Review

Current status of clinical outcome measures in inclusion body myositis: a systematised review

B. Roy[1], M. Lucchini[2], J.B. Lilleker[3], N.A. Goyal[4], E. Naddaf[5], B. Adler[6], L.N. Alfano[7], G.A. Malandraki[8], K.L. (Focht) Garand[9], D. Mochel[10], U. Badrising[11], P.M. Machado[12], R. Pagkatipunan[6], G. Ramdharry[11], L. Wang[13], M.C. Funaro[14], J. Schmidt[15], H. Kushlaf[16], E. Schiopu[17], K. Stipancic[18], N. Goyal[19], M. d'Alessandro[20], E. Conticini[20], B. Cruz-Coble[4], T.E. Lloyd[6], for the International Myositis Assessment and Clinical Studies (IMACS) Inclusion Body Myositis Scientific Interest Group

Bhaskar Roy, MD
Matteo Lucchini, MD, PhD
James B. Lilleker, MRCP, PhD
Namita A. Goyal, MD
Elie Naddaf, MD
Brittany Adler, MD
Lindsay N. Alfano, DPT
Georgia A. Malandraki, PhD, CCC-SLP, BCS-S
Kendrea L. (Focht) Garand, PhD, CScD, CCC-SLP, BCS-S
David Mochel, MD
Umesh Badrising, MD, PhD
Pedro M. Machado, MD, PhD
Ruben Pagkatipunan, PT, DPT, OCS
Gita Ramdharry, PhD, MSc, PGCert, BSc(Hons) MCSP
Leo Wang, MD, PhD
Melissa C. Funaro, MLS, MS
*Jens Schmidt, MD**
Hani Kushlaf, MD
Elena Schiopu, MD
Kaila Stipancic, PhD, CCC-SLP
Neelam Goyal, MD
Miriana d'Alessandro, MS
Edoardo Conticini, MD
Betsaida Cruz-Coble, PT, DPT, NC
Thomas E. Lloyd, MD, PhD

**J. Schmidt is member of the European Reference Network for rare Neuromuscular disorders (ERN EURO-NMD).*

Please address correspondence to:
Bhaskar Roy,
15 York Street, LCI 916
P.O Box 208018
New Haven, CT 06510, USA.
E-mail: bhaskar.roy@yale.edu

Received on July 16, 2022; accepted in revised form on December 5, 2022.

Clin Exp Rheumatol 2023; 41: 370-378.

Key words: myositis, inclusion body myositis, muscle, outcome measures

Affiliations and competing interests: page 376.

ABSTRACT

Objective. *Sporadic inclusion body myositis (IBM) is a debilitating idiopathic inflammatory myopathy (IIM) which affects hand function, ambulation, and swallowing. There is no approved pharmacological therapy for IBM, and there is a lack of suitable outcome measure to assess the effect of an intervention. The IBM scientific interest group under IMACS reviewed the previously used outcome measures in IBM clinical studies to lay the path for developing a core set of outcome measures in IBM.*

Methods. *In this systematised review, we have extracted all outcome measures reported in IBM clinical studies to determine what measures were being used and to assess the need for optimising outcome measures in IBM.*

Results. *We found 13 observational studies, 17 open-label clinical trials, and 15 randomised control trials (RCTs) in IBM. Six-minute walk distance, IBM-functional rating scale (IBM-FRS), quantitative muscle testing, manual muscle testing, maximal voluntary isometric contraction testing, and thigh muscle volume measured by MRI were used as primary outcome measures. Twelve different outcome measures of motor function were used in IBM clinical trials. IBM-FRS was the most used measure of functionality. Swallowing function was reported as a secondary outcome measure in only 3 RCTs.*

Conclusion. *There are inconsistencies in using outcome measures in clinical studies in IBM. The core set measures developed by the IMACS group for other IIMs are not directly applicable to IBM. As a result, there is an unmet need for an IBM-specific core set of measures to facilitate the evaluation of new potential therapeutics for IBM.*

Introduction

Sporadic inclusion body myositis (IBM), the most common idiopathic inflammatory myopathy (IIM) beyond age 50, presents with asymmetric and progressive muscle weakness and atrophy. Although it predominantly affects the quadriceps and long finger flexors, IBM can also affect oropharyngeal and oesophageal musculature, causing dysphagia (1-4). Progression of weakness leads to gradual loss of hand function, increased falls, and eventual loss of independent ambulation (5-7).

Despite efforts over several decades, there is no approved pharmacological therapy for IBM. Based on current clinical trials, IBM does not respond to conventional immunomodulators, including glucocorticosteroids, intravenous immunoglobulins (IVIg), and methotrexate. Several other pharmacological interventions have also failed to show any definitive clinical benefit despite promising results in the early phases of clinical trials in some cases (2, 8-15).

Lack of a detailed understanding of the exact pathophysiology of IBM is a challenge in developing new therapies. In addition, there is an urgent need to identify suitable outcome measures to quantify disease progression and to document therapeutic efficacy (2, 16-18). Although multiple outcome measures have been reported to assess physical function and well-being in IBM,

limitations of these measures include subjectivity of ratings, wide inter-rater and intra-rater variability, possible ceiling and floor effect, and in some cases, lack of proper validation. Without objective, easily administered, responsive, and psychometrically sound outcome measures, the true impact of an intervention cannot be determined, and clinical trials will remain infeasible to confirm benefit (2, 16-19).

Initiatives from the International Myositis Assessment and Clinical Studies (IMACS) group have played a pivotal role in developing a standardised core set of measures for dermatomyositis (DM) and polymyositis (PM) (20). However, at present, no IMACS-defined standardised tool exists for IBM. Here, we discuss the previously used outcome measures reported in IBM clinical trials and longitudinal observational studies to lay the path for developing a core set of outcome measures in IBM (21).

Methods

The IBM scientific interest group (SIG) under the IMACS is comprised of rheumatologists, neurologists, researchers, physical therapists, speech-language pathologists, occupational therapists, and patient representatives across the world. The goal of this group is to critically appraise the outcome measures in IBM and develop a core set of outcome measures for this disease, as exists for the other myositis subtypes.

In this systematised review we have extracted all outcome measures reported in IBM longitudinal, interventional, and observational studies to determine what measures were being used and to assess the need for the optimisation of outcome measures in IBM. This manuscript reflects the viewpoint of the IMACS IBM Scientific Interest Group on the current state of outcome measures in IBM and the need for optimisation.

To perform a systematised literature review, electronic searches were conducted of MEDLINE (Ovid ALL), EMBASE (Ovid), Web of Science Core Collection (Clarivate) and Clinical Trial Registry (Clinical Trials.gov) from database inception to February 1, 2021 (22). We identified 5614 studies, which were pooled in EndNote and deduplicated. Two independent screeners, BR and ML, examined the references (Supplementary Fig. S1) and extracted the data regarding the reported outcome measures in each study. Cross-sectional and case studies were excluded. References from these articles were also manually searched by the screeners to be more inclusive. Clinical Trial Registry was also manually searched by the screeners to obtain more details on some clinical trials. Descriptive statistics were represented as median and range.

