Determining The Likelihood Of Self Designed Questionnaire In Diagnosis Of Lateral Epicondylitis Among Recreational Athletes

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Abs Abstract : The purpose of this study was to determine the prevalence of lateral epicondylitis among recreational athletes of Karachi population, as well as checking the validity of self-designed questionnaire using likelihood ratio. This was a cross sectional study, including 193 participants (176 males and 17 females) from different clubs of karachi districts. A self-designed questionnaire was used to take pre assessment measure of lateral epicondylitis. After the completion of questionnaire, Cozen test was applied on each participant. The results obtained from the scoring of the questionnaire and cozens test were compared using the likelihood ratio, proceeded by the comparison of the pretest and posttest probability. 7 out of 193 were found to have a positive test. The results revealed that the prevalence of LE among young recreational athletes (aged 20-40 years) was estimated to be 3.6%, whereas, the questionnaire used has a sensitivity of 10.5%, and the specificity of 97%. Thus, this confirms that the questionnaire used, is valid to rule in the negative results.

Index Terms: Likelihood, Nomogram, Cozen test, lateral epicondylitis

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1 INTRODUCTION

Sports being a widely recognized pursuit, has a great economic as well as social impact on the society. People belonging to different age groups are found to be quiet fond of sports as it has a significant positive impact on the individual's state of health as well as quality of life [1]. According to the 2018 Physical Activity Council (PAC) Participation Report on sports and activities in the U.S, sports have high participation rates all over the world. In 2014, a survey conducted showed 44% of the European Union population, aged 15 or above are found to practice sports with a frequency of at least once a week while most common participation is found in Denmark, Germany, Finland, Sweden and Austria. In the same year another survey estimated that, 29.9% of the EU population aged 18 or above are found to be involved in recreational activities spending at least 2.5 hours per week of their leisure time in different sports activities [2]. In Asian population more than one third of Chinese population is found to be involved in playing sports whereas, specifically more than one fifth are involved in playing badminton and table tennis, while 18% of their athletes play basketball [3]. In Pakistan, cricket is the most popular sports followed by football, snooker, table tennis, badminton, squash, hockey, tennis, boxing and volleyball [4]. Over the past 30 years, there has been a notable increase in sports participation and athletic activities, among youth [5].Racquet sports majorly including Tennis, Squash and badminton has become quite common during the recent years because of it being highly accessible, convenient and feasible to each individual, irrespective to age group [6].Approximately more than 80 million people are found to participate in Tennis sports worldwide. Most of which are recreational players [7]. Whereas, more than 200 million players of all levels are found to be involved in playing badminton [8].Squash is found to be the 3rd fastest growing sports activity in US with an increasing participation rate of more or less 60% from 2010 to 2015 [9]. Consequently, greater the involvement of individuals in sports, greater will be the prevalence of repetitive MSK disorders, since sports frequently require repetitive movements. During 2009 - 2015 a study was conducted by National Collegiate Athletic Association (NCAA) Injury Surveillance Program ISP with a total 44 participants, 19 male and 25 female varsity

(university) tennis programs. It was found to have an overall injury rate of 4.9 injuries per 1000 athlete exposure. These injuries can lead to withdrawal from the sports participation. After lower extremity, upper extremities are the second most common location of injury among tennis players [10]. Whereas, another study reveals that overuse (chronic) Injuries are more common in upper extremities among racquet sport players [11]. Chiefly, wrist extension is a common movement performed during most of the strenuous activities by manual workers and sports athletes. Various studies explained that repetitive occupational and athletic activities involving high impact upper limb movements, in turn affect the common attachments of the wrist extensor muscles at the lateral epicondyle of humerus [12]. This condition is most often associated with the repetitive contraction of the extensor carpi radialis and it and it could likewise be related with the state of the tennis racquet, an inappropriate technique while playing tennis or with the frequency of play [13].This condition results in pain and tenderness over the lateral epicondyle that may radiate distally to the forearm throughout the extensor muscle area. The pain is said to worsen with passive flexion, resisted wrist extension and with gripping activities [14]. Some authors also suggest that the lateral aspect of the elbow joint experiences more traumas due to repetitive wrist extension and supination leading to the lateral epicondylitis. Kane, et al [15] in 2014 reveals that lateral epicondylitis occurrence is four to ten times more common than medial epicondylitis. However, in 2016 Di Giacomo [16] reveals that professional players are more prone to injury to the medial side of elbow as compared to the lateral side. Most of the researches regarding the prevalence of LE among the racquet sports players are more than 10 years old, which questions their reliability within the ongoing era [17]. Although many Pakistani's are involved in playing sports at either professional as well as recreational level, but no study or survey is recently conducted in order to provide the statistics. Hence, the main aim of this research is to find the prevalence of LE among recreational athletes (Tennis, table tennis, badminton and, squash) of Karachi population, which is a common elbow injury among individuals involved in high impact wrist extension activities and to determine the likelihood ratio between the pre-test assessment (history

