Assessment of Nerve Conduction Parameters in Rheumatoid Arthritis and Other Poly Arthritis and its Correlation with Numerical Pain Score

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ABSTRACT

Background

Rheumatoid arthritis (RA) is a chronic systemic inflammatory disorder characterized by progressive joint involvement and significant pain-related morbidity. In addition to articular manifestations, RA is associated with greater inflammatory burden and symptom severity compared with other forms of polyarthritis. Comparative data evaluating clinical severity, inflammatory markers, serological status, and pain intensity between RA and polyarthritis remain limited.

Materials and Methods

This cross-sectional study included 120 patients aged 30–50 years, both genders, comprising 60 patients with rheumatoid arthritis and 60 patients with other polyarthritis. Clinical parameters including disease duration, tender and swollen joint counts, and duration of morning stiffness were recorded. Pain severity was assessed using the Numerical Pain Score (NPS). Laboratory parameters included erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and rheumatoid factor (RF). Data were analyzed using Student's t-test and chi-square test, with $p < 0.05$ considered statistically significant.

Results

RA patients were significantly older than polyarthritis patients (43.0 ± 5.0 vs 38.0 ± 5.0 years; $p = 0.0001$). Female predominance was observed in both groups without significant difference. RA patients had significantly longer disease duration, higher tender and swollen joint counts, and prolonged morning stiffness ($p < 0.001$). Inflammatory markers were significantly elevated in RA patients (ESR: 42.6 ± 10.3 vs 28.1 ± 9.5 mm/hr; CRP: 12.8 ± 4.4 vs 6.9 ± 3.2 mg/L; $p < 0.001$). RF positivity was more frequent in RA patients. Severe pain predominated in RA patients, with a significantly higher mean NPS score compared to polyarthritis patients (7.6 ± 1.2 vs 5.8 ± 1.4; $p < 0.001$).

Conclusion

Patients with rheumatoid arthritis exhibit greater disease severity, higher inflammatory burden, increased seropositivity, and significantly higher pain intensity compared with patients with other polyarthritis. These findings highlight the aggressive nature of RA and underscore the importance of early diagnosis and comprehensive management to reduce disease-related morbidity.

Keywords: Rheumatoid Arthritis, C-Reactive Protein, Erythrocyte sedimentation rate, Nerve Conduction Velocity, Nerve Conduction Study.

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Introduction: Rheumatoid arthritis (RA) is a chronic, systemic inflammatory disorder characterized by symmetrical polyarthritis affecting peripheral joints and following a progressive course with periods of remission and exacerbation.The disease commonly presents with pain, stiffness, and swelling of small joints, leading to significant functional impairment. Its pathogenesis involves a complex interaction of genetic susceptibility, autoimmune mechanisms, and inflammatory processes primarily targeting the synovial membrane [1,2]. Polyarthritis (Eg: SLE, Gout, Psoriatic arthritis,osteoarthritis etc) can cause neuropathy primarily through chronic inflammation and vascular complications, with rheumatoid vasculitis (RV) being a major contributor [1]. Diagnosis is based on clinical features supported by serological and imaging findings, with classification criteria evolving over time to improve diagnostic accuracy [3].In addition to joint involvement, RA is frequently associated with extra-articular manifestations, including peripheral nervous system involvement. Chronic inflammation and vascular complications, particularly rheumatoid vasculitis, contribute to ischemic nerve damage, resulting in polyneuropathy or mononeuritis multiplex. Endothelial dysfunction and immune-mediated mechanisms further exacerbate axonal degeneration and demyelination in RA patients [1].

Globally, the prevalence of RA ranges from 0.46% to 1%, with a higher burden observed in females and an increasing trend in prevalence and disease-related disability [4–6]. In India, the prevalence of RA ranges between 1% and 1.5% [7].

RA significantly affects nerve conduction due to both inflammatory and mechanical factors. Entrapment neuropathies such as carpal tunnel syndrome and tarsal tunnel syndrome are commonly reported as a result of synovial proliferation and joint erosion, leading to compression of the median and ulnar nerves. These changes result in altered nerve conduction velocities and latencies and may coexist with demyelinating or vasculitic neuropathies, necessitating careful evaluation [8,9]. Systemic immune activation in RA may also contribute to sensory nerve dysfunction and pain through neuroimmune interactions [10].