Results

Study design

We found 13 observational natural history studies with longitudinal data (5, 6, 16, 19, 23-31), 17 open-label clinical trials (32-48), and 15 randomised control trials (RCTs) (9-11, 13-15, 49-57) in IBM (Fig. 1). Among the RCTs, 3 were cross-over trials. The majority of clinical trials before 2015 used Grigg's diagnostic criteria for IBM, and more recent clinical trials used the European Neuromuscular Centre diagnostic (ENMC) diagnostic criteria (4).

Sample size and study duration

The IBM observational studies included 6–181 (median 51) patients followed over 6 months to 12 years) with variable frequency of follow-up visits. The open-label studies were relatively small and recruited 4–16 (median 9) patients with study duration varying between 3 months to 33 months. The RCTs in IBM typically recruited less than 50 patients; however, the RESILIENT trial and the recent arimoclomol trial (NCT02753530) were relatively large, and each recruited 251 and 150 patients, respectively. Overall, the range of patients in IBM clinical trials was 14-251 (median 24) (Table I, Suppl. Tables S1, S2). Five of 13 RCTs treated patients for about a year, and the remaining RCTs were 6 months in duration.

Outcome measures reported

Table I provides a detailed list of outcome measures reported in RCTs, while outcome measures reported in the observational and open-label studies are provided as supplementary resources (Fig. 1, Suppl. Tables S2, S3). The following six outcome measures were used as the primary outcome measure in the RCTs: 6-minute walk distance (6MWD), IBM-functional rating scale (IBM-FRS), quantitative muscle testing (QMT), manual muscle testing (MMT), maximal voluntary isometric contraction testing (MVICT), and thigh muscle volume measured by MRI.

Muscle strength testing, either manually or measured by myometry, was the most commonly used secondary outcome measure. Twelve different outcome measures of motor function were used in different clinical trials. Quantitative outcome measures directly imaging muscle structural health were lacking. Fat fraction analysis from muscle MRI was used in 1 clinical trial and in one longitudinal study. Muscle volume was used as an outcome measure in one RCT (10, 15, 29, 49, 58). Dual energy x-ray absorptiometry (DXA) has been used as a common secondary outcome measure in several trials to evaluate the effects of an interventional drug on lean body muscle mass in IBM patients given the degree of muscle atrophy seen in this disease (10, 15, 53-55).

IBM-FRS was the most commonly used measure of function; however, this tool is physician directed rather than a patient-reported outcome measure (PROM). The IBM physical functioning assessment (sIFA) was subsequently developed as a PROM but has only been used as a secondary outcome measure in the RESILIENT trial (15). Other measures of disability were used inconsistently among the clinical trials, and some of them were only used in a single clinical trial.

Although one item of the IBM-FRS assesses swallowing, swallowing function was never reported as a stand-alone primary outcome measure and was rarely (only 3 RCTs) reported as a stand-alone secondary outcome measure in the reviewed studies (14, 15, 49). One study used ultrasound to quantify swallowing function, whereas the other used video fluoroscopy. When swallowing function was reported as a secondary measure, it was ill-defined (*e.g.* "swallowing efficiency") or incomplete results were reported (13-15, 59). Similarly, respira-

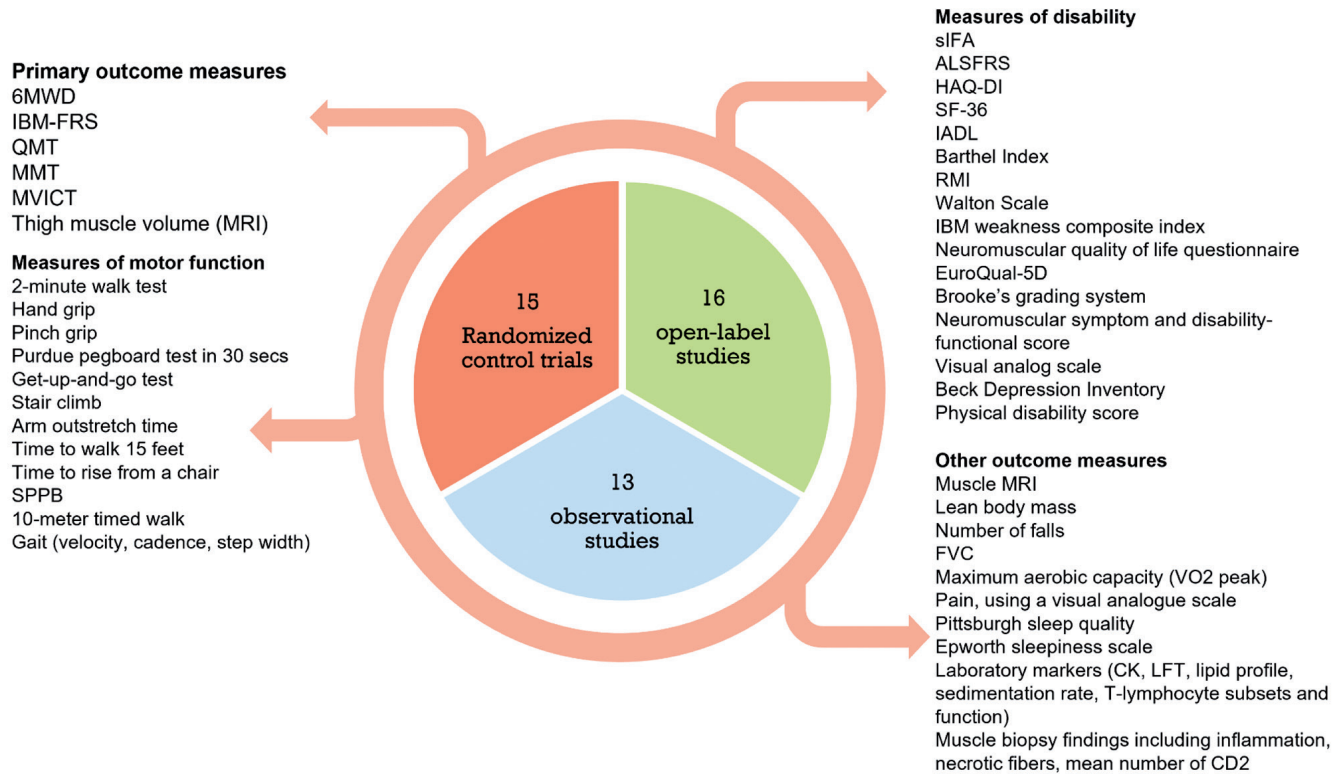

Fig. 1. An overview of outcome measures used in inclusion body myositis.

tory function was rarely used as an outcome measure. No outcome measure specifically related to motor speech/intelligibility was reported in any study included.

