



Original Article

Correlation between the UCLA and Constant-Murley scores in rotator cuff repairs and proximal humeral fractures osteosynthesis[☆]



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ARTICLE INFO

Article history:

Received 11 September 2017

Accepted 19 October 2017

Available online 24 February 2018

Keywords:

Rotator cuff

Arthroscopy

Shoulder fractures

Rehabilitation

Shoulder

Clinical scales

ABSTRACT

Objective: To evaluate the correlation between the UCLA and Constant-Murley scores in the surgical treatment of rotator cuff tears and proximal humeral fractures (PHF).

Methods: Retrospective study evaluating patients submitted to arthroscopic rotator cuff repair and surgical treatment of PHF with 2-year follow-up. Patients were evaluated by the UCLA and Constant-Murley scores in the preoperative period for the rotator cuff repairs, and 3, 6, 12 and 24 months after surgery for both diagnoses. Pearson's correlation coefficient (r) was calculated to measure the degree of correlation between the two clinical scales.

Results: We evaluated 109 patients: 54 with rotator cuff tear and 55 with PHF. Twenty-four months after surgical treatment, the scores according to the UCLA and Constant-Murley scores were 32.6 ± 4.0 and 85.0 ± 12.0 for the rotator cuff tears and 30.3 ± 5.3 and 73.8 ± 13.9 for the PHF, demonstrating significant improvements in both, in relation to the initial evaluation ($p < 0.001$). The scales demonstrated high correlation ($r = 0.88$, $p < 0.001$). The scores obtained in the two scales showed high or very high correlation in all the postoperative clinical evaluations ($r = 0.79$ – 0.91 , $p < 0.001$). The correlation was high in the preoperative evaluation ($r = 0.73$, $p < 0.001$).

Conclusion: The UCLA and Constant-Murley scores presented high or very high correlation in the evaluation of surgical treatment of rotator cuff tears and PHF. The correlation in the preoperative evaluation was high.

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<https://doi.org/10.1016/j.rboe.2018.02.003>

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Correlação entre as escalas da UCLA e Constant-Murley nas roturas do manguito rotador e fraturas da extremidade proximal do úmero

R E S U M O

Palavras-chave:
Manguito rotador
Artroscopia
Fraturas do ombro
Reabilitação
Ombro
Escalas clínicas

Objetivo: Avaliar a correlação entre as escalas da UCLA e de Constant-Murley no tratamento cirúrgico de roturas do manguito rotador e de fraturas da extremidade proximal do úmero (FEPU).

Métodos: Estudo retrospectivo, que avaliou pacientes submetidos ao reparo do manguito rotador por via artroscópica e tratamento cirúrgico de FEPU com dois anos de seguimento. Os pacientes foram avaliados pelas escalas da UCLA e de Constant-Murley no período pré-operatório nas roturas do manguito rotador e após seis, 12 e 24 meses da cirurgia em ambos os diagnósticos. O coeficiente de correlação de Pearson (r) foi calculado para medir o grau de correlação entre as duas escalas clínicas.

Resultados: Avaliamos 109 pacientes, 54 com rotura do manguito rotador e 55 com FEPU. Após 24 meses do tratamento cirúrgico, as pontuações pelas escalas da UCLA e da Constant-Murley foram de $32,6 \pm 4,0$ e $85,0 \pm 12,0$ nas roturas do manguito rotador e $30,3 \pm 5,3$ e $73,8 \pm 13,9$ nas FEPU, com melhoria significativa em ambas em relação à avaliação inicial ($p < 0,001$). As escalas demonstraram alta correlação ($r = 0,88$, $p < 0,001$). Em todas as avaliações clínicas pós-operatórias as pontuações obtidas nas duas escalas se correlacionaram de modo alto ou muito alto ($r = 0,79$ a $0,91$, $p < 0,001$). No pré-operatório a correlação foi alta ($r = 0,73$, $p < 0,001$).

Conclusão: As escalas da UCLA e de Constant-Murley apresentam uma correlação alta ou muito alta na avaliação do tratamento cirúrgico das roturas do manguito rotador e das FEPU. No pré-operatório a correlação é alta.

