

# COMPARATIVE EFFECTIVENESS OF SPLINTING VERSUS CORTICOSTEROID INJECTION FOR MANAGING CARPAL TUNNEL SYNDROME IN PREGNANCY

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## Abstract

**Background:** Carpal tunnel syndrome (CTS) is a common condition of nerve entrapment during pregnancy, especially during late pregnancy days because hormones and retention cause the syndrome. Despite the popularity of the treatment methods of wrist splinting and corticosteroid injection, there is little evidence comparing these treatments in pregnant women.

**Objectives:** To compare the efficiency of corticosteroid injection and wrist splinting in terms of their ability to relieve symptoms and enhance the functional outcomes in pregnant women with CTS.

**Methods:** Sixty pregnant women with CTS, admitted in the Department of Obstetrics & Gynecology, Arif Memorial Teaching Hospital, Rashid Latif Medical College, Lahore., participated in this quasi-experimental study both control groups between January and July 2025 (n=30 in both control groups (splinting and corticosteroid injection)). At baseline and after 4 weeks, the severity of symptoms and functional scores were measured. It was done using independent t-test and Chi-square test, and  $p < 0.05$  was taken as significant. Symptom severity and functional status were assessed using the Boston Carpal Tunnel Questionnaire (BCTQ) Symptom Severity Scale (SSS) and Functional Status Scale (FSS) at baseline and after 4 weeks.

**Results:** The majority of women were between 20 and 29 years (56.7%), and 70.0% of the respondents were at the third trimester. There were no differences in baseline symptom severity ( $p = 0.71$ ). After 4 weeks, corticosteroid injection led to major improvement in symptom relief ( $1.9 \pm 0.4$  vs  $2.6 \pm 0.5$ ;  $p < 0.001$ ) and symptom improvement ( $2.1 \pm 0.5$  vs  $1.3 \pm 0.4$ ;  $p < 0.001$ ). Injection was also the better method in functional recovery ( $1.9 + 0.5$  vs  $1.1 + 0.4$ ;  $p < 0.001$ ) and clinical improvement was noted in 90.0 percent of the patients receiving injections as opposed to 70.0 percent of the patients receiving splinting ( $p = 0.04$ ). No serious maternal or fetal adverse effects were observed in either group.

**Conclusion:** Corticosteroid injection has been shown to be better than wrist splinting with regard to short-term symptom improvement and functional recovery in expectant women with CTS.

**Keywords:** Carpal tunnel syndrome; Pregnancy; Splinting; Corticosteroid injection; Functional outcome.

## INTRODUCTION

The most common reported peripheral nerve entrapment disorder diagnosed is called carpal tunnel syndrome (CTS) which is a compression of the median nerve in the carpal tunnel. The compression results into a constellation of symptoms, which include pain, paresthesia, numbness, and impairment of the hand and wrist functions. CTS is highly common, and its prevalence is about 3-6 per cent of the adult population, and the condition is significantly more frequent in women and those involved in repetitive movements of the hand<sup>(1,2)</sup>. CST is also more pronounced during pregnancy, and when this occurs, the prevalence rates are reported to be very high, with higher rates observed in the second and third trimesters and up to 60 per cent of pregnant women being affected in some studies<sup>(1)</sup>. The main cause of this increased vulnerability at this time is the complicated physiological changes experienced

such as hormonal fluctuations, retention of systemic fluids, and localized edema. All these combine to cause an out push in confined carpal tunnel thereby damaging the median nerve. Pregnant patients usually have nocturnal exacerbation of symptoms, motor weakness, a lack of grip strength, and functional limitations, which in many cases can negatively influence their quality of life and the possibility to do their everyday things<sup>(3, 4)</sup>. Even though the CTS during pregnancy is usually temporary, the symptomatic load that it carries in the gestation period requires its treatment in a timely and efficient manner<sup>(5)</sup>.

