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Índice

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LETTER FROM THE EDITOR-IN-CHIEF

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World Tuberculosis Day: a Persistent Debt in Argentina

Día Mundial de la Tuberculosis: una deuda persistente en Argentina

Tuberculosis continues to be, well into the 21st century, one of the most significant infectious diseases at both the global and national levels. Far from being a problem of the past, its persistence and constant increase directly reflect social inequalities, barriers and major gaps in access to the healthcare system, and difficulties in maintaining continuity of care.

In Argentina, the most recent data reveal a concerning scenario. A sustained increase can be observed in the number of reported cases, which reached 17,283 in 2025, with a rate of 37.3 per 100,000 inhabitants. This increase had a particularly marked impact on young populations, especially those between 15 and 35 years of age, where significant proportions of new diagnoses are concentrated. In 2025, individuals aged <20 accounted for 17.0% of all reported TB cases in Argentina, with the heaviest burden concentrated among adolescents aged 15 to 19, exceeding that observed in the adult population, and positioning this group as central to current transmission dynamics.[1] Adding to this scenario is a particularly serious fact: the increase in severe forms of the disease, such as tuberculous meningitis in children aged <5 years. The analysis of data published by three-year periods shows an increase of 156.5%, which constitutes a critical indicator of failure in early detection and control strategies. Also, low BCG vaccination coverage at birth further contributes to this situation.

The increase in cases and severe disease forms signals an urgent epidemiological concern and must be interpreted as a warning signal reflecting not only ongoing community transmission but also deficiencies in active case finding, diagnostic delays, failures in identifying source cases, and adverse socioeconomic conditions that facilitate disease spread. The persistence of structural determinants such as overcrowding, poverty, and inequality continues to drive this vulnerability. The disease not only reflects these conditions, but also exacerbates them.

In Argentina, approximately 5% to 6% of bacteriologically confirmed cases show drug resistance (332 cases), which complicates treatment and increases the risk of unfavorable outcomes. However, beyond drug resistance, a primary challenge persists: maintaining treatment continuity amid social, economic, and institutional barriers. In this context, 933 deaths from tuberculosis were reported in 2024, a figure that also shows an upward trend.

Given this reality, it is essential to strengthen control strategies through a comprehensive approach. This implies not only optimizing epidemiological surveillance and active case finding, but also guaranteeing access to timely diagnosis and treatment, and reinforcing follow-up and treatment adherence. Likewise, prevention strategies must prioritize geographic equity, with targeted inclusion of children and adolescents as a cornerstone of comprehensive national TB control.

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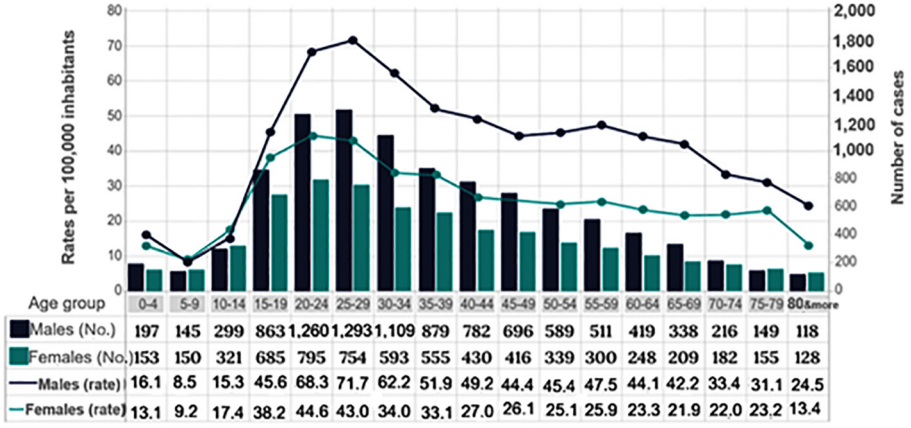
Notification of TB cases (new and relapses) and rates per 100,000 inhabitants, by age group and sex. Argentina, 2025.



Age group	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80&more
Males (No.)	197	145	299	863	1,260	1,293	1,109	879	782	696	589	511	419	338	216	149	118
Females (No.)	153	150	321	685	795	754	593	555	430	416	339	300	248	209	182	155	128
Males (rate)	16.1	8.5	15.3	45.6	68.3	71.7	62.2	51.9	49.2	44.4	45.4	47.5	44.1	42.2	33.4	31.1	24.5
Females (rate)	13.1	9.2	17.4	38.2	44.6	43.0	34.0	33.1	27.0	26.1	25.1	25.9	23.3	21.9	22.0	23.2	13.4

SOURCE: Instituto Nacional de Enfermedades Respiratorias (INER) Dr. Emilio Coni – Administración Nacional de Laboratorios e Institutos de Salud Dr. Carlos Malbrán, based on data from the tuberculosis control programs of the 24 jurisdictions. Ministry of Health of the Nation. Argentina, 2026.

Similarly, it is necessary to consolidate person-centered models of care that take into account the social dimensions of the disease and promote treatment adherence, especially among vulnerable populations.

The role of healthcare teams is crucial, yet sustained institutional and political commitment is equally essential to sustain public policies that address tuberculosis as a multidimensional challenge driven by social determinants. Coordination across levels of care, community-based work, and health system integration are fundamental pillars for reversing the current trend.

On World Tuberculosis Day, it is necessary to renew our commitment to a disease that, although preventable and treatable, continues to rise. The evidence is clear: tuberculosis does not rest. Accordingly, the health system's response cannot either. This disease is not merely a health issue: it is an indicator of inequity. Its increase, especially among children and adolescents, and in its most severe forms, reveals failures extending beyond the healthcare system. As long as its determinants persist, transmission will continue. Halting it is not only a medical challenge, but a collective responsibility.

