the summary estimate and five studies that were located on the right side. In order to demonstrate that the studies were distributed in a symmetrical manner, the software that was utilized for the analysis did not impute any additional studies. We found very little indication of bias. Forest plot asymmetry should only be utilized when there are at least ten studies included in a meta-analysis, according to a rule of thumb that was noted in the Cochrane handbook for systematic review of interventions [21]. Due to the fact that there were fewer than ten studies, a funnel plot for the sub analyses was not constructed. The summary of the heterogeneity testing for simple decompression vs anterior transposition for improvement is shown in Table 03. The threshold of heterogeneity statistical results was set at a value of $p < 0.10$. Using the fixed effect model and random effect model, the analysis was equivalent. The Q test for heterogeneity was 4.206 with a p value of 0.117 and the value of I_2 was 0% which is an indication of low heterogeneity. The summary of the heterogeneity testing for improvement with submuscular vs subcutaneous anterior transposition is shown in Table 04. The threshold of heterogeneity statistical results was set at a value of $p < 0.10$. Using the fixed effect model and random effect model, the analysis was equivalent. The Q test for heterogeneity was 4.692 with a p value of 0.588 and the value of I_2 was 0% shown in forest plot analysis.

Table 03: Heterogeneity for Simple Decompression vs Anterior Transposition for improvement

Number Studies	Point estimate	Lower limit	Upper limit	Z-value	P-value	Q-value	df (Q)	P-value	I-squared	Tau squared	Standard Error	Variance	Tau
12	0.781	0.574	1.063	-1.569	0.117	4.206	11	0.963	0.000	0.000	0.314	0.018	0.000

Table 04: Heterogeneity for Sub muscular vs Subcutaneous Anterior Transposition for improvement

		Effect size and 95% interval			Test of null (2-Tail)				Heterogeneity		Tau-squared			
	Number Studies	Point estimate	Lower limit	Upper limit	Z-value	P-value	Q-value	df (Q)	P-value	I-squared	Tau Squared	Standard Error	Variance	Tau
Fixed	12	0.781	0.574	1.063	-1.569	0.117	4.206	11	0.963	0.000	0.000	0.134	0.018	0.000
Random	12	0.781	0.574	1.063	-1.569	0.117								

A further point to consider is that Table 05 provides a summary of the heterogeneity testing that was performed for infection using simple decompression as opposed to anterior transposition. In order to determine the level of heterogeneity in the statistical results, a criterion of $p < 0.10$ was established. Both the fixed effect model and the random effect model were successful in producing the same results in the analysis. In terms of heterogeneity, the Q test yielded a value of 0.981, with a p value of 0.024. Additionally, the value of I2 was 0%. In order to do a comparison between the trials, the authors decided to use the odds ratio of improvement of symptoms and post-operative infection as the outcome to compare. Between the studies, there was a great deal of diversity and heterogeneity.

Table 05: Heterogeneity for Simple Decompression vs Anterior Transposition for Post-op infection

Model		Effect size and 95% interval			Test of null (2-Tail)				Heterogeneity		Tau-squared			
	Number Studies	Point estimate	Lower limit	Upper limit	Z-value	P-value	Q-value	df (Q)	P-value	I-squared	Tau Squared	Standard Error	Variance	Tau
Fixed	7	1.208	0.609	2.397	0.541	0.588	4.692	6	0.584	0.000	0.000	0.508	0.258	0.000
Random	7	1.208	0.609	2.397	0.541	0.588								

The evaluation procedures that were utilized by certain authors, as indicated in the characteristics of the study, were different, which resulted in the conversion of the outcomes that were measured from their initial scales into the dichotomous categories of improvement and no improvement, as well as post-operative infection, as summarized in Tables 06, 07, and 08. We aggregated and evaluated the data from the included studies to determine the chances ratio of improvement and post-operative infection with simple decompression in comparison to anterior transposition on the other hand. To continue in the same vein, the odds ratio of improvement with submuscular anterior transposition was compared with subcutaneous anterior transposition, and the data from the included trials were pooled and evaluated.

