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RESEARCH ARTICLE
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STUDY OF PREVALENCE OF PRONATOR TERES SYNDROME IN TWO-WHEELER GARAGE WORKERS.

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ABSTRACT

BACKGROUND- Pronator Teres Syndrome is defined as the median nerve compression at the proximal forearm between the two heads of pronator teres muscle. Hypertrophy of pronator teres muscle is the commonest cause of Pronator Teres Syndrome. Incidence of Pronator Teres Syndrome of Upper limb compressive neuropathy is 1.1%. Pronator Compression test is the commonly used test to diagnose Pronator teres syndrome. The activity which requires repetitive movement such as grasping and pronation or both (For example hammering, driving a screw driver) can aggravate the symptoms of Pronator Teres Syndrome.

METHOD- The study was conducted after Ethical Clearance was obtained from Institution ethical committee. According to inclusive criteria total 102 participants were included in this study. Participants were included according to Convenience Sampling method; each participant was assessed by using Pronator Compression Test & Pronator Teres Test.

RESULT- Prevalence of Pronator Teres Syndrome in Two Garage Workers was be analysed by using SPSS software. Out of 102 participants 63 were Positive for pain and reduced grip strength and 37 were negative that showed 61.8% prevalence of Pronator Teres Syndrome in two-wheeler garage workers. The results also showed significance of reduced grip strength in the dominant hand of the garage workers who tested positive for Pronator Teres Syndrome.

CONCLUSION - This study concluded that Prevalence of Pronator Teres Syndrome among two-wheeler garage workers is 63% with reduced grip strength in the dominant hand that highlighted the functional impact of this condition on the two-wheeler garage workers.

Keywords- Pronator Teres Syndrome, Handheld Dynamometer, Grip Strength, NPRS, Pronator Teres Test, Two-wheeler garage workers

INTRODUCTION

Pronator Teres Syndrome was discovered first by Henrik Seyffurth. Pronator Teres Syndrome is caused due to proximal compression of median between two heads of pronator teres muscle. [1] Along with Flexor Carpi Ulnaris, Palmaris Longus and Flexor Carpi Radialis, Pronator Teres muscle forms the superficial layer of anterior forearm group. [2,3]

The Prevalence of Musculoskeletal Disorders in garage workers was done, in which pain was assessed for last 12-month, 1 month and 7 days, where it was concluded that during last 12 months garage workers were having 61.33% pain in neck, 56% in shoulder, 10.66% in elbow and 33.33% in wrist/hand. During last 1-month workers were having 60% pain in neck, 53.33% in shoulder, 10.66% in elbow and 29.33% in wrist/hand and during last 7 days workers were having 57.33% pain in neck, 46.66% in shoulder, 6.66% in elbow and 26.66% in wrist/hands. [4]

Pronator Teres Syndrome is caused due to median nerve compression originating from C5 – C8 and T1 at brachial plexus. Initially it passes with brachial artery at lateral side, crosses it at mid arm and continue distally between bicep brachii and brachialis. Once it reaches the antecubital fossa, it travels beneath the lacertus fibrosus, it travels commonly between ulnar and humeral head of Pronator Teres. Distally it descends deep to two heads of Flexor Digitorum Superficialis and continues into forearm between Flexor Digitorum Superficialis and Flexor Digitorum Profundus. It passes into the palm through a course between Flexor Digitorum Superficialis and Flexor Retinaculum. It supplies sensory branch to palm lateral side and motor branch to the flexors. [5]

The topographical relationship between the course of median nerve and Pronator Teres muscle plays a key role in compression symptoms.[6,7] So any morphological variation in the Pronator Teres muscle is directly related to cause of median nerve compression at that area.[8] Dellon and Mackinnon report that when humeral head origins from 2 cm proximal to medial epicondyle , the fascia connected to the lacertus fibrosus condense the median nerve.[9] Werner et al. showed that in 78% of cases , the nerve penetrated the superficial head of Pronator Teres muscle , itself condense the median nerve.[7]

Pronator Teres Syndrome is diagnosed through physical examination which is GOLD standard method of diagnosis. [10] Pronator Compression test is the commonly used test to diagnose Pronator Teres Syndrome, in this test sustained pressure is applied over the pronator teres muscle for 30 sec. It is the site where median nerve can provoke the symptoms. Positive test include pain and paraesthia at site supplied by the median nerve. The clinical features present in Pronator Teres Syndrome are aching in proximal forearm and paraesthesia in the area supplied by the median nerve. [8] Alder et al. states that numbness in the thenar eminence is commonest sign in patients with Pronator Teres Syndrome. [10] The activity which requires repetitive movements such as grasping and pronation or both (For example hammering, driving a screw driver) can aggravate the symptoms. [6]