Inwentarz, Sandra
Editor-in-chief of the American Review of Respiratory Medicine (Revista Americana de Medicina Respiratoria, RAMR)

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ORIGINAL ARTICLE

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Predictive Equations for the Six-Minute Walk Test in Venezuelan Adults: Inclusion of a Novel Variable

Ecuaciones predictivas en la prueba de caminata de seis minutos en venezolanos adultos: inclusión de una variable novedosa

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ABSTRACT

Introduction: The six-minute walk test is simple, low-cost, and resembles daily physical activity. Multiple factors influence the test performance in different regions; therefore, predictive equations have been developed based on specific sociodemographic and anthropometric characteristics. To date, no reference equations exist for the Venezuelan population.

Objectives: To develop native predictive equations for the six minute walk test distance. To analyze and compare local data with equations derived from other countries.

Methods: An observational and prospective study was conducted between july 2024 and march 2025 with 247 venezuelan adults over 30 years old, of both sexes. Two tests were performed, selecting the longest distance walked for data analysis in order to identify variables with the highest predictive value.

Results: Independent variables with the greatest predictive power were sex, age, height, and waist circumference. The resulting equation, with an R^2 of 50%, was:
6MWT (m) = 278.7 – 58.6 × sex* – 1.2 × age + 3.24 × height (cm) – 2 × waist circumference (cm) + sex* × waist circumference (sex*: male = 1, female = 0).
On average, men walked 616.5 meters (m) and women 547.2 m.

Conclusions: Comparisons with foreign equations showed underestimations or overestimations when applied to our population. The inclusion of waist circumference as a predictive variable is novel and highlights the importance of visceral fat as a relevant factor in daily physical activity. A 20 minutes rest period between both tests is recommended.

Key words: six-minute walk test | reference equations | waist circumference | obesity

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RESUMEN

Introducción: La prueba de caminata de seis minutos es sencilla, económica y representativa de la actividad física diaria. Diversos factores influyen en el rendimiento de la PC6M; por tanto, se han desarrollado ecuaciones predictivas con características sociodemográficas y antropométricas regionales. Hasta la fecha, no existen ecuaciones de referencia para la población venezolana.

Objetivos: Desarrollar ecuaciones predictivas adaptadas a la población venezolana para la prueba de caminata de seis minutos. Analizar y comparar datos locales con ecuaciones de otros países.

Materiales y métodos: Se realizó un estudio prospectivo y observacional entre julio de 2024 y marzo de 2025 con 247 adultos venezolanos mayores de 30 años, de ambos sexos. Se ejecutaron dos pruebas, seleccionando la mayor distancia recorrida para el análisis de datos con el fin de identificar las variables con mayor valor predictivo.

Resultados: Las variables independientes con mayor poder predictivo fueron: sexo, edad, estatura y circunferencia abdominal. La ecuación resultante, con un R^2 del 50 %, fue la siguiente:

PC6M (m) = 278,7 – 58,6 × sexo* – 1,2 × edad + 3,24 × altura (cm) – 2 × circunferencia abdominal (cm) + sexo* × circunferencia abdominal (sexo*: hombre = 1, mujer = 0).

Los hombres caminaron un promedio de 616,5 metros (m) y las mujeres, 547,2 m.

Conclusiones: Las ecuaciones foráneas mostraron subestimaciones o sobreestimaciones al aplicarlas localmente. La circunferencia abdominal como variable predictiva es novedosa y resalta la importancia de la grasa visceral como un factor relevante en la actividad física diaria. El período de descanso de 20 minutos entre ambas pruebas es recomendable.

Palabras clave: Prueba de caminata de seis minutos | valor predictivo de la prueba | circunferencia abdominal | obesidad

INTRODUCTION

The 6-minute walk test (6MWT) is a simple and low-cost field exercise test that requires only basic equipment and adequate space. It allows assessment of functional capacity in healthy individuals and in patients with a variety of conditions, and it may also help estimate mortality risk in several diseases. The American Thoracic Society (ATS)[1] and Latin American working groups[2,3] have established guidelines for this test, and it is widely used as a prognostic and therapeutic variable in clinical trials involving chronic obstructive pulmonary disease (COPD),[4] pulmonary hypertension,[5] heart failure,[6] and many other diseases.[7]

Several studies have been published in the literature establishing reference equations for this test in different countries. However, the ATS recommends establishing reference values for the local population because of anthropometric, geographic, and ethnic differences among populations.

In the specific case of Venezuela, to the best of our knowledge, there are no reference equations available for this test in the local adult population (born and residing in the country) that would allow comparisons in patients with various diseases. A previous multicenter study conducted across several Ibero-American cities included a small local sample, but it was not designed to derive equations specific to each region.[8]

The objectives of this study were to measure the maximum distance covered in two 6-minute walk tests, according to ATS guidelines, in a sample of Venezuelan adults older than 30 years of both sexes without limitations to

normal walking; to assess its association with potential predictive variables, including sociodemographic, anthropometric, and clinical factors; and to develop one or more equations that could serve as local reference standards. Additionally, similarities and differences with comparable reference equations from foreign populations were investigated.

METHODS

Over an 8-month period (July 1, 2024, to March 1, 2025), at the Instituto Clínico La Florida in Caracas, Venezuela, 263 native volunteers aged > 30 years, of both sexes, were screened and deemed eligible for the study according to predefined inclusion criteria. Of these, 247 agreed to participate in this prospective observational study. The study was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Ethics Committee. All participants provided verbal and written informed consent after receiving a detailed explanation of the study procedures, before undergoing any testing.

Inclusion criteria were as follows: apparently healthy adults without disabilities that could interfere with test performance. Participants with controlled systemic hypertension or a history of stable, well-controlled asthma were also eligible.