Discussion

Initial clinical trials in IBM were relatively small in sample size, had short duration, and in many cases were insufficiently powered to detect the effect of an intervention for a slowly progressing disease (2, 13, 14, 53, 54). The diagnostic criteria used for study inclusion historically demonstrated high diagnostic specificity but lacked sensitivity (60). Recently, clinical trials have incorporated the 2013 ENMC diagnostic criteria and Lloyd-Greenberg criteria which have improved access to clinical trials for patients with IBM (4, 60). Furthermore, more recent large-scale clinical trials in IBM have demonstrated feasibility of international collaboration and patient recruitment. However, these advancements in diagnostic accuracy and clinical trial feasibility have also highlighted the need for improvement and standardisation in the clinical outcome measures used, which can facilitate more efficient conduct of clinical trials by being more responsive to change over shorter periods of intervention. While many efforts to date have included small samples of convenience, there is an urgent need for an international collaborative clinical readiness trial to prospectively quantify disease progression in IBM across all domains impacted by this disease (*i.e.* motor function, swallowing, speech, pulmonary function, physical fatigue, etc.).

IBM is a heterogeneous disease with varying degrees of severity. While most patients have finger flexor and quadriceps weakness, the severity and pattern of muscle weakness can vary. Furthermore, about half of IBM patients will experience dysphagia/swallowing dysfunction at some point in their disease course (2). As seen in the limb musculature, variability in bulbar function further contributes to disease heterogeneity. There is no unifying outcome measure that can adequately address such heterogeneity. The IBM-FRS and sIFA cover many disabling aspects of the disease, but they have limitations. Rasch analysis of IBM-FRS showed multidimensionality, possible unequal importance of the items on the scale, and redundancy of some items (19, 61). Three Rasch modified IBM-FRS scorings have been proposed, but none of them has been validated (61). Moreover, even the modified upper extremity IBM-FRS does not correlate well with hand function when compared to PRO measures (62). In contrast to the IBM-FRS, the sIFA was developed using FDA patient reported outcome development guidance including literature review, expert input and direct patient interviews and questionnaires. It has good internal consistency, test-retest reliability, discriminative validity, and correlates well to performance on other functional measures, however its use has not been widely adopted to date (63). A new health index measure in IBM is at the late stage of development but will need to be validated (64). Muscle strength testing is a logical outcome measure of any muscle disease including myositis. However, it is not free from subjective variations that can influence interpretation of interventional trials and make aggregation of data (meta-analyses) across studies suspect. A small longitudinal study in IBM

showed stability or improvement in muscle strength in 4 out of 11 patients over 6 months based on quantitative myometry (19). Similar variability was also noted in quantitative myometry of quadriceps in the recent bimagrumab trial (58). One potential explanation, at least in part, is the variability in muscle strength testing between the study centres in this large multi-centre trial, despite standardisation (15, 17, 58). Such wide variability in outcome measures can significantly affect the power of a study. A trial of methotrexate in IBM only achieved 23% power (*vs*. projected 80%) because of the wider than expected variation in quantitative muscle strength testing (11).

The 6MWD test was originally designed as a sub-maximal exercise test for cardiac and pulmonary diseases but it has been accepted by the FDA as an outcome measure in neuromuscular clinical trials. However, it more appropriately assesses endurance rather than muscle strength and can be affected by many other systemic factors (16). The variability in the 6MWD of recruited patients in the bimagrumab phase 2b trial was much higher than the estimated variance for the sample size, which negatively affected the study (10). While the 6MWD has been used in IBM, it may not be the most suitable outcome measure. It is not useful in more severe patients who have already lost ambulation and is strongly influenced by non-muscle related musculoskeletal issues. Moreover, at the early stage of the disease there is only a minor change in 6MWD (18, 27). Other timed tests may provide the same information while reducing the burden of testing (16). The shorter version of this test, the two-minute walk distance, causes less fatigue and may be more appropriate for clinical trials (27, 65). Another commonly used test, the Timed Up and Go (TUG), can be easily implemented in clinical practice, and provides a reliable and valid test result. TUG also has shown to have a strong association with the self-reported physical function (SF-36) in IBM patients (66).

With the recognition of these limitations, efforts are ongoing to optimise the functional outcome measures used for IBM clinical trials. Recent studies indicate that pinch and grip strength could be valuable in early stages of the disease (62). However, there can be wide variability among the IBM population and also in the rate of deterioration of hand and finger function (16, 58, 62).

Outcome measures related to swallowing dysfunction are not well represented in clinical trials, despite aspiration pneumonia being a frequent cause of death (67). One study examining the effect of IVIg reported improved swallowing function based on ultrasound (14, 68, 69); however, results have not been replicated in another clinical trial, and ultrasound may be less feasible to reliably capture duration of swallowing (13). Video fluoroscopy is well established, but requires x-ray and is not routinely used for time analysis; it has recently been used to demonstrate cricopharyngeal bar occurrence in some IBM patients and its relevance for aspiration (59, 70, 71). In the future, real-time MRI could possibly overcome these shortcomings, but so far it is only available as a research technique (72). While there are some patient reported questionnaire based outcome measures for swallowing, such as the Sydney Swallow Questionnaire (SSQ), and the Swallowing-Related Quality of Life (Swal-QoL) among others, there is a desperate need for inclusion of optimal outcome measures to capture bulbar dysfunction (dysphagia and dysarthria) in IBM. The modified oculobulbar facial respiratory score (mOBFRS) has shown some promise in early analysis (73, 74).

As an additional complexity, recent large observational studies in IBM showed significant variability of progression in a non-linear fashion across multiple outcome measures (16, 31). Based on these studies, the estimated annual rate of decline is 3.7% for MMT and 6.3% for IBMFRS. However, how this information can be applied to improve clinical trial design is not yet clear.

Apart from functional outcome measures, imaging technologies can be helpful in assessing muscle health and as a tool for diagnosis but are not widely utilised to quantify change over time in IBM clinical trials. Magnetic resonance imaging (MRI), muscle ultrasound, and electrical impedance myography can assess muscle health, and some are also able to capture disease progression (29, 75-77). For MRI to become a useful outcome measure in IBM, standardisation of imaging protocols and data analyses methods are required (74). DEXA has been a tool used for evaluation of lean body muscle mass in several interventional studies and showed encouraging results. Specifically, in the RESILIENT study, a dose-dependent effect on lean body mass was seen with bimagrumab treatment, confirming the biological activity of this drug on skeletal muscle mass (10, 15, 19, 53, 54). Similarly, objective measurement of physical activities using devices such as a triaxial wrist-worn accelerometer has shown some promise in IIM but has not yet been tested in IBM (78). A semi-recumbent cycle ergometer has been recently used in a small cohort of IBM patients (79). However, whether these objective measures are more sensitive than other clinical outcome measures remains unexplored.

