Research Article

OPTIMAL CUT-OFF SCORES FOR DISEASE-SPECIFIC QUALITY OF LIFE TO DISCRIMINATE CLINICAL OUTCOMES IN PATIENTS WITH ARTHROSCOPIC ROTATOR CUFF REPAIR

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Abstract

Objective: Identifying a cut-off score would be useful in detecting improvements in disease-specific quality of life (DS-QoL) in patients with arthroscopic rotator cuff repair (ARCR). The aim of this study was to identify clear cut-off values for the Western Ontario Rotator Cuff Index (WORC) score. In addition, the ability of these cut-off scores to predict DS-QoL level was investigated.

Method: A total of 38 ARCR patients were included in this cross-sectional study. Patients were assessed using the Constant-Murley and WORC scores following 12 weeks of physiotherapy. Pearson correlation coefficients were used to analyse the relationship between these scores. The WORC cut-off scores representing excellent and good DS-QoL were calculated on the basis of the Constant score. The ability of the these cut-offs to predict the level of DS-QoL was examined using logistic regression analysis.

Results: The WORC cut-off scores of 87.5 and 79.5 were found to be excellent and good level of DS-QoL. Participants with WORC scores above these cut-offs have a 1.25 and 1.74 times higher level of DS-QoL, respectively.

Conclusion: The success of physiotherapy and ARCR could be assessed using the identified cut-off scores. It seems necessary to use more specific interventions for patients not meeting the WORC cut-off scores in order to improve DS-QoL.

Keywords: Rotator Cuff; Tears; Shoulder Injuries; Orthopaedics

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Artroskopik Rotator Manşet Onarımı Yapılan Hastalarda Klinik Sonuçları Ayırt Etmek İçin Hastalığa Özgü Yaşam Kalitesine Yönelik Optimum Kesme Puanları

Öz

Amaç: Artroskopik rotator manşet onarımı (ARMO) yapılan hastalarda, hastalığa özgü yaşam kalitesindeki (HÖYK) iyileşmelerin tespit edilmesi için bir kesme puanının belirlenmesi yararlı olabilir. Bu çalışmanın amacı Western Ontario Rotator Cuff İndeksi (WORC) skoru için net kesme değerlerini belirlemekti. Ayrıca bu kesme puanlarının HÖYK düzeyini tahmin etme yeteneği araştırıldı.

Yöntem: Bu kesitsel çalışmaya ARMO uygulanan toplam 38 hasta dahil edildi. Hastalar 12 haftalık fizyoterapi sonrasında Constant-Murley ve WORC skorları kullanılarak değerlendirildi. Bu puanlar arasındaki ilişkinin analizinde Pearson korelasyon katsayıları kullanıldı. Mükemmel ve iyi HÖYK' yi temsil eden WORC kesme puanları, Constant puanı temel alınarak hesaplandı. Bu kesme değerlerinin HÖYK düzeyini tahmin etme yeteneği, lojistik regresyon analizi kullanılarak incelenmiştir.

Bulgular: 87,5 ve 79,5' luk WORC kesme puanlarının mükemmel ve iyi düzey HÖYK olduğu bulundu. WORC puanları bu kesme değerlerinin üzerinde olan katılımcıların HÖYK düzeyleri sırasıyla 1,25 ve 1,74 kat daha yüksektir.

Sonuç: Fizyoterapi ve ARMO' nun başarısı belirlenen kesme puanları kullanılarak değerlendirilebilir. HÖYK' yi iyileştirmek için WORC kesme puanlarını karşılayamayan hastalara daha spesifik müdahalelerin kullanılması gerekli görünmektedir.

Anahtar Kelimeler: Rotator Manşet, Rüptür, Omuz Yaralanmaları, Ortopedi

1. INTRODUCTION

Rotator cuff tear (RCT) is a significant cause of shoulder complaints (Doiron-Cadrin et al., 2020). It causes deterioration in functionality and places a significant financial burden on the healthcare system through the need for consultations, radiology, surgery, and rehabilitation (Doiron-Cadrin et al., 2020). Arthroscopic rotator cuff repair (ARCR) is a commonly used surgical procedure for RCT and is usually followed by physiotherapy (Goldberg et al., 2001; Lambers Heerspink et al., 2015; Ranebo et al., 2020). It is suggested that physiotherapy following ARCR provides the best clinical outcomes for patients with ARCR(Goldberg et al., 2001; Lambers Heerspink et al., 2015; Ranebo et al., 2020).

