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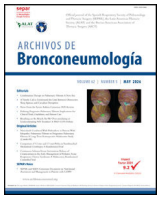

Original Article

Real-World Effectiveness of Tezepelumab Across T2 and Non-T2 Severe Asthma Phenotypes: A Multicenter Spanish Cohort Study

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ABSTRACT

Objectives: To evaluate real-world effectiveness of tezepelumab in severe asthma, by type-2 (T2) status and prior biologic exposure, and response predictors.
Methods: Multicentre retrospective cohort in 17 Spanish tertiary hospitals. Adults with ERS/ATS-defined severe asthma initiating tezepelumab were identified from pharmacy dispensing records. Outcomes included Asthma Control Test (ACT), annualised exacerbations, oral corticosteroid (OCS) exposure (maintenance use, prednisone > 5 mg/day, cumulative dose), spirometry (FEV_1; % predicted), blood eosinophils and fractional exhaled nitric oxide (FeNO). Linear regression assessed predictors of change in ACT and exacerbations.
Results: Of 307 initiators, 304 had paired assessments. Mean ACT rose from 13.6 to 17.0 (+3.4) and annualised exacerbations fell from 2.9 to 0.8; 47% were exacerbation-free. Maintenance OCS use decreased from 22.4% to 16.8%, and prednisone > 5 mg/day fell from 22.4% to 6.9% (70% reduction). Cumulative OCS dose declined from 1575 to 1020 mg (median 420 to 0 mg). Mean FEV_1 increased from 1850 to 1930 mL and % predicted from 70.4% to 73.7%, with larger gains at baseline FEV_1 < 80% predicted. Clinical remission was achieved in 12.3% of patients. At follow-up, 54.8% had eosinophils < 150 cells/μL and 74.6% had FeNO < 25 ppb. Prior biologic exposure predicted smaller improvements in ACT and exacerbations.
Conclusions: In specialist care, tezepelumab was associated with meaningful improvements in asthma control, fewer exacerbations, reduced OCS exposure, modest lung function gains, and reductions in T2 biomarkers across phenotypes. Exploratory analyses identified age, sex, prior OCS use, T2 status and prior biologic exposure as response predictors. Future comparative studies are needed to confirm causality.
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Introduction

Tezepelumab blocks thymic stromal lymphopoietin (TSLP), an epithelial upstream cytokine, and in PATHWAY and NAVIGATOR reduced exacerbations, improved lung function, and lowered biomarkers across phenotypes, including patients with low blood eosinophils [1–3].

Because trial populations may not fully reflect routine-care severe asthma—particularly patients with prior biologic failure and mixed inflammatory profiles—this nationwide multicentre study provides 12-month real-world effectiveness data for tezepelumab across clinical, exacerbation and OCS outcomes, lung function and biomarkers, stratified by T2 status and prior biologic exposure

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Objectives

This study aimed to characterise the clinical and pharmacological profiles of patients receiving tezepelumab in routine practice and to evaluate therapeutic responses across heterogeneous asthma phenotypes.

Methods

Design

This retrospective cohort study enrolled adults with severe asthma managed in Severe Asthma Clinics across 17 tertiary hospitals in Spain. Multidisciplinary teams at each site performed standardised evaluations of clinical, functional, and biomarker parameters at baseline (prior to tezepelumab initiation) and after a minimum of 12 months of therapy. Tezepelumab initiators were identified from pharmacy dispensing records; effectiveness analyses required paired baseline and 12-month assessments.

Outcomes

Outcomes included age, sex, age at asthma onset (childhood vs adulthood), comorbidities, prior oral corticosteroid (OCS) use (expressed as mg/day of prednisone), and history of biologic therapy. Composite response outcomes, including clinical remission (defined as absence of OCS use, ACT score > 20, absence of exacerbations, and stable lung function with FEV_1 within ±10% of baseline) [4], FEOS [5], FEOS intervals [6], and EXACTO [7] were derived at 12 months when sufficient component data were available; missing data were explicitly reported.