The core set measures developed by the IMACS group are widely accepted for assessing disease activity and improvement following an intervention for DM and PM. These core set measures include manual muscle strength testing, Physician Global Activity (Visual Analogue Scale), Patient Global Activity (Visual Analogue Scale), Health Assessment Questionnaire, Muscle enzymes, and Extramuscular Activity or Disease Activity Score (20, 80-82). While this tool is very effective in assessing treatment response in other IIMs (dermatomyositis, polymyositis, and juvenile dermatomyositis), it has limited application in IBM. The muscle strength in IBM usually does not improve. The muscle enzyme CK is usually not very elevated in IBM, and CK values are not reflective of disease severity in IBM. Apart from dysphagia, other extramuscular manifestations of IBM are ill-defined and it would be hard to score them appropriately (2, 80-82). Most importantly, it remains controversial if disease improvement is feasible in IBM like other IIMs, and a

Table I. All the randomised control trials in inclusion body myositis and the used outcome measures.

Study	Type of the study	no. of patients	Inclusion criteria	Dose/Mode of intervention	Duration	Primary outcome measures	Secondary outcome measures
Arimoclomol 2021 (51) (NCT02753530)	RCT Multicentre Phase 2	150	-ENMC research criteria	Arimoclomol 400 mg TID	20 weeks	**IBM-FRS**: Decline from baseline to Month 20	- MMT - Maximal Voluntary Isometric Contraction (MVICT) of quadriceps - Grip and Pinch test - mTUG - 6MWT -> 2MWT - HAQ-DI - SF-36 - Decline in IBM-FRS in 12 months
RESILIENT 2019 (15) (NCT01925209)	RCT Multicentre Phase 2b	251	Pathologically or clinically defined diagnosis of Inclusion body myositis, per modified 2010 Medical Research Council (MRC) criteria	Placebo Bimagrumab 1 mg/Kg, 3 mg/Kg, 10 mg/Kg IV infusion every 4 weeks for at least 48 weeks	52 weeks or longer	**6MWD**: Change from baseline, relative to placebo, at week 52	- Quantitative muscle testing of quadriceps by dynamometer - sIFA score - Lean body mass - Annual number of falls - Short Physical Performance Battery (SPPB) - Swallowing function measured by videofluroscopy - Bilateral hand grip - Bilateral pinch-grip - Changes in thigh muscles (subset of patients)
Community exercise 2019 (56)	RCT phase 2	17	Griggs criteria	Community based exercise training	12 weeks		- Maximum aerobic capacity (VO2 peak) - Fatigue severity scale - Pain, using a visual analogue scale - Muscle dynamometer. - 10-meter timed walk - 6-minute walk distance - Sense-wear activity monitors - SF36 - Pittsburgh sleep quality - Epworth sleepiness scale
Rapamycin 2018 (49) (NCT02481453)	RCT Single centre Phase 2/3	44	Several established criteria for IBM	Placebo Rapamycin 2mg daily	52 weeks	Relative percentage change in maximal voluntary **isometric knee extension strength** (from baseline to month 12)	- 6MWT - IBM weakness composite index - IBM weakness composite index - IBM-FRS - HAQ - Measure of muscle fatty infiltration by MRI - FVC - Questions on swallowing dysfunction Duration in seconds to drink 100 ml of water
Blood-flow restricted resistance training (50)	RCT Single centre phase 2	22	Griggs criteria	BFR *vs*. control	12 weeks	Change from baseline in self-reported physical function using the SF-36	- 2MWT - Timed Up and Go - 30-seconds chair test - IBM-FRS - Myositis Disease Activity Assessment Tool - Patient and Physician Global Activity and Damage - Myositis Damage Index - CK - HAQ - MMT-8 - Maximal Knee Extensor Strength
Bimagrumab 2012(10) (NCT01423110)	RCT Multicentre Phase 2	14	ENMC diagnostic criteria	30 mg/kg IV dose	8 weeks -> with optional 24 weeks extension	Thigh muscle volume (right) using MRI after 8 weeks	- Lean body mass, assessed by DXA - QMT - Timed Up and Go - 6MWD - IBM-FRS - SF 36 - EuroQual-5D
Arimoclomol 2012 (9) (NCT00769860)	RCT Phase 2/3	24	Probable or definite Griggs criteria (1995) -Must have muscle function adequate for quantitative muscle testing	Arimoclomol 100 mg TID	4 months	Safety and tolerability	- HSP level in tissue - Muscle strength testing (MMT) - IBM-FRS - MVICT

Study	Type of the study	no. of patients	Inclusion criteria	Dose/Mode of intervention	Duration	Primary outcome measures	Secondary outcome measures
Etanercept 2014 (52) (NCT00802815)	RCT Phase 1	20	No specific criteria specified. A clinical diagnosis of definite or probable IBM	Etanercept 50 mg subcutaneous	12 months	QMT (12 proximal and 12 distal muscle)	Not available
Methotrexate 2000 (11)	RCT Phase 2	44	ENMC criteria	Methotrexate 5-20 mg per week	48 weeks	QMT (Handheld myometry) -> MVICT	- MMT - Barthel Index - Brooke's Grading System - Rivermead Mobility Index - CK level - Patient's own assessment
Oxandrolone 2001(55)	RCT Phase 2 (Single centre, Cross over study)	19	All the patients needed biopsy, age>40, clinical features consisted with IBM, but no definitive criteria	Oxandrolone 10 mg BID	12 weeks-2-4 months washout-12 weeks	Whole body MVICT	- Whole body MMT - Upper and lower extremity MVICT - Upper extremity MMT - Lower extremity MMT - Get up and go - 6MW - Stair climb - BMI - Lean Body Mass - LFT - Lipid profile
High Dose interferon beta 2002 (54)	RCT	30	Griggs criteria 95	Interferon beta 60 µg IM/weekly)	24 weeks	Safety and olerability	- MVICT - MMT - Lean body mass - Purdue Pegboard Test - ALSFRS - SF 36 - Grip strength - CK - Beck Depression Inventory
Low dose interferon beta 2002 (53)	RCT	30	Griggs criteria 95	Interferon beta 30 µg IM/weekly)	24 weeks	Safety and tolerability	- MVICT using QMA - MMT - Lean body mass - Purdue pegboard for 30 seconds - Time to walk 15 feet - Time to rise from a chair - ASLFRS - SF-36
IVIg+ Prednisone 2001 (13)	RCT	36	Griggs criteria 95	IVIg 2 gm/Kg divided in 2 daily doses + High dose prednisone	3 months	-QMT score (MVICT) -Modified MRC score	- Number of necrotic fiber - Mean number of CD2+ cells
IVIg 2000 (57)	RCT Cross Over	22	Not specified	Monthly IVIg 2 gm/Kg given over 2-5 days	6 months	Modified MRC sum score	Neuromuscular Symptom and Disability Functional Score (NSS) - visual analog scale - Arm outstretched time - mean spontaneous activity on EMG - CK - Muscle biopsy inflammation
IVIg 1997 (14)	RCT Cross over	22	Griggs criteria 95	IVIg 2 gm/Kg divided in 2 daily doses for 3 months	3 months	Muscle strength by MRC	- MMT - MVIC - Swallowing function (20 items of self-assessment questionnaire, videofluroscopy, ultrasound swallowing mean time, 62 individual items of oral motor examination) - limb-by-limb analysis - Patients own assessment

majority of recent clinical trials focused on disease stability only.

