Journal of Asthma

ISSN: 0277-0903 (Print) 1532-4303 (Online) Journal homepage: www.tandfonline.com/journals/ijas20

Evaluating the effectiveness and safety of mepolizumab in elderly patients with severe asthma: insights from the REDES study

Eva Martínez-Moragón, Celia Pinedo, Luis Puente-Maestu, Mariana Muñoz-Esquerre, Ana Gómez-Bastero, Jacinto Ramos, Miguel Díaz-Palacios, Tamara Hermida, David Bañas-Conejero & Santiago Quirce

To cite this article: Eva Martínez-Moragón, Celia Pinedo, Luis Puente-Maestu, Mariana Muñoz-Esquerre, Ana Gómez-Bastero, Jacinto Ramos, Miguel Díaz-Palacios, Tamara Hermida, David Bañas-Conejero & Santiago Quirce (2025) Evaluating the effectiveness and safety of mepolizumab in elderly patients with severe asthma: insights from the REDES study, Journal of Asthma, 62:7, 1128-1132, DOI: 10.1080/02770903.2025.2463956

To link to this article: https://doi.org/10.1080/02770903.2025.2463956

Published online: 13 Feb 2025.

JOURNAL OF ASTHMA
2025, VOL. 62, NO. 7, 1128–1132
https://doi.org/10.1080/02770903.2025.2463956

Evaluating the effectiveness and safety of mepolizumab in elderly patients with severe asthma: insights from the REDES study

Eva Martínez-Moragón, MD, PhD[a], Celia Pinedo, MD, PhD[b], Luis Puente-Maestu, MD, PhD[c,d], Mariana Muñoz-Esquerre, MD, PhD[e], Ana Gómez-Bastero, MD, PhD[f], Jacinto Ramos, MD, PhD[g], Miguel Díaz-Palacios, MD[h], Tamara Hermida, MD[i], David Bañas-Conejero, MSc[j] and Santiago Quirce, MD, PhD[k]

[a]H. Universitario Doctor Peset, Valencia, Spain; [b]H. Clínico San Carlos, Madrid, Spain; [c]H. Universitario Gregorio Marañón, Madrid, Spain; [d]Universidad Complutense de Madrid, Madrid, Spain; [e]H. Universitario Bellvitge-IDIBELL, Barcelona, Spain; [f]H. Universitario Virgen Macarena, Sevilla, Spain; [g]H. Universitario Salamanca, Salamanca, Spain; [h]H. Universitario La Fe, Valencia, Spain; [i]H. Universitario Central de Asturias, Oviedo, Spain; [j]Specialty Care Medical Department, GSK, Madrid, Spain; [k]H. Universitario La Paz, IdiPAZ, Madrid, Spain

ABSTRACT

Objective: Asthma and severe asthma are problems affecting all age groups, but asthma is frequently undiagnosed in the elderly, due to the poor perception of airflow limitation, lack of fitness, and presence of multiple comorbidities. Even so, the proportion of patients with severe asthma aged ≥65 is significant, and data on efficacy of asthma medications in the elderly are sometimes limited. We report here the effectiveness and safety of mepolizumab (an IL-5 inhibitor) in elderly (≥65 years) patients.

Methods: The REDES study was an observational, multicenter study of the effectiveness and safety of mepolizumab 100 mg SC every 4 weeks in 318 severe asthma patients in Spain. This post-hoc analysis compares the effectiveness and safety of patients ≥65 years old to patients <65 years after 12 months of mepolizumab treatment.

Results: 27% of patients were ≥65 years old, compared with 73% of patients <65 years. Elderly patients showed a trend toward less frequent comorbid nasal polyps ($p=0.06$) and a lower proportion of atopic sensitization (as detected by prick test or specific IgE) ($p=0.02$). Similar improvements were noted in ACT score ($p<0.0001$), comparable exacerbation reductions ($p<0.0001$), and lung function parameters ($p<0.04$ in elder group and $p<0.0001$ in younger elder group), although an apparent greater reduction of OCS daily dose was observed in elder patients ($p=0.0002$). No new safety signals were reported in the elderly population.