Data collection

Demographic and clinical data were extracted from electronic medical records and institutional asthma registries. The rationale for initiating tezepelumab was categorised into 5 groups:

1. Suboptimal response to previous biologic therapy.
2. Biologic-naïve patients with severe type 2 (T2) asthma.
3. Biologic-naïve patients with non-T2 severe asthma.
4. Other considerations, including centre-specific economic factors, regional administrative requirements, or patient preference.
5. Adverse events associated with prior treatments.

To explore the potential impact of missing data, baseline demographic and clinical characteristics were compared between the overall cohort and the complete-case subsets for the main outcome analyses, including ACT score, exacerbations, and combined ACT/exacerbation analyses (Supplementary Table 3).

Statistical analysis

Qualitative variables were summarised as absolute frequencies and percentages, whereas quantitative variables were summarised as mean ± SD or median (IQR), according to data distribution. Normality was assessed using the Kolmogorov–Smirnov test. Missing data were not imputed; analyses were performed using a complete-case approach for each outcome, with denominators reported throughout.

Pre-post comparisons were performed using the Wilcoxon signed-rank test. Associations between quantitative outcomes and qualitative variables were assessed using the Student *t* test or Mann–Whitney *U* test, as appropriate. Univariable and multi-

Table 1
Demographic and clinical characteristics of the patients.

Characteristic	*N* = 304	%	Missing values, no. (%)
Age, years, mean (SD)	57.30 (14.30)	–	0 (0%)
Female sex	232	76.32	0 (0%)
Adult onset (>18 years of age)	248	81.58	6 (1.9%)
Asthma phenotype			
T2 phenotype	244	80.26	0 (0%)
Eosinophilic asthma	146	48.03	0 (0%)
Allergic asthma	98	32.22	0 (0%)
Non-T2 phenotype	60	19.73	0 (0%)
Comorbidities			
Obesity	88	28.94	0 (0%)
Allergic rhinitis	79	25.99	0 (0%)
GERD	74	24.34	0 (0%)
Bronchiectasis	60	19.74	0 (0%)
Depression/anxiety	56	18.42	0 (0%)
Smoking history	56	18.42	0 (0%)
CRSwNP	36	11.84	0 (0%)
Atopic dermatitis	13	4.27	0 (0%)
AERD	12	3.95	0 (0%)
ABPA	8	2.63	0 (0%)
Vocal cord dysfunction	4	1.32	0 (0%)
Allergic sensitisation (any type)	163	53.62	0 (0%)
Pollen	118	38.81	0 (0%)
Animal dander	74	24.34	0 (0%)
Dust mites	53	17.43	0 (0%)
Fungi	24	7.89	0 (0%)
Food	21	6.91	0 (0%)
Other	32	10.53	0 (0%)

ABPA, allergic bronchopulmonary aspergillosis; AERD, aspirin-exacerbated respiratory disease; CRSwNP, chronic rhinosinusitis with nasal polyps; GERD, gastroesophageal reflux disease; SD, standard deviation; T2, type 2 asthma phenotype.
Missing values are reported for each variable where applicable. Allergic asthma was defined as asthma with documented sensitisation to at least 1 aeroallergen, confirmed by an expert allergologist on the basis of skin prick testing and/or serum-specific IgE, according to routine clinical practice at each participating centre.

Table 2
Prior biologic exposure, reasons for tezepelumab prescription and inhaled therapy.

Biologic therapy prior to tezepelumab	*N* (304)	%	Missing *n* (%)
Patients with any prior biologic	190	62.50	0 (0%)
Omalizumab	90	29.61	0 (0%)
Mepolizumab	68	22.37	0 (0%)
Benralizumab	58	19.08	0 (0%)
Dupilumab	56	18.42	0 (0%)
Reslizumab	21	6.91	0 (0%)

Reason for Tezepelumab prescription	*N* (304)	%	
Suboptimal response to previous biologic therapy	152	50.00	0 (0%)
Naïve T2 severe asthma patients	55	18.09	0 (0%)
Naïve non-T2 severe asthma patients	46	15.13	0 (0%)
Other reasons	36	11.84	0 (0%)
Adverse reaction to a previous biologic	15	4.93	0 (0%)

Inhaled therapy	*N* (304)	%	
Open triple inhaled therapy	131	43.09	0 (0%)
Fixed triple inhaled therapy	173	56.91	0 (0%)

Table 3
Clinical, lung function, and laboratory outcomes.

