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Effective Performance of the 2022 American College of Rheumatology/EULAR Classification Criteria for Antineutrophil Cytoplasmic Antibody–Associated Vasculitis in Pediatric Patients: An ARChiVe Study

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Objective. To assess the 2022 American College of Rheumatology (ACR)/EULAR classification criteria for antineutrophil cytoplasmic antibody–associated vasculitis (AAV) in children with chronic small-to-medium vessel vasculitis.

Methods. A cohort of 574 patients, identified by physician's diagnosis (MD-diagnosis) in A Registry of Childhood Vasculitis, was classified by computation of registry data as having granulomatosis with polyangiitis (GPA), microscopic polyangiitis (MPA), or eosinophilic GPA after applying (1) ACR/EULAR AAV criteria and (2) pediatric-adapted European Medicines Agency (Ped-EMA) classification algorithm (incorporating Ankara GPA criteria). Venn diagrams compared the resulting GPA and MPA cohorts with MD-diagnosis. Sensitivity and specificity of criteria for GPA were evaluated against MD-diagnosis. Fisher exact test evaluated differences in the frequencies of individual clinical features in GPA versus MPA.

Results. Comparing ACR/EULAR criteria against the Ped-EMA algorithm for classifying AAV, more patients were classified as GPA or MPA (n = 396 vs 360, respectively), fewer had GPA (n = 261 vs 288, respectively), more had MPA (n = 135 vs 72, respectively), and fewer GPA cases coclassified as MPA (12% vs 28%, respectively); there were more differences between GPA and MPA in Pediatric Vasculitis Activity Score–defined clinical features (n = 14 vs 10, respectively). When classifying GPA by ACR/EULAR or Ankara criteria, sensitivity (74.5% vs 72.1%, respectively) was comparable, and specificity for ACR/EULAR criteria (93.9% vs 79.9%, respectively) was improved.

Conclusion. The 2022 ACR/EULAR classification criteria for AAV perform at least as well as previous pediatric criteria and provide categorical MPA criteria where none existed previously; the criteria for GPA and MPA now specifically differentiate each other, with more differences between them in the frequencies of

clinical features. Our findings support the preferential use of ACR/EULAR over Ankara criteria for GPA in pediatrics.

INTRODUCTION

Antineutrophil cytoplasmic antibody (ANCA)–associated vasculitis (AAV) includes granulomatosis with polyangiitis (GPA), microscopic polyangiitis (MPA), and eosinophilic GPA (EGPA), as described by the 2012 Chapel Hill Consensus Conference (CHCC2012).[1] Before 2022, pediatric GPA and EGPA were classified using the American College of Rheumatology 1990 (ACR1990) criteria, which were based on adult patient data[2] that often failed to classify children with GPA accurately.[3,4] To address this, a 2006 consensus meeting in Ankara adapted these criteria for children, validated them in a pediatric cohort, and received formal endorsement by EULAR, the Pediatric Rheumatology International Trials Organization (PRINTO), and the Pediatric Rheumatology European Society (PRES). These "Ankara criteria" for pediatric GPA[5] incorporated features such as subglottic inflammation and the presence of ANCAs, reflecting both more common pediatric-specific manifestations and relatively new knowledge. Previously, there were no categorical classification criteria for MPA in either adults or children.

For research across AAV subtypes, MPA was systematically classified using a European Medicines Agency (EMA)–endorsed algorithm[6,7] with a modified pediatric version, Ped-EMA,[8] but this did not establish mutually exclusive cohorts of GPA and MPA. The ACR/EULAR 2022 classification criteria for AAV in adults addressed the need for a categorical classification of MPA, clearer differentiation across GPA, MPA, and EGPA to ensure mutual exclusivity,[9] and the incorporation of new knowledge.[10]

A unified classification system for both adults and children to categorize patients with AAV into distinct homogeneous clusters (GPA, MPA, and EGPA) would facilitate comparative research on AAV subtypes both among and between children and adults. In 2012, we prospectively created an opportunity to evaluate the evolving ACR/EULAR criteria[11,12,13] for AAV in children; the data set for A Registry of Childhood Vasculitis (ARChiVe), part of the established international Pediatric Vasculitis Initiative (PedVas), was harmonized with that of the adult patient registry being established for the Diagnosis and Classification of Vasculitis (DCVAS) study[9] to develop new classification criteria for vasculitis.

Akca and colleagues'[14] study of 185 children with vasculitis to evaluate the ACR/EULAR GPA[13] criteria determined that it was equivalent to the Ankara GPA criteria and concluded there was no compelling advantage for using it in pediatrics; however, the study did not consider the broader discriminatory requirements for classifying patients with AAV into mutually exclusive subsets of GPA, MPA, and EGPA.

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This study evaluates the performance of the ACR/EULAR classification criteria for AAV[11,12,13] in a pediatric cohort with small-to-medium vessel vasculitis using ARChiVe clinical data. Results are compared to the pediatric criteria, Ankara for classifying GPA and Ped-EMA for classifying MPA. The study also analyzes variations in clinical manifestations between GPA and MPA when the ARChiVe cohort is classified by either ACR/EULAR or Ankara and Ped-EMA criteria and compares these differences.

PATIENTS AND METHODS

Data collection. Patient data were obtained from ARChiVe, a global web-based ambispective registry established in 2007 that uses the REDCap application. ARChiVe collects clinical information on children and adolescents diagnosed before 18 years of age with chronic primary systemic vasculitis and categorizes patients according to physician's diagnoses (MD-diagnoses) at registry enrollment. Recruitment has involved patients from 67 independent sites across 12 countries. Data for cases diagnosed between December 2004 and March 2007 were collected retrospectively, with prospective collection thereafter. Patient eligibility and registry details have been previously published.[8] Baseline data captured all criteria necessary for formal classification using the ACR1990, Ankara classification, and the Ped-EMA algorithm. In 2012, PedVas collaborated with DCVAS[9] to harmonize the existing ARChiVe data set with the emerging DCVAS data set. Consequently, the ARChiVe data set contains all the ACR/EULAR individual criteria for classifying AAV subcategories; however, quantitative eosinophil counts and nasal polyps were only recorded from 2012 onward. Clinical features at diagnosis and follow-up were scored using the Pediatric Vasculitis Activity Score (PVAS),[15] which identifies 64 distinct active clinical features across nine organ systems, whereas disease or treatment-related damage was tracked using the Pediatric Vasculitis Damage Index.[16]