Table 06: Results showing comparison of number of improved cases between simple decompression (SD) vs anterior transposition (SMT and SCT)

Author	Comparison	Number Improved with SD	Number Improved with Transfer
Keiner et al., (2009)	SD vs SMT	11/17	9/16
Biggs & Curtis (2006)	SD vs SMT	14/23	14/21
Gervasio et al., (2005)	SD vs SMT	33/35	35/35
Bartels et al., (2005)	SD vs SCT	49/75	54/77
Nabhan et al., (2005)	SD vs SCT	9/32	9/33
Taha et al., (2004)	SD vs SCT	10/21	10/17
Bimmler et al., (1996)	SD vs SMT	17/31	35/48
Davies et al., (1991)	SD vs SCT	49/54	71/76
Adelaar et al., (1984)	SD vs transposition	1/7	7/30
Foster et al., (1981)	SD vs SCT	27/29	17/19
Chan et al., (1980)	SD vs SCT	94/115	99/120

MacNicol (1979)	SD vs SM	41/52	9/11

Table 07: Result for Sub muscular transposition (SMT) vs Sub cutaneous transposition (SCT)

Paper	Comparison	Number Improved with SMT	Number Improved with SCT
Zhou, Y., et al (2012)	SMT vs SCT	16/19	17/20
Zare zadeh, A., et al. (2012)	SMT vs SCT	23/24	22/24
Luo, S., et al (2010)	SMT vs SCT	39/42	22/24
Jad due, D.A(2009)	SMT vs SCT	8/13	12/13
Charles, Y.P., et al (2009)	SMT vs SCT	20/25	17/24
Köse et al., (2007)	SMT vs SCT	14/16	13/18
Adelaar et al., (1984)	SMT vs SCT	2/8	5/22

Table 08: Result for Wound infection (superficial and Deep) for Simple Decompression (SD) vs Anterior Transposition (SMT and SCT)

Paper	Comparison	Number of infections in SD	Number of infections in Anterior transposition
Biggs & C. (2006)	SD vs SMT	2/23	7/21
Gervasio et al. (2005)	SD vs SMT	1/35	1/35
Bartels et al. (2005)	SD vs SCT	2/75	7/77

It was determined that a value of $p < 0.05$ would serve as the threshold for all statistical outcomes. According to Figure 3, the odds ratio of improvement with simple decompression was 0.781, with a 95% confidence interval ranging from [0.574 to 1.063], an I2 value of 0%, and a p value of 0.117 when applying the fixed effect model. This finding was the same for both the fixed effects model and the random effects model, which is something that the reader should take note of. Due to the fact that the results obtained were the same regardless of the model that was utilized, the assumption was that there was little statistical evidence of heterogeneity. There were also two sub-analyses carried out, which are as follows: The first thing to do is examine the differences between submuscular anterior transposition and subcutaneous anterior transposition, as presented in Table 07. In a study that utilized both fixed effects and random effects, the odds ratio of improvement of subcutaneous transposition (SCT) with submuscular transposition (SMT) was 1.208, with a 95% confidence interval ranging from [0.609 to 2.397]. The I2 value was 0%, and the p value was 0.588. Second, looking at the comparison between simple transposition and anterior transposition in post-operative infections caused by simple decompression and anterior transposition (submuscular and subcutaneous transposition), as indicated in table 8 and figure 6. When both fixed variables and random effects were considered, the odds ratio for post-operative infection of simple decompression (SD) with anterior transposition (SMT and SCT) was 0.287, with a 95% confidence interval ranging from 0.097 to 0.845, an I2 value of 0%, and a p value of 0.024. We conducted sensitivity analysis on a number of different parts of the trial. Investigating the consequences of excluding non-randomized controlled trials was one of these plans. Using the fixed effect model, the odd ratio of improvement after simple decompression versus anterior transposition was 0.781 in patients with cubital tunnel syndrome. The 95% confidence interval for this ratio was between 0.574 and 1.063, and the I2 value was 0%. The p value was 0.117. In this comparison, there were a total of 12 studies, four of which were randomised controlled trials (RCTs), and eight of which were not RCTs. We just used four randomised controlled trials (RCTs) and compared the data for the odd ratio of improvement after simple decompression versus anterior transposition. The results showed that the ratio was 0.813, with a 95% confidence interval (CI) of [0.486, 1.361], and a p value of 0.431 when using a fixed effect model. This allowed us to determine whether or not the non-RCT model is influencing the outcome of our analysis. Because the findings were comparable to those of the study, the analysis was reliable.

