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To cite: Gut et al. Applications of machine learning to the predictive and diagnostic capabilities of ACL injuries in athletes: A systematic review and meta-analysis. Inplasy protocol 202320045. doi: 10.37766/inplasy2023.2.0045

Received: 11 February 2023

Published: 11 February 2023

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Support: None.

Review Stage at time of this submission: Formal screening of search results against eligibility criteria.

Conflicts of interest:
None declared.

Applications of machine learning to the predictive and diagnostic capabilities of ACL injuries in athletes: A systematic review and meta-analysis

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Review question / Objective: The systematic review aims to evaluate the use and predictive performance of ML model for ACL injury among athletic population.
Condition being studied: The anterior cruciate ligament (ACL) is a complex structure capable of withstanding multidirectional stresses and varying tensile strains to prevent leg hyperextension and knee valgus. Frequent changes of direction, jumping, landing and sudden deceleration observed in sports activities are the high-risk factors of ACL injuries. ACL injuries have become one of the most common injuries of athletes and seriously affect the athletes' competitive state.

INPLASY registration number: This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 11 February 2023 and was last updated on 11 February 2023 (registration number INPLASY202320045).

INTRODUCTION

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METHODS

Participant or population: Athletes with ACl injuries , Male or female athletes aged over 15.

Intervention: Athletes with an ACL impairment confirmed by MRI or other diagnostic methods are in the intervention group.

Comparator: MRI diagnosis of athletes with ACL injuries is authoritative and suitable for the target population.

Study designs to be included: Prospective, retrospective, case-control studies using machine learning methods to predict and diagnose sports injuries in ACLProspective studies, retrospective studies, case-control studies, etc.

Eligibility criteria: Case reports, conference proceedings, review articles, or meta-analyses; (2) articles without corresponding control group; (3) Repeated published literature.

Information sources: Searched were conducted in Chinese databases (CNKI and CBM) and foreign databases (PubMed, Medline, Embase, Scopus, Web of Science, and Cochran).

Main outcome(s): Name of first author, year of publication, country, Studydesign, sample size, data inputInput, machine learning algorithm, Reference standard, accuracy, sensitivity, Specificity, cross-validationThe true positive values (TP), false positive values (FP), false negative values (FN), true negative values (TN) can be extracted directly or obtained through calculation.

Quality assessment / Risk of bias analysis: The scale of Quality Assessment of Diagnostic Accuracy Studies-2 (QUADAS-2) was used to evaluate the quality of each included article. The quality was assessed based on 14 items to classify each article as either "low", "high" or "unclear". The quality evaluation chart of the included articles was obtained through Review Manager 5.4 software (name of the company, country of origin). Quality evaluation was carried out independently by two researchers. When there was inconsistency and no consensus can be reached after discussion, the third researcher shall make a decision.

Strategy of data synthesis: The threshold effect was tested by calculating the Spearman correlation coefficient to assess whether there was heterogeneity caused by the threshold effect. When the Spearman correlation coefficient is > 0 and p < 0.05, the threshold effect is considered to exist, and only the value of Area Under Curve（AUC）is calculated. If there is no threshold effect, it is necessary to determine whether there was heterogeneity caused by other potential factors. Heterogeneity between the original studies was quantified by I2 value from the Cochrane Q test. Among them, I2＜25% means relatively low heterogeneity, 25%≤I2＜50% means low heterogeneity, 50%≤I2＜75% means moderate heterogeneity, and I2＞75% means high heterogeneity. When I2 is ＜50%, heterogeneity is considered to be not obvious, and the fixed-effect model is used to combine the effect quantity. When I2 is >50%, heterogeneity is considered to be obvious, and the random effect model is used for data consolidation and exploration of the potential factors leading to heterogeneity.

Subgroup analysis: subgroup analysis was used in this meta-analysis to explore potential sources of heterogeneity. If no obvious causes of heterogeneity were found, meta-regression was conducted to further analyze the factors of heterogeneity.

Sensitivity analysis: sensitivity analysis was required, and the I2 values of the remaining literature were combined after the included articles were excluded one by one. After the exclusion of a single study, if the total I2 value of the remaining studies was significantly lower than that before the exclusion, it indicated that this article may be the source of heterogeneity of the study. Then, the causes of heterogeneity should be further discussed. Deek's funnel plot was drawn to measure publication bias for the inclusion of the original studies. $p \geq 0.05$ indicated no publication bias. $p < 0.05$ indicated the existence of publication bias.

Country(ies) involved: China and Malaysia.

Keywords: “Anterior Cruciate Ligament Injuries", "Machine Learning" and “Athletes”.

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