Participants. A study cohort of 574 eligible patients selected from ARChiVe included only those with chronic, primary, small-to-medium vessel vasculitis with complete time-of-diagnosis data between December 2004 and June 2024. Our prior survey of 129 pediatric rheumatology experts revealed considerable variation in classifying patients with AAV as GPA and MPA.[17] Therefore, in this study, the patient cohort selected based on multi-expert physician assessments, or MD-diagnosis as cataloged in ARChiVe, did not serve as a definitive gold standard for diagnosis or classification. The cohort, representing a narrow spectrum of vasculitis diagnoses, was used as a reference standard to evaluate the relative performance of the different classification criteria to discriminate among AAV subtypes and clinically overlapping non-AAV phenotypes, such as polyarteritis nodosum (PAN).

Accordingly, the following MD-diagnoses were included: GPA (including limited GPA), MPA, EGPA, unclassified AAV (which covers AAV not subclassified and ANCA-positive pauci-immune glomerulonephritis), PAN (including both systemic and cutaneous PAN), and unclassified small-to-medium vessel vasculitis. Vasculitides easily distinguished clinically, such as Takayasu arteritis or Bechet disease, were excluded. Patients with acute self-limited Kawasaki disease and IgA vasculitis were not included in ARChiVe.

Classification. The 574 patients in the study cohort were independently classified computationally as EGPA, GPA, MPA, and unclassifiable AAV: first using pediatric criteria (Ankara/Ped-EMA; Supplementary Figure 1) and second using adult criteria (ACR/EULAR criteria; Supplementary Table 1).

Ped-EMA classification (Supplementary Figure 1) follows a stepwise process of excluding patients classified by ACR1990 with EGPA, then GPA by the Ankara criteria. Those who do not fully meet the criteria for GPA but exhibit any CHCC2012 descriptors (surrogate markers) of GPA are excluded from being classified as MPA and in our study are described as unclassifiable AAV. The remaining patients in this exclusionary process have either MPA if they fulfill CHCC12 descriptors or are considered "not AAV."

In our ACR/EULAR computation (Supplementary Table 1), "nasal septal defect/perforation" received three points without also receiving two points for "cartilaginous involvement"; the GPA criteria do not clarify the potential for double-scoring these items. After applying the ACR/EULAR criteria, unclassifiable AAV refers to patients with small-medium vessel vasculitis and ANCA seropositivity who did not fulfill any specific AAV subtype criteria or patients who fulfilled classification criteria for more than one AAV subtype; the remaining patients were described as "not AAV."

Analysis. Analyses were conducted with R software. Descriptive statistics for the cohorts are reported as frequencies, medians, and interquartile ranges. Statistical comparisons between pediatric and ACR/EULAR classifications primarily examined discriminant validity (sensitivity and specificity) for GPA only, given the absence of prior categorical classification criteria for MPA.

To determine the discriminant validity of GPA classification of ACR/EULAR relative to Ankara criteria, we used MD-diagnosis as the reference standard as described above. Notably, such MD expert assessments were also used (albeit described as a "gold standard") in developing and evaluating the ACR/EULAR classification criteria for AAV[11,12,13] and in a pediatric study evaluating the performance of the ACR/EULAR criteria for GPA.[14]

Venn diagrams illustrate relative sizes, concordance, and discrimination among subcohorts defined by MD-diagnosis, Ankara/Ped-EMA criteria, or ACR/EULAR criteria, first for

GPA and then for MPA. A third diagram compares the MPA subcohort classified by ACR/EULAR (the only available categorical criteria) with GPA subcohorts defined by Ankara or ACR/EULAR criteria. Bar graphs present differences in the frequency of involvement of nine PVAS-defined organ system manifestations and specific ANCA types among patients with GPA classified by ACR/EULAR versus Ankara criteria and among patients with MPA classified by ACR/EULAR versus Ped-EMA criteria.

Fisher exact test was used to compare categorical variables, specifically, the frequencies of involvement of the nine PVAS-defined organ systems and the 64 individual PVAS-defined clinical features at diagnosis in GPA versus MPA. Odds ratios with 95% confidence intervals were calculated to estimate the strength of association of each feature. Analyses were conducted first among patients classified by ACR/EULAR criteria and then among those classified by Ankara/Ped-EMA criteria. To illustrate the role of ANCA specificity within the ACR/EULAR criteria, differences in the frequency of these clinical features were also examined between cohorts defined solely by proteinase 3 (PR3)–ANCAs or myeloperoxidase (MPO)–ANCAs.

Ethics approval. The Ethics Committee of the University of British Columbia provided ethics approval (# H12-00894) as the primary coordinating site for PedVas, and each participating registry site similarly obtained institutional review board or ethics committee approval from its institution.

Data availability. The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

RESULTS

Characteristics of the study cohort and newly classified AAV subcohorts. The 574-patient cohort included the following MD-diagnoses: GPA 297 (52%); limited GPA 33 (6%); MPA 87 (15%); EGPA 19 (3%); AAV-unclassified 45 (8%); ANCA-positive pauci-immune glomerulonephritis 31 (5%); systemic polyarteritis nodosa 34 (6%); cutaneous polyarteritis nodosa 24 (4%); unclassified small-to-medium vessel vasculitis 4 (0.7%). Among them, 388 (68%) were female and the median age was 14.3 years (interquartile range 11.2–16.2). After applying Ankara/Ped-EMA criteria (Supplementary Figure 1) and ACR/EULAR criteria (Supplementary Table 1) to the study cohort, the distribution of patients in each diagnostic category, according to the classification system, is summarized in Table 1.

There were too few patients with EGPA for further analysis. Overall, more patients were uniquely classified as either GPA or MPA by ACR/EULAR (n = 396) versus the Ankara/Ped-EMA criteria (n = 360). Table 2 lists ACR/EULAR individual criteria frequencies, along with age, sex, and PVAS at diagnosis, among patients classified as GPA or MPA.