Exclusion criteria: uncompensated chronic disease and any musculoskeletal, sensory, or neurological condition that could impair walking ability or comprehension of instructions; a cardiac ischemic event within the preceding 6 months; acute illness within 4 weeks prior to enrollment; resting systolic blood pressure > 150 mm Hg and/or resting diastolic blood pressure > 100 mm Hg; and resting heart rate < 50 beats/min or > 100 beats/min.

Data collection

The study procedures were conducted by experienced personnel under the supervision of three physicians and one nurse. Each participant completed a questionnaire before the walk that collected demographic and anthropometric data. A thorough medical history was obtained, including relevant comorbidities, smoking status, current medications, and vital signs. A cardiopulmonary examination was subsequently performed to verify eligibility criteria.

Anthropometric measurements included body weight (kg), height (cm), and body mass index (BMI), calculated as weight in kilograms divided by height in m^2. Neck circumference (NC) was measured in centimeters with the superior edge of the measuring tape positioned just inferior to the thyroid cartilage, parallel to the floor, and with the neck in neutral, erect position. Waist circumference (WC) was measured in centimeters at the level of the umbilicus at the end of normal expiration with the participant in a standing position.

The following equipment and instruments were used: a desk, two traffic cones, colored adhesive tape, a pulse oximeter, a digital sphygmomanometer, a stethoscope, a medical scale with an integrated stadiometer, a tailor's measuring tape in centimeters, a retractable tape measure, and the Borg Category Ratio 0–10 scale. Mobile phone stopwatches and lap counters were also used. The first three instruments were periodically calibrated against comparable reference devices.

Six-minute walk test (6MWT)

Each participant performed two 6-minute walk tests (6MWT1 and 6MWT2), separated by a randomized rest period of either 20 or 30 minutes. This approach allowed for the assessment of differences in the distance walked between the two tests relative to the duration of the rest interval. The tests were conducted in a straight, level indoor corridor exceeding 30 m in length, with ambient stable temperature of 23 °C. A 30-m walking course was marked, and two traffic cones were positioned at each end. The walking course was laterally marked every 3 m with adhesive tape in accordance with American Thoracic Society guidelines. Participants were instructed to walk as far as possible without running. Standardized encouragement was provided throughout the test. Participants were allowed to stop and rest if necessary, with instructions to resume walking as soon as possible. The supervising physician stood at the far end of the course, notified the participants of the elapsed time every minute while also providing verbal encouragement, such as "good job, keep up the pace." The total distance walked during the 6-minute period was recorded.

Oxygen saturation, heart rate, and blood pressure were recorded immediately before and after each test. Values obtained within 30 seconds after

completion of the test were defined as immediate post-test vital signs. Participants were also asked to rate their perceived fatigue and dyspnea using the Borg scale. The same measurements were repeated at a mean of 3 minutes after completion of the test. Participants remained seated at rest for the randomly assigned interval of either 20 or 30 minutes (see Appendix), after which the same procedure was repeated. For purposes of calculation and derivation of the reference equations, the test with the greatest walking distance was selected for analysis, together with the corresponding Borg scale score and vital signs obtained during that test.

Data analysis

Continuous variables were expressed as mean ± standard deviation (SD), whereas categorical variables were expressed as percentages. Age and maximal walking distance were compared using the Welch variant of the Student t test. Maximal walking distance was compared across rest interval durations using the Student t-test for independent samples with equal variances. Finally, the distances walked during the two tests were compared using a paired-samples Student t-test. For all analyses, a two-sided p value < 0.05 was considered statistically significant.

The best-fitting reference multiple linear regression equation was obtained using a bidirectional stepwise selection procedure based on the Akaike Information Criterion, which ensures an optimal balance between goodness of fit and model complexity. Goodness of fit was assessed by residual analysis using different graphical methods for visual inspection. Cook's distance was also used to identify influential observations. In addition, analysis of variance was performed according to the principle of marginality using Type II sums of squares to summarize the results of the fitted model. The initial set of candidate predictors included sex, age, BMI, weight (kg), height, NC (cm), and WC (cm).

Sample size: After reviewing reference equation estimation studies from multiple countries, we determined that the final estimated equations would include a maximum of 8 parameters, comprising an intercept, 5 regression coefficients, and 2 interaction terms. According to Green's criterion,[10] a minimum sample of 114 participants would therefore be required. However, to obtain stable parameter estimates with small standard errors, a sample size of approximately 240 participants would be preferable. Accordingly, 263 individuals were recruited, of whom 247 ultimately completed the study protocol.

The multiple regression model providing the best fit according to the Akaike Information Criterion included 3 quantitative predictors, 1 dichotomous qualitative predictor, and 1 interaction term between the qualitative factor and one of the quantitative predictors. Thus, the final model required estimation of 6 parameters, for which a sample size of 180 participants would have been sufficient.[11]

Statistical analyses were performed using the R statistical programming language, version 4.5.0. URL of the website: https://cran.r-project.org/.

RESULTS

A total of 263 volunteers were assessed, of whom 16 were excluded for the following reasons: uncontrolled arterial hypertension (n = 12), invalid sociodemographic data (n = 2), acute respiratory symptoms (n = 1), and test interruption due to low back pain (n = 1). Consequently, 247 participants were considered eligible for the analysis (Figure 1, flow diagram).

Sex-stratified characteristics are shown in Table 1.

Overall, 61% of participants reported no comorbid conditions, whereas 24% reported cardiovascular disease, 9% respiratory disease, and 6% conditions of other etiologies. In addition, 63% of participants had never smoked, and 60% were sedentary. All anthropometric variables were lower in women (p < 0.001), with the exception of BMI (p = 0.097) (Table 2).