Several clinical measures have been used inconsistently across clinical trials and longitudinal observational studies in IBM. There is significant variability in terms of outcome measures used. There is inter-/intra-rater variability in specific outcome measures, and even for quantitative outcome measures, there was wide variations in measurement across large international trials. Unfortunately, even the core set measures developed by IMACS group for IIM are not directly applicable to IBM given the unique characteristics of this IIM subtype. Developing an IBM-specific core set of measures by this scien-

tific interest group will enable efficient conduct of clinical trials and facilitate evaluation of the next wave of new potential therapeutics for IBM.

Affiliations

[1]Yale University School of Medicine, New Haven, CT, USA; [2]Fondazione Policlinico Universitario Agostino Gemelli IRCCS, Rome, Italy; [3]The University of Manchester, Centre for Musculoskeletal Research, UK; [4]University of California, Irvine, CA, USA; [5]Mayo Clinic, Rochester, MN, USA; [6]Johns Hopkins University, Baltimore, MD, USA; [7]Nationwide Children's Hospital, Columbus, OH, USA; [8]Purdue University, West Lafayette, IN, USA; [9]University of South Alabama, Mobile, AL, USA; [10]The Myositis Association, Columbia, MD, USA; [11]Leiden University Medical Center, Leiden, The Netherlands; [12]University College London, UK; [13]University of Washington Medical Center, Seattle, WA, USA; [14]Harvey Cushing/John Hay Whitney Medical Library, Yale University, New Haven, CT, USA; [15]University Medical Center Göttingen, Germany; [16]University of Cincinnati, OH, USA; [17]Medical College of Georgia at Augusta University, Augusta, GA, USA; [18]University at Buffalo, NY, USA; [19]Stanford Neuroscience Health Center, Palo Alto, CA, USA; [20]University of Siena, Italy.

Competing interests

B. Roy reports serving as a consultant for Alexion Pharmaceuticals, now part of AstraZeneca, Takeda Pharmaceuticals and Argenx, and having stocks (<$5000) in Cabaletta Bio. No direct conflicts related to this work.

N.A. Goyal has served on Advisory Boards for Abcuro, Alexion, Amylyx, Annexon, Argenx, AstraZeneca, CSL Behring, Fulcrum, Kezar, MT Pharma, Sanofi Genzyme, Sarepta, UCB. In relation to these activities, she has received travel reimbursement and honoraria. She has also served on the speaker's bureau for Argenx and CSL.

L.N. Alfano reports personal fees and other support from Sarepta Therapeutics, royalties for licensed technologies, other support from Novartis Gene Therapies, personal fees from Biogen. Also provides consultancy services for ATOM International (Amicus Therapeutics Pty Ltd., Edgewise, Genethon, Italfarmaco, NS Pharma, Pfizer, PTC Therapeutics), outside the submitted work.

P.M. Machado has received consulting/speaker's fees from Abbvie, BMS, Celgene, Eli Lilly, Galapagos, GSK, Janssen, MSD, Novartis, Orphazyme, Pfizer, Roche and UCB, and is supported by the National Institute for Health Research (NIHR) University College London Hospitals (UCLH) Biomedical Research Centre (BRC).

J. Schmidt has received payments for Advisory boards, speakers honoraria, travel expenses, research projects from Abcuro, Alnylam, Argenx, Biotest, CSL Behring, Euroimmun, Janssen, Kezar, LFB, Novartis, Octapharma, UCB.

T.E. Lloyd has received consulting fees or research support from Aavogen, Abata Therapeutics, Abcuro, Acceleron, DrenBio, EMD Serano, Kezar Life Sciences, Ono Pharma, Orphazyme, Pharnext, Regenecy, Sarepta, and Takeda.

The other authors have declared no competing interests.

References

1. DIMACHKIE MM, BAROHN RJ: Inclusion body myositis. *Semin Neurol* 2012; 32(3): 237-45. https://doi.org/10.1055/s-0032-1329197
2. GREENBERG SA: Inclusion body myositis: clinical features and pathogenesis. *Nat Rev Rheumatol* 2019; 15(5): 257-72. https://doi.org/10.1038/s41584-019-0186-x
3. MOHANNAK N, PATTISON G, HIRD K, NEEDHAM M: Dysphagia in patients with sporadic inclusion body myositis: management challenges. *Int J Gen Med* 2019; 12: 465-74. https://doi.org/10.2147/IJGM.S198031
4. ROSE MR, GROUP EIW: 188th ENMC International Workshop: Inclusion Body Myositis, 2-4 December 2011, Naarden, The Netherlands. *Neuromuscul Disord* 2013; 23(12): 1044-55. https://doi.org/10.1016/j.nmd.2013.08.007
5. BENVENISTE O, GUIGUET M, FREEBODY J *et al*.: Long-term observational study of sporadic inclusion body myositis. *Brain* 2011; 134 (Pt 11): 3176-84. https://doi.org/10.1093/brain/awr213
6. COX FM, TITULAER MJ, SONT JK, WINTZEN AR, VERSCHUUREN JJGM, BADRISING UA: A 12-year follow-up in sporadic inclusion body myositis: an end stage with major disabilities. *Brain* 2011; 134: 3167-75. https://doi.org/10.1093/brain/awr217
7. FINDLAY AR, GOYAL NA, MOZAFFAR T: An overview of polymyositis and dermatomyositis. *Muscle Nerve* 2015; 51(5): 638-56. https://doi.org/10.1002/mus.24566
8. Orphazyme announces topline results from pivotal trial of arimoclomol for Inclusion Body Myositis (IBM). globalnewswire; 2021 [cited 2021 April 19]; Available from: https://ml-eu.globenewswire.com/Resource/Download/8b7102b3-2a44-4ae5-9ffb-2610f4073cf1
9. AHMED M, MACHADO PM, MILLER A *et al*.: Targeting protein homeostasis in sporadic inclusion body myositis. *Sci Transl Med* 2016; 8(331): 331ra41. https://doi.org/10.1126/scitranslmed.aad4583
10. AMATO AA, SIVAKUMAR K, GOYAL N *et al*.: Treatment of sporadic inclusion body myositis with bimagrumab. *Neurology* 2014; 83(24): 2239-46. https://doi.org/10.1212/WNL.0000000000001070
11. BADRISING UA, MAAT-SCHIEMAN ML, FERRARI MD *et al*.: Comparison of weakness progression in inclusion body myositis during treatment with methotrexate or placebo. *Ann Neurol* 2002; 51(3): 369-72. https://doi.org/10.1002/ana.10121
12. BAROHN RJ, AMATO AA, SAHENK Z, KISSEL JT, MENDELL JR: Inclusion body myositis: explanation for poor response to immunosuppressive therapy. *Neurology* 1995; 45(7): 1302-4. https://doi.org/10.1212/wnl.45.7.1302
13. DALAKAS MC, KOFFMAN B, FUJII M, SPECTOR S, SIVAKUMAR K, CUPLER E: A controlled study of intravenous immunoglobulin combined with prednisone in the treatment of IBM. *Neurology* 2001; 56(3): 323-7. https://doi.org/10.1212/wnl.56.3.323
14. DALAKAS MC, SONIES B, DAMBROSIA J, SEKUL E, CUPLER E, SIVAKUMAR K: Treatment of inclusion-body myositis with IVIg: A double-blind, placebo-controlled study. *Neurology* 1997; 48(3): 712-6. https://doi.org/10.1212/wnl.48.3.712
15. HANNA MG, BADRISING UA, BENVENISTE O *et al*.: Safety and efficacy of intravenous bimagrumab in inclusion body myositis (RESILIENT): a randomised, double-blind, placebo-controlled phase 2b trial. *Lancet Neurol* 2019; 18(9): 834-44. https://doi.org/10.1016/S1474-4422(19)30200-5.
16. OLDROYD AGS, LILLEKER JB, WILLIAMS J, CHINOY H, MILLER JAL: Long-term strength and functional status in inclusion body myositis and identification of trajectory subgroups. *Muscle Nerve* 2020; 62(1): 76-82. https://doi.org/10.1002/mus.26859
17. ROY B, GRIGGS RC: Challenges for treatment trials of inclusion body myositis. *Neurology* 2021; 96(12): 555-6. https://doi.org/10.1212/WNL.0000000000011628
18. SCHMIDT J: Endpoint choice for inclusion body myositis: a step too far? *Lancet Neurol* 2019; 18(9): 807-8. https://doi.org/10.1016/S1474-4422(19)30279-0
19. ROSE MR, MCDERMOTT MP, THORNTON CA, PALENSKI C, MARTENS WB, GRIGGS RC: A prospective natural history study of inclusion body myositis: implications for clinical trials. *Neurology* 2001; 57(3): 548-50. https://doi.org/10.1212/wnl.57.3.548
20. RIDER LG, AGGARWAL R, MACHADO PM *et al*.: Update on outcome assessment in myositis. *Nat Rev Rheumatol* 2018; 14(5): 303-18. https://doi.org/10.1038/nrrheum.2018.33