Table 1. Study cohort (N = 574) defined by AAV subsets according to MD-diagnosis or Ankara/Ped-EMA versus ACR/EULAR classification criteria*

	MD-diagnosis	Ankara/Ped-EMA	ACR/EULAR
EGPA	19	5	6
GPA	330	288	261
MPA	87	72	135
Unclassifiable AAV	76	131	38[a]
Not AAV[b]	62	78	134
Total	574	574	574

* AAV, ANCA-associated vasculitis; ACR, American College of Rheumatology; ANCA, antineutrophil cytoplasmic antibody; EGPA, eosinophilic granulomatosis with polyangiitis; GPA, granulomatosis with polyangiitis; MD-diagnosis, physician's diagnosis; MPA, microscopic polyangiitis; Ped-EMA, pediatric-adapted European Medicines Agency.
[a] 36 patients were double classified as GPA and MPA, and 2 ANCA-positive patients did not meet a classification score threshold.
[b] Describes remaining patients in cohort after assigning other 4 AAV subclassifications.

The study cohort was divided into GPA subgroups using three methods: MD-diagnosis for GPA, Ankara criteria, and ACR/EULAR criteria, resulting in 330, 288, and 261 patients in each subgroup (Table 1). Similarly, for MPA, the MD-diagnosis, Ped-EMA criteria, and ACR/EULAR criteria identified 87, 72, and 135 patients. Thirty-six patients were concurrently classified by ACR/EULAR as GPA and MPA (Tables 1 and 2).

Discriminant validity of ACR/EULAR and Ankara criteria for classifying GPA. In our cohort, the ACR/EULAR criteria had 74.5% sensitivity and 93.9% specificity, whereas the Ankara criteria showed 72.1% sensitivity and 79.5% specificity. There are no previous categorical criteria for MPA for comparison. Table 3 compares these results with an independent study[14] evaluating both criteria for GPA.

Concordance of differently defined GPA/MPA subcohorts. The relative size and concordance of the three subcohorts defined by MD-diagnosis, Ankara/Ped-EMA, or ACR/EULAR criteria are shown for GPA in Figure 1A and for MPA in Figure 1B. Among 391 patients diagnosed as GPA by any method, 195 (49.9%) were concordant for all three methods; for the 200 with MPA, only 23 (11.5%) had concordant classification. The low concordance for patients with MPA signals the need for clearer categorical criteria. Therefore, ACR/EULAR MPA criteria were used as the benchmark to compare how Ankara versus ACR/EULAR GPA criteria differentiate GPA from MPA, as shown in Figure 1C. Of the 360 patients meeting GPA criteria by either Ankara (n = 288) or ACR/EULAR (n = 297) criteria, only

Table 2. Demographics and frequency of ACR/EULAR classification criteria among study cohort according to GPA/MPA diagnosis*

	GPA (n = 261)	MPA (n = 135)	GPA + MPA (n = 36)[a]	All GPA/MPA (n = 432)	Not GPA/MPA (n = 142)	Study cohort (n = 574)
Demographics and disease activity						
Sex, female, %	62	82	64	69	65	68
Age, median (IQR), years	15.0 (13.3–16.3)	12.2 (8.2–15.4)	13.7 (10.3–16.5)	14.5 (11.4–16.2)	13.2 (10.7–16.0)	14.3 (11.3–16.2)
PVAS, median (IQR)	19 (13–25)	18 (13–20)	19 (15–24)	18 (13–23)	8 (3–14)	16 (10–21)
ACR/EULAR clinical criteria, %						
Nasal bloody discharge, crusting, ulcers, blockage, congestion, septal defect	64.8	10.3	44.4	46.1	11.2	37.5
Cartilaginous involvement	19.9	3.7	8.3	13.9	4.2	11.5
Conductive or sensorineural hearing loss	12.3	1.5	5.6	8.3	3.5	7.1
ACR/EULAR laboratory, imaging & biopsy criteria, %						
MPO-ANCA	3.1	97.8	100	40.7	4.9	31.9
PR3-ANCA	92.7	5.9	72.2	63.9	3.5	49.0
Pulmonary nodules, mass, or cavitation	49.0	18.5	58.3	40.2	10.6	32.9
Fibrosis or interstitial lung disease	2.7	3.7	8.3	3.5	1.4	3.0
Pauci-immune glomerulonephritis	46.4	72.6	80.6	57.4	14.1	46.7
Inflammation, consolidation or effusion of nasal/paranasal sinuses or mastoiditis	51.7	11.9	47.2	38.9	8.5	31.4
Granuloma, giant cells, or extravascular granulomatous inflammation	15.3	4.4	13.9	11.8	4.2	10.0

* ACR, American College of Rheumatology; ANCA, antineutrophil cytoplasmic antibody; GPA, granulomatosis with polyangiitis; IQR, interquartile range; MPA, microscopic polyangiitis; MPO, myeloperoxidase; PR3, proteinase 3; PVAS, Pediatric Vasculitis Activity Score.
[a] Patients concurrently fulfilling classification criteria for both GPA and MPA.

Table 3. Discriminant validity of Ankara and ACR/EULAR GPA classification criteria for the current ARChiVe study and study of Akca et al[13]*

Discriminant validity	ARChiVe (n = 574)		Akca et al (n = 185)	
	ACR/EULAR	Ankara	ACR/EULAR	Ankara
Sensitivity, %	74.5	72.1	89.6	94.8
Specificity, %	93.9	79.5	96.3	95.3
PPV, %	94.3	82.6	94.5	93.5
NPV,%	73.2	67.8	92.8	96.2
Accuracy, %	82.8	75.3	NR	NR

* ACR, American College of Rheumatology; ARChiVe, A Registry of Childhood Vasculitis; NPV, negative predictive value; NR, not reported; PPV, positive predictive value.

225 (62.5%) were classified commonly by both methods. Of the 297 patients with ACR/EULAR-classified GPA, 36 (12%) also met criteria for MPA, whereas among the 288 patients Ankara-classified GPA, 81 (28%) also met MPA criteria. Collectively, ACR/EULAR criteria for GPA and MPA diagnosed 432 patients (75% of the total cohort), including 36 who were classified as both—these groups are also characterized in Table 2.