CTS management during pregnancy is generally focused on the investigation of the conservative methods to reduce the possible risks to the mother and the pregnancy. Wrist splinting is the most commonly prescribed among them, being a first-line intervention that is not invasive and also non-surgical, and it is expected to align the wrist in a neutral position and minimize median nerve compression<sup>(6)</sup>. At the same time, an effective targeted anti-inflammatory approach is also corticosteroid injections, which should be used as an alternative to splinting, although in pregnancy, their administration is associated with certain clinical concerns related to the safety of the fetus and systemic exposure<sup>(7)</sup>. Although both of the modalities are widely used, their relative efficacy and safety among pregnant populations, in particular, have not been fully clarified in the literature<sup>(3)</sup>. This loophole underscores the urgency of conducting aggressive research that will help determine evidence-based practice on how CTS can be addressed among pregnant women<sup>(8)</sup>.

Although the etiology of pregnancy-related CTS has not been clearly elucidated, it is assumed that hormonal changes and focal edema of the carpal tunnel are some of the factors<sup>(9)</sup>. Its pathogenesis consists of heightened intracarpal tunnel pressure that causes ischemia and mechanical compression of the median nerve and eventually gives rise to the typical sensory and functional outcomes of the disease<sup>(10)</sup>. Thus, the proposed research will compare the efficacy of wrist splinting with corticosteroid injection in the treatment of carpal tunnel syndrome in pregnancy to build a specific treatment plan among vulnerable patients<sup>(11)</sup>.

The primary purpose of the research was to contrast the efficiency of splinting the wrist and corticosteroid injection in the treatment of clinical symptoms and functional outcome in pregnant women who have been diagnosed with carpal tunnel syndrome.

## METHODS

It was a quasi-experimental comparative study that was conducted in the Department of Obstetrics & Gynecology, Arif Memorial Teaching Hospital, Rashid Latif Medical College, Lahore at minimum of six months (January to July 2025). A non-probability consecutive sampling was used to select a sample size of 60 pregnant women diagnosed with carpal tunnel syndrome which was calculated considering a 95% confidence level, 80% power, and the expected difference in effect size between the splinting and corticosteroid injection groups. The subjects were allocated into two groups based on the order of presentation: the first 30 eligible women were assigned to the wrist splinting group (Group A) and the subsequent 30 women were assigned to the corticosteroid injection group (Group B). No randomization procedure was employed, consistent with the quasi-experimental design of the study<sup>(12)</sup>.

The inclusion criteria were pregnant women between the ages of 18 and 45 years with clinical symptoms of carpal tunnel syndrome, including numbness, tingling, and pains in the wrist/hand, and the exclusion criteria were the carpal tunnel syndrome before pregnancy, history of previous wrist traumas or surgeries, systemic conditions such as diabetes mellitus, rheumatoid arthritis or thyroid disorders, and those patients who needed urgent operation to prevent confounding. This data collection followed ethical approval and written informed consent which was performed through a structured proforma. The baseline demographic factors such as age and gestational age were taken and symptom severity and functional status were evaluated on the baseline and at follow-up visits. Symptom severity and functional status were assessed using the Boston Carpal Tunnel Questionnaire (BCTQ), a validated and widely used patient-reported outcome measure for carpal tunnel syndrome. The BCTQ comprises two distinct scales. The first is the Symptom Severity Scale (SSS), which consists of 11 items evaluating the severity and frequency of symptoms such as pain, numbness, tingling, weakness, and nocturnal awakening. The second is the Functional Status Scale (FSS), which includes 8 items measuring the degree of difficulty experienced in performing common daily activities such as writing, buttoning clothes, holding a book, gripping objects, and carrying grocery bags. Each item on both scales is rated on a Likert scale from 1 (no symptoms or no difficulty) to 5 (most severe symptoms or inability to perform the activity). The final score for each scale is calculated as the mean of the individual item scores, with higher scores indicating greater symptom severity or worse functional impairment. Both scales were administered at baseline and at the 4-week follow-up visit