Variables	Before tezepelumab	After tezepelumab	*p* value	Missing values, no. (%)
ACT score, mean (SD)	13.60 (5.45)	17.00 (5.86)	<.01	58 (19.07%)
Number of exacerbations, mean (SD)	2.90 (2.40)	0.80 (1.21)	<.01	36 (11.84%)
Exacerbation-free during 12 months post-treatment, no. (%)	29 (9.53%)	143 (47.0%)	<.01	36 (11.84%)
Patients receiving continuous OCS therapy, no. (%)	68 (22.40%)	51 (16.80%)	<.01	2 (0.70%)
Patients receiving > 5 mg/day prednisone, no. (%)	68 (22.40%)	21 (6.90%)	<.01	21 (6.90%)
Cumulative systemic OCS exposure, mean (SD)	1574.9 mg (SD, 3737.5)	1020.4 mg (SD, 3517.4)	<.01	42 (13.81%)
FEV_1, mL, mean (SD)	1850 (748)	1930 (783)	<.01	14 (4.60%)
FEV_1, % predicted, mean (SD)	70.10 (22.80)	73.70 (23.50)	<.01	10 (3.30%)
FEV_1, % predicted in patients with baseline FEV_1 < 80%, mean (SD)	56.3 (14.3)	61.0 (17.7)	<.01	42 (13.81%)
FEV_1, % predicted in patients with baseline $FEV_1 \geq 80\%$, mean (SD)	94.6 (12.0)	94.4 (16.3)	<.01	17 (5.59%)
Blood eosinophils, cells/μL, mean (SD)	386 (404)	218 (223)	<.01	29 (9.50%)
Serum total IgE, IU/mL, mean (SD)	412 (777)	276 (634)	<.01	36 (11.80%)
FeNO, ppb, mean (SD)	29.10 (34.20)	20.10 (20.90)	<.01	50 (16.40%)

ACT, Asthma Control Test; FeNO, fractional exhaled nitric oxide; FEV_1, forced expiratory volume in 1 second; IgE, immunoglobulin E; IU, international units; mL, millilitres; OCS, oral corticosteroids; SD, standard deviation.

variable linear regression models were used to identify factors associated with changes in the main outcomes. Final multivariable models were selected using backward elimination based on the Bayesian information criterion (BIC). Results are reported as β coefficients with 95%CI. All tests were 2-sided, with $p < .05$ considered statistically significant. Analyses were performed using R version 4.3.3.

Results

Baseline characteristics

A total of 304 patients with severe asthma were included. Demographic and pharmacological data are presented in Table 1 and Supplementary Tables 1 and 2. Comparisons between the overall cohort and the complete-case subsets for ACT score, exacerbations, and combined ACT/exacerbation analyses showed no statistically significant differences in baseline demographic or clinical characteristics. Overall, the complete-case subsets were comparable with the full cohort, suggesting no major selection bias related to missing data (Table 2, Supplementary Table 3).

Clinical outcomes

Treatment with tezepelumab resulted in significant improvements in asthma control as assessed using the ACT. Mean ACT score increased from 13.60 (SD, 5.45) at baseline to 17.00 (SD, 5.86) after treatment ($p < .01$; Table 3).

The annualised rate of asthma exacerbations decreased markedly, from a mean of 2.90 (SD, 2.40) events before treatment to 0.80 (SD, 1.21) after tezepelumab initiation ($p < .01$; Table 3). In addition to the reduction in mean annualised exacerbation rate, 143 patients (47%) remained exacerbation-free during the 12 months after tezepelumab initiation (Table 3, Figs. 1 and 2).

The median change in exacerbation count did not differ materially according to FeNO < 25 vs ≥25 ppb ($p = .5728$) or blood eosinophil count < 300 vs ≥300 cells/μL ($p = .5501$) (Supplementary Table 1). The 4 baseline FeNO/blood eosinophil quadrants comprised 95 low/low, 53 low/high, 23 high/low, and 61 high/high patients (Supplementary Fig. 2).