Comparing the frequency of organ involvement and ANCAs in patients with GPA and MPA according to the classification method. Figure 2A shows that GPA organ involvement is similar between ACR/EULAR and Ankara criteria, with fewer MPO-ANCA seropositive patients. Figure 2B demonstrates that patients with MPA classified by ACR/EULAR versus Ped-EMA criteria have a nearly two-fold difference or more in the frequency of manifestations across four organ systems designated as cutaneous (23% vs 50%), mucous membrane (13% vs 25%), ear nose and throat (17% vs 1%), and chest (32% vs 13%), as well as a two-fold variation in the frequency of both PR3-ANCAs (decrease) and MPO-ANCAs (increase) when classified by ACR/EULAR criteria compared to Ped-EMA criteria.

Clinical differences between GPA and MPA according to classification. We compared organ-specific phenotypic differences between patients with GPA and MPA, classified according to either ACR/EULAR or Ankara/Ped-EMA

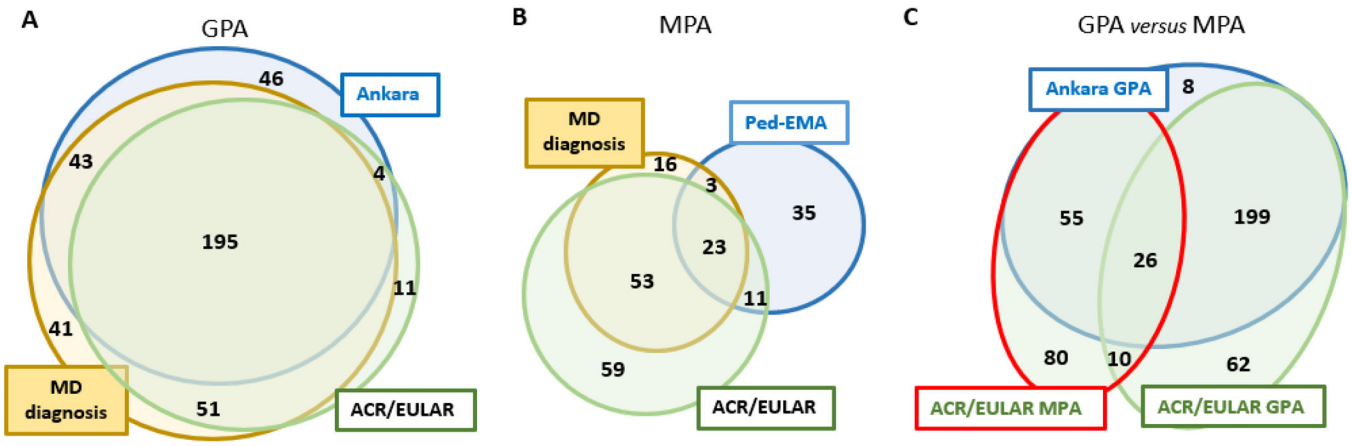

Figure 1. Venn diagrams depict overlap of subcohorts (GPA and/or MPA) of the study population (N = 574) when classified by different methods. Comparison of cohorts according to MD diagnosis (yellow), Ankara or Ped-EMA (blue), and ACR/EULAR (green), except in the last Venn figure, ACR/EULAR MPA is a red ellipse. (A) Among 391 patients with GPA collectively classified, the three criteria overlap in 49.9%. (B) Among 200 patients with MPA collectively classified, the three criteria overlap in 11.5%, with limited concordance of Ped-EMA with other criteria. (C) Among 360 patients with GPA collectively classified by ACR/EULAR or Ankara, 62.5% overlapped. Among 288 patients with Ankara GPA, there was 28% overlap with the MPA cohort, compared to a 12% overlap for the 297 ACR/EULAR GPA patient cohort. Collectively, ACR/EULAR criteria for GPA and MPA diagnosed 432 patients (75% of total cohort). ACR, American College of Rheumatology; GPA, granulomatosis with polyangiitis; MD diagnosis, physician's diagnosis; MPA, microscopic polyangiitis; Ped-EMA, pediatric-adapted European Medicines Agency.

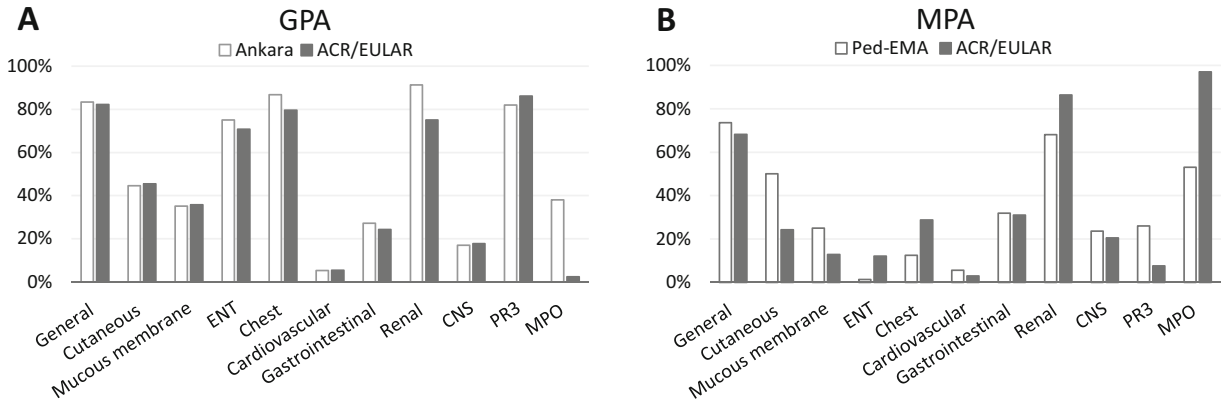

Figure 2. Graphs compare differences in frequency of clinical features and ANCAs for GPA (or MPA) depending on classification method. Comparison of frequency of clinical organ involvement and ANCAs against PR3 and MPO among patients with AAV depending on how they are subclassified. Frequencies shown are for patients classified as (A) GPA by either ACR/EULAR (black bars) or Ankara (white bars) criteria and (B) MPA by either ACR/EULAR (black bars) or Ped-EMA (white bars) criteria. AAV, ANCA-associated vasculitis; ACR, American College of Rheumatology; ANCA, antineutrophil cytoplasmic antibody; CNS, central nervous system; ENT, ear, nose, and throat; GPA, granulomatosis with polyangiitis; MPA, microscopic polyangiitis; MPO, myeloperoxidase; Ped-EMA, pediatric-adapted European Medicines Agency; PR3, proteinase 3.