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Introduction

Clinical evaluation scales and questionnaires are useful for objectively evaluating the surgical results and enabling comparison between different studies.¹ The strength of an evaluation system depends on its validity, reproducibility, sensitivity and responsiveness.^{2,3}

There are more than forty scales for evaluating pain and shoulder function.¹ In the last 5 years, the Constant-Murley score⁴ and the University of California, Los Angeles (UCLA) scale⁵ have been the first and third most used scales, respectively, in published studies on rotator cuff in the orthopedic journals with greatest impact. The UCLA scale presents reliability ranging from moderate to very high.⁶ Due to inconsistencies in validity, reliability and responsiveness, it is not considered the ideal tool for clinical research.⁷ The Constant-Murley score,⁴ meanwhile, was previously validated and has high reliability.⁸⁻¹⁰ Some studies have correlated the results obtained using different scales applied to the shoulder, and observed whether there is any similarity between the results obtained.^{2,10-19} Only two studies have evaluated the correlation between the UCLA and Constant-Murley scores in patients submitted to open rotator cuff repair¹⁵ or in the early postoperative period of proximal humeral fractures.¹⁰ There is no article evaluating the correlation between the two scales after arthroscopic rotator cuff repair, or in the long-term follow-up of these fractures.

The aim of this study was to evaluate the correlation between the UCLA and Constant-Murley scores before and after surgical treatment of rotator cuff repairs and after surgical treatment of proximal humeral fractures.

Methods

Study design

A retrospective study was carried out, evaluating a database obtained prospectively. The procedures were performed between 09/30/2008 and 03/06/2014 by two surgeons from the same institution.

Participants

Patients with small or medium full-thickness supraspinatus tears and 2- or 3-part surgical neck PHFs were included. The patients with RCTs were submitted to single-row arthroscopic repair and patients with PHFs to osteosynthesis with locking intramedullary nail or locking plate.

In the rotator cuff tears group, patients with full-thickness tears of the subscapularis or infraspinatus tendons, glenohumeral arthritis, grade 3 fatty degeneration according to Fuchs et al.,²⁰ previous shoulder surgeries, cervicobrachialgia or rheumatological diseases were excluded. In the PHF, the exclusion criteria were isolated tuberosity fractures, articular

split, fracture dislocation, open fractures, neurological injury, previous surgery to the affected shoulder, associated fractures in the ipsilateral limb, pathologic fractures, active or previous infection in the shoulder, and irreparable rotator cuff tears. Loss to follow-up and inability to understand the questionnaires were also reasons for exclusion.

Variables/functional scales

The patients were evaluated by the Constant-Murley and UCLA scores, by a evaluator who was not participating in the study. The scales were applied at 3, 6, 12 and 24 months after the surgical treatment. In the rotator cuff tears, the scores were also applied before the surgery.

Sex, age, affected side and dominance were described in all cases. The dimension of the tear, involvement of the long head of the biceps, whether distal resection of the clavicle was performed, and the intraoperative appearance of the subscapularis tendon were described in the cases submitted to repair. In the fractures group, the type of osteosynthesis and the Neer classification were also reported.

Surgical procedure

The surgical procedures were performed under general anesthesia associated with interscalene block. During arthroscopy, we positioned the patients in the beach chair position. Bursectomy and acromioplasty were performed in all cases. Tenotomy or tenodesis of the long head of the biceps was performed in the cases of partial lesion or tendon instability, and distal resection of the clavicle if there was symptomatic arthritis. The suture was performed after debridement of the greater tuberosity, using single-row double-loaded anchors. In the fractures, the patients were positioned in horizontal decubitus dorsal with 30° of elevation, and the osteosynthesis was performed with Centronail® nails (Orthofix®, Verona, Italy) by the minimally invasive anterolateral approach, or with Philos® plates (DePuy-Synthes®, Solothurn, Switzerland), by the deltopectoral approach.

Statistical analysis

Normality of the continuous variables was checked using the Kolmogorov-Smirnov test, and homogeneity through the Levene test. We presented the continuous variables as means and standard deviations, and the categorical variables as absolute values and percentages.

We used the paired t-test to compare the variables obtained in the initial clinical evaluations with the postoperative values.