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taking) of findings and post-test confirmation (special test) of findings gathered by the physical therapist among the lateral epicondylitis patients.

2 METHODOLOGY

2.1 STUDY SETTING
The study was conducted in DHA Suffa University Defence, Iqra University Defence, Institute of Business Administration, Karachi Gym khana Metropolitan, Karachi Club Clifton, Pavilion End Club, Sindh Sports Board Complex

2.2 STUDY DESIGN
Cross sectional study

2.3 TARGET POPULATION
Recreational athletes of Karachi population

2.4 DURATION OF THE STUDY
6 months after the approval of synopsis

2.5 SAMPLING TECHNIQUE
Cluster sampling technique.

2.6 SAMPLE SIZE
Sample size of 193 is calculated using EPI software for sample size calculation, with the population size of 1000000, keeping Confidence Interval (CI) 95%, frequency 50%and 7% bound of error

$$n =[DEFF*Np(1-p)]/[(d2/Z21-α/2*(N1)+p*(1-p)]$$

2.7 DATA COLLECTION METHOD AND INSTRUMENT
The study was conducted by a group of students from Ziauddin College of Rehabilitation Sciences; the data was collected through a self-designed questionnaire followed by the application of Cozens test for the diagnosis of lateral epicondylitis.

2.8 PROCEDURE
A total of 193 individuals were enrolled in the study including 176 males and 17 females, who were involved in playing at least one racquet sport (i.e.; Tennis, Squash, Badminton and table tennis) for more than 2 hours a week. Six trained physical therapists were dispensed for gathering of the data. Visiting schedule for the data collection was decided keeping the peak visited days and hours by the recreational athletes under consideration. Well known sports organizations from the different districts of Karachi, like Karachi club, Karachi gym Khana, and pavilion end club, Sindh sports board complex North Nazimabad, Iqra University, IBA Karachi University and DHA Suffa University were selected to recruit the athletes by cluster sampling technique. On each visit to the organization, firstly, the permission letter was displayed and written consent was taken and there questions regarding the research were addressed.

1-PRE-TEST MEASUREMENT USING A SELF-DESIGNED QUESTIONNAIRE
A self-designed questionnaire was used to take pre assessment measure of lateral epicondylitis. At each organization, all the participants were greeted and introduction was given, followed by the explanation of the research purpose along with its pros and cons. Next the

consent was taken and the questionnaire as well as special test was explained to all the participants. The participants were then asked to fill the questionnaire in their chosen language (English/Urdu). Later each question was assessed using a specific scoring system, in which out of total 11 questions 8 were scored as; question 1, 2, 5, 6 were scored out of 4 from which question 1 and 5 were given 1 till 4 points as much the options were selected, while question 2 and 6 were given points 1 2 3 or 4 for a b c and d respectively. Whereas, Question 3, 8, 10, 11 were scored as 1 for a yes and 0 for a no. however, question 4, 7 and 9 were not used for scoring. This questionnaire helped in identifying the probability of patient having the disease

2- POST-TEST ASSESSMENT
After the completion of questionnaire, each participant was assessed for the presence of any signs and symptoms related to lateral epicondylitis. Followed by the application of the cozens test since it has a sensitivity of 84%, whereas the specificity is 0% (Saroja et al, 2014).The procedure of performing cozens test is as follows: Participant was seated in a comfortable position with the elbow made stable over the surface. He/ she were then asked to flex the elbow 90º and therapist pronated the arm passively while keeping the wrist in neutral position. The therapist stabilized the elbow of the participant and palpated the lateral epicondyle with his thumb. Participants were then asked to actively make a fist, radially deviate and extend the wrist. The therapist exerted resistance against the direction of the wrist extension and watches for the signs of pain or discomfort or for any sign of weakness while the procedure was performed. The results of each participant were recorded.