criteria by calculating odds ratios. Among the nine organ categories, significant differences ($P < 0.01$) in the odds of having a particular disease manifestation were found in ear-nose-throat, chest, and renal systems across both classifications; additionally, using ACR/EULAR classification, there were differences in general, cutaneous, and mucous membranes/eyes (Table 4). For both classification systems, no significant differences were found in cardiovascular, abdominal, and nervous systems. Among the 64 PVAS disease activity features, 14 were significantly different using the ACR/EULAR criteria versus 10 using the Ankara/Ped-EMA criteria; these differences were common for 5 features, with ACR/EULAR showing more differences among the general, cutaneous, and mucous membrane/eye features, whereas Ankara/Ped-EMA identified more chest differences. Table 4 selectively displays 22 of the 64 individual PVAS items in which the odds of a particular manifestation were significantly different between the groups; full results are in Supplementary Table 2. In patient cohorts classified exclusively according to ANCA specificity to either PR3 or MPO, the differences in frequencies of clinical features were calculated for comparison against the GPA and MPA cohorts defined by ACR/EULAR criteria (Supplementary Table 3).

Table 4. Frequency of organ involvement and individual clinical features are compared using ORs between patients with GPA and MPA, classified according to either the ACR/EULAR or Pediatric (Ankara/Ped-EMA) criteria*

	ACR/EULAR				Pediatric (Ankara/Ped-EMA)			
	GPA (n = 261)	MPA (n = 135)	OR (95% CI)	*P* value	GPA (n = 288)	MPA (n = 72)	OR (95% CI)	*P* value
General	210	91	2.0 (1.2–3.3)	**0.006**[a]	239	53	1.7 (0.9–3.3)	0.091
Arthralgia or arthritis	153	50	2.4 (1.5–3.8)	**<0.001**[a]	166	31	1.8 (1.0–3.2)	0.034
Body weight loss ≥5%	108	33	2.1 (1.3–3.5)	**<0.001**[a]	117	21	1.7 (0.9–3.1)	0.079
Cutaneous involvement	116	31	2.7 (1.6–4.5)	**<0.001**[a]	118	36	0.7 (0.4–1.2)	0.184
Purpura	82	17	3.2 (1.8–6.0)	**<0.001**[a]	77	24	1.9 (1.1–2.8)	0.022
Mucous membrane/eye involvement	92	18	3.5(2.0–6.6)	**<0.001**[a]	93	18	1.4 (0.8–2.7)	0.256
Mouth ulcers/granulomata	47	6	4.7 (1.9–13.9)	**<0.001**[a]	46	6	2.1 (0.8–6.2)	0.133
Red eye (epi)scleritis	28	3	5.3 (1.6–27.6)	**0.002**[a]	26	2	3.4 (0.8–30.8)	0.087
Red eye conjunctivitis/blepharitis/keratitis	32	5	3.6 (1.4–12.2)	**0.006**[a]	34	2	4.7 (1.2–41.1)	0.026
ENT involvement	180	23	10.8 (6.3–19.0)	**<0.001**[a]	199	1	**157 (26.4–6139)**	**<0.001**[a]
Bloody nasal discharge/crusts/ulcers/granuloma	145	10	15.5 (7.7–34.7)	**<0.001**[a]	151	0	–	**<0.001**[a]
Paranasal sinus involvement	98	10	7.5 (3.7–16.8)	**<0.001**[a]	113	0	–	**<0.001**[a]
Subglottic stenosis/stridor/hoarseness	24	4	3.3 (1.1–13.4)	0.023	27	0	–	**0.004**[a]
Conductive hearing loss	29	1	16.7 (2.7–687.1)	**<0.001**[a]	26	1	7.02 (1.1–292.5)	0.024
Chest involvement	203	43	7.4 (4.6–12.3)	**<0.001**[a]	230	9	27.4 (12.6–66.5)	**<0.001**[a]
Nodules or cavities	128	24	4.4 (2.6–7.7)	**<0.001**[a]	170	2	50.0 (12.89–429)	**<0.001**[a]
Pleural effusion/pleurisy	55	35	0.8 (0.5–138)	0.312	75	4	6.0 (2.1–23.39)	**<0.001**[a]
Infiltrate	83	40	1.1 (0.7–1.8)	0.731	116	5	9.0 (3.5–29.5)	**<0.001**[a]
Massive hemoptysis/alveolar hemorrhage	89	34	1.5 (0.9–2.5)	0.085	105	8	4.6 (2.1–11.5)	**<0.001**[a]
Cardiovascular involvement	14	4	1.9 (0.6–7.9)	0.321	14	4	0.9 (0.3–3.8)	0.766
Abdominal involvement	63	42	0.7 (0.4–1.2)	0.150	72	23	0.7 (0.4–1.3)	0.235
Abdominal pain	60	41	0.7 (0.4–1.1)	0.115	70	22	0 (0.0–0.1)	**<0.001**[a]
Renal involvement	191	115	0.58 (0.3–0.8)	**0.008**[a]	242	49	2.5 (1.3–4.6)	**0.004**[a]
Hypertension >95th centile	52	46	0.5 (0.3–0.8)	**0.003**[a]	70	22	0.73 (0.4–1.4)	0.292
Proteinuria >0.3 g/24 h, >20 mg/mmol creatinine	156	106	0.4 (0.2–0.7)	**<0.001**[a]	209	36	2.6 (1.5–4.7)	**<0.001**[a]
Hematuria ≥2, 5 rbc/hpf, or rbc casts	169	99	0.7 (0.4–1.1)	0.090	218	38	2.78 (1.6–4.9)	**<0.001**[a]
GFR 15–49 ml/min/1.73 m^2	21	26	0.4 (0.2–0.7)	**0.002**[a]	35	7	1.3 (0.5–3.6)	0.684
GFR <15 ml/min/1.73 m^2	18	25	0.3 (0.2–0.6)	**<0.001**[a]	29	7	1.0 (0.4–2.9)	1
Nervous system involvement	45	26	0.9 (0.5–1.6)	0.679	45	17	0.6 (0.3–1.2)	0.118

* Table is limited to only those features showing significant differences. (Complete table provided as supplementary material). "–" indicates that an OR could not be calculated due to one cell containing zero value. ACR, American College of Rheumatology; CI, confidence interval; ENT, ear, nose, and throat; GFR, glomerular filtration rate; GPA, granulomatosis with polyangiitis; hpf, high-power field; MPA, microscopic polyangiitis; OR, odds ratio; Ped-EMA, pediatric-adapted European Medicines Agency; rbc, red blood cell.
[a] Statistical significance assessed using Fisher's exact test, where bold text and footnote[a] indicate $P < 0.01$.