Prior systemic OCS exposure, including short courses for exacerbations and/or maintenance OCS therapy, was recorded in 82.6% of patients, whereas 22.4% were receiving maintenance OCS at baseline. Cumulative OCS dose decreased significantly from the 12 months before tezepelumab initiation to the 12 months after initiation (Wilcoxon $p < .001$), decreasing from 1574.9 mg (SD, 3737.5; $N = 262$) to 1020.4 mg (SD, 3517.4; $N = 261$). Median cumulative OCS dose decreased from 420 mg to 0 mg (IQR, 61.25–900 mg vs 0–420 mg). During the 12 months after tezepelumab initiation, 53.4% of patients had 0 mg cumulative OCS exposure, and the proportion receiving prednisone > 5 mg/day decreased from 22.4% to 6.9% (70% reduction) (Table 3).

Tezepelumab also resulted in statistically significant improvements in lung function. Mean post-bronchodilator FEV_1 increased from 1850 mL (SD, 748 mL) to 1930 mL (SD, 783 mL) ($p < .01$), whereas predicted FEV_1 increased from 70.40% (SD, 22.80%) to

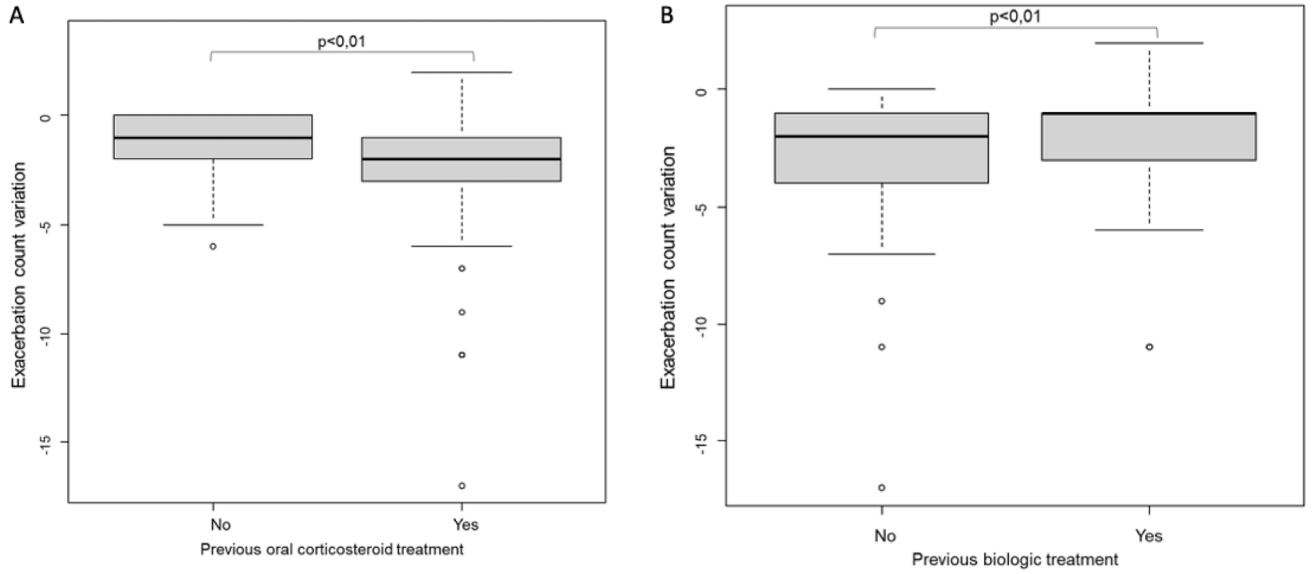

Fig. 1. Univariable predictors of improvement in ACT score at 12 months of treatment with tezepelumab. Negative values indicate worsening in ACT score, whereas positive values indicate improvement in ACT score. Panel A: Scatterplot and linear regression analysis of ACT score change according to age (years). Points represent individual observations, and the solid line represents the fitted linear regression model, suggesting a weak positive association ($r = 0.15$; $p = .04$). Panel B: Distribution of ACT score change according to sex. Boxplots show the median, IQR, and range (whiskers), with outliers represented as individual points. The p value for the comparison between groups is shown above the plots ($p = .0241$). ACT, Asthma Control Test.