There is no agreement on the methodology for measuring the outcomes of postoperative rehabilitation in ARCR. The assessment of outcome could be performed using clinical scores, cuff continuity or patient satisfaction (Goldberg et al., 2001; Harvie et al., 2005; Lambers Heerspink et al., 2015; Ranebo et al., 2020). When designing a postoperative physiotherapy programme, the primary objective is to improve the quality of life (QoL) of patients. Therefore, it is recommended to use disease-specific QoL questionnaires (DS-QoL) as a measurement outcome for patients with ARCR. The Western Ontario Rotator Cuff Index (WORC) was designed to assess DS-QoL in patients with rotator cuff-related shoulder pain and is recommended for use as a DS-QoL Questionnaire (Kirkley et al., 2003). The scale has been translated into various languages, including German (Huber et al., 2005), Persian (Mousavi et al., 2009), Norwegian (Ekeberg et al., 2008), Portuguese (Lopes et al., 2008), and Turkish (Ozlem El et al., 2006), and has been demonstrated to be a valid, reliable, and feasible measure.

However, the cut-off scores for the WORC are still lacking. The establishment of a cut-off score for DS-QoL with a high sensitivity and specificity is considered to be useful for the detection of the level of DS-QoL in the postoperative rehabilitation in ARCR. Therefore, the aim of this study was to identify cut-off values for the WORC score. Additionally, the ability of these cut-off scores to predict DS-QoL levels was investigated.

2. METHODS

2.1. Study design

ARCR was performed by an orthopaedic surgeon (HÇB) at the Orthopaedic and Traumatology Outpatient Clinic. Thirty-eight patients with ARCR were referred to the physiotherapy clinic after the surgical procedure. All patients completed physiotherapy treatment and were assessed by an experienced physiotherapist (CK) for the variables. This cross-sectional study was approved by the local ethics committee (2022-203). Patients were informed about the study protocol and the STROBE guidelines were followed.

2.2. Patient selection

The inclusion criteria for this study were to undergo ARCR after a RCT of less than 3 cm, ability to comprehend Turkish language, and to be between 18 and 65 years of age (Moosmayer et al., 2019). Exclusion criteria were as follows: tears including more than quarter of the width of the subscapularis tendon, presence of any other systemic diseases that affect shoulder function, any prior surgical or conservative treatments of the involved shoulder, and medical contraindications for physiotherapy (Moosmayer et al., 2019).

2.3. Interventions

All patients underwent ARCR in a modified beach chair position. The chosen ARCR technique depended on the size of the defect, fatty degeneration, and retraction of the tendon. The single-row technique was used for small defects and the modified suture bridge technique for medium-sized defects. If required, an additional procedure such as acromioplasty or biceps tenotomy was performed (Basat et al., 2019).

Following ARCR, the physiotherapy treatment program of participants was designed according to the current guideline (Thigpen et al., 2016). The patient's arm was immobilised using a sling, and passive range-of-motion (ROM) exercises were initiated for a duration of 6 weeks. Supplementary activities including active range of motion, strengthening, mobilisation, stretching, perturbation and sensorimotor training through motor control exercises were performed over a six-week period.

2.4. Outcome measures

Clinical data were collected. Functional assessment of the shoulder joint was carried out and reported using the WORC and Constant scores, which are reliable, valid, and culturally adapted tools (Demirhan et al., 2004; O. El et al., 2006). A Constant score of 90 and above was considered as excellent outcome, and a score of 80 and above was considered good (Constant & Murley, 1987). Participants were divided into two groups: those with excellent outcome and those with good outcome, using the cut-off scores of Constant.

The WORC comprises 21 items, each rated on a 100-mm scale that ranges from 0 (the best) to 100 (the worst) and covers 5 areas(O. El et al., 2006): physical symptoms (6 items), sports/recreation (4 items), work (4 items), lifestyle (4 items), and emotions (3 items). The total score, ranging from 0 to 2100, is calculated based on the scores of 21 items. For better comprehensibility, the original version's authors suggest converting the raw score into a percentage score out of 100 by inverting it. The worst possible score is 0, and a score of 100 indicates no reduction in DS-QoL (Kirkley et al., 2003).

2.5. Sample size

The variable used for sample size calculation was the minimal clinically important difference (MCID) value of WORC in ARCR proposed by Wessel et al. The MCID for WORC in patients with ARCR is

34.0 units (Wessel et al., 2018). In a previos pilot study performed within our population, the mean WORC had a standard deviation of 14.24. Therefore, the minimum required sample size for analysis was 38 participants for a probability level of 0.05, the anticipated effect size as 0.41 and the statistical power level of 80% using G*Power software (version 3.1.9.2).