DISCUSSION

Among this cohort of 574 children with small-to-medium vessel vasculitis, the ACR/EULAR criteria for AAV uniquely classified more patients (n = 396) as having either GPA or MPA than the Ankara and Ped-EMA criteria (n = 360). There were fewer patients with unclassified AAV using ACR/EULAR criteria (38 vs 131), but more remained as "not AAV" (134 vs 78). This may have resulted from the more rigorous categorical criteria, which also led to fewer patients with concurrently classified GPA and MPA (12% vs 28%), that is, more patients were uniquely classified as GPA or MPA, with an increased number of phenotypic differences between GPA and MPA (Table 4). These favorable comparisons suggest ACR/EULAR criteria perform at least as well as the pediatric criteria, albeit acknowledging the lack of any previous categorical criteria for MPA in either children or adults.

Although the ACR/EULAR GPA and Ankara GPA criteria identified similar numbers of patients with GPA, only about two-thirds of them overlapped, that is, the two sets of criteria identified substantially different populations of GPA. For MPA, the ACR/EULAR criteria identified nearly twice as many patients as MD-diagnosis or Ped-EMA criteria. This shifted the GPA:MPA ratio from 4:1 to 2:1. Despite known phenotypic similarities between GPA and MPA, differences between individual PVAS-defined clinical features were observed more often with ACR/EULAR (n = 14) than Ankara/Ped-EMA (n = 10) criteria.

Akca et al[14] studied 185 children with a wide range of vasculitis diagnoses to compare the performance of ACR/EULAR and Ankara criteria for GPA using MD-diagnosis as the reference. Sensitivity and specificity for ACR/EULAR showed 89.6% sensitivity and 96.3% specificity; Ankara had 94.8% sensitivity and 95.3% specificity (Table 3), suggesting that the two criteria are essentially equivalent. These results contrast with those of the current study in which both criteria showed notably lower sensitivity and specificity (Table 3), and this likely stems from differences in diagnoses of patients in the study cohorts. The ARChiVe cohort comprised patients with a narrow spectrum of closely related chronic primary small-medium-vessel vasculitides, which may be clinically similar and difficult to differentiate; such patients composed only 58% of the Akca et al cohort,[14] whereas the remaining patients had a wider spectrum of acute and chronic primary vasculitis diagnoses that are overall more readily differentiated. Nonetheless, when comparing classification criteria within each study cohort (Table 3), results suggest that the ACR/EULAR GPA criteria performed equally well, if not better than the Ankara GPA criteria; in the ARChiVe cohort, ACR/EULAR GPA criteria show overall improved discrimination, having comparable sensitivity to Ankara GPA criteria but higher specificity and better predictive values.

The ACR/EULAR AAV subclassification criteria have been evaluated in adult patients from several countries including the Netherlands (N = 264),[18] Turkey (N = 164),[19] Japan (N = 477),[20] South Korea (N = 233),[21] and Sweden (N = 374)[22]; conclusions from some of these have been summarized and compared.[23] Most of these studies validated these criteria using only patients with confirmed diagnoses of GPA, MPA, or EGPA as determined by either the EMA classification algorithm or clinical diagnosis. No patients had unclassifiable AAV or other small-to-medium vessel chronic vasculitis, regardless of ANCA positivity. The ACR/EULAR criteria for GPA were typically only tested on patients previously diagnosed or classified as having GPA and not on patients with MPA. In contrast, the ARChiVe study cohort comprised all patients with chronic small-to-medium vessel vasculitis with or without ANCAs. When developing the new ACR/EULAR criteria in DCVAS, patients without clear-cut diagnoses were also excluded, and this could be seen as a limitation to their approach. Second, most of these above adult studies used EMA criteria to select their cohorts and, except for the Dutch study, used EMA as a gold standard comparator. This practice overlooks a primary criticism of the EMA algorithm in that it does not distinguish between patients with GPA and MPA at the outset; instead, MPA is diagnosed by a process of exclusion.

Most of these adult studies found that the inclusion of interstitial lung disease and ANCA antigen specificity improved classification criteria. However, they highlighted challenges stemming from the disease-specific point allocation for the two ANCA types used in classification scoring. Although they also had concerns about identifying cases of ANCA-negative AAV, in the ARChiVe cohort, about 5% of patients with ACR/EULAR-classified GPA were ANCA-negative, similar to the reported frequency of ANCA-negative GPA using previous Ankara/Ped-EMA criteria.[8] Classifying patients with granuloma and positive MPO-ANCA results as MPA by ACR/EULAR criteria was a concern that we shared, as granulomatous inflammation has been a key defining feature of GPA. In such cases, a high point score for MPO-ANCA positivity weighs more toward MPA classification than the relatively lower point score for granulomatous inflammation contributes toward GPA classification (Table 1). In ARChiVe, this resulted in ACR/EULAR criteria classifying six patients with granuloma as MPA. If "granuloma" was assigned a higher point score toward classifying GPA and/or a negative score toward classifying MPA, these six ARChiVe patients might have been considered to have unclassifiable AAV, that is, not meeting criteria for either GPA or MPA or meeting criteria for both. Five additional patients with granulomatous histopathology were simultaneously classifiable as both GPA and MPA, three of whom had antibodies to both PR3- and MPO-ANCA. Although unclassifiable AAV was not an explicit classification category provided by ACR/EULAR, we propose that such a classification might provide more face validity in cases like these until further research clarifies the biologic importance of MPO-ANCA relative to granulomatous inflammation.