DISCUSSION

Using a fixed effect model, the findings of our meta-analysis showed that the odds ratio of improvement between simple decompression and anterior transposition (SMT and SCT) was 0.781, with a 95% confidence interval ranging from [0.574 to 1.063], I2 = 0%, and p value =0.117. Simple decompression and transposition (subcutaneous or submuscular) of the ulnar nerve produced the same level of postoperative clinical improvement; however, there was no discernible difference between the two. When compared to transposition (SMT and SCT), the odds ratio of post-operative infection with simple decompression (SD) was 0.287, with a 95% confidence interval ranging from 0.097 to 0.845. The interaction coefficient was 0%, and the p value was 0.024 when using a fixed effect model. While there was no heterogeneity detected, there was a significant difference in post-operative infection between simple decompression and anterior transposition. This difference demonstrated that there is an increase in the likelihood of post-operative infection in anterior transposition. An investigation revealed that the rate of complications among patients who were treated with SD was noticeably lower than the rate of complications among patients who were treated with AT. On the other hand, SD is not indicated in situations where the cubital tunnel is being constricted due to bony spurs and synovial edema, or even scarring, as well as in situations where the nerve is experiencing repeated or fixed subluxation [22]. Following this, the findings of the sub-analysis showed that the odds ratio of improvement for subcutaneous transposition (SCT) was 1.208, with a 95% confidence interval ranging from [0.609 to 2.397], I2 = 0%, and a p value of 0.588 when utilizing both the fixed effect model and the random effect model. The results of this study reveal that there is no significant difference between the odds ratio of improvement between subcutaneous transposition (SCT) and submuscular transposition (SMT), and there was also no heterogeneity detected. Our study also showed similar findings, which revealed that simple decompression can be a suitable choice for surgical intervention. These findings are consistent with the findings of a previous review study of non-randomized studies (n = 2652), which recorded that if the preoperative condition of the patients was not taken into consideration, simple decompression would be the best option of surgical intervention [23,24]. On the other hand, due to the fact that the conclusions were based on non-randomized data, it was believed that they were susceptible to major sources of selection bias. In a meta-analysis recently published in 2007, which included four studies with a total of 261 patients using randomized controlled trials comparing simple decompression with anterior ulnar nerve transposition (two submuscular and two subcutaneous), found out that there was no difference in clinical outcome scores or motor nerve-conduction velocities between simple decompression and anterior transposition for the treatment of cubital tunnel syndrome in patients with no prior surgical procedures or traumatic injuries involving the affected elbow [25]. The results of a meta-analysis that was only recently published revealed that the odds ratio was 0.751, with a 95% confidence interval ranging from [0.542,1.040], and a p value of 0.084 [26]. The meta-analysis included 10 studies with a total of 449 simple decompression and 457 anterior transposition procedures (342 subcutaneous transposition and 115 submuscular transposition). Our research, which consisted of a total of seventeen different studies. Among the twelve studies that compared simple decompression to anterior transposition, there were 491 simple decompression and 766 anterior transpositions, with 472 subcutaneous and 294 submuscular transpositions. The findings were comparable when comparing improved to unimproved patients, with an odds ratio of 0.781, a 95% confidence interval of [0.574, 1.063], an I2 value of 0%, and a p value of 0.117. However, when conducting a sub-analysis with three studies that compared post-operative infections with odds ratios of 0.287, 95% confidence intervals of [0.097, 0.845], I2 = 0%, and p value = 0.024, a significant difference was discovered, indicating that simple decompression could be an appropriate treatment option for cubital tunnel syndrome. Furthermore, there was no heterogeneity found in the data. When it comes to the treatment of cubital tunnel syndrome, this is an indicator that simple decompression is a potential alternative to anterior transposition. According to the findings of one published author [27], individuals who have simple decompression have a higher percentage of full recovery than those who undergo anterior transposition. After conducting four randomized control studies, researchers came to the conclusion that simple decompression is the most effective surgical treatment for cubital tunnel syndrome [28,29]. There was no statistically significant difference between submuscular transposition and subcutaneous transposition, according to the findings of the sub-analysis study that we conducted. On the other hand, contrary to what we discovered, a number of studies have also proposed that subcutaneous anterior transposition is a straightforward and efficient surgery [30,31]. An additional author demonstrated that the subcutaneous group experienced a much reduced incidence of adverse events compared to the submuscular group [32]. When compared to the subcutaneous approach, the submuscular method was shown to have healthier axons and less perineural scar tissue, according to the findings of a histologic investigation that was conducted on rats and published in 2009 [33]. When it comes to the treatment of cubital tunnel syndrome, an author came to the conclusion that both anterior subcutaneous transposition and submuscular transposition are comparable. However, the author believes that anterior subcutaneous transposition is the superior treatment option for elderly patients because it has a lower incidence of traumas [34], and post-operative immobilization is not required after subcutaneous transposition, as it is required after submuscular transposition [35,36]. The post-operative dash score was 7.27 out of 100, and the patient satisfaction rate was 96%, according to a study that was just recently published [40]. The study comprised 73 patients who had undergone anterior subcutaneous transposition of the ulnar nerve between January 2000 and January 2010, and the minimum follow-up period was three years. In conclusion, the author of this study came to the conclusion that anterior subcutaneous transposition is a successful surgical treatment for cubital tunnel syndrome, with good clinical results, physical function, and satisfaction [37,38]. After stating that anterior transposition results in lower ulnar nerve strains than simple decompression during elbow flexion and higher nerve strains during elbow extension, similar results were shown [39]. This was demonstrated by the fact that the anterior transposition was performed. In situations where the ulnar nerve has a tendency to subluxate, either during the preoperative or intraoperative assessment, the author [41] demonstrates that transposition is the recommended method. According to the findings of a researcher, the anterior transposition of the ulnar nerve in conjunction with epineurium decompression yields superior results when compared to simple decompression [42]. We have provided a better understanding of the many treatment choices that are available for cubital tunnel syndrome as a consequence of our study, which has extended past findings and supplied additional information.