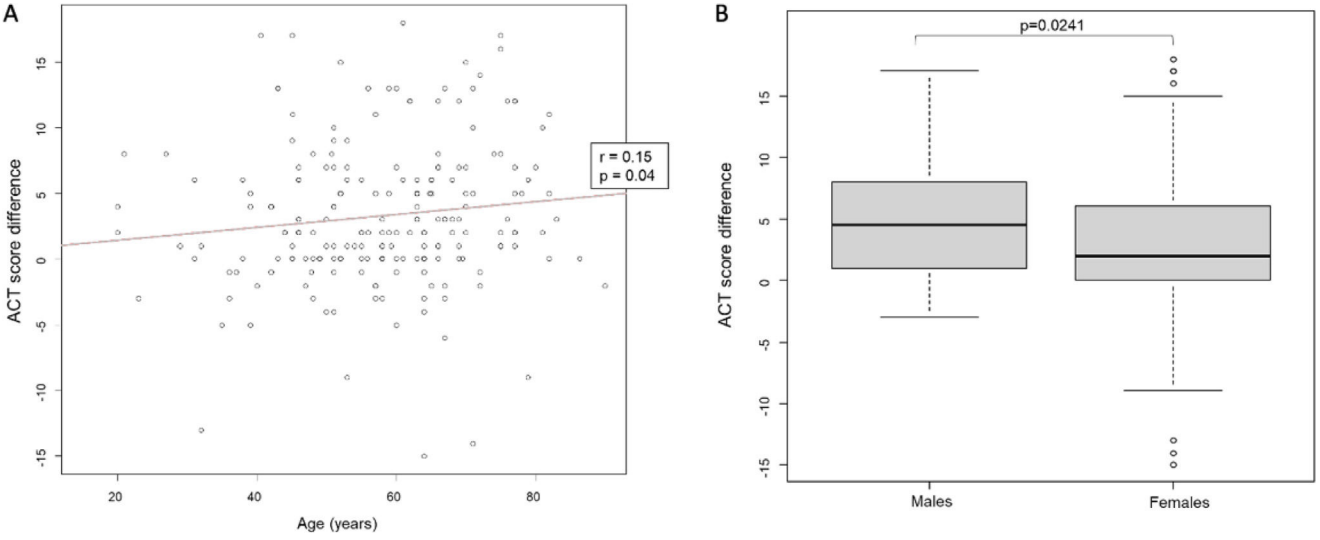

Fig. 2. Univariable predictors of change in exacerbation count at 12 months. Panel A: Boxplot showing the change in the number of exacerbations (exacerbation count variation) according to previous oral corticosteroid treatment. For both groups, the central line represents the median, the box denotes the interquartile range, and whiskers indicate variability outside the upper and lower quartiles. Patients with previous oral corticosteroid treatment exhibited a lower median change and greater dispersion, with several outliers, compared with previously untreated patients ($p < 0.01$), indicating an inverse association. Panel B: Boxplot showing the change in the number of exacerbations (exacerbation count variation) according to previous biologic treatment. For both groups, the central line represents the median, the box denotes the interquartile range, and whiskers indicate variability outside the upper and lower quartiles. Patients without prior biologic therapy exhibited a lower median change and greater dispersion, with several outliers, compared with previously treated patients ($p < 0.01$).

73.70% (SD, 23.50%) ($p < .01$; Table 3). Ninety-four patients achieved post-treatment predicted $FEV_1 \geq 80\%$.

When stratified according to baseline predicted FEV_1, improvements were mainly observed in patients with baseline predicted $FEV_1 < 80\%$ (mean, 56.3% [SD, 14.3] at baseline vs 61.0% [SD, 17.7] after treatment), whereas patients with baseline predicted $FEV_1 \geq 80\%$ showed minimal change (94.6% [SD, 12.0] vs 94.4% [SD, 16.3]), consistent with a ceiling effect.

When stratified according to prior biologic exposure, biologic-naïve patients showed a greater reduction in exacerbations at 12 months (median change, −2 [IQR, −4 to −1]) compared with biologic-experienced patients (−1 [IQR, −2.8 to −1]; Mann–Whitney $p = .0002$) (Supplementary Table 2).

At 12 months, clinical remission (defined as absence of OCS use, ACT score > 20, absence of exacerbations, and stable lung function with FEV_1 within ±10% of baseline) [4] was achieved in 28 patients (12.3%), whereas 199 patients (87.7%) did not achieve remission.