The incidence of Pronator Teres Syndrome of the Compressive Neuropathies of Upper Extremity is 1.1%. [11] Carpel tunnel syndrome has found to be the most common misdiagnosis of Pronator Teres Syndrome. [5]

Pronator Teres Syndrome commonest cause is the hypertrophy of Pronator teres muscle. There are some researches which have discovered some other structures that provokes Pronator Teres Syndrome, such as Lacertus Fibrosus, the Flexor Digitorum Superficialis Fibrous Arch, ligaments of supracondylar process and the accessory head of Flexor Pollicis Longus. The incidence of causes varies, ranging from 33% to 76% when the cause is pronator teres muscle, 0% to 42% for lacertus fibrosus and 14 % to 36% for flexor digitorum superficialis fibrous arch. [12,6,13]

Lacertus fibrosus is facial extension which extends from the distal part of the ulnar aspects of the bicep tendon, it obliquely crosses antecubital fossa, and then travels anteriorly and merges with deep fascia of forearm flexors. It causes Pronator Teres Syndrome symptoms when the underlying inferior structure are compressed including the median nerve. According to a study the nerve compression site is common when it coincides with high origin of humeral head of pronator teres muscle. [5]

Flexor Digitorum Superficialis is largest extrinsic flexor of forearm. It forms primary flexor of the Proximal Interphalangeal Joint of middle phalanx and form the intermediate muscle layer between superficial and deep muscle group of forearms. Commonly it has humeroulnar head, originating from medial epicondyle and either interosseous membrane or the radial head and radial surface of ulna.

Two head jointly form a fibrous arch under which the Median Nerve travels before continuing distally. This is the site where Median Nerve can get compressed. [5]

Differentiation between the cause of Pronator Teres Syndrome I.e. Pronator Teres muscle, Lacertus Fibrosus and Flexor Digitorum Superficialis Fibrous Arch can be done with the help of physical examination. For testing the Pronator Teres muscle as the compression site, the patient is instructed to perform forearm pronation against resistance given by the examiner with elbow flexed from 0 – 45°. Increase pain sensation or paraesthesia indicates median nerve compression against the pronator teres muscle. [12,14,11] The lacertus fibrosus can be tested by placing patient elbow in 100°-135° flexion, resistance is given during elbow flexion and forearm supination, paraesthesia during resistance suggests that the Lacertus Fibrosus may be the potential site for compression of median nerve. Sustained resistance applied during flexion of middle Proximal Interphalangeal Joint can be used to check the Flexor Digitorum Superficialis Fibrous Arch as the compression site for median nerve. [12,11]

The Pronator Teres Syndrome can be treated either conservative or surgically. Treatment method which can be used as conservative method includes rest, activities which exacerbate the symptoms should be modified, Physiotherapy and Occupational therapist, NSAIDS. [8,11] Patient can continue their work until they are present with prominent motor/sensory deficits which limit Their work and the conservative treatment should be continued for 6 weeks. [15]

Surgery is indicated if the patient is symptomatic, exhibits one or more signs of weakness or muscle atrophy during a physical examination, does not respond to conservative treatment, and has abnormal electrodiagnostic study results. [10] In surgical treatment exploration of median nerve in the forearm & release of Pronator Teres muscle as well as other compressive structure such as ligament of Struthers, Lacertus Fibrosus, and/or fascia of Flexor Digitorum Superficialis is done. [15]

METHODOLOGY

The study was carried out after receiving ethical clearance from the Institutional Ethical Committee. A total of 102 participants were selected based on the inclusion criteria.

INCLUSION CRITERIA

Participants belonging to the age group from 30-50 years of age, two-wheeler garage workers working for more than 5 years, belonging to the Male gender.

EXCLUSION CRITERIA

PROCEDURE:

Patients having fractures of Upper limb, having history of trauma of upper limb Surgeries.

