**eFigure 1. Structural MRI measures of female subsamples in MOGAD, AQP4+ NMOSD, MS and HC.**

Structural MRI measures including (A) lesion volume, (B) brain parenchyma volume, (C) cortical GM volume, (D) subcortical GM volume, (E) brainstem volume, (F) cerebellar volume, (G) cerebral WM volume, (H) FA and (I) MD between HC, MOGAD, AQP4+ NMOSD and MS.

Statistical analyses were performed using one-way ANOVA or Kruskal-Wallis tests followed by post-hoc comparison with Bonferroni correction. Significance with two-sided p<0.05 were considered. MRI=magnetic resonance imaging; MOGAD=myelin oligodendrocyte glycoprotein antibody disease; AQP4+ NMOSD=aquaporin 4 antibody positive neuromyelitis optica spectrum diseases; MS=multiple sclerosis; HC, healthy controls; GM=grey matter; WM=white matter; FA=fractional anisotropy; MD=mean diffusivity.
eFigure 2. Structural MRI measures of subsamples in early phase (disease duration less than 3 years) in MOGAD, AQP4+ NMOSD, MS and HC.

Structural MRI measures including (A) lesion volume, (B) brain parenchyma volume, (C) cortical GM volume, (D) subcortical GM volume, (E) brainstem volume, (F) cerebellar volume, (G) cerebral WM volume, (H) FA and (I) MD between HC, MOGAD, AQP4+ NMOSD and MS. Statistical analyses were performed using one-way ANOVA or Kruskal-Wallis tests followed by post-hoc comparison with Bonferroni correction. Significance with two-sided p<0.05 were considered. MRI=magnetic resonance imaging; MOGAD=myelin oligodendrocyte glycoprotein antibody disease; AQP4+ NMOSD=aquaporin 4 antibody positive neuromyelitis optica spectrum diseases; MS=multiple sclerosis; HC, healthy controls; GM=grey matter; WM=white matter; FA=fractional anisotropy; MD=mean diffusivity.
eFigure 3. Structural MRI measures of subsamples without brain lesions in MOGAD, AQP4+ NMOSD and HC.

Structural MRI measures including (A) brain parenchyma volume, (B) cortical GM volume, (C) subcortical GM volume, (D) brainstem volume, (E) cerebellar volume, (F) cerebral WM volume, (G) FA and (H) MD between HC, MOGAD, AQP4+ NMOSD. Statistical analyses were performed using one-way ANOVA or Kruskal-Wallis tests followed by post-hoc comparison with Bonferroni correction. MRI=magnetic resonance imaging; MOGAD=myelin oligodendrocyte glycoprotein antibody disease; AQP4+ NMOSD=aquaporin 4 antibody positive neuromyelitis optica spectrum diseases; MS=multiple sclerosis; HC, healthy controls; GM=grey matter; WM=white matter; FA=fractional anisotropy; MD=mean diffusivity.
eFigure 4. Structural MRI measures of single centre subsamples (centre 1) in MOGAD, AQP4+ NMOSD, MS and HC.

Structural MRI measures including (A) lesion volume, (B) brain parenchyma volume, (C) cortical GM volume, (D) subcortical GM volume, (E) brainstem volume, (F) cerebellar volume, (G) cerebral WM volume, (H) FA and (I) MD between HC, MOGAD, AQP4+ NMOSD and MS. Statistical analyses were performed using one-way ANOVA or Kruskal-Wallis tests followed by post-hoc comparison with Bonferroni correction. Significance with two-sided p<0.05 were considered. MRI=magnetic resonance imaging; MOGAD=myelin oligodendrocyte glycoprotein antibody disease; AQP4+ NMOSD=aquaporin 4 antibody positive neuromyelitis optica spectrum diseases; MS=multiple sclerosis; HC, healthy controls; GM=grey matter; WM=white matter; FA=fractional anisotropy; MD=mean diffusivity.
eFigure 5. Covariance matrix of the MRI and clinical variables in MOGAD, AQP4+ NMOSD and MS.

These variables were considered in the univariate logistic and forward step-wise logistic regression models. Pair-wise Pearson's correlation was used for the inter-variates correlation matrix. GM = grey matter; WM = white matter; FA = fractional anisotropy; MD = mean diffusivity, EDSS, expanded disability status scale, TIV, total intracranial volume.
**Figure 6.** Tableplot of condition indices (CI), variance proportions and variance inflation factor (VIF) for the MRI and clinical variables.