Using FEOS, 58 patients (39.7%) met criteria for a super-response (≥75 points), 56 (38.4%) for a good response (50–75 points), and 32 (21.9%) for a poor response (<50 points). Using EXACTO, 23 patients (11.9%) had a complete response, 88 (45.6%) had a good response, 74 (38.3%) had a partial response, and 8 (4.1%) had no response.

Biomarker outcomes

Tezepelumab resulted in statistically significant reductions in key T2 inflammatory biomarkers. Mean blood eosinophil count decreased from 386 cells/μL (SD, 404) to 218 cells/μL (SD, 223) ($p < .01$). Serum total IgE levels decreased from 412 IU/mL (SD, 777) to 276 IU/mL (SD, 634) ($p < .01$). Fractional exhaled nitric oxide (FeNO) also decreased, from a mean of 29.10 ppb (SD, 34.20) to 20.10 ppb (SD, 20.90) ($p < .01$; Table 3).

At 12 months, 97 of 177 patients (54.8%) achieved blood eosinophil counts < 150 cells/μL, and 100 of 134 patients (74.6%) achieved FeNO < 25 ppb. Additionally, 95 of 134 patients (70.9%) achieved both FeNO < 25 ppb and blood eosinophil counts < 150 cells/μL among patients with available follow-up data.

Predictors of response

In the final multivariable model, ACT improvement (defined as ACT score at 12 months minus baseline ACT score) was positively associated with increasing age ($\beta = 0.06$; 95%CI, 0.01–0.11; $p = .0398$) and negatively associated with female sex ($\beta = -2.18$; 95%CI, −3.99 to −0.37; $p = .0187$). Previous biologic treatment showed a negative, non-significant trend towards smaller ACT improvement ($\beta = -1.37$; 95%CI, −2.94 to 0.20; $p = .0878$).

Exacerbation change was defined as the number of exacerbations at 12 months minus baseline exacerbations; therefore, negative β coefficients indicate greater reductions in exacerbations, whereas positive β coefficients indicate smaller reductions. In the final multivariable model, previous biologic treatment was associated with a smaller reduction in exacerbations ($\beta = 0.69$; 95%CI, 0.07–1.30; $p = .0283$), as was T2 asthma ($\beta = 0.76$; 95%CI, 0.03–1.49; $p = .0419$).

Baseline OCS use ($\beta = -0.68$; 95%CI, −1.42 to 0.06; $p = .0734$) and baseline predicted $FEV_1 \geq 80\%$ ($\beta = -0.55$; 95%CI, −1.10 to 0.01; $p = .0527$) showed non-significant trends towards greater reductions in exacerbations. Full univariable analyses and final multivariable models are provided in Supplementary Table 4.

Discussion

In this multicentre real-world cohort of 304 adults with severe asthma treated across 17 Spanish tertiary hospitals, tezepelumab was associated with clinically meaningful improvements after 12 months of follow-up. Asthma control improved, the annualised exacerbation rate decreased from 2.9 to 0.8 events/year, 47% of patients remained exacerbation-free, and oral corticosteroid (OCS) exposure was reduced. Lung function gains were statistically significant but modest, whereas blood eosinophil counts and FeNO levels decreased during follow-up. These findings were observed in a clinically complex population, including a high proportion of patients previously exposed to other biologics and a subgroup with low T2 biomarker expression.

Overall, our results are consistent with the mechanism of action of tezepelumab as an upstream epithelial cytokine blocker and with pivotal clinical evidence demonstrating reductions in exacerbations, improvements in lung function, and biomarker reductions across severe asthma phenotypes, including patients with low blood eosinophil counts [1–11]. They are also broadly consistent with emerging real-world studies reporting clinical and biological improvement with tezepelumab in heterogeneous severe asthma populations, including multicentre and nationwide cohorts, patients with previous biologic failure, and cohorts assessing multidomain remission or small-airway outcomes [2,12–22].