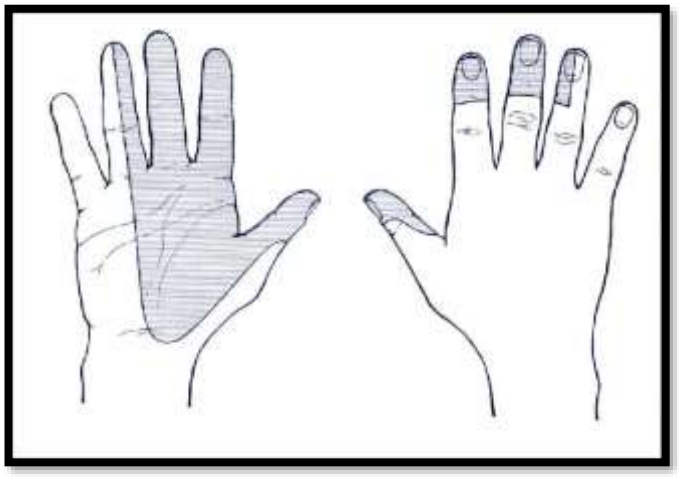
Prior written consent form was obtained from the participants. Pre assessment value was recorded before the study was started. The patient will be explained in detail about the procedure of the examination and symptoms which he may feel during the test. The patient may have symptoms of dull aching pain in forearm with paraesthesia in areas supplied by the median nerve i.e. the thumb palmar surface, the index finger, the middle finger, and the little ring finger. (9, 10, 15) Median nerve can be compressed proximally by three structures i) Pronator Teres muscle ii) Lacertus Fibrosus iii) The Flexor Digitorum Superficialis Fibrous Arch. (6, 11, 15) So to diagnose Pronator teres syndrome the other cause for the nerve compression should be excluded. All the three structures should be assessed for the accurate diagnosis of the median nerve compression. Pronator Teres muscle can be palpated around 6 cm below to the elbow and 4 cm lateral to the medial epicondyle. (7, 8) During physical examination The Pronator Teres Syndrome can be diagnosed mainly using static examination.

PRONATOR COMPRESSION TEST: - The patient may be in sitting position or standing as per the patient comfortness, therapist then apply pressure maintained for 30 sec. over the muscle at the place where median nerve course can increase paraesthesia. A positive test indicates paraesthesia in the areas supplied by the median nerve. (7, 14)

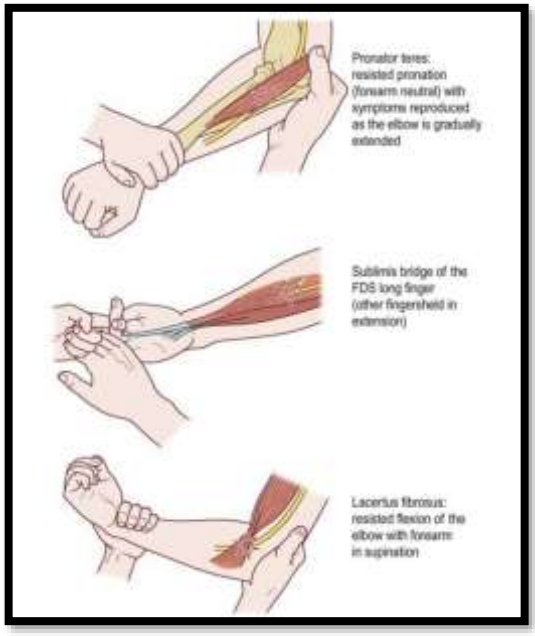
For differentiating between the other site of nerve compression proximally, dynamic test should be performed. To test Pronator Teres muscle as the site of nerve compression, the patient elbow is flexed between 0° - 45° and perform forearm pronation against the resistance provided by the Therapist hand. Positive test will show increase pain sensation and paraesthesia in the area supplied by the median nerve. [6, 7, 14] It has sensitivity **of 44%** and a **specificity of 100%.** [26]

For testing lacertus fibrosus as the site of compression, the patient is asked to flexed the elbow between 100°-135°. Resistance is applied during elbow flexion and forearm supination. A positive test indicates paraesthesia in the area of median nerve course. Sustained resistance applied against the flexion of Proximal Interphalangeal Joint of middle finger can be used to check the cause of nerve compression at the Flexor Digitorum Superficialis Fibrous Arch. [6, 14]

Data was collected on all study variables will be entered in MS Excel to prepare Master sheet.