Pearson's correlation coefficient (r) was calculated to measure the degree of correlation between the two clinical scales. This coefficient assumes values of -1 to 1 , where r equal to 1 or -1 corresponds to a perfect linear correlation. The r values can be interpreted as follows: very high (r 0.90-1.00), high (r 0.70-0.89), moderate (r 0.50-0.69), and so on.²¹

The Fisher transformation test was used to determine whether there was a difference in the degree of correlation between the different subgroups.

The scores obtained in all the clinical evaluations were submitted to linear regression, to define a coefficient for conversion of the scores of the two scales.

For the data analysis, we used the program SPSS version 21.0 for Mac (Chicago, IL, USA) and a level of significance of 5%.

Results

A total of 109 patients were included in the study, of which 54 underwent rotator cuff repair and 55, treatment of proximal humeral fracture.

In the patients with rotator cuff tears, the mean age was 54.7 ± 7.4 years and 37 patients (68.5%) were female. The mean tear retraction was 16.7 ± 6.4 mm, while the extension was 13.8 ± 5.1 mm. Distal resection of the clavicle was performed in 2 patients (3.7%), tenotomy of the long head of the biceps in 4 (7.4%) and tenodesis in 13 (24.1%). The subscapularis tendon presented partial tear in 23 patients (42.6%) and was intact in 31 (57.4%). The data are shown in Table 1.

In the proximal humeral fractures, the mean age was 65.8 ± 8.9 years and the sample was comprised of 40 women (72.7%). The fractures were treated with a locking intramedullary nail in 28 cases (50.9%) and a locking plates in 27 (49.1%). Twenty-seven patients (49.1%) presented 2-part fractures, while 28 (50.9%) presented 3-part fractures. The data are shown in Table 2.

The mean preoperative UCLA and Constant-Murley scores in patients with rotator cuff tears were 13.8 ± 4.1 and 47.2 ± 11.4 , respectively. Twenty-four months after surgical

Table 1 – Baseline demographic and clinical characteristics, rotator cuff [continuous data: means \pm standard deviations; categorical data: n (%)].

| | |
|---------------------------|----------------|
| Sex | |
| Male | 17 (31.5) |
| Female | 37 (68.5) |
| Age (years) | 54.7 ± 7.4 |
| Side | |
| Right | 43 (79.6) |
| Left | 11 (20.4) |
| Dominant side | |
| Yes | 42 (77.8) |
| No | 12 (22.2) |
| Tear size | |
| Retraction | 16.7 ± 6.4 |
| Extension | 13.8 ± 5.1 |
| Biceps procedure | |
| Tenotomy | 4 (7.4) |
| Tenodesis | 13 (24.1) |
| None | 37 (68.5) |
| Distal clavicle resection | |
| Yes | 2 (3.7) |
| No | 52 (96.3) |
| Subscapular inspection | |
| Partial tear | 23 (42.6) |
| Intact tendon | 31 (57.4) |

Table 2 – Baseline demographic and clinical characteristics, proximal humeral fracture (continuous data: means ± standard deviations; categorical data: n (%)).

| | |
|---------------------|------------|
| Sex | |
| Male | 15 (27.3) |
| Female | 40 (72.7) |
| Age (years) | 65.8 ± 8.9 |
| Side | |
| Right | 33 (60.0) |
| Left | 22 (40.0) |
| Dominant side | |
| Yes | 52 (94.5) |
| No | 3 (5.5) |
| Osteosynthesis | |
| Plate | 27 (49.1) |
| Nail | 28 (50.9) |
| Neer classification | |
| 2-part | 27 (49.1) |
| 3-part | 28 (50.9) |

treatment, the scores for these two scales were 32.6 ± 4.0 and 85.0 ± 12.0 ($p < 0.001$), respectively (Table 3).

In patients with proximal humeral fractures, the mean UCLA and Constant-Murley scores increased from 21 ± 4.7 and 47.9 ± 13.8 at 3 months to 30.3 ± 5.3 and 73.8 ± 13.9 at 24 months ($p < 0.001$), respectively (Table 3).