3-OUTCOME MEASURES
Afterwards, the results obtained from the scoring of the questionnaire and cozens test were compared using the likelihood ratio, proceeded by the comparison of the pre-test and post-test probability.

2.9 SAMPLE SELECTION

INCLUSION CRITERIA
Athletes will be recruited from variant sports clubs of Karachi, fulfilling the criteria of being recreational athletes aged between 20-40 years of both genders, who should be involved in playing one or more of the following sports: table-tennis, tennis, squash and badminton, for more than 2 hours per week [18].The participants should be able to read and write English or Urdu and are willing to participate in the study.

EXCLUSION CRITERIA
Individuals with the prior diagnosis of any neuro-musculoskeletal disorders (like carpal tunnel syndrome, fibromyalgia, upper limb fractures, polyarthritis, soft tissue inflammatory conditions), cervical radiculopathy, prior upper extremity surgery, or malignancy [19]

2.10 DATA ANALYSIS METHOD
Data was analysed using SPSS version 20. Demographical data was represented by frequency and percentage chart
For the purpose of posttest analysis, likelihood ratio of cozens test was calculated which was found to be 0.8 (sensitivity:

84%, specificity: 0%). A likelihood nomogram was used to find out posttest probability for the diagnosis of LE

Table 2: Posttest probability analysis using nomogram

Post-test probability	Frequency	Percent
.09	2	1.0
.09	28	14.5
.12	31	16.1
.17	20	10.4
.20	45	23.3
.24	26	13.5
.29	9	4.7
.34	7	3.6
.39	6	3.1
.44	7	3.6
.48	5	2.6
.54	3	1.6
.60	1	.5
.64	3	1.6
Total	193	100.0

3 RESULTS

A total of 193 participants including both genders with the mean age of 26.15±6.51 were recruited in the study. Out of which 176 were males and 17 were females, the gender distribution of participants is depicted in Figure1.
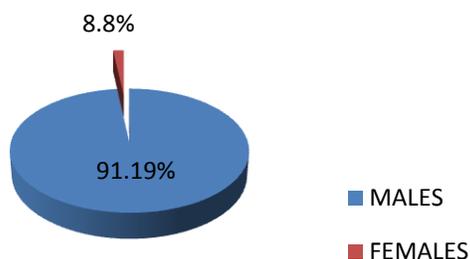
GENDER DISTRIBUTION

Figure 1: Gender distribution of participant enrolled in study

3.1 PRE TEST AND POST TEST ANALYSIS USING LIKELIHOOD RATIO

A pretest analysis using a self-designed questionnaire was performed for the diagnosis of lateral epicondylitis. The results suggest that, the pretest probability of LE among the

recreational athlete within the age group was between 0.10 to 0.70 i.e., 10% -70% (Table 1)

Table 1: Pretest probability analysis using questionnaire.

Pre-test probability	Frequency	Percent
.10	30	15.5
.15	31	16.1
.20	20	10.4
.25	45	23.3
.30	26	13.5
.35	11	5.7
.40	7	3.6
.45	4	2.1
.50	7	3.6
.55	5	2.6
.60	3	1.6
.65	1	.5
.70	3	1.6
Total	193	100.0

For the purpose of posttest analysis, likelihood ratio of cozens test was calculated which was found to be 0.8 (sensitivity: 84%, specificity: 0%). A likelihood nomogram (figure 2) was used to find out posttest probability for the diagnosis of LE. The results obtained revealed the posttest probability was found in between 0.9 to 0.64. i.e., 9% to 64% (Table 2)
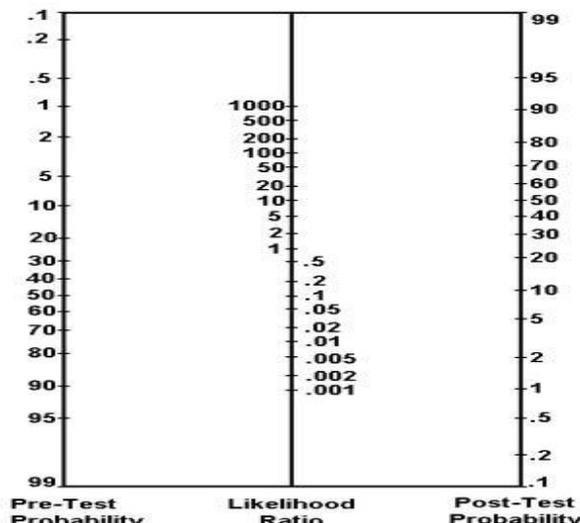

Figure 2: Likelihood ratio nomogram.