6MWT

The mean distance covered in the best of the 2 tests was 581 ± 70 m and was lower in women than in men (547 ± 54 m vs 615 ± 67 m, respectively). The mean difference was 69 m and was statistically significant (p < .001). On average, the distance walked during the first 6MWT was 19.3 m shorter than that recorded during the second test (p < .001). For both sexes, the distance walked was greater among participants who reported performing at least 1 hour per week of exercise (brisk walking or jogging), divided into two or more sessions, and

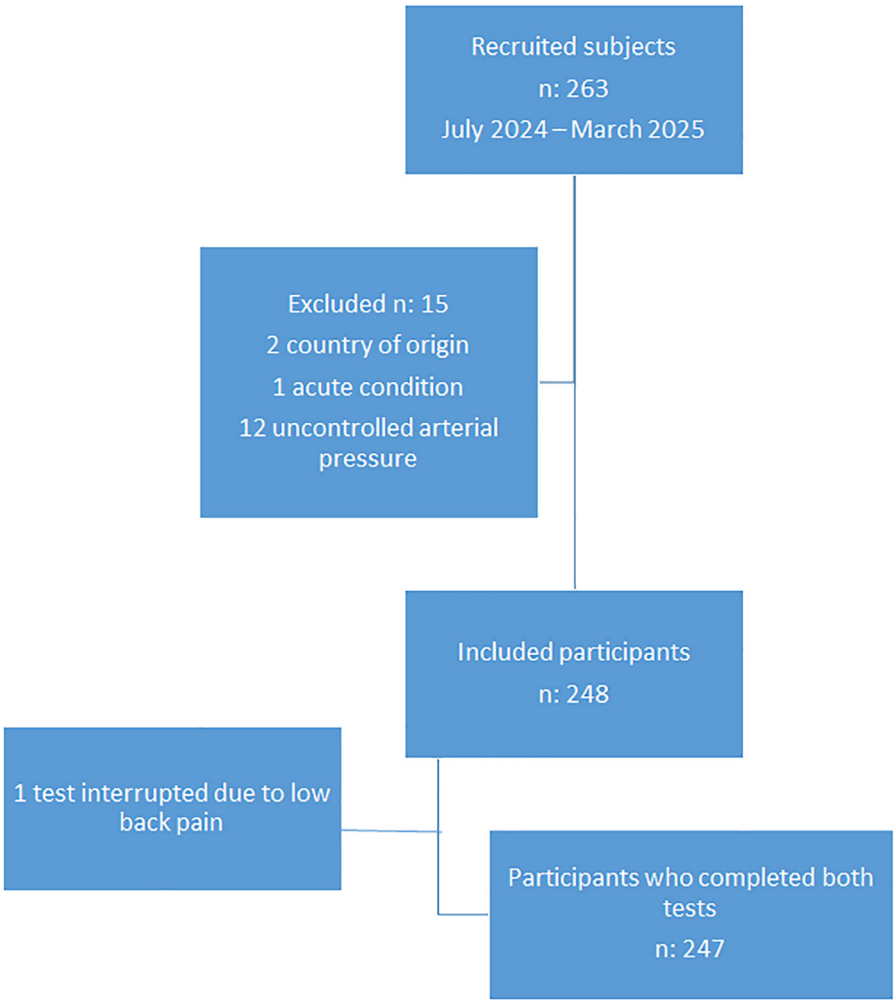

Figure 1. Flow chart

who were classified as physically active rather than sedentary ($p < .05$).

The maximum distance walked by participants with high school or university education was greater than that achieved by participants with lower educational attainment ($p < .001$) Regarding health status, participants who reported no medical conditions walked a greater average distance during the tests than those with controlled comorbidities ($p < .05$). No statistically significant differences were observed for the remaining sociodemographic variables.

The study also included a randomized experiment to determine whether a 20- or 30-minute rest period between the 6MWT1 and 6MWT2 influenced the distance walked. No significant differences were observed between the 2 rest intervals ($p = .981$).

Association between the 6MWT and study variables

Of all the variables analyzed, only age, sex, height, and WC were significantly and independently associated with the maximum distance walked during the 6MWT. The prediction equation for the maximum distance walked that best fit the data, with an R^2 of 50%, was:

$$6MWT = 278.7 - (58.6 \times Sex) - (1.2 \times Age) + (3.24 \times Height\ in\ cm) - (2 \times WC\ in\ cm) + (Sex \times WC\ in\ cm)$$

The sex regressor has a value of 0 for females and 1 for males; For a better interpretation, the equation can be specified for women as:

TABLE 1. Sociodemographic data of the participants

Sociodemographic data		Female (n)	%	Male (n)	%	Total	%
Volunteers	Excluded	9	3.4	7	2.7	16	6.1
	Participants	125	50.6	122	49.4	247	100.0
Participants	Mean age	51.7		53.3		52.5	
Geographic origin	Capital area	64	25.9	87	35.2	151	61.1
	Country interior	61	24.7	35	14.2	96	38.9
Ethnic group	Non-white	62	25.1	63	25.5	125	50.6
	Caucasian	63	25.5	59	23.9	122	49.4
Civil status	Married/Cohabiting	28	11.3	37	15.0	65	26.3
	Other	97	39.3	85	34.4	182	73.7
Academic level	Basic	23	9.3	19	7.7	42	17.0
	Superior	102	41.3	103	41.7	205	83.0
Health status	Healthy	70	28.3	80	32.4	150	60.7
	Controlled disease	55	22.3	42	17.0	97	39.3
Smoking habits	Never smoked	93	37.7	62	25.1	155	62.8
	Former smoker	20	8.1	42	17.0	62	25.1
	Active smoker	12	4.9	18	7.3	30	12.1
Physical activity	Active	43	17.4	55	22.3	98	39.7
	Sedentary	82	33.2	67	27.1	149	60.3