In particular, our findings align with the recently published Spanish prospective multicentre real-world study, which reported clinically relevant 12-month improvements with tezepelumab across multidomain clinical and biological outcomes [15]. However, the magnitude of response in our cohort appears more modest than that reported in some real-world series and in studies of other biologics, particularly in highly selected T2 populations. This may be explained by the high proportion of biologic-experienced patients, many of whom had previously shown suboptimal responses to 1 or more targeted therapies and may therefore represent a more treatment-refractory population with less residual potential for improvement [2,6,16,20,22,23].

Regarding individual response domains, the most clinically relevant findings were the marked reduction in exacerbations and the OCS-sparing effect. The annualised exacerbation rate decreased from 2.9 to 0.8 events/year, and 47% of patients remained exacerbation-free, outcomes that are particularly important in severe asthma because exacerbations are associated with morbidity, healthcare utilisation, and cumulative corticosteroid exposure.

OCS outcomes also support a clinically relevant steroid-sparing effect, with fewer patients requiring >5 mg/day prednisone and lower cumulative OCS exposure. Although OCS tapering was not protocolised, it was generally undertaken gradually in accordance with Spanish expert-consensus recommendations, which advocate minimising systemic glucocorticoid exposure and tapering cautiously in long-term users [24].

ACT score also improved by more than the minimal clinically important difference; however, as a patient-reported outcome, it is inherently influenced by symptom perception, comorbidities, and individual variability. Moreover, the mean ACT score at 12 months remained below 20, indicating that many patients were not fully symptomatically controlled. Therefore, in this severe and clinically complex cohort, ACT score should be interpreted as a complementary measure of response rather than the primary marker of therapeutic benefit.

Lung function gains were statistically significant but modest, with a mean FEV_1 improvement of approximately 80 mL, which may reflect long-standing disease, fixed airway remodelling, prior biologic exposure, and a ceiling effect among patients with preserved baseline lung function. Radiological markers of remodelling, mucus plugging, and small-airway dysfunction were not assessed and should be explored in future studies, particularly given emerging evidence suggesting that tezepelumab may improve small-airway dysfunction in real-world settings [10,16,19,20].

Composite response frameworks, including clinical remission, FEOS, and EXACTO, provided an integrated assessment of multidomain response beyond individual endpoints [4–6,23,24]. Clinical remission was defined according to a 4-domain framework including absence of OCS use, ACT score > 20, absence of exacerbations, and stable lung function, in line with recent proposals for standardising remission assessment in severe asthma.4 FEOS and EXACTO further allowed response to be characterised across exacerbations, symptoms, OCS exposure, and airflow obstruction, domains that are particularly relevant when evaluating biologic therapy in heterogeneous real-world populations [5,6,23,24]. These tools showed that a substantial proportion of patients achieved good or super-response, whereas a meaningful minority derived limited benefit. In this context, composite response tools may complement clinical judgement, particularly when improvements in symptoms, exacerbations, OCS exposure, and lung function do not occur in parallel.

The predictor analyses should be interpreted as exploratory. ACT improvement was positively associated with increasing age and negatively associated with female sex, findings that differ from several previous tezepelumab analyses in which response was generally consistent across demographic subgroups [3,11,19]. Previous biologic treatment was associated with a smaller reduction in exac-

erbations, supporting the hypothesis that biologic-experienced patients may have more refractory disease or a reduced margin for additional improvement, as suggested by other real-world cohorts including patients switched after prior biologic exposure [2,18,20–22].

Findings related to T2 status should be interpreted cautiously, as T2 and non-T2 classification was based on routinely available biomarkers that may fluctuate and can be suppressed by maintenance OCS therapy or prior biologic treatment. Therefore, the apparent benefit in patients with low T2 biomarker expression should be considered descriptive rather than definitive evidence of efficacy in biologically confirmed non-T2 asthma, despite the biological rationale and clinical trial evidence supporting tezepelumab activity across inflammatory phenotypes [1–3,8,10,11].

Tezepelumab was generally well tolerated in this cohort. Two patients experienced non-serious, non-treatment-related adverse events and continued treatment. No early discontinuations due to lack of effectiveness were recorded among patients with evaluable paired follow-up data. These findings are consistent with the favourable safety profile reported in clinical trials, meta-analyses, and real-world studies [1–3,10,12,16–18,20,22]. However, the retrospective design limits systematic ascertainment of adverse events.