2.6. Statistical analysis

The data was analyzed using IBM SPSS Statistics for Windows software (version 22.0; IBM Corp, Armonk, New York). Pearson correlation coefficient was used for the analysing the relationship between the WORC and Constant scores. Following this, we divided participants into two categories according to whether they achieved an excellent treatment outcome based on Constant. The optimum WORC cut-off score was determined by analysing the ROC, AUC, specificity, and sensitivity to discriminate between patients with and without excellent DS-QoL (Field et al., 2012). The optimal cut-off score was detected using the Youden index, which represents the highest possible combination of sensitivity and specificity.(Field et al., 2012) The AUC values were reported according to the previous procedure (Field et al., 2012). A binary logistic regression analysis with Hosmer-Lemeshow goodness-of-fit analysis was conducted to examine the ability of WORC cut-offs to predict the level of DS-QoL (Field et al., 2012). The findings were reported as adjusted odds ratios with 95%CI. The cut-off WORC values for the good (80 points) Constant score were determined using a similar procedure. The level of significance was set at $p<0.05$.

3. RESULTS

The study was conducted on a cohort of 38 participants, with females constituting 84.0% of the sample. Descriptive statistics of the subjects are presented in Table 1.

Table 1. Participant Characteristics

Female (n, %)	32 (84.00)
Age (mean±SD; min-max)	51.43±9.12; (34-65)
Body mass index (mean±SD; min-max)	25.91±5.78; (19.92-32.77)
Arm dominance (right n, %)	33 (86.84)
Affected side (right n, %)	34 (89.47)
Education status (at least high school n, %)	12 (31.57)
Goutallier classification before the ARCR (Grade 1-2, n; %)	12 (31.57) – 26 (68.42)
Tear size on MRI	
Anterior-posterior plane (mm)	21.19±4.59
Medial-lateral plane (mm)	11.91±1.38
Constant score (mean±SD; min-max)	87.87±9.36 (78-98)

≥90 (n, %)	26 (68.42)
≥80 (n, %)	38 (100.00)
WORC score (mean±SD; min-max)	86.65±8.80 (74-96)

SD: Standard deviation; min-max: minimum-maximum; WORC: Western Ontario Rotator Cuff Index; MRI: Magnetic resonance imaging; ARCR: Arthroscopic rotator cuff repair; mm: millimeter.

There was a statistically significant correlation between Constant and WORC scores (r=0.717; p<0.001, Table 2).

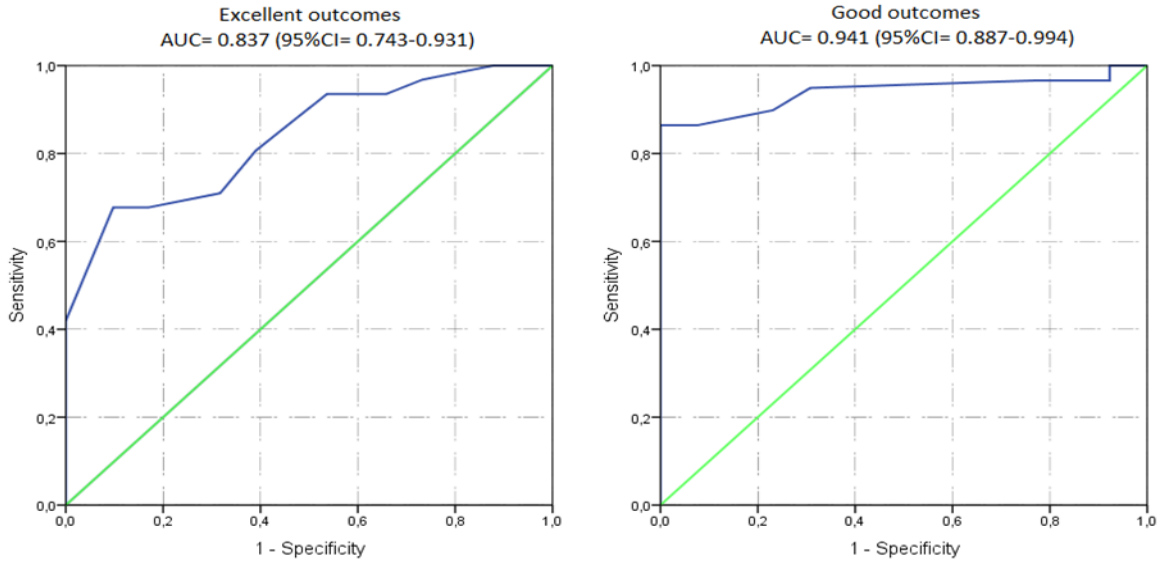
Table 2. Correlation Between Constant and WORC Scores

Variable	Mean+SD	r	p
Constant	87.87±9.36	0.717	<0.001
WORC	86.65±8.80		

According to ROC analysis, the WORC cut-off score was 87.50 for excellent DS-QoL [Sensitivity=88.57%, Specificity=90.24%, AUC=0.837 (95%CI=0.743-0.931)]. Based on the AUC value, the predictivity of the model was excellent (Figure 1). It was found that patients with a WORC cut-off score of ≥87.50 had a DS-QoL level 1.25 times higher than those with lower WORC scores.