TABLE 2. Anthropometric data

	Female		Male		
Variables	Mean±SD	Min. Max..	Mean±SD	Min. Max.	*P value*
Weight (kg)	70.3 ± 14.3	44.5 134	80.3 ± 14.7	50 125	<0.001
Height (cm)	157.3 ± 6	144 173.3	171 ± 7.2	154 190	<0.001
Neck (cm)	34.4 ± 2.9	29 45	39.2 ± 3.1	32 47	<0.001
Waist (cm)	89 ± 11.7	62 125	94.9 ± 10.8	62 130	<0.001
BMI (kg/m^2)	24.4 ± 5.1	19.1 47.8	27.4 ± 4.3	15.2 40	<0.097

6MWT (m) = 278.7 – (1.2 × Age) + (3.24 × Height in cm) – (2 × WC in cm) For men:

6MWT (m) = 220.1 – (1.2 × Age) + (3.24 × Height in cm) – (WC in cm)

Among women, each 1-year increase in age was associated with a mean decrease of 1.2 m in maximum distance walked, whereas each 1-cm increase in height was associated with a mean increase of 3.2 m (Figures 2 and 3). Additionally, each 1-cm increase in waist circumference was associated with a 2-m reduction in maximum distance walked. Among men, the only difference compared with women was that each 1-cm increase in waist circumference was associated with a 1-m reduction in maximum distance walked (Figure 4).

DISCUSSION

This study shows that waist circumference should be considered, alongside sex, age, and