Nerve conduction studies (NCS) are a non-invasive and objective method for assessing peripheral nerve function and play a crucial role in diagnosing and characterizing peripheral neuropathies. They allow differentiation between axonal and demyelinating neuropathies and facilitate early detection of subclinical nerve involvement, which may not be evident on routine clinical examination [11–13]. Given their diagnostic utility, NCS are valuable in evaluating neurological involvement in inflammatory arthritis.

Pain remains a predominant symptom in RA and other polyarthritis and is commonly assessed using the Numerical PainScore (NPS), a simple and reliable tool for quantifying pain intensity. The NPRS has demonstrated good reliability and validity across various chronic pain conditions and correlates well with patient-reported outcomes [14–18]. Additionally, inflammatory and serological markers such as rheumatoid factor, C-reactive protein, and erythrocyte sedimentation rate reflect disease activity and systemic inflammation, which may influence nerve function.

Many studies are done in comparison of nerve conduction velocity in Rheumatoid arthritis and normal patients and Polyarthritis and normal patients but few studies are done in rheumatoid arthritis with polyarthritis patients with nerve conduction velocity.

The present study aims to compare demographic characteristics, clinical severity, inflammatory markers, serological profiles, and pain intensity between patients with rheumatoid arthritis and other polyarthritis, in order to better delineate differences in disease severity and symptom burden between these two inflammatory joint conditions

MATERIALS AND METHODS

The case–control, cross-sectional studywas conducted in Departmentof Physiology and Orthopaedics at Dr. Bhim Rao Ramji Ambedkar Government Medical College, Kannauj after obtaining approval from the Institutional Ethics Committee.

A total of 120 patients aged between 30 and 50 years of both gender were included in this study, comprising 60 patients diagnosed with rheumatoid arthritis and 60 patients with other forms of polyarthritis. Patients were recruited from the Departments of Orthopaedics based on clinical evaluation and available laboratory findings. Rheumatoid arthritis was diagnosed according to the 2010 ACR/EULAR classification criteria, with a minimum score of six, while patients with inflammatory arthritis not fulfilling these criteria were classified as polyarthritis. Patients with other systemic disease, pregnancy or lactation, history of drug intake known to affect inflammatory markers or pain perception, and those outside the specified age range

were excluded from the study.

After obtaining consent, a detailed medical history was recorded and a thorough clinical examination was performed. Disease duration, tender joint count, swollen joint count, and duration of morning stiffness were documented for each participant. Pain severity was assessed using the Numerical Pain Score (NPS). Laboratory parameters, including erythrocyte sedimentation rate, C-reactive protein, rheumatoid factor were obtained from patient medical records and laboratory reports.In this, Ulnar and Median nerves of both upper limb will be used for the assessment of Motor and sensory nerve conduction parameters by using **Clarity NCV/EMG 4 channel Machine**with standard protocol.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using appropriate statistical software. Confidentiality has been strictly maintained. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Comparison of continuous variables between the rheumatoid arthritis and polyarthritis groups was performed using the independent Student's *t*-test, and categorical variables were compared using the chi-square test. A *p*-value of less than 0.05 was considered statistically significant.

Results

The present study included a total of 120 participants, comprising 60 patients with Rheumatoid Arthritis (RA) and 60 patients with other Polyarthritis, aged between 30 and 50 years. Out of the total 120 study participants, 60 patients (50%) were diagnosed with rheumatoid arthritis and 60 patients (50%) had other forms of polyarthritis.The mean age of RA patients was 43.0 ± 5.0 years, with a minimum of 30 years and a maximum of 50 years, whereas the mean age of Polyarthritis patients was 38.0 ± 5.0 years, also ranging from 30 to 50 years. A statistically significant age difference was observed between the two groups ($t = 4.92$, $p = 0.0001$), indicating that RA patients were significantly older compared to Polyarthritis subjects despite identical inclusion age limits.