Conclusions: This study further supports mepolizumab as an effective and well tolerated therapy in the difficult to treat population of elderly patients with severe asthma.

ARTICLE HISTORY
Received 9 October 2024
Revised 20 January 2025
Accepted 3 February 2025

KEYWORDS
Real-world; difficult to treat; effectiveness; IL-5; comorbidities; fitness

Introduction

Asthma remains a complex heterogeneous syndrome encompassing a series of respiratory manifestations associated with chronic airway inflammation and, in spite of the increasing availability and research in this particular area of medicine, the majority of the burden of asthma morbidity is avoidable (1).

Asthma and severe asthma are problems affecting all age groups, but asthma is frequently undiagnosed in the elderly, due to the poor perception of airflow limitation, lack of fitness, and presence of multiple comorbidities. Asthma costs may be higher as well among these patients, as they suffer from frequent hospitalizations and use multiple medications (1).

In Spain, the population of patients with asthma managed by secondary care are, on average, 51 years old, and those with severe asthma, 57 years old. One in every three patients with severe asthma is ≥65 years old, according to the PAGE study (2). However, data on efficacy of asthma medications in the elderly are sometimes limited, as these patients are often excluded from clinical trials (1).

As age-related physiological and immunological changes (e.g. lung function decline) complicate asthma management and affect treatment effectiveness in elderly patients, the data on the safety and effectiveness of biologic therapies in these patients is still limited (3,4).

The aim of our study is to report the effectiveness and safety of mepolizumab (an IL-5 inhibitor) in elderly (≥65 years) patients in a post-hoc analysis of the real-world REDES study (5).

CONTACT Eva Martínez-Moragón evamartinezmoragon@gmail.com H. Universitario Doctor Peset, Valencia, Spain.

Methods

The REDES study was a retrospective, real-world, multicenter, cohort study of the effectiveness and safety of mepolizumab 100 mg SC every 4 weeks for 12 months, that enrolled patients with severe eosinophilic asthma from 24 Spanish hospitals. Patients enrolled were ≥18 years old, had a clinical diagnosis of severe asthma, and had initiated mepolizumab ≥12 months before study inclusion. The primary endpoint was the change in the annual rate of clinically significant asthma exacerbations, and secondary endpoints included average OCS daily maintenance dose, pre- and post-bronchodilator spirometric tests, changes in Asthma Control Test (ACT), and blood eosinophil counts. The results in the overall study population have been previously reported (5).

The REDES study was performed in line with the guiding principles of the Declaration of Helsinki and order SAS/3470/2009. Approval of the study protocol was granted by the ethics committee of Hospital La Princesa, Madrid, Spain (5). Separate ethics approval was not required for this analysis.

This analysis compares the clinical and sociodemographic features, and the effectiveness and safety of mepolizumab in elderly patients from the REDES study (≥65 years old) compared with patients <65 years old after 12 months of mepolizumab therapy.

Differences between groups were analyzed as per the following: for continuous variables, comparisons were made using the Student's t-test to assess whether there were statistically significant differences between the groups. Chi-square (χ^2) test was used for qualitative or categorical variables to determine if there were significant differences in proportions between the groups. All statistical tests were two-tailed, and a p-value of less than 0.05 was considered significant.

Results

318 patients with severe asthma were included in the REDES study. Of these, 85 (27%) patients were aged ≥65 years, with a mean (SD) of 70.8 (4.6) years, and 233 (73%) patients were <65 years, with a mean age of 51.3 (10.2) years.

Elderly patients were characterized by a higher female presence, 76% vs 67%, than patients <65 years old. They also had their diagnosis of asthma at a posterior time (46.1 (17.7) vs 29.5 (15.8) years old) and were less likely to have comorbid nasal polyps, 38% vs 49% than the younger group. Atopic sensitization was more common in the younger group with 45% compared to 31% of elderly patients and comorbid bronchiectasis was more prevalent in the older group, with 28%, compared with 15% in the younger group (Table 1).