In column 1, the square symbols are scaled relative to a maximum condition index of $2 \times 10^9$ and color indicated the CI range (red, CI>100; orange, 30<CI≤100; yellow, 10<CI≤30; green, CI≤10). In the remaining columns, variance proportions are shown as circles scaled relative to 1 and color indicated the ranges (red, variance proportion≥0.5; pink, 0.2≤variance proportion<0.5; white, variance proportion<0.2). A VIF≥10 indicated a high collinearity of the variable in the regression model.
eFigure 7. The structural MRI measures between AQP4+ NMOSD patients with and without brain lesions.

Statistical analyses were performed using Student’s t-test. MRI measurements were adjusted for total intracranial volume (only for volume measurements), gender, age and scanner type.

Significance with two-sided p<0.05 were considered. AQP4+ NMOSD=aquaporin 4 antibody positive neuromyelitis optica spectrum diseases; GM=grey matter; WM=white matter; FA=fractional anisotropy; MD=mean diffusivity.
eFigure 8. The structural MRI measures between MOGAD patients with and without brain lesions.

Statistical analyses were performed using Student’s t-test. MRI measurements were adjusted for total intracranial volume (only for volume measurements), gender, age and scanner type.

Significance with two-sided $p<0.05$ were considered. MOGAD=myelin oligodendrocyte glycoprotein antibody disease; GM=grey matter; WM=white matter; FA=fractional anisotropy; MD=mean diffusivity.
Table 1 Univariate logistic regression using unadjusted MRI and clinical variables.

|                      | Odds ratio | 95% CI Lower Bound | 95% CI Upper Bound | p-value | Accuracy (%) | Sensitivity (%) | Specificity (%) | AUC  |
|----------------------|------------|--------------------|--------------------|---------|--------------|-----------------|-----------------|------|
| **MOGAD vs AQP4+**   |            |                    |                    |         |              |                 |                 |      |
| NMOSD                |            |                    |                    |         |              |                 |                 |      |
| Lesion volume (ml)   | 1.049      | 1.033              | 1.071              | 0.26    | 56           | 29              | 82              | 0.48 |
| Brain parechyma      | 1.0062     | 1.0049             | 1.0081             | 0.018   | 67           | 63              | 71              | 0.67 |
| Cortical GM volume   | 1.017      | 1.015              | 1.021              | 0.0033  | 67           | 57              | 76              | 0.70 |
| Subcortical GM       | 1.12       | 1.082              | 1.18               | 0.082   | 64           | 77              | 53              | 0.64 |
| Brainstem volume     | 1.16       | 1.078              | 1.27               | 0.26    | 60           | 63              | 58              | 0.58 |
| Cerebellum volume    | 1.05       | 1.038              | 1.066              | 0.022   | 67           | 69              | 66              | 0.66 |
| Cerebral WM volume   | 1.011      | 1.0078             | 1.015              | 0.063   | 66           | 91              | 42              | 0.64 |
| FA                   | 1.1e+12    | 3.19e+9            | 1.33e+16           | 0.014   | 66           | 71              | 61              | 0.69 |
| MD (10^-3 mm²/s)     | 1.10e-06   | 5.49e-08           | 5.19e-06           | <0.001  | 73           | 91              | 55              | 0.74 |
| Disease duration     | 1.028      | 0.98               | 1.075              | 0.70    | 58           | 26              | 87              | 0.42 |
| EDSS                 | 0.8        | 0.74               | 0.87               | 0.12    | 60           | 46              | 74              | 0.59 |
| Number of relapse    | 1.099      | 1.012              | 1.18               | 0.47    | 58           | 17              | 95              | 0.48 |
| TIV (ml)             | 1.0038     | 1.0029             | 1.0051             | 0.035   | 68           | 54              | 82              | 0.63 |
| Gender               | 3.56       | 2.57               | 5.16               | 0.024   | 63           | 40              | 84              | 0.59 |
| Age (year)           | 0.99       | 0.98               | 1.0031             | 0.66    | 58           | 31              | 82              | 0.54 |
| Scanner              | 1.63e-45   | 1.39e-45           | 1.91e-45           | 1       | 73           | 10              | 47              | 0.47 |
| **MOGAD vs AQP4+**   |            |                    |                    |         |              |                 |                 |      |
| NMOSD without brain lesion |      |                    |                    |         |              |                 |                 |      |
| Brain parechyma      | 1.00045    | 1                  | 1.0029             | 0.9     | 56           | 65              | 47              | 0.50 |
| Cortical GM volume   | 1.0068     | 1.0017             | 1.013              | 0.41    | 60           | 65              | 60              | 0.57 |
| Subcortical GM       | 1.089      | 1.011              | 1.19               | 0.46    | 69           | 88              | 47              | 0.60 |
| Brainstem volume     | 0.97       | 0.84               | 1.11               | 0.88    | 63           | 94              | 27              | 0.49 |
| Cerebellum volume    | 1.036      | 1.012              | 1.065              | 0.35    | 63           | 76              | 47              | 0.57 |
| Cerebral WM volume   | 1          | 0.991              | 1.0027             | 0.74    | 63           | 59              | 67              | 0.55 |