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RESULT

Table No. 1 Age and Working Experience Distribution



Table No. 1 Age and Working Experience Distribution

Working experience	Mean
Positive	13.3
Negative	6.97
Age	39.05

Table No.1 shows mean of working experience of positive participants, negative participants and mean positive participants is 13.3yrs whereas for negative participants it is 6.97yrs. The overall mean of age of total participants is 39.05 years. of age. Mean

Table No. 2 No. of participants Positive/negative for Pronator Compression test

Pronator compression test	No. of Participants	Percentage
Positive	63	62%
Negative	39	38%
Total	102	100%

Table no.2 shows the tabular representation of participants who were underwent with pronator compression test which shows total no participants 102 in which 62% were positive and 38% were negative in pronator compression test.

Table No. 3 No. of participants Positive/negative for Pronator Teres test

Pronator Teres muscle test	No. of Participants	Percentage
Positive	63	62%
Negative	39	38%
Total	102	100%

Table no. 3 shows the tabular representation of participants who were underwent with pronator teres test which shows total no participants 102 in which 62% were positive and 38% were negative in pronator teres test.

Table No.4 Right/Left Grip strength among the positive and negative participants

Grip Strength	Right side		Left side		P-value
	Mean	S.D.	Mean	S.D.	
Positive	50.75	10.45	47.32	11.83	8.98E-08*
Negative	52.00	10.31	47.67	10.32	3.11E-06*

Table no. 4 shows tabular representation of Grip strength of right and left side of participants. The mean grip strength for negative participants (52.00) is more than for positive participants (50.75). However, the variability is quite similar for both groups, with slightly higher variability in positive participants. There is small difference in mean grip strength of left hand between the positive (47.32) and negative (47.67) participants. In left hand grip strength positive participants is noticeably higher compared to negative participants.

Both p values are extremely small and less than significance level (0.05) which state that there is statistically significant difference between the right & left grip strength of positive and negative participants.

Table No. 5 NPRS score of Positive & Negative Participants at Rest & on Movement

Numeric Pain Rating Scale	On Rest		On Movement		P-value
	Mean	S.D.	Mean	S.D.	
Positive	1.71	0.75	4.05	1.20	7.5E-29*
Negative	0.10	0.31	0.10	0.31	0.50

Table no. 5 shows tabular representation of Numeric Pain Rating Scale (NPRS) scores for both positive and negative participants at two conditions: on movement and on rest. The mean pain score at rest is 1.71with SD of 0.75 in positive participants. The mean pain score at rest is 0.10 with SD of 0.31 in negative participants. The p- value is 7.5E-29, which is significant. This shows that there is statistically significant difference in pain scores at rest between positive and negative participants. This means positive participants report significantly higher pain at rest compared to negative participants.

The mean pain scores during movement is 4.05 with a SD of 1.20 in positive participants. The mean pain score during movement is 0.10 with a SD of 0.31. The p- value is 7.5E-29, which is significant. This indicates that there is significant difference in pain scores at rest between positive negative participants. This means positive participants report significantly higher pain on movement compared to negative participants. Positive participants experience significantly higher pain during movement compared to negative participants.

DISCUSSION

In the above study, the mean age of the participants was 39.05. Pronator Syndrome was screened by Pronator compression test and Pronator syndrome test which is used as a gold standard measure for assessing pronator teres syndrome. Grip strength was assessed through handheld dynamometer.

Previous study conducted by Alka Chandrakanta indicate that jobs involving heavy labour or manual material handling are classified as high-risk. Manual handling operations such as lifting, carrying, pushing, pulling, and holding heavy objects can contribute to various injuries, including strains, sprains, fractures, cuts, bruises, and lower back pain caused by improper posture and fatigue. The research also highlights the increased risk of musculoskeletal conditions affecting the back, spine, head, elbows, and hands due to heavy manual lifting and carrying tasks. Additionally, awkward postures—such as prolonged or repetitive reaching, overhead work, squatting, bending, kneeling, and maintaining fixed positions or pinch grips—are main contributors to musculoskeletal disorders. [4]

Garage workers are highly exposed to heavy material handling. Heavy lifting and repetitive tasks of certain activity in the garage increase the risk of work-related occupational health hazards within the garage workers. In this study the researchers assessed the Musculoskeletal Disorders among the people who have experience of 7 days, one month, and 12 months. When assessed about the occurrence of pain during last one month, 60% of the garage workers complained of pain at neck and 30.66 % of garage workers complained of pain and discomfort in both shoulders respectively. Whereas, only 6.66 % of garage workers complained of pain in the right elbow. The Data revealed that during the last 12 months 61.33 % of the garage workers reported pain in neck pain, 5.33% and 30.66 % in the right shoulder, left shoulder, and both shoulders respectively. The Garage workers had pain in the right elbow (8%). 57.33 % of garage workers reported pain in the neck whereas 26.66 % in both shoulders during the last 7 days. On the other hand, 4 % of workers reported right elbow pain. [4]