The WORC cut-off score was 79.50 for good DS-QoL [Sensitivity=88.14%, Specificity=100.00%, AUC=0.941 (95%CI=.887-.994)]. Based on the AUC, the predictivity of the model is very excellent (Figure 1). It was found that patients with a WORC cut-off score of ≥79.50 had a DS-QoL level 1.74 times higher than those with lower WORC scores.

Figure 1. Receiver Operating Characteristic Curves of the WORC Score Corresponding to Constant Scores Indicating Excellent and Good Outcomes in Patients With ARCR



4. DISCUSSION

We found that patients who scored above the WORC cut-off scores of 87.50 and 79.50 had 1.25 and 1.74 times higher levels of DS-QoL, respectively. This study is the first to identify the cut-off scores of the WORC as a reliable and valid tool for assessing DS-QoL in patients with ARCR.

Many questionnaires concerning shoulder pathology such as Disabilities of the Arm, Shoulder and Hand Questionnaire (Angst et al., 2011), Simple Shoulder Test (Angst et al., 2011), Shoulder Pain and Disability Index (Angst et al., 2011), Rowe Score (Jensen et al., 2009), Oxford Shoulder Score (Angst et al., 2011), American Shoulder and Elbow Surgeons Score (ASES) (Angst et al., 2011), Rotator Cuff Quality-of-Life Measure (RC-QOL) (Richards et al., 2022), and the Western Ontario Shoulder Tools (WORC, WOOS, WOSI) (Angst et al., 2011; Kirkley et al., 2003) have been used in clinical practice for evaluating outcomes in patients with rotator cuff-related shoulder pain. Disease-specific tools are recommended for enhancing sensitivity to change, if feasible. Two of the aforementioned measures are DS-QoL surveys that address rotator cuff disorder: RC-QOL and WORC. We prefer calculating the cut-offs of the WORC over the RCQOL due to its translation into multiple languages and its use in diverse studies, making it suitable for international comparison.

Accurate detection of DS-QoL levels is vital in reducing undertreatment of RCT patients. Clinical assessment of outcomes in a combined treatment strategy of RCT is primarily based on patient reported outcomes or physical assessments. Precise methods, such as the WORC, may be necessary to accurately evaluate the effects of the treatment strategy on DS-QoL.

MacDermid et al. followed the 2 years-term treatment outcomes in patients with RCT treated via ARCR or mini-open repair in combined with physiotherapy and suggested that the pre-operative WORC score of 39.60 improved to 77.50 after 6 months (MacDermid et al., 2021). MacDonald et al. employed ARCR with and without acromioplasty to treat full-thickness RCT and noted that the mean postoperative WORC scores improved to 78.2 regardless of the presence of the acromioplasty (range, 57.6-78.2) after surgery (MacDonald et al., 2011). Lapner et al. followed the 2 years-term treatment outcomes in patients with RCT treated via single-row and double-row suture techniques and noted that the WORC scores improved to 75.8 and 72.5, respectively, after 6 months (Lapner et al., 2012). Using the WORC cut-off score of 87.5 or 79.5 points for the studies conducted by MacDermid et al (MacDermid et al., 2021), MacDonald et al (MacDonald et al., 2011), and Lapner et al (Lapner et al., 2012), the results were judged to be unsatisfactory, although a detectable change from the preoperative score was obtained. The success of physiotherapy and ARCR could be assessed using the identified cut-off scores. It seems necessary to

use more specific interventions for patients not meeting the WORC cut-off scores in order to improve DS-QoL.

Strength of current study is that the conservative treatment program of all the patients attending to the our clinic specialized in post-operative rehabilitation of upper extremity injuries are designed according to the current, detailed, and structured guideline(Thigpen et al., 2016). Moreover, ARCR procedures are performed by a shoulder surgeon experienced in ARCR for 12 years. Therefore, we are pleased to recommend these cut-off values for optimal assessment.

There are several limitations to our study. Firstly, as there has been no previously reported WORC cut-off value, it proved challenging to assess the credibility of our findings. While the WORC cut-off values of 87.50 and 79.50, corresponding excellent and good DS-QoL respectively, have yet to undergo validation within a longitudinal cohort study to establish their reliability, the present findings offer only a valuable knowledge in terms of the elimination of undertreatment in patients and precise assessment. This can help to educate RCT patients and develop interventions for coping with unsatisfactory results. A further limitation is the unequal number of male and female participants. To minimize sex-related differences, future studies are recommended to include a more homogeneous sample in terms of sex.

CONCLUSION

Patients who scored above the WORC cut-off scores of 87.50 and 79.50 had 1.25 and 1.74 times higher levels of DS-QoL, respectively. This study is the first to identify the cut-off scores of the WORC as a reliable and valid tool for assessing DS-QoL in patients with ARCR.

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Conflict of interest

The authors have no conflicts of interest to declare.

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