4. CONCLUSIONS

This meta-analysis of simple decompression versus anterior transposition of the ulnar nerve for the treatment of cubital tunnel syndrome suggests and emphasizes that simple decompression could be considered a reasonable alternative or viable surgical option for the treatment of cubital tunnel syndrome. This is because simple decompression is less invasive than anterior transposition. Furthermore, our findings were robust to different statistical strategies fixed effect model. Our research demonstrated that there is no significant difference between the treatment of cubital tunnel syndrome with subcutaneous transposition and submuscular transposition. This is despite the fact that some of the literature suggested that subcutaneous transposition should be considered the first choice for treatment rather than submuscular transposition. Compared to anterior transposition, the odds ratio of improvement with simple decompression was 0.781, with a 95% confidence interval ranging from 0.574 to 1.063. The I2 value was 0%, and the p value was 0.117. The odds ratio of improvement in subcutaneous transposition versus sub muscular transposition was 1.208 with a 95% confidence interval of [0.609, 2.397], I2 = 0%, and p value = 0.588. On the other hand, the odds ratio of post-operative infection in simple decompression versus anterior transposition was 0.287 with a 95% confidence interval of [0.097, 0.845], I2 = 0%, and p value = 0.024. Sensitivity studies that made use of the fixed-effects methodology indicated that these findings were reliable, and there was no evidence of heterogeneity detected. This study demonstrated that there is no significant difference between the treatment of cubital tunnel syndrome when comparing the improvement parameter for simple decompression versus anterior transposition and sub muscular transposition versus subcutaneous transposition. However, when conducting a sub-analysis comparing the post-operative infection between simple decompression and anterior transposition, a significant difference was discovered. This was also the case with subcutaneous transposition and sub muscular transposition.

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