No differences were found between subgroups at baseline in terms of eosinophil counts (mean (SD) of 660.4 cells/μL (1096) and 728.1 cells/μL (723.1) in elderly and younger patients, respectively), ACT scores (14.1 (4.82) and 14.1 (5.1) points) or in the proportion of patients with an ACT ≥ 20 (13% vs 16%) but, some differences ($p < 0.05$) were found in the baseline annual rate of exacerbations, with a smaller rate of 3.8 (2.7) exacerbations/year in elderly patients than younger patients, with 4.7 (3.8) exacerbations/year.

Significant differences were also found ($p < 0.0001$) in baseline lung function absolute values, with an FEV_1 of 1.5 L (0.6) and 2.0 L (0.8), however, this corresponded with similar predicted values of 71.4% and 69.7% respectively (Figure 1).

After 12 months of treatment with mepolizumab, the changes in ACT (6.5 and 7.3 points), exacerbation rates (75% and 78.4% reductions), and lung function parameters (Table 1) were overall similar between the two groups (Table 1). A greater reduction of OCS daily dose was observed in elder patients (71% vs 56%) with a final dose of 2.93 mg/day and 5.8 mg/day after 12 months of mepolizumab therapy in the elderly and younger patients, respectively ($p < 0.05$) (Figure 2).

There was just one elderly patient that reported adverse events, compared with 8 younger patients (1% vs 3%). No particular safety signals were observed in the elderly population of the REDES study.

Discussion

In this study, we report the results of 12 months of treatment with mepolizumab in an elderly population, defined as those patients aged ≥65 years. We chose 65 years of age, as most age stratifications in asthma use 6, 18, and 65 years as thresholds when patient populations are divided by age groups (3,6,7).

The proportion of elderly patients was 27%, which represents more than one quarter of severe asthma patients in the REDES real-world study. These results are descriptive, but they show that the use of mepolizumab in elderly patients was overall well tolerated and similarly effective than in younger patients. The main limitations of the study were the retrospective nature of the REDES study, subject to missing data specially in older patients, as clinical records of these patients are likely to have a longer trajectory and less frequent follow-up, the fact that atopic sensitization and nasal polyps are reported without the number of

Table 1. Stratification of clinical results according to age subgroup.

