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Shear Wave Elastography in Sjögren's Syndrome Diagnosis: A Meta-Analysis of Major Exocrine Glands

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Wu, XN; Ming, JB; Kong, BC; Peng, J; Zhao, XZ.

Corresponding author:
Xunzhong Zhao

zxz18975660910@126.com

Author Affiliation:
Department of Ultrasound Imaging, Xiangya Changde Hospital。
Changde City, Hunan Province.

ADMINISTRATIVE INFORMATION

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 17 June 2025 and was last updated on 17 June 2025.

INTRODUCTION

Review question / Objective Objective—Shear wave elastography (SWE) offers a non-invasive approach to assess gland stiffness in Sjögren's syndrome (SS). However, its diagnostic performance across major exocrine glands (parotid, submandibular, and lacrimal) remains unclear. This meta-analysis evaluates SWE's diagnostic efficacy for SS in these glands.

Condition being studied Sjögren's syndrome (SS) is a chronic autoimmune disorder primarily affecting exocrine glands, with diagnosis traditionally reliant on invasive procedures such as salivary gland biopsy. Shear wave elastography (SWE) has emerged as a non-invasive alternative for assessing gland stiffness; however, its diagnostic performance across major exocrine glands (parotid, submandibular, and lacrimal) remains systematically unexplored. This study aims to evaluate the diagnostic effect of SWE on SS in different exocrine glands, highlighting its potential as a reliable, non-invasive diagnostic tool.

METHODS

Search strategy This study systematically searched the China National Knowledge Infrastructure (CNKI), Wanfang, Chongqing VIP Information Network (CQVIP), PubMed, Embase, and Cochrane Library databases for all studies evaluating shear wave elastography (SWE) in the diagnosis of SS. The following search terms were employed: (shear wave elastography OR Supersonic Shear Imaging) AND (Lacrimal gland OR Salivary gland OR Parotid gland OR Submandibular gland OR Sublingual gland) AND (Sjögren's Syndrome OR Sjogren Syndrome OR Sicca Syndrome).

Participant or population Adult patients (≥ 18 years) with suspected or confirmed Sjögren's syndrome.

Intervention Shear wave elastography (SWE) for diagnosing Sjögren's syndrome.

Comparator The gold standard for diagnosis of Sjögren's syndrome.

Study designs to be included Original diagnostic studies (prospective or retrospective), cross-sectional studies with reported diagnostic accuracy data, or case-control studies with clearly defined controls that evaluated the diagnostic performance of SWE for SS.

Eligibility criteria Inclusion criteria were as follows: (1) Original diagnostic studies (prospective or retrospective), cross-sectional studies with reported diagnostic accuracy data, or case-control studies with clearly defined controls that evaluated the diagnostic performance of SWE for SS; (2) Studies using accepted reference standards, such as the American College of Rheumatology(ACR) / European Alliance of Associations for Rheumatology (EULAR) or American-European Consensus Group (AECG) criteria; (3) Studies assessing SWE of major salivary glands (parotid, submandibular) or lacrimal glands and reporting quantitative stiffness values (in kPa or m/s); (4) Studies providing sufficient data to construct 2 × 2 tables or calculate at least one of the following metrics: sensitivity or specificity; (5) Studies involving adult patients (≥ 18 years) with suspected or confirmed SS; (6) Publications in English or Chinese (with accessible translation if necessary).
Exclusion criteria were as follows: (1) Reviews, case reports (< 10 patients), conference abstracts without full data, or articles published in languages other than English or Chinese; (2) Studies focusing on pediatric patients (< 18 years) or secondary Sjögren's Syndrome; (3) Studies reporting only qualitative elastography or utilizing non-standard SWE protocols (e.g., non-supersonic shear wave systems); (4) When multiple studies were conducted by the same research group, the study with the smaller sample size or lower methodological quality was excluded; (5) Studies where SWE was performed post-treatment (e.g., after immunosuppressive therapy).

Information sources This study systematically searched the China National Knowledge Infrastructure (CNKI), Wanfang, Chongqing VIP Information Network (CQVIP), PubMed, Embase, and Cochrane Library databases for all studies evaluating shear wave elastography (SWE) in the diagnosis of SS.

Main outcome(s) This meta-analysis aims to comprehensively evaluate the diagnostic performance of shear wave elastography (SWE) across major exocrine glands in Sjögren's syndrome (SS), addressing gaps in the literature by synthesizing pooled sensitivity, specificity, and area under the curve (AUC). The results revealed significant variability in SWE diagnostic accuracy across glands, with the lacrimal gland demonstrating the highest pooled AUC (0.935), significantly outperforming the parotid (pooled AUC = 0.916) and submandibular glands (pooled AUC = 0.892).

Quality assessment / Risk of bias analysis Two authors (Jinbo Ming and Baichun Kong) independently assessed the methodological quality of the included studies using the Quality Assessment of Diagnostic Accuracy Studies-2 (QUADAS-2) tool, which evaluates risk of bias and applicability across four domains: patient selection, index test, reference standard, and flow and timing. Patient selection was evaluated for appropriate inclusion criteria and avoidance of case-control design bias, with particular attention to whether studies adhered to the 2016 ACR/EULAR classification criteria for Sjögren's syndrome. The index test was assessed for the standardization of SWE protocols, including probe frequency and measurement locations in lacrimal and parotid glands. The reference standard was verified for the use of diagnostic gold standards. Finally, flow and timing were examined to ensure an appropriate interval between the index test and reference standard. Each domain was rated for risk of bias (low risk, high risk, or unclear risk), and the first three domains were additionally evaluated for applicability concerns. Discrepancies were resolved through discussion with a third senior author (Xunzhong Zhao) and by referring to original study protocols when available.

Strategy of data synthesis The following search terms were employed: (shear wave elastography OR Supersonic Shear Imaging) AND (Lacrimal gland OR Salivary gland OR Parotid gland OR Submandibular gland OR Sublingual gland) AND (Sjögren's Syndrome OR Sjogren Syndrome OR Sicca Syndrome).

Subgroup analysis Subgroup analyses were conducted according to predefined criteria: (1) Diagnostic criteria subgroups: AECG criteria, ACR/EULAR criteria, ACR criteria; (2) Measurement parameter subgroups: shear wave velocity,

Young's modulus; (3) Cut-off value subgroups: shear wave velocity (< 2m/s, ≥ 2m/s), Young's modulus (20kPa).

Sensitivity analysis This study did not conduct a sensitivity analysis.

Country(ies) involved China - Department of Ultrasound Imaging, Xiangya Changde Hospital。Changde City, Hunan Province.

Keywords Shear wave elastography, Sjögren's syndrome, meta-analysis, diagnostic accuracy, exocrine glands.

Contributions of each author

Author 1 - Xiaoni Wu.
Author 2 - Jinbo Ming.
Author 3 - Baichun Kong.
Author 4 - Jie Peng.
Author 5 - Xunzhong Zhao.