The harmonized development of the ACR/EULAR classification criteria for all three AAV subcategories was designed to uniquely categorize patients. This goal was accomplished by

combining a machine learning model with Lasso regression–based statistical analysis of the DCVAS data set, assigning variable weights and diagnosis-specific point values to individual criteria. Evidence supporting associations of PR3-ANCA and MPO-ANCA with distinct clinical manifestations—aligning somewhat with the GPA and MPA phenotypes—likely shaped the gold standard diagnoses provided by the multiple physician experts and influenced point allocations for PR3-ANCA and MPO-ANCA toward GPA and MPA, respectively. As anticipated, applying the ACR/EULAR AAV criteria to our cohort demonstrates pronounced differences in the frequencies and distribution of both PR3-ANCA and MPO-ANCA among patients with GPA and MPA, contrasting with findings obtained using the Ankara/Ped-EMA criteria (Figure 2).

Applying the ACR/EULAR classification for AAV to the ARChiVe cohort resulted in more phenotypic differences between GPA and MPA subcohorts than the Ankara/Ped-EMA criteria (Table 4). This enhanced phenotypic differentiation is mirrored (although not identically) when patient subcohorts are classified based solely on PR3-ANCA or MPO-ANCA status (Supplementary Table 3). The data-driven heavy weighting of ANCA antigen specificity in the ACR/EULAR subclassification of AAV recognizes its contribution to biologic underpinnings; however, other considerations remain. Previous RNA sequencing analysis of 41 children and 11 adults with small-to-medium vessel vasculitis suggests a more complex process.[24] Differential gene expression separated patients into endotypes that only partially aligned with either the disease classification at that time or the ANCA (PR3 vs MPO) specificity.

The 2022 ACR/EULAR GPA classification paper cautioned against applying its criteria to children because they were not part of their validation cohort.[13] This study tested (and arguably validated) the ACR/EULAR AAV criteria in pediatric cohorts—GPA (n = 261) and MPA (n = 135)—similar in size to those of the DCVAS cohorts used for adult validation. There are notable clinical differences between adults and children with vasculitides; adults tend to have lower rates of constitutional, respiratory, and renal involvement, whereas children experience more conductive hearing loss and fewer ear, nose, and throat findings.[8,25] Children show a higher prevalence of GPA (62%) and MPA (82%) in females, whereas adults have either more males affected or an even gender distribution. It remains unclear whether the phenotypic differences and the reversed sex bias between pediatric and adult-onset vasculitides reflect fundamental disease differences. Genome-wide association data currently suggest that genetic risk factors are shared between children and adults,[26] although unique pediatric risks may yet be identified. In adults, AAV typically presents after age 60 years, suggesting that environmental factors and existing comorbidities may be more significant triggers than genetics. There is no evidence that children's disease manifestations differ because of their immaturely primed immune system.[27]

A key limitation of this study is the absence of a gold standard for evaluating new classification criteria for diagnostic subcohorts of AAV in children, and this was considered in our analysis approach. Nonetheless, using MD-diagnosis as a comparative reference standard, our assessment indicates that ACR/EULAR criteria outperform Ankara/Ped-EMA criteria when applied to our large pediatric cohort. Because the ACR/EULAR classification criteria for GPA incorporates new knowledge, it represents an evolution of both the adult ACR1990 criteria and Ankara criteria for GPA; the classification initiative has also established categorical criteria for MPA where none previously existed.

In conclusion, based on the above considerations and despite its limitations (notably, MPO-ANCA positivity outscoring granuloma), we propose that the ACR/EULAR classification criteria for both GPA and MPA should be universally adopted for children. We do not support the suggestion to use Ankara and ACR/EULAR criteria interchangeably for pediatric GPA.[14] Using the same classification system for both GPA and MPA and grouping patients into discriminated homogeneous clusters will better enable comparative research of AAV subtypes both in children and between children and adults. It will provide a foundation for future data-driven revisions to classification criteria across the lifespan.

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AUTHOR CONTRIBUTIONS

All authors contributed to at least one of the following manuscript preparation roles: conceptualization AND/OR methodology, software, investigation, formal analysis, data curation, visualization, and validation AND drafting or reviewing/editing the final draft. As corresponding author, Dr Cabral confirms that all authors have provided the final approval of the version to be published and takes responsibility for the affirmations regarding article submission (eg, not under consideration by another journal), the integrity of the data presented, and the statements regarding compliance with institutional review board/Declaration of Helsinki requirements.

REFERENCES

1. Jennette JC, Falk RJ, Bacon PA, et al. 2012 revised International Chapel Hill Consensus Conference Nomenclature of Vasculitides. Arthritis Rheum 2013;65(1):1–11. doi:https://doi.org/10.1002/art.37715
2. Fries JF, Hunder GG, Bloch DA, et al. The American College of Rheumatology 1990 criteria for the classification of vasculitis. Summary.