	≥65 years old (n = 85)			<65 years old (n = 233)		Inter-group p
Age, mean (SD), years	70.84 (4.58)			51.34 (10.19)		<0.0001
Asthma duration, mean (SD), years	25.8 (18.18)			21.67 (14.56)		0.06
Sex, female, n (%)	65 (76%)			155 (67%)		0.09
Comorbid nasal polyps, n (%)	32 (38%)			115 (49%)		0.06
Comorbid bronchiectasis, n (%)	24 (28%)			45 (15%)		0.09
Never smokers, n (%)	57 (67%)			141 (61%)		0.18
Ex-smokers, n (%)	24 (28%)			82 (35%)		0.29
Current smokers n (%)	0 (0%)			4 (2%)		0.23
Age of asthma diagnosis, mean (SD)	46.12 (17.67)			29.48 (15.75)		<0.0001
Atopic sensitization, n (%)	26 (31%)			105 (45%)		0.02
	Baseline	12 months	Intra-group p	Baseline	12 months	Intra-group *p*
Blood eosinophil counts, mean (SD)	660.37 (1095.95)	93.89 (202.45)	0.0001	728.12 (723.11)	99.97 (248.19)	<0.0001
ACT score, mean (SD)	14.10 (4.82)	21.40 (3.34)	<0.0001	14.05 (5.14)	20.58 (4.05)	<0.0001
Patients with ACT score ≥20, n (%)	10 (13%)	61 (79%)	<0.0001	32 (16%)	128 (70%)	<0.0001
Annual exacerbations, mean (SD)	3.84 (2.69)	0.96 (1.18)	<0.0001	4.70 (3.75)	1.02 (1.52)	<0.0001
Prednisolone dose, mean (SD), mg/day	10.09 (8.48)	2.93 (4.11)	0.0002	13.13 (10.54)	5.80 (7.73)	<0.0001
Patients that interrupted OCS, n/N (%)		14/29			29/61	
Pre-bronchodilator FVC, mean (SD), L	**2.47 (0.83)**	**2.61 (0.80)**	0.07	**3.14 (0.97)**	**3.30 (0.94)**	<0.0001
Pre-bronchodilator FEV_1, mean (SD), L	**1.51 (0.55)**	**1.63 (0.51)**	0.03	**2.02 (0.78)**	**2.24 (0.77)**	<0.0001
Pre-bronchodilator FEV_1, mean (SD), %	71.43 (21.45)	78.35 (21.42)	0.0152	69.65 (22.57)	81.34 (21.76)	<0.0001
Ratio pre-bronchodilator FEV_1/FVC, mean (SD)	61.52 (11.10)	**63.61 (11.85)**	0.35	64.11 (13.26)	**67.60 (11.73)**	<0.0001
Post-bronchodilator FVC, mean (SD), L	**2.48 (0.77)**	**2.60 (0.72)**	0.02	**3.24(0.91)**	**3.38 (0.88)**	0.0016
Post-bronchodilator FEV_1, mean (SD), L	**1.64 (0.56)**	**1.69 (0.54)**	0.04	**2.17 (0.74)**	**2.31 (0.68)**	<0.0001
Post-bronchodilator FEV_1, mean (SD), %	77.22 (25.41)	78.87 (23.96)	0.11	75.94 (22.22)	83.96 (23.18)	<0.0001
Ratio post-bronchodilator FEV_1/FVC, mean (SD)	66.11 (13.04)	64.55 (13.07)	0.83	66.89 (11.91)	67.82 (11.90)	0.0036
Patients with adverse events related to treatment, n (%)	1 (1%)		–	8 (3%)		

Bold: intergroup $p < 0.05$ at baseline or at 12 months.

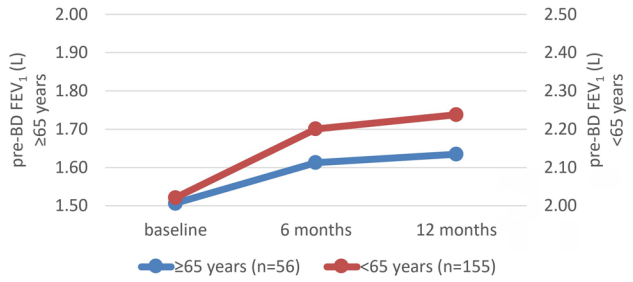

Figure 1. Change in pre-bronchodilator FEV_1 according to age subgroup.

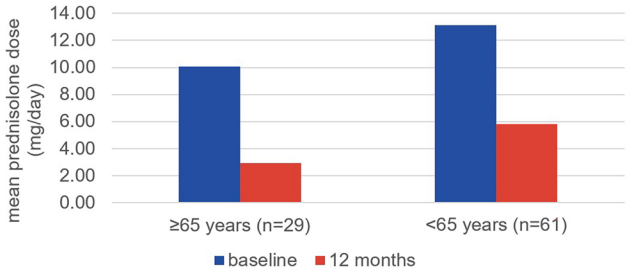

Figure 2. Reduction of OCS according to age subgroup.

patients with the specific tests for these comorbidities represents another significant limitation. On the other hand, the strengths of the REDES study data are the fact that it was developed originally in specialized asthma units (which would imply a higher completeness and accuracy of data collection in severe asthma patients), and the sample size was big enough to conduct several post-hoc analyses.

The safety and efficacy of mepolizumab has been documented previously (8–12), In pivotal trials, additional treatment with mepolizumab reduced exacerbations in 50-58%, improved FEV_1 by 120 ml (10), and had an acceptable safety profile, compared to placebo. In our study, we show >75% reduction of exacerbations, albeit without placebo arm in real-world patients, and a 120 ml and 220 ml improvement in FEV_1 in elderly and younger patients, respectively, with comparably acceptable safety profile. Overall our results are in line with previous real-world evidence studies and add some specific data on elderly patients that has not been extensively explored in patients with severe asthma (7,13,14).