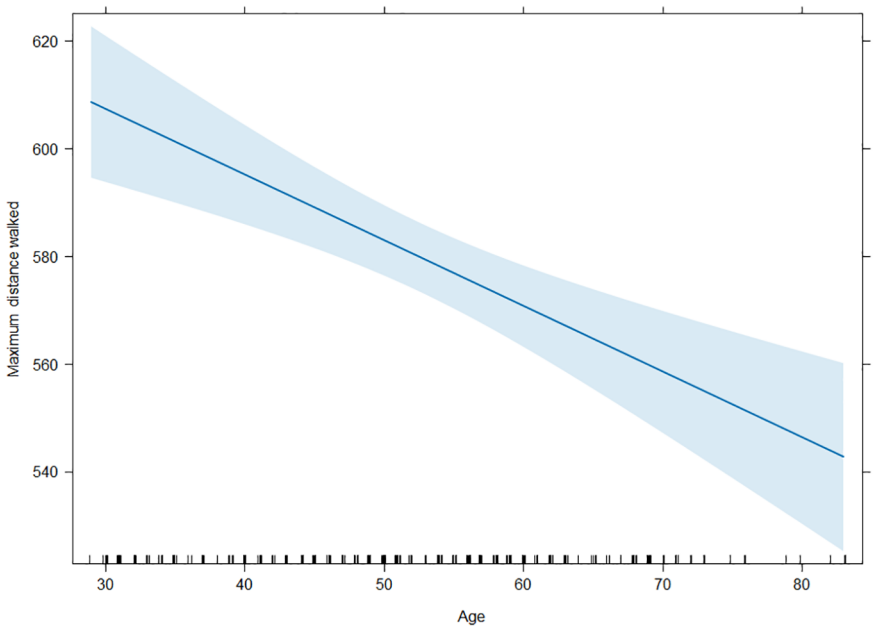

Figure 2. Effect of agen on maximum distance walked

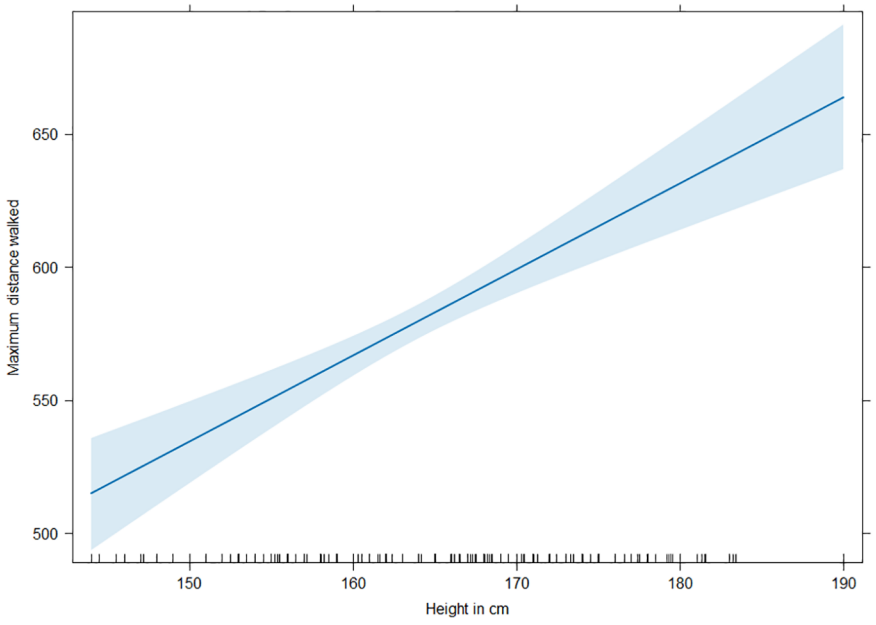

Figure 3. Effect of height on maximum distance walked

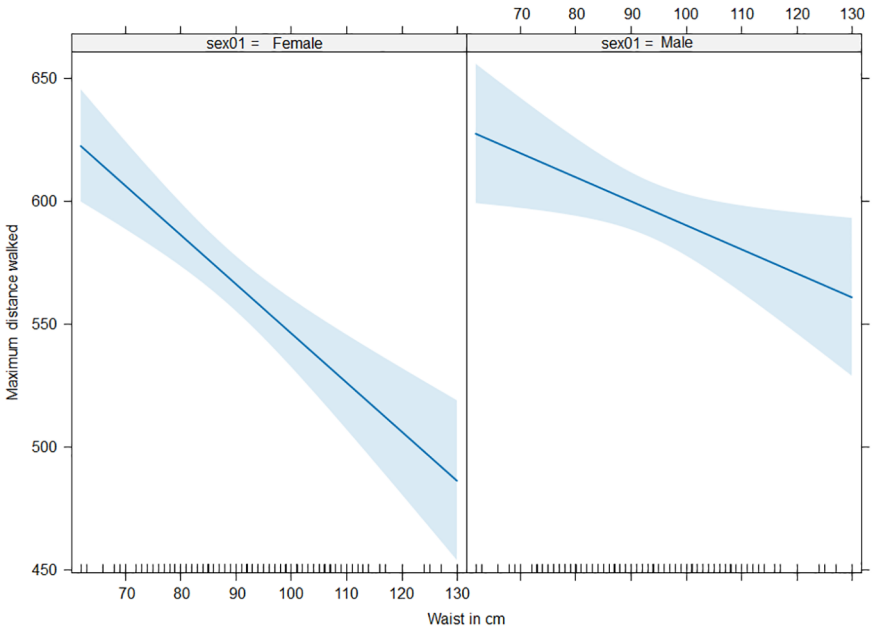

Figure 4. Effect of waist on maximum distance walked

height, as an important determinant of functional capacity. Collectively, these variables accounted for 50% of the variability in the 6MWT.

To our knowledge, no previously published reference equation for the 6MWT derived in Western populations has identified waist circumference as a determinant variable of distance walked in healthy individuals. Waist circumference has previously been reported as a significant variable and incorporated into 6MWT equations in only one study involving healthy Japanese subjects[12] and another conducted in obese Asian patients with diabetes mellitus.[13] Unlike other published studies,[14-16] our exclusion criteria did not omit participants with out-of-range BMI values; rather, their inclusion was considered essential to ensure greater representation of the general population. Notably, the mean BMI of the study population was 27.9 ± 5.1 kg/m², corresponding to an overweight status.

In contrast to previous studies, BMI was not selected during the initial predictor selection procedure because its inclusion could have introduced multicollinearity into the model. Given the absence of BMI in our results –which has been significantly different from zero in other published studies– we repeated the selection procedure, forcing the inclusion of BMI. Although BMI remained in the resulting equation, it was not significantly different from zero (p = 0.8825).

We speculate that including overweight and obese participants in the study cohort may have driven the inclusion of waist circumference, offering greater predictive power for maximum distance walked than BMI. Some authors have suggested that body composition may be more informative than BMI when evaluating individuals, as BMI primarily reflects nutritional status rather than body fat distribution. [17,18] Most previous clinical trials used body weight[8,19-21] and body mass index[22,27] as predictors of distance walked in their reference equations, among other anthropometric variables. Only one clinical trial[12] included WC in the equation. In our study, both body weight and BMI were evaluated; however, WC demonstrated greater predictive power and was therefore retained in the final equation. Waist circumference, a surrogate marker of visceral adiposity, probably lacked relevance in the aforementioned studies simply because it was omitted from the anthropometric variables and not compared with other predictors. More recent

studies, such as that by Zhou et al,[23] using a metabolic score designed to assess abdominal obesity, demonstrated an inverse relationship between visceral fat and muscle mass in a large cohort of adults from the database of the National Health and Nutrition Examination Survey (NHANES). This association was more pronounced among overweight and obese individuals, which could help explain the inverse relationship between abdominal obesity and distance walked. Additionally, a physical rehabilitation program for patients with chronic heart failure (NYHA class II-III) without congestion showed that, independent of weight loss, decreases in visceral fat were directly associated with increases in the 6-minute walk distance.[24] We speculate that increased WC, as a surrogate marker of visceral adiposity, exerts a negative effect on gait performance. Potential mechanisms underlying this association have been attributed to chronic inflammatory response, insulin resistance, sedentary lifestyle, poor nutritional status, and hormonal changes associated with increased visceral adiposity. It is noteworthy that NC was also included among the anthropometric variables, as it is an easily obtainable measurement, representative of visceral adiposity, and has predictive value for cardiovascular mortality.[25,26] However, according to the statistical method used, it was not selected as a significant predictor of distance walked.

The mean distance walked observed in our cohort was statistically comparable to that reported in the multicenter studies conducted in Brazil[27] and Spain.[16] In the study conducted in a Chinese population by Zou et al,[28] a distinctive finding was observed: women achieved walking distances similar to those of men (mean difference < 50 m), with a significant difference observed for women ($p < 0.001$), but not for men ($p = 0.33$), when compared with our study population. We observed marked differences in walking distances compared with those reported in other populations[14,16,19,21,27-30], as well as in the predictive values obtained when applying foreign reference equations to our population (Table 3). Several factors may account for these differences beyond ethnic considerations, including the selected age range, inclusion of overweight or obese participants, comorbidities, regular physical activity, and academic level.

The 247 subjects included in this study reflect the proportions reported in the most recent Venezuelan National Population and Housing Census.[31] In particular, the sex distribution was similar, comprising 51% women and 49% men. The mean age of participants, ranging from 30 to 83 years, was 52.5 ± 12.5 years. Skin color distribution was also consistent with the 2011 census, with 49% White individuals and 51% mixed-race and Afro-descendant individuals.

In the present study, the distance walked was greater among participants with higher educational attainment than among those with only basic education. In addition, individuals who reported engaging in physical exercise for more than 1 h per week, distributed across two or more sessions, achieved greater walking distances than those who did not. Several studies have demonstrated these relationships with educational attainment, as well as with higher socioeconomic status, which has been linked to regular physical exercise. [32,33]

The study randomly assigned participants to either a 20- or 30-min rest interval between the two tests. No differences were observed between protocols; therefore, we recommend the use of a 20-min rest period, as it shortens the overall study duration.

We acknowledge several limitations of this study. First, this research was conducted at a single center and utilized a convenience sample, similar to pioneering studies in this field across other countries; therefore, our findings cannot be extrapolated to the general population. However, nearly 40% of the participants were from cities or towns in the country's interior. Second, the minimum age of recruited participants was 30 years; consequently, the equation cannot be applied to individuals younger than this age. Third, 19% of included subjects had well-controlled systemic hypertension, 12% were otherwise healthy smokers, and 7% had well-controlled asthma. However, all of these participants were clinically stable and considered healthy, thereby representing real-world individuals.

