STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No.	Recommendation	Page No.	
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2	Methods: This This cross-sectional study was carried out on a Chinese RA cohort.
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2	Conclusions: Upper extremity muscle loss is associated with hand dysfunction in RA independent of inflammation, implying the significance of routine muscle assessment into RA care to identify high-risk patients who may benefit from muscle targeted interventions to mitigate muscle loss.
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3	Background
Objectives	3	State specific objectives, including any prespecified hypotheses	3-4	In this study, we aimed to address this gap by exploring the impact of upper extremity muscle loss on hand dysfunction in RA patients. By focusing on localized muscle loss, we seek to provide novel insights into the mechanisms underlying hand dysfunction and identify potential targets for early intervention to improve patient outcomes.

Methods				
Study design	4	Present key elements of study design early in the paper	4	Study design and participants This cross-sectional study was conducted within our prospective cohort of patients diagnosed with RA at the Department of Rheumatology and Immunology, Sun Yat-sen Memorial Hospital, Guangzhou, China.
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4-5	
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	4	This cross-sectional study was conducted within our prospective cohort of patients diagnosed with RA at the Department of Rheumatology and Immunology, Sun Yat-sen Memorial Hospital, Guangzhou, China. Participants were recruited based on the 2010 American College of Rheumatology/European League Against Rheumatism classification criteria for RA, with recruitment occurring from January 2019 to August 2024. Exclusion criteria included: pregnancy, severe mental health disorders, the presence of implanted electronic devices,

				other autoimmune diseases, severe infections, significant organ dysfunction, malignancies, and other conditions that could impair hand function (e.g., hemiplegia, upper limb fractures, or surgeries performed within the last six months).
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case		
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4-5	Clinical assessment Assessment of muscle mass in upper extremity Assessment of hand function
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	4-5	Clinical assessment Assessment of muscle mass in upper extremity Assessment of hand function
Bias	9	Describe any efforts to address potential sources of bias	5-6	Statistical analysis To analyze the relationship between MMI_{UE} and hand dysfunction in RA patients, both univariate and multivariate logistic regression analyses were employed.
Study size	10	Explain how the study size was arrived at	6	Among 1305 recruited patients with RA, 43 had other autoimmune diseases, 30 were

		accompanied with malignancy, 21 had other diseases that affect hand function, and 107 had incomplete assessment of muscle mass and/or hand function. After excluding these patients, a total of 1104 RA patients were included in the analyses

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Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5	Statistical analysis The normality of data distributions for continuous variables was assessed prior to analysis. Data are presented as mean ± SD for normally distributed variables, median (25th, 75th percentiles) for non-normally distributed variables, and n (%) for categorical variables. Comparisons of continuous variables between patients with and without hand dysfunction were performed using either the two independent samples T-test or the Mann-Whitney U test. Categorical variables were compared using Chi-squared tests or Fisher's exact tests.
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	5-6	To analyze the relationship between MMI_{UE} and hand dysfunction in RA patients, both univariate and multivariate logistic regression analyses were employed.
		(*b*) Describe any methods used to examine subgroups and interactions	6	Comprehensive stratified analyses were conducted across various subgroups, focusing on age groups (< 60 or ≥ 60 years), gender (male or female), active smoking (yes or no), disease duration (≤ 12 or > 12 months), positive rheumatoid factor (RF, yes or no), positive anti-cyclic citrullinated peptide antibody (ACPA, yes or no), disease activity

				(remission or active) and RJD (yes or no).
		(*c*) Explain how missing data were addressed	NA	
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	NA	
		(*e*) Describe any sensitivity analyses	NA	
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6	Among 1305 recruited patients with RA, 43 had other autoimmune diseases, 30 were accompanied with malignancy, 21 had other diseases that affect hand function, and 107 had incomplete assessment of muscle mass and/or hand function. After excluding these patients, a total of 1104 RA patients were included in the analyses
		(b) Give reasons for non-participation at each stage	6	Supplemental Figure S1
		(c) Consider use of a flow diagram	6	Supplemental Figure S1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6	Demographic and clinical characteristics of patients with RA and controls
		(b) Indicate number of participants with missing data for each variable of interest	NA	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	NA	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	NA	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	NA	
		Cross-sectional study—Report numbers of outcome events or summary measures	*7*	Decreased handgrip strength in RA patients with low MMI_{UE} Higher prevalence of HAQ hand

				disability in RA patients with low MMI_{UE}
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8	Logistic regression analysis showed the relevant association characteristics of hand dysfunction in patients with RA (Supplemental Figure S4). After adjustment for those potential cofounders, including age, sex, smoking, BMI, disease duration, RF positive, ACPA positive, CRP, pain VAS, CDAI, mTSS and previous treatment, significantly negative association between the MMIUE and hand dysfunction were observed in patients with RA: each unit increased in MMIUE, the adjusted odds ratio (AOR) for the risk of reduced handgrip strength and HAQ hand disability decreased by 91% (AOR=0.09, 95% CI 0.04-0.20) and 84% (AOR=0.16, 95% CI 0.07-0.41, both $P < 0.05$, Figure 4), respectively. Results were similar when we categorized individuals by normal or low MMIUE. Compared with normal ones, RA patients with low MMIUE had higher risks of reduced handgrip strength (AOR=2.49, 95% CI 1.76-3.54) and HAQ hand disability (AOR=1.57, 95% CI 1.06-2.32, both $P < 0.05$),

			respectively.
	(*b*) Report category boundaries when continuous variables were categorized	6	According to the reference values of MMIUE from control subjects (mean-SD: 1.74 kg/m2 for male; 1.24 kg/m2 for female), there were 33.6% RA patients with low MMI_{UE}
	(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA	

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Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	8-9	The dose-response relationship between MMIUE and the AOR for hand dysfunction was depicted using RCS plot analysis. The result showed a linearity association between MMIUE with reduced handgrip strength and HAQ hand disability (Figure 4). In addition, results of association between MMIUE and hand dysfunction were consistent after stratification of patients by age (< 60 or ≥ 60 years), gender (male or female), active smoking (yes or no), disease duration (≤ 12 or > 12 months), positive RF (yes or no), positive ACPA (yes or no), disease activity (remission or active) and RJD (yes or no, all P value for interaction > 0.05, Supplemental Figure S5).
Discussion				
Key results	18	Summarise key results with reference to study objectives	9	To the best of our knowledge, this study represents the first large-sample cross-sectional investigation into the associations between muscle mass loss in upper extremities and impaired hand function in patients with RA. Our findings indicated that 33.6% RA patients exhibited low MMI_{UE}, which is 2 times than matched

				controls (16.8%). MMI_{UE} showed a linearity association with reduced handgrip strength and HAQ hand disability, with low MMI_{UE} conferring 2.49- and 1.57-fold risks for these outcomes, respectively. These results imply the necessity for early detection of hand muscle mass loss and the significance of muscle improvement for prevention of hand dysfunction in patients with RA.
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11-12	There were several limitations to our study.
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	9-12	
Generalisability	21	Discuss the generalisability (external validity) of the study results	9-12	
Other information				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	13	Funding: This research was funded by the Chinese National Key Technology R&D Program, Ministry of Science and Technology (2022YFC2504600 and 2022YFC2504601), National Natural Science Foundation of China (82171780, 82471832 and 82402094), Guangdong Basic and Applied Basic Research Foundation (2023A1515030253 and 2024A1515012882).

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.