21. [01/23/2022]; Available from: https://grants.nih.gov/policy/clinical-trials/definition.htm.
22. GRANT MJ, BOOTH A: A typology of reviews: an analysis of 14 review types and associated methodologies. *Health Info Libr J* 2009; 26(2): 91-108. https://doi.org/10.1111/j.1471-1842.2009.00848.x
23. ALFANO LN, YIN H, DVORCHIK I *et al*.: Modeling functional decline over time in sporadic inclusion body myositis. *Muscle Nerve* 2017; 55(4): 526-31. https://doi.org/10.1002/mus.25373
24. ALLENBACH Y, BENVENISTE O, DECOSTRE V *et al*.: Quadriceps strength is a sensitive marker of disease progression in sporadic inclusion body myositis. *Neuromuscul Disord* 2012; 22(11): 980-6. https://doi.org/10.1016/j.nmd.2012.05.004
25. CORTESE A, MACHADO P, MORROW J *et al*.: Longitudinal observational study of sporadic inclusion body myositis: implications for clinical trials. *Neuromuscul Disord* 2013; 23(5): 404-12. https://doi.org/10.1016/j.nmd.2013.02.010
26. FELICE KJ, NORTH WA: Inclusion body myositis in Connecticut: observations in 35 patients during an 8-year period. *Medicine* (Baltimore) 2001; 80(5): 320-7. https://doi.org/10.1097/00005792-200109000-00006
27. HOGREL JY, ALLENBACH Y, CANAL A *et al*.: Four-year longitudinal study of clinical and functional endpoints in sporadic inclusion body myositis: implications for therapeutic trials. *Neuromuscul Disord* 2014; 24(7): 604-10. https://doi.org/10.1016/j.nmd.2014.04.009
28. LINDBERG C, OLDFORS A: Prognosis and prognostic factors in sporadic inclusion body myositis. *Acta Neurol Scand* 2012; 125(5): 353-8. https://doi.org/10.1111/j.1600-0404.2011.01584.x
29. MORROW JM, SINCLAIR CD, FISCHMANN A *et al*.: MRI biomarker assessment of neuromuscular disease progression: a prospective observational cohort study. *Lancet Neurol* 2016; 15(1): 65-77. https://doi.org/10.1016/S1474-4422(15)00242-2
30. PENG A, KOFFMAN BM, MALLEY JD, DALAKAS MC: Disease progression in sporadic inclusion body myositis: observations in 78 patients. *Neurology* 2000; 55(2): 296-8. https://doi.org/10.1212/wnl.55.2.296
31. SANGHA G, YAO B, LUNN D *et al*.: Longitudinal observational study investigating outcome measures for clinical trials in inclusion body myositis. *J Neurol Neurosurg Psychiatry* 2021 Apr 13. https://doi.org/10.1136/jnnp-2020-325141
32. AMATO AA, BAROHN RJ, JACKSON CE, PAPPERT EJ, SAHENK Z, KISSEL JT: Inclusion body myositis: treatment with intravenous immunoglobulin. *Neurology* 1994; 44(8): 1516-8. https://doi.org/10.1212/wnl.44.8.1516
33. ARNARDOTTIR S, ALEXANDERSON H, LUNDBERG IE, BORG K: Sporadic inclusion body myositis: pilot study on the effects of a home exercise program on muscle function, histopathology and inflammatory reaction. *J Rehabil Med* 2003; 35(1): 31-5. https://doi.org/10.1080/16501970306110
34. BAROHN RJ, HERBELIN L, KISSEL JT *et al*.: Pilot trial of etanercept in the treatment of inclusion-body myositis. *Neurology* 2006; 66 (2 Suppl 1): S123-4. https://doi.org/10.1212/01.wnl.0000192258.32408.54
35. BERNHARDT K, OH T, KAUFMAN K: Stance control orthosis trial in patients with inclusion body myositis. *Prosthet Orthot Int* 2011; 35(1): 39-44. https://doi.org/10.1177/0309364610389352
36. DALAKAS MC, RAKOCEVIC G, SCHMIDT J *et al*.: Effect of Alemtuzumab (CAMPATH 1-H) in patients with inclusion-body myositis. *Brain* 2009; 132 (Pt 6): 1536-44. https://doi.org/10.1093/brain/awp104
37. DOBLOUG C, WALLE-HANSEN R, GRAN JT, MOLBERG O: Long-term follow-up of sporadic inclusion body myositis treated with intravenous immunoglobulin: a retrospective study of 16 patients. *Clin Exp Rheumatol* 2012; 30(6): 838-42.
38. JOHNSON LG, EDWARDS DJ, WALTERS S, THICKBROOM GW, MASTAGLIA FL: The effectiveness of an individualized, home-based functional exercise program for patients with sporadic inclusion body myositis. *J Clin Neuromuscul Dis* 2007; 8(4): 187-94. https://doi.org/10.1097/CND.0b013e3181237291
39. JOHNSON LG, COLLIER KE, EDWARDS DJ *et al*.: Improvement in aerobic capacity after an exercise program in sporadic inclusion body myositis. *J Clin Neuromuscul Dis* 2009; 10(4): 178-84. https://doi.org/10.1097/CND.0b013e3181a23c86