Lung function decreases with age, due to the stiffening of the chest wall, reduced respiratory muscle function, and an increase in the residual volume due to a loss of elasticity. Bronchiectasis is also a more common comorbidity in these patients. Overall, elderly patients show a reduced response to bronchodilators and inhaled glucocorticoids because of these physiological changes (15). At the same time, aging-related immunosenescence encompasses changes in adaptative and innate immune pathways, that could entail increased susceptibility to foreign and self-antigens,

infections, autoimmune disease, and other chronic processes (16,17). Besides, elderly patients struggle to adhere to inhaled treatments, because they have more difficulties to competently operate their inhalers (18).

Overall, elderly patient population has been shown to represent a clinically different, more frail, phenotype of patients with asthma, with higher disease severity and higher frequency of relevant comorbidities, thus, requiring a multidimensional management (16).

Our study supports the use of mepolizumab for severe asthma in this difficult to treat population, without remarkable differences in effectiveness or safety with younger patients. Exacerbations and asthma control were reduced similarly in both groups of patients. A numerical greater reduction of oral corticoids was observed in elderly patients, which could be related to an excess of OCS use in this population due to the long trajectory of their disease an/or other comorbidities. On this, it should be noted that cumulative doses of oral glucocorticoids are associated with weight gain, sleep apnea-hypopnea syndrome, osteoporosis, and other adverse events, and that sparing strategies should be used to avoid and reduce such consequences (16,19).

The only adverse event reported to be related with mepolizumab in the elderly population was an acneiform dermatitis which didn't lead to treatment withdrawal.

The most evident difference between these population was the lower lung function in elderly patients at baseline, and although the percent predicted lung function was somewhat similar and increased similarly after treatment, only the younger group was able to normalize the mean pre-bronchodilator FEV_1 (FEV_1>80%). In general, lower absolute improvements were seen in elderly patients, compared with younger patients, supporting the notion that these patients have suffered a greater or longer irreversible lung function decline. Our results are aligned with the thesis that an earlier intervention could imply better outcomes for asthma patients, to normalize as best as possible their lung function trajectories during the duration of disease.

Conclusion

Elderly patients with severe asthma are a difficult to treat phenotype of patients that struggle to normalize the lung function, possibly due to a longer impact of airway inflammation on their age-related lung function decline. These results further support the use of mepolizumab in these patients as an effective and well tolerated therapy.

Author contributions

EMM and DBC contributed to the study design. EMM, CP, LPM, MME, AGB, JR, MDP, TH, SQ enrolled patients. DBC performed the analyses. All authors critically reviewed and approved the manuscript.

Declaration of interest

EMM reports consulting fees from AstraZeneca, GSK, Sanofi, and Teva, and Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing, or educational events from AstraZeneca, Chiesi, Gebro, GSK, Novartis, Sanofi, and Teva. CP reports consulting fees from AstraZeneca, GSK, and Sanofi, and honoraria for lectures or presentations from GSK, AstraZeneca, Sanofi, and Gebro. LPM reports: Educational an investigation grants for my Institution from GSK, AZ, and Chiesi. Consulting fees from MSD, honoraria for lectures from AZ and Chiesi. MME reports consulting fees, and payment or honoraria for lectures or presentations from AstraZeneca, Chiesi, GSK, Sanofi, Novartis, and Teva. AGB reports consulting fees from AstraZeneca, GSK, and Sanofi, and honoraria for lectures or presentations from AstraZeneca, Gebro, GSK, Menarini, and Sanofi. JR reports consulting fees from AstraZeneca and Sanofi, and honoraria for lectures or presentations from GSK, AstraZeneca, Sanofi and Gebro, Novartis, and Menarini. MDP reports consulting fees and honoraria for presentations from Astrazeneca and GSK. TH reports consulting fees from AstraZeneca, GSK, and Sanofi, and honoraria for lectures or presentations from GSK, AstraZeneca, Sanofi, and Gebro. SQ reports consulting fees and honoraria for lectures from ALK, Allergy Therapeutics, AstraZeneca, Chiesi, GSK, Mundipharma, Novartis, Sanofi, and Teva. DBC is employee of GSK and hold stocks/shares in GSK.