**Note:** The table presents odds ratios, 95% confidence intervals, p-values, accuracy, sensitivity, specificity, and AUC for various clinical and MRI variables in the context of distinguishing MOGAD from AQP4+ NMOSD.
|                                |     |     |     |     |     |     |
|--------------------------------|-----|-----|-----|-----|-----|-----|
| **volume (ml)**                |     |     |     |     |     |     |
| **FA**                         | 5.80e+18 | 1.48e+14 | 1.36e+25 | 0.055 | 69 | 100 | 33 | 0.68 |
| **MD (10^-3 mm^2/s)**          | 4.27e-09 | 1.85e-11 | 9.11e-08 | 0.029 | 75 | 100 | 47 | 0.72 |
| **Disease duration (year)**    | 1.017 | 0.95 | 1.098 | 0.85 | 53 | 18 | 93 | 0.42 |
| **EDSS**                       | 0.74 | 0.63 | 0.83 | 0.14 | 72 | 100 | 40 | 0.63 |
| **Number of relapse**          | 0.87 | 0.66 | 1.039 | 0.57 | 59 | 88 | 27 | 0.52 |
| **TIV (ml)**                   | 1 | 0.99 | 1.0017 | 0.99 | 69 | 53 | 87 | 0.55 |
| **Gender**                     | 1.15 | 0.68 | 2.037 | 0.86 | 50 | 29 | 73 | 0.47 |
| **Age (year)**                 | 0.96 | 0.93 | 0.98 | 0.24 | 63 | 35 | 93 | 0.64 |
| **Scanner**                    | 1.51e-45 | 1.07e-45 | 1.98e-45 | 1 | 72 | 100 | 40 | 0.40 |
| **MOGAD vs MS**                |     |     |     |     |     |     |
| **Lesion_volume (ml)**         | 0.93 | 0.89 | 0.95 | 0.0084 | 82 | 80 | 84 | 0.84 |
| **Brain parechyma volume (ml)**| 1.0033 | 1.0023 | 1.0046 | 0.089 | 63 | 97 | 30 | 0.63 |
| **Cortical GM volume (ml)**    | 1.0076 | 1.0053 | 1.01 | 0.084 | 61 | 94 | 30 | 0.6 |
| **Subcortical GM volume (ml)** | 1.18 | 1.152 | 1.23 | 0.0013 | 75 | 80 | 70 | 0.74 |
| **Brainstem volume (ml)**      | 1.11 | 1.041 | 1.2 | 0.35 | 61 | 83 | 41 | 0.56 |
| **Cerebellum volume (ml)**     | 1.025 | 1.015 | 1.038 | 0.16 | 64 | 74 | 54 | 0.61 |
| **Cerebral WM volume (ml)**    | 1.0085 | 1.0061 | 1.012 | 0.059 | 69 | 91 | 49 | 0.65 |
| **FA**                         | 2.74e+33 | 1.74e+30 | 4.15e+42 | <0.001 | 89 | 86 | 92 | 0.92 |
| **MD (10^-3 mm^2/s)**          | 1.94e-10 | 2.38e-13 | 1.20e-09 | <0.001 | 90 | 91 | 89 | 0.94 |
| **Disease duration (year)**    | 0.94 | 0.89 | 0.97 | 0.34 | 65 | 51 | 78 | 0.62 |
| **EDSS**                       | 1.33 | 1.22 | 1.49 | 0.072 | 61 | 54 | 68 | 0.64 |
| **Number of relapse**          | 1.06 | 0.97 | 1.14 | 0.63 | 58 | 17 | 97 | 0.46 |
| **TIV (ml)**                   | 1.095 | 0.83 | 1.44 | 0.85 | 51 | 40 | 62 | 0.44 |
| **Age (year)**                 | 1.017 | 1.0057 | 1.03 | 0.38 | 57 | 54 | 59 | 0.56 |
| **Scanner**                    | 1.14e-45 | 9.39e-46 | 1.33e-45 | 1 | 81 | 100 | 62 | 0.62 |

**Note:** MOGAD=myelin oligodendrocyte glycoprotein antibody disease; AQP4+NMOSD=aquaporin 4 antibody positive neuromyelitis optica spectrum diseases; MS=multiple sclerosis; GM=grey matter; WM=white matter; FA=fractional anisotropy; MD=mean diffusivity; TIV, total intracranial volume; EDSS, Expanded Disability Status Scale; CI=confidence interval; AUC= area under the curve.