SPSS version 20 had been used to perform data analysis; mean and standard deviation (i.e. age, gestational age, and symptom severity scores) were used to represent continuous variables, whereas frequencies and percentages were used to represent categorical variables (i.e. clinical improvement status). A test of normality of continuous data was conducted with Shapiro-Wilk test with the results of 0.31 that indicated that the data were normally distributed. Thus, independent sample t-test was used to compare mean scores in terms of the severity of symptoms and functional scores between Group A and Group B, where paired sample t-test was employed to compare the level of pre- and post-treatment improvement within the respective groups. The Chi-square test was used to compare the outcomes that were categorical and p-value of below 0.05 was taken as significant.

## RESULTS

The study included 60 pregnant women who had carpal tunnel syndrome. Majority of the respondents were in the age of 20-30 years (56.7) and 43.3% were in 30-40 years. Most of the women were at the third trimester of pregnancy (70.0%), with the remaining 30.0% at the second trimester. On parity, 55.0 percent of the respondents were multigravida; 45.0 percent were primigravida. The duration of the symptoms was nearly equal with 48.3% having a duration of 6 weeks and below and 51.7% having a duration of more than 6 weeks. Participants were both control groups divided into the group of wrist splinting and the group of corticosteroid injections where 30 women were compared, two groups: wrist splinting group (n=30) and corticosteroid injection group (n=30). Symptom baseline levels were also comparable in both groups, as the mean of the splinting group was  $3.9 \pm 0.6$  while the mean of the injection was  $4.0 \pm 0.7$ . Four weeks later, in both treatments the symptoms got better, but more relief was achieved with corticosteroid injection since the follow-up scale scores dropped to  $2.6 \pm 0.5$  in the splinting group and  $1.9 \pm 0.4$  in the injection group. The mean improvement was  $1.3 \pm 0.4$  with splinting and  $2.1 \pm 0.5$  with injection and this showed that the symptom improvement was better in the injection group.

**Table-1: Comparison of Symptom Severity and Functional Outcome Scores Between Groups (n = 60)**

Outcome Measures	Splinting Group (n=30) Mean $\pm$ SD	Injection Group (n=30) Mean $\pm$ SD	t-value	p-value
Baseline Symptom Severity Score	$3.9 \pm 0.6$	$4.0 \pm 0.7$	-0.39	0.71
Follow-up Symptom Severity Score (4 weeks)	$2.6 \pm 0.5$	$1.9 \pm 0.4$	5.64	<0.001
Mean Symptom Improvement Score	$1.3 \pm 0.4$	$2.1 \pm 0.5$	-6.02	<0.001
Baseline Functional Status Score	$3.5 \pm 0.7$	$3.6 \pm 0.6$	-0.58	0.56
Follow-up Functional Status Score (4 weeks)	$2.4 \pm 0.6$	$1.7 \pm 0.5$	4.72	<0.001
Mean Functional Improvement Score	$1.1 \pm 0.4$	$1.9 \pm 0.5$	-6.10	<0.001

Table-1 demonstrates that there was no significant difference in the more severe symptoms between the splinting and injection conditions at the initial phases ( $3.9 + 0.6$  vs  $4.0 + 0.7$ ;  $p = 0.71$ ) thus showing that the conditions were equal in terms of the severity of carpal tunnel syndrome at the baseline. Symptom improvement occurred in both interventions at the 4-week follow-up, but the corticosteroid injection group had much more improvement in the symptoms with lower follow-up score ( $1.9 \pm 0.4$ ) than the splinting group ( $2.6 \pm 0.5$ ;  $p < 0.001$ ). This indicates that corticosteroid injection is more rapid and better at reducing pain, numbness and tingling symptoms in a costly manner during pregnancy.