The UCLA and Constant-Murley scores demonstrated high correlation ($r = 0.88$, $p < 0.001$) (Fig. 1). In the postoperative clinical evaluations, the scores obtained in the two scales showed high or very high correlation in the cases of rotator cuff repair ($r = 0.83-0.91$, $p < 0.001$) and high in the cases of osteosynthesis ($r = 0.79-0.86$, $p < 0.001$). In the preoperative period (data available only for the rotator cuff tears), the scales showed high correlation ($r = 0.73$, $p < 0.001$), a value that was statistically lower than for the other evaluation periods ($p = 0.002$) (Fig. 2). In the other analyses of subgroups, the differences between the coefficients of correlation were small (Table 4). The dispersion graphs are shown for all the evaluations together (Fig. 1), and separately for the cases of rotator cuff tear (Fig. 2A) and proximal humeral fracture (Fig. 2B).

Through linear regression, we obtained a coefficient for the scores of the two scales, which was equal to: Constant-Murley = (UCLA*2.2) + 8.6 ($p < 0.001$).

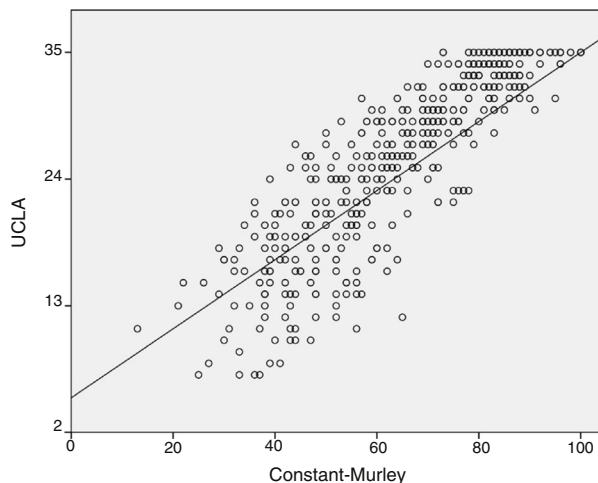


Fig. 1 – Scatter plot showing the correlation between University of California, Los Angeles (UCLA) and Constant-Murley scores.

Discussion

Our results showed high correlation ($r = 0.88$, $p < 0.001$) between the UCLA and Constant-Murley scores: high or very high in the cases of rotator cuff repair ($r = 0.83-0.91$, $p < 0.001$) and high in the cases of osteosynthesis ($r = 0.79-0.86$, $p < 0.001$). In the preoperative period (data available only for the rotator cuff tears), the scales also showed high correlation ($r = 0.73$, $p < 0.001$), but with a lower level than in the postoperative period.

So far, few studies have evaluated the correlation between the different clinical scales in the shoulder.^{2,10-19} Six have performed this study in patients with rotator cuff repair^{2,12,14,15,17,19} and two^{10,18} in patients with proximal humeral fractures. The correlation between the UCLA and Constant-Murley scores was studied in only 2 articles.^{10,15} Romeo et al.¹⁵ compared the results in patients submitted to open rotator cuff repair, and found a correlation of 0.66. Van de Water et al.¹⁰ compared these scales in the early follow-up of proximal humeral fractures, including 20 patients submitted to both conservative treatment and surgery, observing a correlation of 0.70 at 6 weeks and 0.92 at 12 weeks of follow-up. No study, to date, has compared the results

Table 3 – Clinical scores preoperative and postoperative period (means ± standard deviations).

| | Preoperatively | 3 months | 6 months | 12 months | 24 months | p |
|---------------------------|----------------|-------------|-------------|-------------|-------------|---------------------|
| Rotator cuff | | | | | | |
| UCLA | 13.8 ± 4.1 | 24.7 ± 6.7 | 28.7 ± 5.5 | 31.2 ± 4.2 | 32.6 ± 4.0 | <0.001 ^a |
| Constant-Murley | 47.2 ± 11.4 | 61.4 ± 16.2 | 71.2 ± 16.2 | 80.1 ± 12.5 | 85.0 ± 12.0 | <0.001 ^a |
| Proximal humerus fracture | | | | | | |
| UCLA | NA | 21 ± 4.7 | 26.1 ± 6.0 | 29.1 ± 5.1 | 30.3 ± 5.3 | <0.001 ^b |
| Constant-Murley | NA | 47.9 ± 13.8 | 62.3 ± 16.3 | 70.6 ± 14.5 | 73.8 ± 13.9 | <0.001 ^b |

NA, not applicable.