CONCLUSIONS

The present study, conducted in a native adult Venezuelan population with a broad age range and an adequate sample size, demonstrated that

Table 3. Distance walked during the 6MWT (m) across different populations and estimated distance obtained by applying Venezuelan data to foreign equations

Country (*)	Distance walked	Estimated distance	Distance- Venezuela	Reference	*p value*
EE UU	576♂ 494♀	576♂ 539♀	617♂ 547♀	Enright (19)	<0,001
Chile	644♂ 576♀	637♂ 578♀	617♂ 547♀	Osses (21)	<0,05
Brasil	614♂ 560♀	578♂ 529♀	617♂ 547♀	Britto (27)	NS
Saudi Arabia	409 (Δ)	474	581	Alameri (30)	<0,001
India	512♂ 457♀	486♂ 444♀	617♂ 547♀	Fernandes (29)	<0,001
China	623♂ 578♀	605♂ 554♀	617♂ 547♀	Zou (28)	NS ♂ - <0,001♀
Portugal	658♂ 605♀	615♂ 559♀	617♂ 547♀	Oliveira (14)	<0,001
España	615♂ 557♀	670♂ 605♀	617♂ 547♀	Gimeno-Santos (16)	NS

(*) Clinical trials with a sample size greater than 100 participants and a 30-meter corridor. In the Spanish study, 61% of the sample performed the 6MWT in a 30-meter corridor.
(Δ) Reports an equation not stratified by sex.

the values obtained from the 6-minute walk test (6MWT), estimated using the following equation: 6MWT = 278.7 − (58.6 × Sex) − (1.2 × Age) + (3.24 × Height in cm) − (2 × WC in cm) + (Sex × WC in cm), where Sex = 1 for men and 0 for women, differ from the results obtained when applying foreign reference equations to our population. In this study, waist circumference contributed independently to functional capacity, as measured by the distance walked during the 6MWT. The study also demonstrated that a 20-min rest interval provides results comparable to those obtained with a 30-min interval, thereby reducing the total time required to complete the two mandatory walks recommended by current guidelines.

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Conflict of interest.

None

AC reports receiving professional fees from Laboratorios La Sante for statistical analysis, which didn't have any interference in the conduct of the study or interpretation of the results.

Author contributions

HS and MG conceived the study. AC and HS designed the study with the collaboration of SG and MG. AC performed the data management and statistical analysis. G, MG, and HS conducted the fieldwork. HS, AC, SG, and MG contributed to the discussion and critical revision of the manuscript.

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ORIGINAL ARTICLE

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Patients with Asthma in Primary Care Versus a Salbutamol-Free Asthma Center Observational Study

Pacientes con asma en atención primaria versus un centro de asma sin salbutamol. Estudio observacional

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ABSTRACT

Introduction: Given the evidence against the prolonged use of short-acting beta2-agonists (SABAs), including an increased likelihood of exacerbations and mortality, the Global Initiative for Asthma (GINA) report no longer recommends SABA monotherapy. Since 2014, our asthma center at the Hospital from G. Baigorria (Argentina) has implemented a rescue strategy using budesonide/formoterol as anti-inflammatory maintenance and reliever therapy (AIR/MART), eliminating the use of SABAs. The Asthma Refer ID Questionnaire (ReferID) was designed to identify patients with uncontrolled asthma who should be referred to a specialist.

Objectives: To compare ReferID outcomes between a SABA-free asthma center and primary care using SABAs.

Materials and methods: This was an observational, cross-sectional, comparative study applying the ReferID questionnaire (which consists of four simple questions) between September 2020 and August 2021 at a public hospital in Buenos Aires, Argentina, and at the SABA-free asthma center between December 2021 and January 2022.

Results: The SABA-free asthma center achieved significantly better outcomes, including fewer courses of systemic corticosteroids (SCS) and fewer emergency department visits for asthma exacerbations. Eleven patients had been intubated before entering the SABA-free asthma center.

Conclusions: AIR/MART treatment without SABAs, combined with asthma specialist follow-up, significantly reduced SCS courses and emergency department visits compared with primary care management using SABAs.

Key words: asthma | anti-inflammatory reliever therapy | salbutamol

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RESUMEN

Introducción: Dada la evidencia en contra del uso prolongado de agonistas beta2 de acción corta (SABA), incluida la mayor probabilidad de exacerbaciones y mortalidad, el Informe de la Iniciativa Global para el Asma (GINA) ya no recomienda la monoterapia con SABA. Desde 2014, en nuestro centro de asma del Hospital de G. Baigorria (Argentina) implementamos una estrategia de rescate con budesonida/formoterol como mantenimiento y rescate antiinflamatorio (AIR/MART), eliminando el uso de SABA. El Cuestionario de Identificación de Derivación para Asma (REFID) se diseñó para identificar pacientes con asma no controlada que deben derivarse a un especialista.

Objetivos: Comparar los resultados del REFID entre un centro de asma sin SABA y la atención primaria con SABA.

Materiales y métodos: Estudio observacional, transversal y comparativo aplicando El REFID (consta de cuatro preguntas sencillas) entre septiembre de 2020 y agosto de 2021 en un hospital público de Buenos Aires, Argentina, y en el centro de asma sin SABA entre diciembre de 2021 y enero de 2022.

Resultados: El centro sin SABA logró resultados significativamente mejores, menos ciclos de corticosteroides sistémicos (SCS) y menos visitas a urgencias por exacerbaciones de asma. Los once pacientes que habían sido intubados; esto ocurrió antes de ingresar al centro sin SABA.