Table1. Demographic, Anthropometric, and Clinical Characteristics of Study Participants

Parameter	Rheumatoid Arthritis (n=60)	Polyarthritis (n=60)	Test value	p-value
Gender				
Male, n (%)	18 (30.0%)	26 (43.3%)	$\chi^2 = 2.31$	0.128
Female, n (%)	42 (70.0%)	34 (56.7%)		
Height (cm)	160.8 ± 8.3	162.3 ± 7.9	t = 1.27	0.21
Weight (kg)	65.9 ± 9.1	66.5 ± 9.7	t = 0.41	0.68
Disease Duration (years)	6.2 ± 2.5	3.1 ± 1.9	t = 7.29	0.0001
Tender Joint Count	6.8 ± 3.0	4.1 ± 2.7	t = 5.06	<0.001
Swollen Joint Count	4.5 ± 2.2	2.8 ± 1.9	t = 4.23	<0.001
Morning Stiffness (minutes)	56 ± 20	34 ± 15	t = 6.48	<0.001

Female predominance was noted in both groups (RA: 70.0%; polyarthritis: 56.7%), with no significant difference in gender distribution ($\chi^2 = 2.31$, $p = 0.128$), and anthropometric parameters were comparable ($p > 0.05$). In contrast, rheumatoid arthritis patients had a significantly longer disease duration (6.2 ± 2.5 vs 3.1 ± 1.9 years; $p = 0.0001$) and significantly higher tender joint count, swollen joint count, and duration of morning stiffness than polyarthritis patients ($p < 0.001$ for all), reflecting greater disease severity in rheumatoid arthritis.

Table 2. Comparison of Inflammatory Markers Between Groups

Marker	Rheumatoid Arthritis (Mean ± SD)	Polyarthritis (Mean ± SD)	t-value	p-value
ESR (mm/hr)	42.6 ± 10.3	28.1 ± 9.5	7.40	<0.001
CRP (mg/L)	12.8 ± 4.4	6.9 ± 3.2	8.01	<0.001

The mean erythrocyte sedimentation rate was significantly higher in rheumatoid arthritis patients (42.6 ± 10.3 mm/hr) compared to polyarthritis patients (28.1 ± 9.5 mm/hr). Similarly, C-reactive protein levels were markedly elevated in the rheumatoid arthritis group (12.8 ± 4.4 mg/L) when compared with the polyarthritis group (6.9 ± 3.2 mg/L). Both differences were highly statistically

significant ($p < 0.001$), indicating greater systemic inflammatory activity in rheumatoid arthritis.

Table 3. Distribution of Pain Severity Based on Numerical Pain Score

Pain Severity (NPS)	RA (n=60)	Polyarthritis (n=60)	Total (%)	χ^2-value	p-value
Mild (1–3)	0	6	6 (5%)	17.2	**<0.001**
Moderate (4–6)	14	32	46 (38 %)		
Severe (7–10)	46	22	68 (57 %)		

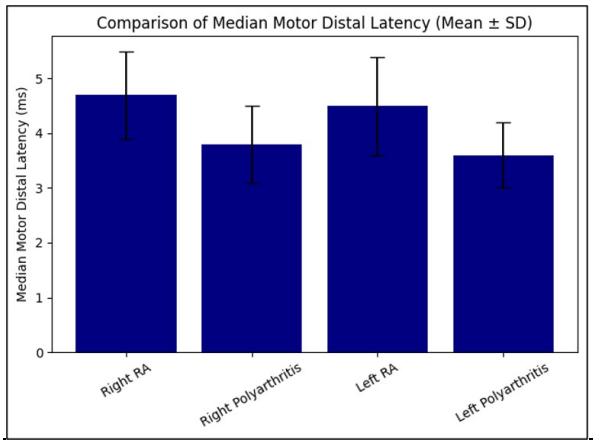
Severe pain (NPS 7–10) was predominantly observed in rheumatoid arthritis patients, with 46 cases compared to 22 cases among polyarthritis patients. Moderate pain was more frequently reported in polyarthritis patients, while mild pain was observed only in the polyarthritis group. The difference in pain severity distribution between the two groups was statistically significant ($\chi^2 = 17.2$, $p < 0.001$), indicating higher pain burden in rheumatoid arthritis.

Table 4. Comparison of Mean Numerical Pain Score Between Groups

Group	Mean NPS ± SD	t-value	p-value
Rheumatoid Arthritis	7.6 ± 1.2	6.84	**<0.001**
Polyarthritis	5.8 ± 1.4		

The mean numerical pain score was significantly higher in rheumatoid arthritis patients (7.6 ± 1.2) compared to polyarthritis patients (5.8 ± 1.4). This difference was statistically significant ($t = 6.84$, $p < 0.001$), reflecting greater pain intensity in rheumatoid arthritis.