^a Paired t test. 24 months versus preoperatively.

^b Paired t test. 24 months versus 3 months.

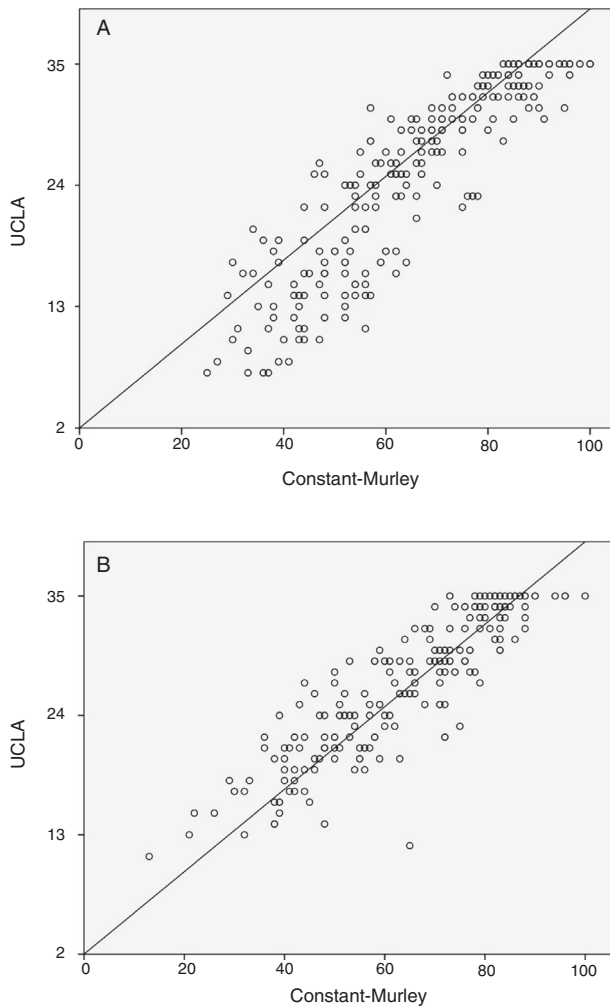


Fig. 2 – Scatter plots showing the correlation between University of California, Los Angeles (UCLA) and Constant-Murley scores for rotator cuff tears (A) and proximal humeral fractures (B).

of the UCLA and Constant-Murley scores in patients submitted to arthroscopic rotator cuff repair and in long-term follow-up of proximal humeral fractures. Other studies testing the correlations between clinical scales applied to the shoulder found results ranging from 0.75 and 0.93 for rotator cuff tears^{2,12,14,17,19} and 0.7–0.87 for proximal humeral fractures.¹⁸

Our study evaluated the patients at four standard follow-up times, giving additional information on the correlation between the scales during recovery period, up to 24 months. Of the studies that evaluated the correlations of the scales in patients with rotator cuff disorders, only Allom et al.¹⁷ and Assunção et al.¹⁹ conducted a similar evaluation. The rest performed the correlations in either transversal¹² or with once-only postoperative evaluations.^{2,14,15} In the studies on proximal humeral fractures,^{10,18} van de Water et al. performed the evaluation at 6–12 weeks, and Baker et al. at 3 and 12 months.

Our case series, although with a smaller number of patients than^{2,11,14,16,17,19} similar studies,^{2,10–18} works with a total number of correlations that is less than that of only four

Table 4 – Correlation of UCLA and Constant-Murley.

| Variable | r Coefficient | p |
|----------------------------------|---------------|--------|
| <i>Rotator cuff</i> | | |
| Preoperatively | 0.73 | <0.001 |
| 3 months | 0.87 | <0.001 |
| 6 months | 0.91 | <0.001 |
| 12 months | 0.83 | <0.001 |
| 24 months | 0.83 | <0.001 |
| <i>Proximal humerus fracture</i> | | |
| 3 months | 0.86 | <0.001 |
| 6 months | 0.79 | <0.001 |
| 12 months | 0.86 | <0.001 |
| 24 months | 0.86 | <0.001 |
| Total | 0.88 | <0.001 |

studies,^{2,14,17,19} as it uses evaluations in various follow-up times. It is also the largest case series, in terms of the number of evaluations, in the treatment of proximal humeral fractures.