Arthritis Rheum 1990;33(8):1135–1136. doi:https://doi.org/10.1002/art.1780330812

3. Bowyer S, Roettcher P; Pediatric Rheumatology Database Research Group. Pediatric rheumatology clinic populations in the United States: results of a 3 year survey. J Rheumatol 1996;23(11):1968–1974.
4. Malleson PN, Fung M, Rosenberg AM. The incidence of pediatric rheumatic diseases: results from the Canadian Pediatric Rheumatology Association Registry. J Rheumatol 1996;23(11):1981–1987.
5. Ruperto N, Ozen S, Pistorio A, et al; Paediatric Rheumatology International Trials Organisation (PRINTO). EULAR/PRINTO/PRES criteria for Henoch-Schönlein purpura, childhood polyarteritis nodosa, childhood Wegener granulomatosis and childhood Takayasu arteritis: Ankara 2008. Part I: Overall methodology and clinical characterisation. Ann Rheum Dis 2010;69(5):790–797. doi:https://doi.org/10.1136/ard.2009.116624
6. Watts R, Lane S, Hanslik T, et al. Development and validation of a consensus methodology for the classification of the ANCA-associated vasculitides and polyarteritis nodosa for epidemiological studies. Ann Rheum Dis 2007;66(2):222–227. doi:https://doi.org/10.1136/ard.2006.054593
7. Abdulkader R, Lane SE, Scott DG, et al. Classification of vasculitis: EMA classification using CHCC 2012 definitions. Ann Rheum Dis 2013;72(11):1888. doi:https://doi.org/10.1136/annrheumdis-2013-203511
8. Cabral DA, Canter DL, Muscal E, et al; ARChiVe Investigators Network within the PedVas Initiative. Comparing presenting clinical features in 48 children with microscopic polyangiitis to 183 children who have granulomatosis with polyangiitis (Wegener's): an ARChiVe cohort study. Arthritis Rheumatol 2016;68(10):2514–2526. doi:https://doi.org/10.1002/art.39729
9. Craven A, Robson J, Ponte C, et al. ACR/EULAR-endorsed study to develop Diagnostic and Classification Criteria for Vasculitis (DCVAS). Clin Exp Nephrol 2013;17(5):619–621. doi:https://doi.org/10.1007/s10157-013-0854-0
10. Watts RA, Suppiah R, Merkel PA, et al. Systemic vasculitis--is it time to reclassify? Rheumatology (Oxford) 2011;50(4):643–645. doi:https://doi.org/10.1093/rheumatology/keq229
11. Suppiah R, Robson JC, Grayson PC, et al; DCVAS Study Group. 2022 American College of Rheumatology/European Alliance of Associations for Rheumatology classification criteria for microscopic polyangiitis. Arthritis Rheumatol 2022;74(3):400–406. doi:https://doi.org/10.1002/art.41983
12. Grayson PC, Ponte C, Suppiah R, et al; DCVAS Study Group. 2022 American College of Rheumatology/European Alliance of Associations for Rheumatology Classification Criteria for Eosinophilic Granulomatosis With Polyangiitis. Arthritis Rheumatol 2022;74(3):386–392. doi:https://doi.org/10.1002/art.41982
13. Robson JC, Grayson PC, Ponte C, et al; DCVAS Study Group. 2022 American College of Rheumatology/European Alliance of Associations for Rheumatology classification criteria for granulomatosis with polyangiitis. Arthritis Rheumatol 2022;74(3):393–399. doi:https://doi.org/10.1002/art.41986
14. Akca UK, Batu ED, Jelusic M, et al. Comparison of EULAR/PRINTO/PReS Ankara 2008 and 2022 ACR/EULAR classification criteria for granulomatosis with polyangiitis in children. Rheumatology (Oxford) 2024;63(SI2):SI122–SI128. doi:https://doi.org/10.1093/rheumatology/kead693
15. Dolezalova P, Price-Kuehne FE, Özen S, et al. Disease activity assessment in childhood vasculitis: development and preliminary validation of the Paediatric Vasculitis Activity Score (PVAS). Ann Rheum Dis 2013;72(10):1628–1633. doi:https://doi.org/10.1136/annrheumdis-2012-202111
16. Dolezalova P, Wilkinson N, Brogan PA, et al. Paediatric vasculitis damage index: a new tool for standardised disease assessment. Ann Rheum Dis 2014;73(supp 2):696–697. doi:https://doi.org/10.1136/annrheumdis-2014-eular.5893
17. Westwell-Roper C, Lubieniecka JM, Brown KL, et al; for ARChiVe Investigators Network within the PedVas initiative. Clinical practice variation and need for pediatric-specific treatment guidelines among rheumatologists caring for children with ANCA-associated vasculitis: an international clinician survey. Pediatr Rheumatol Online J 2017;15(1):61. doi:https://doi.org/10.1186/s12969-017-0191-z
18. van Leeuwen JR, Hafemann S, van der Boog P, et al. The impact of reclassification by the 2022 ACR/EULAR classification criteria on risk factors for relapse in patients with ANCA-associated vasculitis. Clin Kidney J 2023;16(12):2754–2756. doi:https://doi.org/10.1093/ckj/sfad225
19. Yilmaz S, Kucuk H, Sungur Ozgunen M, et al. Performance of the 2022 American College of Rheumatology/European Alliance of Associations for Rheumatology Classification Criteria for antineutrophil cytoplasmic antibody-associated vasculitis in previously diagnosed adult patients from Türkiye. Arch Rheumatol 2024;39(2):194–202. doi:https://doi.org/10.46497/ArchRheumatol.2024.10268
20. Sada KE, Kaname S, Higuchi T, et al. Validation of new ACR/EULAR 2022 classification criteria for anti-neutrophil cytoplasmic antibody-associated vasculitis. Mod Rheumatol 2023;34(1):144–150. doi:https://doi.org/10.1093/mr/road017
21. Pyo JY, Lee LE, Park YB, Lee SW. Comparison of the 2022 ACR/-EULAR Classification Criteria for antineutrophil cytoplasmic antibody-associated vasculitis with previous criteria. Yonsei Med J 2023;64(1):11–17. doi:https://doi.org/10.3349/ymj.2022.0435
22. Rathmann J, Segelmark M, Mohammad AJ. Evaluation of the ACR/-EULAR 2022 criteria for classification of ANCA-associated vasculitis in a population-based cohort from Sweden. Rheumatology (Oxford) 2024;63(7):1965–1972. doi:https://doi.org/10.1093/rheumatology/kead516
23. Rathmann J, Mohammad AJ. Classification criteria for ANCA associated vasculitis - ready for prime time? Curr Rheumatol Rep 2024;26(9):332–342. doi:https://doi.org/10.1007/s11926-024-01154-9
24. Gill EE, Smith ML, Gibson KM, et al; PedVas Initiative Investigators. Different disease endotypes in phenotypically similar vasculitides affecting small-to-medium sized blood vessels. Front Immunol 2021;12:638571. doi:https://doi.org/10.3389/fimmu.2021.638571
25. Bohm M, Gonzalez Fernandez MI, Ozen S, et al. Clinical features of childhood granulomatosis with polyangiitis (Wegener's granulomatosis). Pediatr Rheumatol Online J 2014;12(1):18. doi:https://doi.org/10.1186/1546-0096-12-18
26. Gibson KM, Drögemöller BI, Foell D, et al; PedVas Investigator's Network. Association between HLA-DPB1 and antineutrophil cytoplasmic antibody-associated vasculitis in children. Arthritis Rheumatol 2023;75(6):1048–1057. doi:https://doi.org/10.1002/art.42423
27. Simon AK, Hollander GA, McMichael A. Evolution of the immune system in humans from infancy to old age. Proc Biol Sci 2015;282(1821):20143085. doi:https://doi.org/10.1098/rspb.2014.3085