IDENTIFICATION OF SHOULDER INJURY RISK AMONG COLLEGE FOOTBALL PLAYERS

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BACKGROUND AND PURPOSE

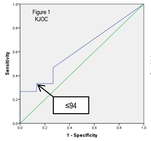
- Shoulder injury may adversely affect performance in up to 50% of elite college football players[1]
- Shoulder function can be quantified through administration of a self-report survey
- The Kerlan-Jobe Orthopaedic Clinic Shoulder and Elbow Score (KJOC) provides such a measure[2]
- ROM, strength, and radiographs have been criticized as indicators of shoulder function[3]
- Survey-derived information has been shown to be a more valid indicator of performance capabilities[4]
- Core stability is an important factor influencing upper extremity function[5]
- Core muscle endurance may be a critical component of core stability, and rapid fatigue may be an injury risk factor
- The purpose of this study was to assess the value of pre-season KJOC scores for: 1) differentiation of shoulder injury cases among college football players from matched-controls, and 2) prospective quantification of injury risk

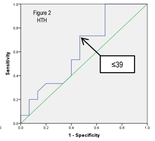
SUBJECT CHARACTERISTICS

- 85 NCAA Division I-FCS football players: Age: 19.7 ±1.5 years; Height: 1.85 ±0.08 m; Weight: 102.08 ±19.90 kg
  - Cases: 15 players who sustained a shoulder injury during pre-season practices or 11-game season
    - 19.1 ±1.4 years; 1.83 ±.08 m; 96.77 ±19.35 kg
  - Controls: 15 players matched on the basis of position, height, and weight
    - 19.7 ±1.5 years; 1.84 ±.07 m; 96.83 ±18.36 kg

Table 1. Univariable Analyses for Case-Control Comparisons

Variable	Cut-pt	AUC	p	Sn	Sp	OR
WSH	≤25	.64	.12	.47	.80	3.50
KJOC	≤94	.62	.20	.33	.87	3.25
HTH	≤39	.62	.13	.73	.53	3.14
TFH	≤41	.50	.34	.33	.80	2.00





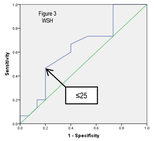


Table 2. Logistic Regression Result

Factor	Cut-pt	Adj. OR
KJOC	≤94	3.46
HTH	≤39	2.60
WSH	≤25	2.19

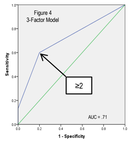


Table 3. 3-Factor Model

Positive Factors	Injury	No Injury
≥ 2	9	3
0 - 1	6	12
Total	15	15

Fisher's Exact One-Sided p = .030

+LR =3.00 -LR = .50 Sn = .60 Sp = .80

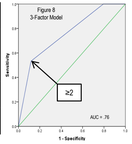
OR = 3.00 / .50 = 6.00

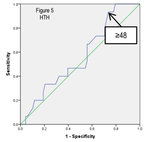
Table 4. Univariable Analyses for Entire Cohort (Injury vs. No Injury)

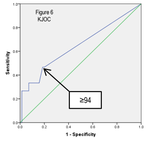
Variable	Cut-pt	AUC	p	Sn	Sp	OR	RR
KJOC	≤94	.65	.02	.33	.91	5.33	3.36
HTH	≤48	.56	.09	.93	.27	5.04	4.16
TFH	≤39	.47	.04	.33	.90	4.43	3.00
WSH	≤22	.52	.23	.47	.67	1.79	1.60

Table 5. Logistic Regression Result

Factor	Cut-pt	Adj. OR
HTH	≤48	5.45
KJOC	≤94	5.42
TFH	≤39	5.09







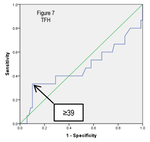


Table 6. 3-Factor Model

Positive Factors	Injury	No Injury
≥ 2	8	8
0 - 1	7	60
Total	15	15

Fisher's Exact One-Sided p = .001

+LR = 4.53 -LR = .53 Sn =.53 Sp = .88

OR = 4.53 / .53 = 8.57 RR = .500 / .104 = 4.78

METHODS

- Electronic injury documentation records reviewed post-season to identify players who sustained shoulder injuries
  - Shoulder girdle and/or glenohumeral joint sprains, strains, dislocations, and subluxations
  - Operational definition of injury:
    - Interruption of participation in practice session or competitive event
    - Evaluation by an athletic trainer or physician
    - Administration of any therapeutic procedure
    - Inclusion on coaches' injury report
- Relative predictive power of KJOC scores compared to that of other pre-participation measures of injury risk
  - Joint function survey: Kerlan-Jobe Orthopaedic Clinic Shoulder and Elbow Score (KJOC)
  - Core muscle endurance: Trunk Flexion Hold (TFH), Wall Sit Hold (WSH), Horizontal Trunk Hold (HTH)
- Receiver operating characteristic (ROC) analysis utilized to assess potential predictors of shoulder injury
  - Cases compared to matched-controls
  - Cases compared to all uninjured players
- Fisher's exact test, odds ratio (OR), and relative risk (RR) were used to assess associations with injury occurrence
- Logistic regression analysis used to identify the smallest set of strongest predictors

RESULTS

- Results of univariable analyses for matched case-control group comparisons presented in Table 1
  - Logistic regression analysis yielded a 3-factor prediction model (Table 2)
    - KJOC ≤ 94, HTH ≤ 39 sec, and WSH Average of dominant and non-dominant extremities ≤ 25 sec
    - Univariable ROC curves presented in Figures 1-3
  - ROC analysis demonstrated ≥ 2 positive factors as the best model for discrimination (Table 3, Figure 4)
- Results of univariable analyses for entire cohort (injury vs. no injury) presented in Table 4
  - Logistic regression analysis yielded a 3-factor prediction model (Table 5)
    - HTH ≤48 sec, KJOC ≤ 94, and TFH ≤ 39 sec
    - Univariable ROC curves presented in Figures 5-7
  - ROC analysis demonstrated ≥ 2 positive factors as the best model for discrimination (Table 6, Figure 8)

CLINICAL RELEVANCE

- Although the KJOC survey was developed for the purpose of quantifying shoulder and elbow function in injured athletes, the results of this study suggest that it is also an exceptionally good predictor of shoulder injury
  - The KJOC cut-point of ≤ 94 identified by matched case-control comparison (15 pairs) was identical to the one that resulted from comparison of injured to all non-injured players in the cohort (85 players)
- The combination of KJOC with core muscle endurance tests substantially increases the discriminatory power of a prediction model for quantification of shoulder injury risk in college football players
  - Pre-participation assessment of shoulder injury risk can facilitate concentration of time and resources on a subset of high-risk players who would derive greatest benefit from preventive interventions

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