Our study included patients submitted to primary arthroscopic rotator cuff repair, with small or medium tears. This provides greater internal validity and may be a reason why the correlation found in our study is greater than that reported by other authors.^{12,14,15,17} It should be highlighted that Allom et al.¹⁷ obtained significantly greater correlations in the subgroup of arthroscopic repairs. Otherwise, Cunningham et al.² observed greater agreement in the revision cases.

In the fracture group, the results of the correlation remained stable throughout the follow-up time, with 0.86 in all the evaluations, except for the 6-month evaluation, when it was 0.79. Otherwise, Baker et al.¹⁸ observed a progression from 0.77 to 0.87 between the 3 and 12 month follow-up times, and van de Water et al.¹⁰ from 0.70 to 0.92 between 3 and 6 months. We evaluated only cases submitted to surgical treatment, unlike other authors,^{10,18} which may explain the different behavior of the correlations during the follow-up time.

An additional favorable point of this study is the determination of a conversion formula between the scales, something not done by other authors.^{2,10–18} The linear regression generated the Constant-Murley coefficient = (UCLA*2.2) + 8.6. We believe that this formula may be useful for future articles, facilitating the comparison of results between studies that use the two scales studied.

The UCLA scale was developed to evaluate patients submitted to total arthroplasty of the shoulder,²² and was subsequently used by Ellman et al.²³ to evaluate the results of the rotator cuff repairs. Several problems can be identified with this tool. The reliability ranges from moderate to very high,⁶ and many questions do not have an ideal and exact answer, which can make it difficult for the patient to know how to answer.⁷ Also, due to inconsistencies in the validity, reliability and responsiveness, it is considered a non-ideal tool for clinical research.⁷ Another weakness of this tool is the item relating to satisfaction, which makes this instrument appropriate only for postoperative use.⁷ This may explain the lower correlation, good but tending to moderate, found by us in the preoperative period. The Constant-Murley⁴ score was validated previously, and has high reliability.^{8–10} A possible source of failure in this scale is the dynamometer,^{24,25} which can lead

to errors due to calibration, accuracy and precision.²⁴ Despite these differences, our results show that these scales have high postoperative correlation, and can be used by different orthopedic surgeons, according to their preference.

The clinical results presented significant improvement during the follow-up. The UCLA and Constant-Murley scores evolved from 13.8 ± 4.1 and 47.2 ± 11.4 points to 32.6 ± 4.0 and 85.0 ± 12.0 ($p < 0.001$), respectively, when comparing the preoperative with the 24-month evaluations. These results are compatible with other studies who evaluated single-row repair.²⁶⁻³⁰ In the fractures, the main scores of the UCLA and Constant-Murley increased from 21 ± 4.7 and 47.9 ± 13.8 at 3 months to 30.3 ± 5.3 and 73.8 ± 13.9 at 24 months ($p < 0.001$), respectively. The clinical results were similar to those of two systemic reviews,^{31,32} which demonstrated a mean score of 74 points on the Constant-Murley scale.

Our study has some limitations. In the rotator cuff group, we evaluated only cases of primary repair of small and medium rotator cuff repairs. Likewise, the fractures included only 2- or 3-part fractures treated surgically. Thus, the results and the conversion formula cannot be applied to other disorders, other patterns of lesions, or conservative treatment. The scales were applied by a single evaluator, and it was not possible to assess the intra- and interobserver reliability. Moreover, the Constant-Murley score was used with its absolute value, without reference to the contralateral side, or to the indices of normality for age.

Conclusion

The UCLA and Constant-Murley scores present high correlation in the evaluation of surgical treatment of rotator cuff tears and proximal humeral fractures. Through linear regression, we obtained a coefficient for conversion between the two scales Constant-Murley = (UCLA*2.2) + 8.6.

Conflicts of interest

The authors declare no conflicts of interest.

Acknowledgements

Thais Cristina Pereira Vasques, Research Assistant, by the contribution in obtaining the study data.

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