Graph 1: Comparison of Median Motor Distal Latency (Right & Left)



Graph 2:Comparison of Median Sensory Conduction Velocity (Right & Left)

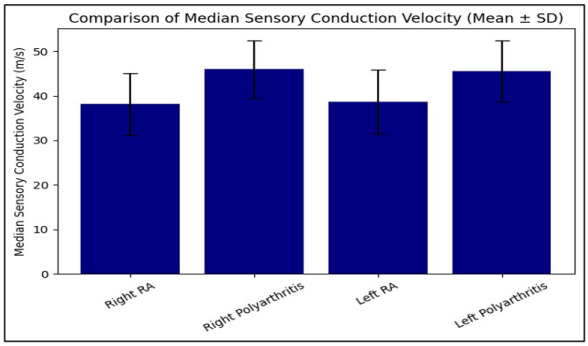
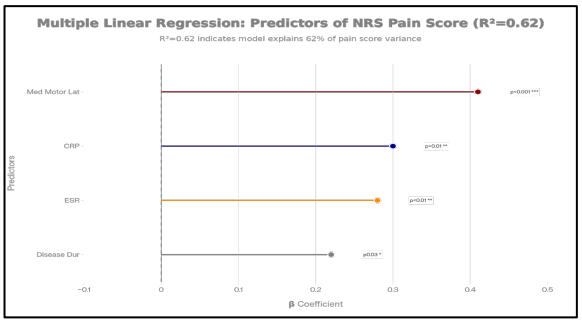


Table 5. Pearson correlation matrix between clinical, inflammatory, pain and nerve conduction parameters in RA patients

Variable	Age	Disease Duration	ESR	CRP	NPS Pain	Median Motor Latency	Median Motor CV	Median Sensory CV
Age	1.00	0.45	0.28	0.25	0.18	0.26	-0.22	-0.20
Disease Duration	0.45	1.00	0.36	0.33	0.40	0.41	-0.38	-0.35
ESR	0.28	0.36	1.00	0.70	0.44	0.39	-0.41	-0.32
CRP	0.25	0.33	0.70	1.00	0.51	0.42	-0.46	-0.37
NPS Pain	0.18	0.40	0.44	0.51	1.00	0.60	-0.58	-0.49
Median Motor Latency	0.26	0.41	0.39	0.42	0.60	1.00	-0.71	-0.52
Median Motor	-0.22	-0.38	-0.41	-0.46	-0.58	-0.71	1.00	0.64

CV								
Median Sensory CV	-0.20	-0.35	-0.32	-0.37	-0.49	-0.52	0.64	1.00

Graph 3: Multiple Linear Regression for Predictors of Pain (NPS/NRS)



DISCUSSION

The present study compared demographic, clinical, inflammatory, serological, and pain-related characteristics between patients with Rheumatoid Arthritis (RA) and other Polyarthritis, providing insight into differences in disease severity and symptom burden between these two groups.

In the present study, an equal number of patients with RA and Polyarthritis (60 each) were included, ensuring balanced group representation. This is a methodological advantage compared to earlier studies such as Agarwal et al. (2008) [19], Kaeley et al. (2019) [20], and Sakini et al. (2005) [21], which evaluated only RA cohorts without a Polyarthritis comparison group. The balanced design in the present study allowed more reliable comparison between the two diagnostic categories.

RA patients were significantly older than Polyarthritis patients (43.0 ± 5.0 vs 38.0 ± 5.0 years, p = 0.0001), despite identical inclusion age limits. This finding is consistent with Agarwal et al. (2008) [19], who reported a mean age of 45.83 years, and Sakini et al. (2005) [21], who observed that RA was most prevalent in the 40–49-year age group. Age-category analysis in the present study further demonstrated that Polyarthritis predominated in younger adults (30–39 years), while RA showed a shift toward older age groups, supporting known epidemiological patterns of RA onset.

Female predominance was observed in both groups, with females constituting 70.0% of RA patients and 56.7% of Polyarthritis patients, although the difference was not statistically significant. This finding is consistent with previous studies reporting higher prevalence of RA among females, including Agarwal et al. (2008) [19] and Kaeley et al. (2019) [20]. The slightly lower female proportion observed in the present study remains within the expected epidemiological range. Anthropometric parameters including height, weight, and body mass index were comparable between the two groups, a finding similar to that reported by Bhise et al. (2025) [22] and Dash et al. (2019) [23], suggesting that body habitus does not significantly differ between RA and Polyarthritis patients.