3.2 SPECIAL TEST RESULTS

A cozen test was performed among the participants for the confirmed diagnosis of LE. The results obtained suggested that 3.6% of the individuals were confirmed to have LE while 96.4% were found to have a negative result. (Table 3)

Table 3: Test results.

Test results	Frequency	Percent
Negative	186	96.4
Positive	7	3.6
Total	193	100.0

3.3 SENSITIVITY AND SPECIFICITY OF QUESTIONNAIRE

In order to calculate the prevalence of LE and, the sensitivity and specificity of the questionnaire, a 2x2 estimation table (Table 4) was designed for assessing the post-test probability of disease.

TABLE 4

	CONFIRMED DIAGNOSIS	NON CONFIRMED DIAGNOSIS	TOTAL
SCREEN POSITIVE	2	17	19
SCREEN NEGATIVE	5	169	174
TOTAL	7	186	193

The prevalence is calculated by the formula:
- Prevalence = Total number of confirmed diagnosis/ total population*100
  =7/193*100
  =3.6%

Sensitivity is calculated by using a formula:
- Sensitivity= participants with condition who test positive / all the participants with the condition.
  Sensitivity= 2/19*100
  Sensitivity= 10.5%.

Specificity is calculated by using a formula:
- Specificity= participant without the condition who test negative / all the participants who test negative.
  Specificity= 169/174*100
  Specificity= 97%

The results reveal that the prevalence of LE among young recreational athletes is estimated to be 3.6%, whereas, the questionnaire used has a sensitivity of 10%, and the specificity of 97%. Sensitivity is the ability to obtain the positive result when the condition is present, while the specificity is the ability to obtain a negative result when the condition is absent. Thus, this ensures that the questionnaire used is good to rule in the negative results but is weak to rule out the positive results.

4 DISCUSSION

.The results of our survey revealed that the prevalence of Lateral epicondylitis among the young recreational athletes of Karachi aged between 20 to 40 years was found to be 3.6%, which is almost equal to its prevalence among the general population that is 1%-3% [20]. Most of the recent studies conducted regarding the prevalence of LE are among the manual workers and the general population or the professional athletes involving the adult age group, reporting high prevalence among 50 -59 years of age [21] whereas; in our research we have estimated the prevalence of LE among the young recreational athletes i.e.; 20-40 years of age. In our

study we have used a self-designed questionnaire for the diagnosis of LE and its Sensitivity is evaluated to be 10% while the specificity is 97%, which indicates its high validity and reliability. On the other hand Cozen test sensitivity is 84% and specificity is 0% 19.This self-designed questionnaire is more specific for the athletes as compared to the other questionnaires like "PRTEE", which we think is more suitable for LE diagnosis among general population and manual workers. Relatively, a study revealed that the PRTEE has an excellent validity and reliability of LE diagnosis among both the athletes and non-athletes, showing a test- retest reliability (ICC = 0.87 and 0.96 respectively) and an ICC of 0.89 in a mixed athletes and non-athletes LE sample. These results show that this questionnaire is more reliable for non-athletes (ICC= 0.96) as compared to the athletes (ICC =0.87) [22-25]. The study has some limitations as it is limited to a small sample involving specific sports population. Most of the participants involved in our study are males hence the study is less specific for female athletes. There were no other studies that focused on LE prevalence among recreational athletes; hence, the results could not be compared.

5 CONCLUSIONS

The prevalence of lateral epicondylitis in recreational athletes amongst the age of 20-40 is found to be 3.6% in this study. While, the questionnaire used is found to have a sensitivity of 10% and a specificity of 97%, which means it is more reliable to rule out the negative results.

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