Data sharing statement

For requests for access to anonymised subject level data, please contact corresponding author.

Funding

This study was funded by GSK (study number 213172).

ORCID

Eva Martínez-Moragón http://orcid.org/0000-0003-3770-1735
Celia Pinedo http://orcid.org/0009-0001-0114-7472
Luis Puente-Maestu http://orcid.org/0000-0001-8501-0117
Mariana Muñoz-Esquerre http://orcid.org/0000-0002-6747-7116
Ana Gómez-Bastero http://orcid.org/0000-0002-4173-783X
Jacinto Ramos http://orcid.org/0000-0003-4904-2829
Miguel Díaz-Palacios http://orcid.org/0000-0002-8492-7158
Tamara Hermida http://orcid.org/0000-0002-2139-1165
David Bañas-Conejero http://orcid.org/0000-0002-2035-264X
Santiago Quirce http://orcid.org/0000-0001-8086-0921

References

1. Asthma G. Global Strategy for Asthma Management and Prevention. 2023. https://ginasthma.org/
2. Melero Moreno C, Almonacid Sánchez C, Bañas Conejero D, Quirce S, Álvarez Gutiérrez FJ, Cardona V, Sánchez-Herrero MG, Soriano JB; PAGE Study Group. Understanding Severe Asthma Through Small and Big Data in Spanish Hospitals - PAGE Study. J Investig Allergol Clin Immunol. 2023;33(5):373–382.
3. Mir-Ihara P, Narváez-Fernández E, Domínguez-Ortega J, Entrala A, Barranco P, Luna-Porta J-A, Romero D, Villamañán E, Losantos-García I, Quirce S, et al. Safety of Biological Therapy in Elderly Patients with Severe Asthma. J Asthma. 2022;59(11):2218–2222. doi:10.1080/02770903.2021.2010747.
4. Tat TS, Cilli A. Evaluation of Long-Term Safety and Efficacy of Omalizumab in Elderly Patients with Uncontrolled Allergic Asthma. Ann Allergy Asthma Immunol. 2016;117(5):546–549. doi:10.1016/j.anai.2016.09.006.
5. Domingo Ribas C, Carrillo Díaz T, Blanco Aparicio M, Martínez Moragón E, Banas Conejero D, Sánchez Herrero MG; REDES Study Group. REal worlD Effectiveness and Safety of Mepolizumab in a Multicentric Spanish Cohort of Asthma Patients Stratified by Eosinophils: the REDES Study. Drugs. 2021;81(15):1763–1774. doi:10.1007/s40265-021-01597-9.
6. Lombardi C, Comberiati P, Ridolo E, Cottini M, Yacoub MR, Casagrande S, Riccò M, Bottazzoli M, Berti A. Anti-IL-5 Pathway Agents in Eosinophilic-Associated Disorders Across the Lifespan. Drugs. 2024;84(6):661–684. doi:10.1007/s40265-024-02037-0.
7. Yamamoto LdR, Vianna EDSO, Cetlin AdCVA, Ferriani MPL, Trevisan Neto O, Melo JML, Zanetti MET, Arruda LK, de Menezes MB. Worse Lung Function, More Allergic Sensitization but Less Blood Eosinophilia in Elderly Patients with Long-Standing versus Late-Onset Asthma. J Asthma. 2024:1–10. doi:10.1080/02770903.2024.2438099.
8. Ortega HG, Liu MC, Pavord ID, Brusselle GG, FitzGerald JM, Chetta A, Humbert M, Katz LE, Keene ON, Yancey SW, et al. Mepolizumab Treatment in Patients with Severe Eosinophilic Asthma. N Engl J Med. 2014;371(13):1198–1207. doi:10.1056/NEJMoa1403290.