Previous literature by Ahmadreza Afshar on Pronator Syndrome Due to Schwannoma concluded that Pronator Teres Syndrome (PTS) caused due to median nerve (MN) compression proximally between two head of pronator teres muscle. It is commonly seen in individuals whose work or daily activities involve repetitive pronation-rotation movements of the forearm. Additionally, it may cause due to excessive muscle overload of the pronator and finger flexor muscles, leading to nerve compression and associated symptoms. [16]

Another study conducted by Rahul Jain found that grip strength values vary significantly based on working experience levels. The study also revealed that significant differences in grip strength across various upper-limb muscle activities indicate that prolonged exposure to hand tools—especially under conditions involving twisting, bending, or other repetitive hand movements—causes a significant impact on manual arm strength. [17]

Previous study by Stål M, Hagert CG, Englund JE investigated Pronator teres syndrome among female machine milkers, an occupation involving repetitive forearm movements similar to those performed by two-wheeler Garage workers. These findings suggest that repetitive tasks which requires forearm pronation and wrist flexion can increase the risk of developing Pronator teres syndrome. [18]

Another study conducted by Zhou Z, Meng P, Jia N states that prevalence of elbow WMSDs among workers was 7.3%. This Study shows that the risk factors for having elbow WMSDs include age above 40, lifting weights, work requiring upper limb or hand force, who works on uncomfortable position, and doing repetitive operation in one minute. The other factors which can cause elbow WMSDs are work involving cold, cool draughts, work being done outdoor, often working overtime. [19]

The above study investigates the prevalence of **Pronator Teres Syndrome (PTS)** among two-wheeler garage workers and its impact on grip strength. These findings reveal that **63%** of the participants tested positive for Pronator Teres Syndrome, with a significant proportion exhibiting reduced grip strength in their dominant hand.

The high prevalence of PTS (Pronator Teres Syndrome) in this cohort can be associated to occupational activities involving repetitive forearm pronation and forceful gripping. Such movements are integral to tasks like using wrenches and screwdrivers, common in garage work. These repetitive motions can cause median nerve entrapment at the Pronator Teres muscle, resulting in symptoms such as pain, numbness, and weakness in area supplied by median nerve in the affected hand. Similar previous research showed that occupations requiring repetitive and forceful manual movements are associated with a higher prevalence of nerve entrapment syndromes.

The observed reduction in grip strength among Pronator Teres Syndrome-positive individuals are reliable with the pathophysiology of the syndrome. Compression of the median nerve can be impaired motor function, particularly affecting the flexor muscles responsible for grip strength. This impairment can significantly impact the efficiency and productivity of workers, potentially leading to long-term musculoskeletal disabilities. Similar findings have been reported in studies of other occupations which involves repetitive manual tasks.

Our findings underscore the importance of ergonomic interventions, screening regularly, and strategies to reduce and prevent the risk of Pronator Teres Syndrome among two-wheeler garage workers. Implementing measures such as stretching exercises, tool modifications, and work-rest cycles could help reduce the incidence of Pronator teres syndrome. Future research with larger sample sizes and electromyographic assessments could provide more definitive understanding the functional impairment caused by pronator teres syndrome in this population. Intervention-based studies focusing on physiotherapy and ergonomic modifications could also help to provide effective strategies for preventing and managing Pronator teres syndrome among two-wheeler garage workers.

CONCLUSION

This study concluded that Prevalence of Pronator Teres Syndrome among two-wheeler garage workers, is 63% of participants testing positive. Notably, individuals with Pronator Teres Syndrome showed reduced grip strength in their dominant hand, highlighting the functional impairment of the condition.

Furthermore, the average working experience of individuals with Pronator Teres Syndrome was 13.30 years, suggesting a potential link between prolong occupational exposure and the development of Pronator Teres Syndrome. It indicates the need for targeted interventions, workplace modifications and regular health screenings to reduce the risk of Pronator Teres Syndrome among two-wheeler garage workers.

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