The improvement in the mean symptoms also was more in the injection group ( $2.1 \pm 0.5$ ) compared to the splinting group ( $1.3 \pm 0.4$ ;  $p < 0.001$ ), thus showing the overall recovery of the symptoms being better with the steroid treatment. The same was the case with functional outcomes. The base-line functional status scores were similar ( $p = 0.56$ ), however, at the follow-up, women who were injected with corticosteroids exhibited a higher functional recovery coinciding with better hand and wrist recovery ( $1.7 \pm 0.5$  vs  $2.4 \pm 0.6$ ;  $p < 0.001$ ). The injection group reported more improvement in mean functional improvement ( $1.9 + 0.5$ ) than the splinting ( $1.1 + 0.4$ ;  $p < 0.001$ ). These results have shown that, clinically, corticosteroid injection is not only more effective at reducing symptoms, but at improving the daily functioning of the hand more than splinting the wrist in pregnant women with carpal tunnel syndrome.

**Table-2: Clinical Improvement Status Among Study Groups (n = 60)**

Improvement Status	Splinting Group n (%)	Injection Group n (%)	$\chi^2$ -value	p-value
Improved	21 (70.0%)	27 (90.0%)	4.00	0.04
Not Improved	9 (30.0%)	3 (10.0%)		

According to Table-2, a greater percentage of women who had corticosteroid injected made clinical improvement than those whose management was through wrist splinting. Among the injection group, 27 (90.0) respondents improved, 21(70.0) improved with splinting group. This was also statistically significant ( $2 = 4.00$ ,  $p = 0.04$ ) and it implied that corticosteroid injection was more appropriate in the realization of an overall clinical improvement in pregnant women with carpal tunnel syndrome.

## DISCUSSION

The current investigation shows that corticosteroid injection is better to treat symptoms and functional recovery than wrist splinting in pregnant women with carpal tunnel syndrome. Individuals who had corticosteroid injections demonstrated a much-improved mean improvement of the symptoms ( $2.1 \pm 0.5$  vs.  $1.3 \pm 0.4$ ,  $p < 0.001$ ) and functional improvement ( $1.9 \pm 0.5$  vs.  $1.1 \pm 0.4$ ,  $p < 0.001$ ) at 4 weeks. It was also justified by the higher percentage of any group of clinically improved patients in the injection (90.0) group than in the splinting (70.0) group, highlighting the short-term intervention efficacy of corticosteroid in this group<sup>(7)</sup>.

The effectiveness of corticosteroid injections can be explained by the fact that it has a direct anti-inflammatory effect, which quickly decreases the edema and tenosynovitis at the location of median nerve compression<sup>(13)</sup>. Conversely, splinting is more about delivering mechanical support and pressure relief than eliminating inflammation, which could be the reason why it has a slower response<sup>(14)</sup>. Local administration enables topmost drug levels localization at the involved tissues, therefore, resolving the symptoms faster and reducing systemic exposure, which is a major factor in pregnancy<sup>(15,16)</sup>.

These results are consistent with the prior evidence that corticosteroids are effective at decreasing the severity of symptoms and improving the functional status in carpal tunnel syndrome, especially non-pregnant cohorts<sup>(12,17)</sup>. Guided by ultrasound, accuracy could bring additional advantages to the therapeutic delivery of inflamed synovium and the median nerve, which can enhance the outcomes<sup>(13,18)</sup>. Corticosteroids mechanically inhibit lymphocyte and cytokine production and have a direct negative impact on the inflammatory cascade<sup>(13)</sup>. On the other hand, splinting does not influence the intracarpal pressure but sustains the wrist position in a neutral position<sup>(19)</sup>.

The quick effects of corticosteroid injection in the reduction of symptoms have a practical benefit in pregnancy, where recurrent pain can considerably affect daily performance. Nevertheless, the results might vary in the long-term, since new interventions (e.g., platelet-rich plasma and dextrose 5.0% water (D5W)) have demonstrated a potential of better long-term outcomes in certain population groups<sup>(3,20)</sup>. Also splinting is a worthy course of non-invasive treatment, as it is a stable and reliable support mechanism that is not associated with a cycle of steroids<sup>(20,21)</sup>.