9. Bel EH, Wenzel SE, Thompson PJ, Prazma CM, Keene ON, Yancey SW, Ortega HG, Pavord ID, SIRIUS Investigators. Oral Glucocorticoid-Sparing Effect of Mepolizumab in Eosinophilic Asthma. N Engl J Med. 2014;371(13):1189–1197. doi:10.1056/NEJMoa1403291.
10. Chupp GL, Bradford ES, Albers FC, Bratton DJ, Wang-Jairaj J, Nelsen LM, Trevor JL, Magnan A, Ten Brinke A. Efficacy of Mepolizumab Add-On Therapy on Health-Related Quality of Life and Markers of Asthma Control in Severe Eosinophilic Asthma (MUSCA): A Randomised, Double-Blind, Placebo-Controlled, Parallel-Group, Multicentre, Phase 3b Trial. Lancet Respir Med. 2017;5(5):390–400. doi:10.1016/S2213-2600(17)30125-X.
11. Lugogo N, Domingo C, Chanez P, Leigh R, Gilson MJ, Price RG, Yancey SW, Ortega HG. Long-Term Efficacy and Safety of Mepolizumab in Patients With Severe Eosinophilic Asthma: A Multi-Center, Open-Label, Phase IIIb Study. Clin Ther. 2016;38(9):2058–2070.e1. doi:10.1016/j.clinthera.2016.07.010.
12. Khurana S, Brusselle GG, Bel EH, FitzGerald JM, Masoli M, Korn S, Kato M, Albers FC, Bradford ES, Gilson MJ, et al. Long-Term Safety and Clinical Benefit of Mepolizumab in Patients With the Most Severe Eosinophilic Asthma: The COSMEX Study. Clin Ther. 2019;41(10):2041–2056.e5. doi:10.1016/j.clinthera.2019.07.007.
13. Harrison T, Canonica GW, Chupp G, Lee J, Schleich F, Welte T, Valero A, Gemzoe K, Maxwell A, Joksaite S, et al. Real-World Mepolizumab in the Prospective Severe Asthma REALITI-A Study: Initial Analysis. Eur Respir J. 2020;56(4):2000151. doi:10.1183/13993003.00151-2020.
14. Ji H, Tan LD, Hafzalla GW, Nguyen N, Alismail A. Navigating Biologic Therapies in Elderly Asthma. Respir Med. 2024;227:107655. doi:10.1016/j.rmed.2024.107655.
15. Reed CE. Asthma in the Elderly: Diagnosis and Management. J Allergy Clin Immunol. 2010;126(4):681–687; quiz 688–689. doi:10.1016/j.jaci.2010.05.035.
16. Curto E, Crespo-Lessmann A, González-Gutiérrez MV, Bardagí S, Cañete C, Pellicer C, Bazús T, Vennera MDC, Martínez C, Plaza V, et al. Is Asthma in the Elderly Different? Functional and Clinical Characteristics of Asthma in Individuals Aged 65 years and Older. Asthma Res Pract. 2019;5(1):2. doi:10.1186/s40733-019-0049-x.
17. Murray MA, Chotirmall SH. The Impact of Immunosenescence on Pulmonary Disease. Mediators Inflamm. 2015;2015(1):692546. doi:10.1155/2015/692546.
18. Perpiñá M, Gómez-Bastero A, Trisán A, Martínez-Moragón E, Álvarez-Gutiérrez FJ, Urrutia I, Blanco-Aparicio M. Expert Consensus Recommendations for the Management of Asthma in Older Adults. Med Clin (Barc). 2022;159(1):53.e1–53.e14. doi:10.1016/j.medcle.2021.04.034.
19. Domingo C, Sogo A, Casado E, Martínez-Moragón E, Blanco-Aparicio M, Carrillo T, Bañas-Conejero D, Sánchez-Herrero M-G. Potential Impact of Mepolizumab in Stepping Down Anti-Osteporotic Treatment in Corticosteroid-Dependent Asthma. Front Pharmacol. 2023;14:1183156. doi:10.3389/fphar.2023.1183156.