The main strengths of this study include its multicentre design, inclusion of all tezepelumab initiators identified through pharmacy dispensing records during the study period, 12-month follow-up, and detailed assessment of clinical, functional, biomarker, and corticosteroid-related outcomes. Nevertheless, several limitations should be acknowledged. The retrospective uncontrolled pre-post design precludes causal inference, and improvements may partly reflect regression to the mean, optimisation of concomitant care, changes in adherence, or intensified specialist follow-up.

Missing data were handled using a complete-case approach, although baseline comparisons suggested that the complete-case subsets were broadly comparable with the overall cohort. OCS tapering was clinician-driven rather than protocolised, and cumulative OCS estimates may have been affected by incomplete documentation. Pharmacy records captured treatment initiators but not treatment persistence in detail; therefore, requiring paired 12-month data may have introduced survivorship or selection bias. However, only 3 of 307 initiators lacked paired baseline and 12-month data, making a material impact on the overall interpretation unlikely even under a conservative worst-case assumption.

Finally, residual confounding remains possible, and the predictor analyses should be considered hypothesis-generating. Prospective comparative studies, including matched-cohort designs and head-to-head analyses against other biologics, are needed to better define the positioning of tezepelumab within current severe asthma treatment algorithms [7,23,25–27].

Conclusions

In this large Spanish real-world cohort, tezepelumab was associated with clinically meaningful improvements in routine specialist care for severe asthma, including among biologic-experienced patients and those with low T2 biomarker expression. Treatment was associated primarily with marked reductions in exacerbations and OCS exposure, together with biomarker suppression, improved patient-reported asthma control, and modest lung function gains. However, the uncontrolled study design prevents attribution of these improvements exclusively to tezepelumab. Prospective comparative studies are needed to better define its positioning among biologic therapies and to identify patients most likely to benefit.

Authors' contributions

All authors (Villamañán E[1,4,5], Carpio C[2,4,5], Laorden D[2,5], Domínguez-Ortega J[3,5], Romero D[2,5], De Las Vecillas LV[3,5], Soto A[1], Villaroya E[1], Romero B[2], Losantos I[6], Sobrino C[1,5], De Andrés S[1,5], Herrero A[1,5], Quirce S[3,5], Álvarez-Sala R[2,4,5]) meet the four authorship criteria of the International Committee of Medical Journal Editors (ICMJE). All made substantial contributions to the conception and design of the study or to the acquisition, analysis, or interpretation of data; participated in drafting the Article or revising it critically for important intellectual content; gave final approval of the version to be published; and agree to be accountable for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Each author has individually completed and submitted the ICMJE uniform disclosure form for potential conflicts of interest. There are no guest, honorary, or ghost authors. More than one author had full access to and verified the underlying data. All authors had access to all relevant data, approved the final version of the manuscript, and accept responsibility for the integrity, reliability, and completeness of the data and the analyses.

All authors confirm that the study protocol and the final version of the manuscript were reviewed and approved by all authors. The authors certify that this Article reports original work that has not been published previously and is not under consideration for publication elsewhere. The authors further declare that all required patient or participant consents and permissions were obtained and documented in accordance with applicable ethical and legal requirements.

Ethics

The study was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of Hospital Universitario La Paz (PI-6401). All patient data were anonymised before analysis, and confidentiality was maintained in compliance with Spanish Organic Law 3/2018 on Personal Data Protection. Owing to the retrospective, observational design, written informed consent was not required.

Artificial intelligence

Medical writing and English-language editing support, including refinement of scientific style, were provided in part by an artificial intelligence-based tool (ChatGPT 5.1, OpenAI) and were subsequently reviewed and approved by the authors.

Role of the funding source

There was no funding source in the study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit the manuscript for publication.

Conflicts of interest

None declared.

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Appendix A.

On behalf of the AsmaGrave-HULP study group: Rodolfo Alvarez-Sala; Carlos Carpio; Javier Contreras; Susana De Andrés; Javier Domínguez-Ortega; Mar Gandolfo; Daniel Laorden; Leticia De Las Vecillas, Mihaela Ifrim, Valentin López, Magdalena Lluch; Alberto Luna; Santiago Quirce; David Romero; Carmen Sobrino; Inés Torrado; Elena Villamañán.

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Appendix B. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.arbres.2026.05.022.

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