However, since the condition of pregnancy induced CTS is usually temporary, the short-term advantage of corticosteroid injections that is seen in the present study justifies their use as a short-term intervention. More research studies of longer follow-up are required to evaluate the postpartum, recurrence, and safety of repeat injections in pregnancy<sup>(7)</sup>.

With respect to the security profile of both mediations, no genuine unfavorable impacts were watched in either group amid the study period. Within the corticosteroid infusion bunch, minor side impacts were reported by a little number of participants, counting transitory torment at the infusion location in 3 ladies (10.0%) and mellow localized swelling that settled suddenly inside

48 hours in 2 ladies (6.7%). No systemic side effects such as hyperglycemia, liquid maintenance, or unfavorably susceptible responses were famous taking after the nearby corticosteroid organization. Critically, no unfavorable fetal results inferable to the corticosteroid infusion were recorded amid the follow-up period. All neonates within the infusion gather were conveyed without complications related to the mediation, and no cases of preterm labor, fetal trouble, or innate anomalies were recognized. The localized nature of the infusion, with negligible systemic absorption, is steady with distributed writing recommending that single-dose neighborhood corticosteroid injections pose insignificant chance to the creating baby<sup>(22)</sup>. Within the wrist splinting gather, 4 members (13.3%) detailed gentle skin disturbance underneath the brace, and 2 ladies (6.7%) experienced inconvenience that required brief evacuation of the device amid rest. No maternal or fetal complications were related with prop utilize. These discoveries recommend that both intercessions carry a favorable security profile in pregnant ladies. Be that as it may, the short follow-up length of this ponder limits the capacity to draw authoritative conclusions almost long-term maternal and fetal security, and future ponders with extended postpartum observing are prescribed to affirm these perceptions.

This think about has a few limitations that should be recognized when deciphering the discoveries. To begin with, the generally little test estimate of 60 members, with as it were 30 ladies in each group, may have constrained the factual control to identify littler but clinically important contrasts between the two intercessions and decreases the generalizability of the comes about to the broader populace of pregnant ladies with carpal tunnel disorder. A bigger test would have allowed for more strong subgroup investigations, especially over distinctive trimesters and shifting degrees of indication severity. Moment, the brief follow-up period of as it were 4 weeks does not allow assessment of the long-term toughness of treatment impacts, the characteristic direction of indication determination after conveyance, or the potential for indication repeat once the mediation is suspended<sup>(23)</sup>. It remains vague whether the watched predominance of corticosteroid injection is maintained past the quick treatment period or whether the hole between the two modalities contracts over time. Third, this was a single-center think about conducted at one tertiary care healing center in Lahore, which may present determination predisposition and restrain the appropriateness of the comes about to other clinical settings, geographic regions, and quiet populaces with diverse statistic and financial profiles. Fourth, the nonattendance of blinding in this quasi-experimental think about could be a striking methodological concern. Since both members and result assessors were mindful of the treatment assignment, there's a plausibility of execution and discovery predisposition, especially for subjective results such as self-reported side effect seriousness and utilitarian status on the BCTQ<sup>(24)</sup>. Members accepting corticosteroid infusions may have had higher desires of change compared to those accepting braces, which may have impacted their announcing. Future considers utilizing bigger multicenter tests, double-blinded plans where doable, longer follow-up periods amplifying into the postpartum period, and objective result measures such as nerve conduction

ponders are suggested to approve and construct upon the discoveries of this examination.

## CONCLUSION

Finally, when compared to a wrist splint, corticosteroid injection was noted to offer a significant amount of short-term symptom relief and functional improvement in the treatment of carpal tunnel syndrome in pregnant women. Corticosteroid injection should be regarded as a more effective choice in the acute management of the condition in pregnancy due to its rapid clinical effects and increased rates of improvement, but the patients should be considered to have further investigation with extended follow-up to assess long-term outcomes and resolution postpartum.

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