40. KOSMIDIS ML, ALEXOPOULOS H, TZIOUFAS AG, DALAKAS MC: The effect of anakinra, an IL1 receptor antagonist, in patients with sporadic inclusion body myositis (sIBM): a small pilot study. *J Neurol Sci* 2013; 334(1-2): 123-5. https://doi.org/10.1016/j.jns.2013.08.007
41. KOSMIDIS ML, PIKAZIS D, VLACHOYIANNOPOULOS P, TZIOUFAS AG, DALAKAS MC: Trial of canakinumab, an IL-1beta receptor antagonist, in patients with inclusion body myositis. *Neurol Neuroimmunol Neuroinflamm* 2019; 6(4): e581. https://doi.org/10.1212/NXI.0000000000000581
42. LINDBERG C, TRYSBERG E, TARKOWSKI A, OLDFORS A: Anti-T-lymphocyte globulin treatment in inclusion body myositis: a randomized pilot study. *Neurology* 2003; 61(2): 260-2. https://doi.org/10.1212/01.wnl.0000071852.27182.c7
43. MENDELL JR, SAHENK Z, AL-ZAIDY S, RODINO-KLAPAC LR, LOWES LP, ALFANO LN *et al*.: Follistatin gene therapy for sporadic inclusion body myositis improves functional outcomes. *Mol Ther* 2017; 25(4): 870-9. https://doi.org/10.1016/j.ymthe.2017.02.015
44. MOHANNAK N, PATTISON G, RADICH B *et al*.: Exploring the efficacy of the expiratory muscle strength trainer to improve swallowing in inclusion body myositis: a pilot study. *Neuromuscul Disord* 2020; 30(4): 294-300. https://doi.org/10.1016/j.nmd.2020.02.010
45. SANCRICCA C, MORA M, RICCI E, TONALI PA, MANTEGAZZA R, MIRABELLA M: Pilot trial of simvastatin in the treatment of sporadic inclusion-body myositis. *Neurol Sci* 2011; 32(5): 841-7. https://doi.org/10.1007/s10072-011-0657-6
46. SIVAKUMAR K, COCHRANE TI, SLOTH B *et al*.: Long-term safety and tolerability of bimagrumab (BYM338) in sporadic inclusion body myositis. *Neurology* 2020; 95(14): e1971-e8. https://doi.org/10.1212/WNL.0000000000010417
47. SPECTOR SA, LEMMER JT, KOFFMAN BM *et al*.: Safety and efficacy of strength training in patients with sporadic inclusion body myositis. *Muscle Nerve* 1997; 20(10): 1242-8. https://doi.org/10.1002/(sici)1097-4598(199710)20:10<1242::aid-mus6>3.0.co;2-c
48. JOFFE MM, LOVE LA, LEFF RL *et al*.: Drug therapy of the idiopathic inflammatory myopathies: predictors of response to prednisone, azathioprine, and methotrexate and a comparison of their efficacy. *Am J Med* 1993; 94(4): 379-87. https://doi.org/10.1016/0002-9343(93)90148-i
49. BENVENISTE O, HOGREL JY, BELIN L *et al*.: Sirolimus for treatment of patients with inclusion body myositis: a randomised, double-blind, placebo-controlled, proof-of-concept, phase 2b trial. *Lancet Rheumatol* 2021; 3(1): E40-E8. https://doi.org/10.1016/S2665-9913(20)30280-0
50. JORGENSEN AN, AAGAARD P, FRANDSEN U, BOYLE E, DIEDERICHSEN LP: Blood-flow restricted resistance training in patients with sporadic inclusion body myositis: a randomized controlled trial. *Scand J Rheumatol* 2018; 47(5): 400-9. https://doi.org/10.1080/03009742.2017.1423109
51. MEDICINE UNLO: Study of Arimoclomol in Inclusion Body Myositis (IBM) (NCT02753530). Available from: https://clinicaltrials.gov/ct2/show/NCT02753530?cond=IBM&rank=4.
52. MEDICINE UNLO: Double-blind, Randomized, Placebo-controlled Trial of Etanercept for 12 Months in Subjects With Inclusion Body Myositis (NCT00802815). Available from: https://www.clinicaltrials.gov/ct2/show/NCT00802815.
53. MUSCLE STUDY GROUP: Randomized pilot trial of betaINF1a (Avonex) in patients with inclusion body myositis. *Neurology* 2001; 57(9): 1566-70. https://doi.org/10.1212/wnl.57.9.1566
54. MUSCLE STUDY GROUP: Randomized pilot trial of high-dose betaINF-1a in patients with inclusion body myositis. *Neurology* 2004; 63(4): 718-20. https://doi.org/10.1212/01.wnl.0000134675.98525.79
55. RUTKOVE SB, PARKER RA, NARDIN RA, CONNOLLY CE, FELICE KJ, RAYNOR EM: A pilot randomized trial of oxandrolone in inclusion body myositis. *Neurology* 2002; 58(7): 1081-7. https://doi.org/10.1212/wnl.58.7.1081
56. WALLACE A, PIETRUSZ A, DEWAR E *et al*.: Community exercise is feasible for neuromuscular diseases and can improve aerobic capacity. *Neurology* 2019; 92(15): e1773-e85. https://doi.org/10.1212/WNL.0000000000007265
57. WALTER MC, LOCHMULLER H, TOEPFER M *et al*.: High-dose immunoglobulin therapy in sporadic inclusion body myositis: a double-blind, placebo-controlled study. *J Neurol* 2000; 247(1): 22-8. https://doi.org/10.1007/s004150050005
58. AMATO AA, HANNA MG, MACHADO PM *et al*.: Efficacy and safety of bimagrumab in

