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Original article

Comparison and agreement of outcome scores through nine months after acetabular fracture fixation

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ABSTRACT

Introduction: The Modified Merle d'Aubigne-Postel Score and the Harris Hip Score are commonly used to assess the functional outcomes after acetabular fractures. A previous report showed that correlation between scores is good, that there is poor concordance among functional classes, and that the distribution of the scores is highly asymmetrical. Several issues were not addressed in this report, mainly that the data set was treated as transversal data without comparison of scores through time; therefore the objective of this article is to assess the degree of correlation and concordance between the Modified Merle d'Aubigne-Postel Score and the Harris Hip Score during the first 9 months after acetabular fracture treatment.
Methods: Both scores were recorded in a cohort of 23 previously healthy patients after 3, 6 and 9 months after fixation of acetabular fractures. Through a mixed-effects repeated measures model, we assessed differences between standardized scores. Pearson's interclass correlation coefficients for full scores and each of their domains, as well as agreement for clinical graduation classification was calculated.
Results: Between score correlation was 89%. We found no differences between scores at 3, 6 and 9 month follow-ups. Agreement between scores was 0.95, while agreement for clinical graduation classification was 0.67.
Discussion: Very short term correlation and concordance between scores is excellent, while concordance for clinical graduation classification is modest. We suggest the widespread use of the simpler score.

1. Introduction

Acetabular fractures are relatively uncommon injuries, accounting for 0.3–6% of all fractures, and are associate to high energy traumatisms, mainly in the context of traffic accidents or falls from height.[2,5] In order to assess the functional outcomes after these injuries, the Modified Merle d'Aubigne-Postel Score and the Harris Hip Score are commonly used. Both scores evaluate changes in hip function through the evaluation of 3 domains in the Modified Merle d'Aubigne-Postel Score (pain, ambulation and range of movement (ROM)), and 4 in the Harris Hip Score (pain, function, absence of deformity and ROM).[1,3]

Correlation between scores for patients assessed between 6 months and 10 years was found to be R = 0.81 (Spearman's correlation coefficient) in one report.[10] The authors noted that even though there was a high degree of correlation, concordance analysis with a kappa test was rather poor (kappa = 0.45), and that the distribution of the scores was highly asymmetrical, with values grouping towards the upper end of the scores. The authors concluded that a cautious approach should be used for comparing outcomes in smaller data sets, and that the score's design could be skewed, favouring the classification of patients into the higher ends of the score systems. To our opinion, several issues were not addressed in this report: first, the data set was treated as transversal data, although 661 observations of 450 patients were available. This did not allowed for comparison of scores through time. Second, they started following patients after 6 months of

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Table 1
Patient's clinical characteristics.

Variable	Value
Age (years)	33.91 SD 10.73
Sex	Male = 16 (69.57%)
	Female = 7 (30.43%)
Mechanism of injury	Traffic accident = 16 (69.57%)
	Run over injury = 4 (17.39%)
	Height fall = 3 (13.04%)
Type of fracture	Transverse = 10 (43.47%)
	Posterior wall = 6 (26.13%)
	Anterior column = 2 (8.69%)
	Posterior column = 2 (8.69%)
	Posterior column with posterior wall = 1 (4.34%)
	Transverse with posterior column = 1 (4.34%)
	Anterior column with posterior hemitransverse = 1 (4.34%)
Complications	None = 18 (73.92%)
	Associated sciatic nerve injury = 4 (17.39%)
	Erectile disfunction = 2 (8.69%)

SD = standard deviation. Total of patients (n) = 23.

treatment, which may have allowed sufficient time for observations in the lower end of the scores to have been missed. Lastly, statistical analysis were based on the total numeric scores. This could represent a bias because scores have different maximum possible values. Spearman's correlation coefficient addresses this point, and comparison between data sets with different maximum possible values are not affected, but kappa tests are highly affected, and it may not be the best test of concordance for continuous data sets. In order to address this issues, and with the hypothesis that the best score is the simpler, the objective of this study was to compare the correlation between the Modified Merle d'Aubigne-Postel and Harris Hip Score at 3, 6 and 9 months in patients with acetabular fractures, and to compare their correlation by domains and for clinical graduation classification.