The present study demonstrated that disease duration was significantly longer in RA patients (6.2 ± 2.5 years) compared with Polyarthritis patients (3.1 ± 1.9 years, p = 0.0001). This finding reflects the chronic and progressive nature of RA and is in agreement with Kaeley et al. (2019) [20], who reported longer disease duration in RA patients. The longer duration in RA likely contributes to greater disease burden and symptom severity.

Clinical parameters indicated significantly greater disease severity in RA patients, as evidenced by higher tender joint count, swollen joint count, and longer duration of morning stiffness (all p < 0.001). These findings align with Kaeley et al. (2019) [20], who reported higher disease activity scores in RA patients. The increased joint involvement and prolonged stiffness observed in the present study highlight persistent inflammatory activity in RA compared to other Polyarthritis conditions.

Inflammatory markers were significantly elevated in RA patients, with higher ESR and CRP levels compared to Polyarthritis patients (p < 0.001). These findings are consistent with previous studies, including Kaeley et al. (2019) [20] and Li et al. (2019) [24], which reported higher inflammatory burden in RA. The elevated ESR and CRP levels observed in the present study indicate increased systemic inflammation in RA, which likely contributes to greater clinical severity and symptom burden.

Serological analysis showed significantly higher positivity for rheumatoid factor and antibodies in RA patients compared to Polyarthritis patients. These findings closely mirror those reported by Agarwal et al. (2008) [19] and Kaeley et al. (2019) [20], confirming the diagnostic specificity of these markers for RA and reinforcing their role in distinguishing RA from other inflammatory arthritis.

The reduced median motor CV observed in our study is consistent with the electrophysiological pattern of conduction slowing reported in RA-related

neuropathy. Similar findings have been reported by Bhise et al. (2025) [22], who observed reduced deep peroneal conduction velocity in RA patients compared with controls and foundthat sensory conduction velocity of the median nerve was significantly reduced in RA patients compared with Polyarthritis patients. Dash et al. (2019) [23] also reported reduced sensory conduction velocity in deep peroneal nerves among RA patients compared with controls. Agarwal et al. (2008) [19] described predominantly sensory or sensorimotor axonal neuropathy in 85.5% of affected RA patients, which typically results in reduced conduction velocity and amplitude.

Pain assessment revealed a significantly higher pain burden in RA patients. Severe pain (NPS 7–10) was predominantly observed in RA patients, while moderate and mild pain were more common in Polyarthritis patients. The mean numerical pain score was also significantly higherin RA patients (7.6 ± 1.2) compared with Polyarthritis patients (5.8 ± 1.4, $p < 0.001$). These findings are in agreement with Kaeley et al. (2019) [20] and Pereira et al. (2022) [25], who reported higher pain scores in RA patients, indicating that RA is associated with greater pain intensity than other forms of Polyarthritis.

Correlation analysis demonstrated strong interrelationships between pain, inflammation, and nerve conduction abnormalities, with pain strongly correlated with median motor latency ($r = 0.60$) and negatively correlated with motor conduction velocity ($r = -0.58$) and sensory conduction velocity ($r = -0.49$).Regression analysis confirmed median motor latency as the strongest independent predictor of pain ($B = 0.52$, $p < 0.001$), followed by CRP, ESR, and disease duration, indicating the combined influence of neuropathic and inflammatory factors.

Overall, the present study demonstrates that patients with Rheumatoid Arthritis exhibit greater disease severity, higher inflammatory burden, increased seropositivity, and more intense pain compared with patients with other Polyarthritis. These findings emphasize the need for early identification and comprehensive management of RA to address both inflammatory activity and pain-related morbidity.

Conclusion

The present study demonstrates that patients with Rheumatoid Arthritis exhibit significantly greater disease severity compared to those with other Polyarthritis, as evidenced by older age at presentation, longer disease duration, higher tender and swollen joint counts, prolonged morning stiffness, elevated inflammatory markers, increased seropositivity for rheumatoid factor and a markedly higher pain burden. The predominance of severe pain and higher mean numerical pain scores in RA patients highlight the substantial impact of the disease on patient well-being. These findings underscore the chronic, systemic, and more aggressive nature of rheumatoid arthritis relative to other inflammatory arthritis and emphasize the importance of early diagnosis, regular assessment of disease activity, and comprehensive management strategies aimed at controlling inflammation and alleviating pain to reduce disease-related morbidity.

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