sporadic inclusion body myositis: longterm extension of RESILIENT. *Neurology* 2021; 96(12): e1595-e1607. https://doi.org/10.1212/wnl.0000000000011626
59. ZENG R, SCHMIDT J: Impact and management of dysphagia in inflammatory myopathies. *Curr Rheumatol Rep* 2020; 22(10): 74. https://doi.org/10.1007/s11926-020-00950-3
60. LLOYD TE, MAMMEN AL, AMATO AA, WEISS MD, NEEDHAM M, GREENBERG SA: Evaluation and construction of diagnostic criteria for inclusion body myositis. *Neurology* 2014; 83(5): 426-33. https://doi.org/10.1212/WNL.0000000000000642
61. RAMDHARRY G, MORROW J, HUDGENS S *et al*.: Investigation of the psychometric properties of the inclusion body myositis functional rating scale with rasch analysis. *Muscle Nerve* 2019; 60(2): 161-8. https://doi.org/10.1002/mus.26521
62. LIN AY, SIENER CS, FAINO AV, SEIFFERT M, WEIHL CC, WANG LH: Optimizing hand-function patient outcome measures for inclusion body myositis. *Neuromuscul Disord* 2020; 30(10): 807-14. https://doi.org/10.1016/j.nmd.2020.08.358
63. WILLIAMS V, COLES T, GNANASAKTHY A *et al*.: Psychometric validation of a patient-reported measure of physical functioning in sporadic inclusion body myositis. *Muscle Nerve* 2016; 54(4): 658-65. https://doi.org/10.1002/mus.25080
64. GIBSON C, JOHNSON NE, EASTWOOD E, HEATWOLE C: Inclusion body myositis: what most impacts patients' lives. *J Clin Neuromuscul Dis* 2016; 18(2): 67-71. https://doi.org/10.1097/CND.0000000000000138
65. ALFANO LN, LOWES LP, DVORCHIK I *et al*.: The 2-min walk test is sufficient for evaluating walking abilities in sporadic inclusion body myositis. *Neuromuscular Disord* 2014; 24(3): 222-6. https://doi.org/10.1016/j.nmd.2013.11.012
66. JORGENSEN AN, AAGAARD P, NIELSEN JL *et al*.: Physical function and muscle strength in sporadic inclusion body myositis. *Muscle Nerve* 2017; 56(6): E50-E8. https://doi.org/10.1002/mus.25603
67. MURATA KY, KOUDA K, TAJIMA F, KONDO T: A dysphagia study in patients with sporadic inclusion body myositis (s-IBM). *Neurol Sci* 2012; 33(4): 765-70. https://doi.org/10.1007/s10072-011-0814-y
68. CHERIN P, PELLETIER S, TEIXEIRA A *et al*.: Intravenous immunoglobulin for dysphagia of inclusion body myositis. *Neurology* 2002; 58(2): 326. https://doi.org/10.1212/wnl.58.2.326
69. CHERIN P, DELAIN JC, DE JAEGER C, CRAVE JC: Subcutaneous immunoglobulin use in inclusion body myositis: a review of 6 cases. *Case Rep Neurol* 2015; 7(3): 227-32. https://doi.org/10.1159/000441490
70. TAIRA K, MORI-YOSHIMURA M, YAMAMOTO T *et al*.: More prominent fibrosis of the cricopharyngeal muscle in inclusion body myositis. *J Neurol Sci* 2021; 422: 117327. https://doi.org/10.1016/j.jns.2021.117327
71. TAIRA K, YAMAMOTO T, MORI-YOSHIMURA M *et al*.: Cricopharyngeal bar on videofluoroscopy: high specificity for inclusion body myositis. *J Neurol* 2021; 268(3): 1016-24. https://doi.org/10.1007/s00415-020-10241-7
72. OLTHOFF A, CARSTENS PO, ZHANG S *et al*.: Evaluation of dysphagia by novel real-time MRI. *Neurology* 2016; 87(20): 2132-8. https://doi.org/10.1212/WNL.0000000000003337
73. WENCEL M, ARAUJO N, MEDINA E *et al*.: Feasibility and validation of modified Oculobulbar Facial Respiratory Score (mOBFRS) in sporadic inclusion body myositis. *Ann Neurol* 2018; 84: S217-8.
74. ALFANO LN, FOCHT GARAND KL, MALANDRAKI GA, SALAM S, MACHADO PM, DIMACHKIE MM: Measuring change in inclusion body myositis: clinical assessments versus imaging. *Clin Exp Rheumatol* 2022; 40(2): 404-13. https://doi.org/10.55563/clinexprheumatol/0q2voe
75. ROY B, RUTKOVE SB, NOWAK RJ: Electrical impedance myography as a biomarker of inclusion body myositis: A cross-sectional study. *Clin Neurophysiol* 2020; 131(2): 368-71. https://doi.org/10.1016/j.clinph.2019.10.030
76. ANSARI B, SALORT-CAMPANA E, OGIER A *et al*.: Quantitative muscle MRI study of patients with sporadic inclusion body myositis. *Muscle Nerve* 2020; 61(4): 496-503. https://doi.org/10.1002/mus.26813
77. LEEUWENBERG KE, VAN ALFEN N, CHRISTOPHER-STINE L *et al*.: Ultrasound can differentiate inclusion body myositis from disease mimics. *Muscle Nerve* 2020; 61(6): 783-8. https://doi.org/DOI 10.1002/mus.26875
78. BACHASSON D, LANDON-CARDINAL O, BENVENISTE O, HOGREL JY, ALLENBACH Y: Physical activity monitoring: A promising outcome measure in idiopathic inflammatory myopathies. *Neurology* 2017; 89(1): 101-3. https://doi.org/10.1212/WNL.0000000000004061
79. RAMDHARRY GM, WALLACE A, HENNIS P *et al*.: Cardiopulmonary exercise performance and factors associated with aerobic capacity in neuromuscular diseases. *Muscle Nerve* 2021; 64(6): 683-90. https://doi.org/10.1002/mus.27423
80. AGGARWAL R, RIDER LG, RUPERTO N *et al*.: 2016 American College of Rheumatology/European League Against Rheumatism criteria for minimal, moderate, and major clinical response in adult dermatomyositis and polymyositis: An International Myositis Assessment and Clinical Studies Group/Paediatric Rheumatology International Trials Organisation Collaborative Initiative. *Ann Rheum Dis* 2017; 76(5): 792-801. https://doi.org/10.1136/annrheumdis-2017-211400
81. AGGARWAL R, RIDER LG, RUPERTO N *et al*.: 2016 American College of Rheumatology/European League Against Rheumatism Criteria for Minimal, Moderate, and Major Clinical Response in Adult Dermatomyositis and Polymyositis: An International Myositis Assessment and Clinical Studies Group/Paediatric Rheumatology International Trials Organisation Collaborative Initiative. *Arthritis Rheumatol* 2017; 69(5): 898-910. https://doi.org/10.1002/art.40064
82. RIDER LG, AGGARWAL R, PISTORIO A *et al*.: 2016 American College of Rheumatology/European League Against Rheumatism Criteria for Minimal, Moderate, and Major Clinical Response in Juvenile Dermatomyositis: An International Myositis Assessment and Clinical Studies Group/Paediatric Rheumatology International Trials Organisation Collaborative Initiative. *Arthritis Rheumatol* 2017; 69(5): 911-23. https://doi.org/10.1002/art.40060