2. Material and methods

2.1. Patients

All previously healthy patients with an acetabular fracture who were treated in the "Dr. Ignacio Morones Prieto" Central Hospital of the Autonomous University of San Luis Potosí, Mexico, between 2009 and 2014 were recorded prospectively. The fractures were classified according to the Letournel and Judel classification[8] and the patient's clinical characteristics are presented in Table 1. At each follow-up at 3, 6 and 9 months after fixation, clinical outcomes assessed through Modified Merle d'Aubigne-Postel Score[3] and Harris Hip Score were recorded[1] (Table 2). The study was submitted and approved by the local Ethics Committee (registry 169872), and all patients agreed to participate in it.

2.2. Score analysis

The total numeric sum value for both scores were used in the present study.Clinical grades for the Modified Merle d'Aubigne-Postel Score were considered excellent at a cut-off value of 18, good at 15-17, fair at 12-14, and poor at 3-11 points[4]. For the Harris Hip Score, grades were considered excellent at 90-100, good at 80-89, fair at 70-79, and poor below 70 points[10]. In order to allow the comparison of two scores with different maximum values, we standardized them by dividing their values by the maximum possible value for each of them: 18 for the Modified Merle d'Aubigne-Postel Score, and 100 for the Harris Hip Score, thus obtaining a new numeric value representing a ratio of the full score.

First, we analysed through a lineal model the correlation between the total numeric score for both scores without adjusting for time, and without standardizing the scores. Afterwards, through a mixed-effects repeated measures lineal model we analysed the correlation between both standardized scores at 3, 6 and 9 months to obtain the correlation for same subject observations and assess for differences between scores. We calculated agreement between scores through the Pearson's interclass correlation coefficient (ICC) for average random raters (Shrout and Fleiss type 3.2[9]) for the full scores, and afterwards, for each of the three standardized domains shared by both scores (pain, function and ROM). Finally, to assess the correlation for clinical graduation classification, we performed a weighted kappa analysis for both full scores.

Statistical analysis was performed with R for Windows (version 3.0.2, R Core Team 2013) at 95% confidence level. Ethical approval was obtained from the Local Ethics Committee (registry 169862).

3. Results

From twenty seven patients admitted to the hospital with acetabular fractures during 2009 to 2014, twenty three were enrolled in the study. The reminder 4 patients were excluded because of previous comorbidities (1 diabetic, 2 with hypertension, and 1 with hypothyroidism). From the twenty three patients enrolled, 69 follow-ups were recorded, which sums a total of 138 observations (69 for the Merle d'Aubigne-Postel Score and 69 for the Harris Hip Score, Table 3). No patients died because of the injury or during follow-up.

Total score correlation, without accounting for time, was 89% ($R^2 = 0.89$, $p < 0.0001$). For each increase in 1 point in the Modified Merle d'Aubigne-Postel Score, there is a 5.65 (95%CI 4.91–6.39) point increase in the Harris Hip Score (Fig. 1). When accounting for time variation in the scores values, correlation for same subject observations was found to be 40.03%. We found no statistical significant differences between both standardized scores at 3 (0.53 ± 0.13 vs. 0.44 ± 0.17, $p = 0.065$), 6 (0.70 ± 0.16 vs. 0.69 ± 0.17, $p = 0.98$) and 9 months (0.81 ± 0.15 vs. 0.84 ± 0.16, $p = 0.49$) (Fig. 2). Modified Merle d'Aubigne-Postel Score increase by month was 0.16 (95%CI 0.06–0.27) standardized points from month 3 to 6, and 0.11 (95%CI 0.008–0.21) from month 6 to 9, whereas Harris Hip Score increase was 0.25 (95%CI 0.14–0.36) standardized points from month 3 to 6, and 0.14 (95%CI 0.02–0.26) from month 6 to 9.

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