Conclusiones: El tratamiento AIR/MART sin SABA, junto con el seguimiento por un especialista en asma, redujo significativamente los ciclos de SCS y las visitas a urgencias en comparación con la atención primaria con SABA.

Palabras clave: asma | rescate antiinflamatorio | salbutamol

INTRODUCTION

Given the evidence against the prolonged use of SABAs, including an increased likelihood of exacerbations and mortality, the GINA report no longer recommends SABA monotherapy. In addition, the SABINA program indicated that overuse of SABAs remains a major global public health concern, highlighting a global burden, as 40% of the asthma population worldwide was prescribed three or more SABA inhalers annually.[2] Although there were differences in prescribing practices between primary care physicians (PCPs) and specialists, overprescription was common in both models of care. SABA monotherapy for mild asthma was prescribed at a higher frequency and volume by PCPs; conversely, SABA prescription rates for moderate-to-severe asthma were similarly high across both PCPs and specialists.[2] Only a small proportion of patients in the Latin American cohort were treated in primary care (11.8%). A greater proportion of these patients were prescribed ≥3 and ≥10 SABA inhalers (56.2% and 50.8%, respectively) compared with those who were managed by a specialist (37.3% and 21.9%, respectively). [3] Overprescription and over-reliance on SABAs are problems that affect everyone involved.

The ReferID questionnaire was designed to identify uncontrolled asthma requiring referral to a specialist.[4] ReferID consists of four questions, each with a yes/no recommendation for evaluation by a specialist. These four questions address the main risk factors associated with inadequate asthma management.

OBJECTIVES

To compare ReferID results in a tertiary hospital primary care setting with the specialty care provided by the world's first SABA-free asthma department.[5]

MATERIALS AND METHODS

Through an observational, cross-sectional, and comparative study, we aimed to highlight the advantages of the MART strategy, which remains underdisseminated and limited in availability, particularly in

countries such as Argentina.[1-3] Patients between 18 and 75 years of age with a diagnosis of asthma of at least 12 months of evolution were included in the study.

ReferID is a simple and concise tool that primary care physicians can use to quickly identify patients with uncontrolled or potentially severe asthma who may benefit from an evaluation by a specialist. The questions are as follows:

1) Has the patient received two or more courses of SCS or been on maintenance SCS therapy in the past 12 months?

2) Has the patient had two or more emergency or unscheduled visits for asthma within the last 12 months?

3) Has the patient ever required intubation or admission to an ICU due to asthma? 4) Has the patient used 3 or more SABA inhalers within the last 12 months?

The ReferID data was initially collected at a tertiary care level public hospital in Buenos Aires, Argentina, between September 2020 and August 2021. The population of patients with asthma using SABAs received care from general practitioners, internists, emergency department staff, and healthcare resources outside the hospital. The ReferID was also conducted at the public SABA-free asthma center between December 2021 and January 2022. Patients who had attended the SABA-free asthma center for at least 12 months completed the ReferID questionnaire. All patients at the SABA-free center received treatment with budesonide/formoterol as both maintenance and reliever therapy (AIR/MART).[6]

Statistical analysis

Quantitative variables with a normal distribution were expressed as the mean with standard deviation (SD). The Student's t-test for independent samples was used for continuous variables. A two-tailed Fisher's exact test was used to analyze the contingency tables, comparing the absolute numbers for each ReferID question between the hospital using SABAs and the center not using SABAs. The analysis was performed using GraphPad Prism 9 software (San Diego, CA, USA).

RESULTS

The hospital using SABAs included 105 patients with asthma, whereas the SABA-free center included 60. Table 1 shows demographic characteristics and main findings. Patients at the SABA-free asthma center received significantly fewer courses of systemic corticosteroids and made fewer emergency department visits or unscheduled consultations during the previous 12 months. Eleven patients in the non-SABA group required endotracheal intubation due to respiratory arrest before being admitted to the center. After admission, none of the patients required hospitalization.

DISCUSSION

This retrospective, observational study compared SABA-free asthma management with that of patients using SABA in primary care. It provides compelling evidence supporting the elimination of SABAs from asthma treatment protocols. Current guidelines do not recommend complete elimination of SABAs, despite evidence of a dose-response association with outcomes such as hospitalizations and mortality.[1-3] Particularly in resource-limited settings, such as low- and middle-income countries (LMICs), limited availability and

Table 1. Basal characteristics and main findings

ReferID Asthma Questionnaire	Hospital using SABAs	SABA-free hospital	*Difference
Sample size (males)	105 (31)	60 (18)	NS
Age in years (mean±SD)	43.82±16.2	45.5±14.6	NS
No. of patients on ICS/LABA	24	60	<.0001
Smoking: n (mean pack-years)	31 (10 pack-years)	22 (5 pack-years)	NS
≥2 courses of SCS the last 12 months: n	58	3	<0.0001
≥2 visits to the Emergency Department or unscheduled consultations the last 12 months: n	69	2	<0.0001
Intubation/admission to the ICU	14	11	0.4988
≥3 SABA units the last 12 months	76	0	N/A
Referral to a specialist is required	92 (87.6%)	11 (18%)	<0.0001

SD= standard deviation ICS/LABA: inhaled corticosteroids/long-acting beta-agonists ICU: Intensive Care Unit.

higher costs of inhaled corticosteroid-containing medications contribute to excessive reliance on SABAs. In addition, many physicians are unfamiliar with the evidence-based shift away from SABA monotherapy toward bronchodilator plus anti-inflammatory therapy as a safer and more effective option.[6] Our data support the SABA-free approach, specifically using the AIR/MART strategy at the Hospital of Granadero Baigorria in Argentina, which was associated with significantly better outcomes in patients with asthma.[7]

Despite the high standards of practice at their hospital, primary care physicians (SABA users) demonstrated poor asthma management. Simply eliminating SABAs from asthma treatment would improve most outcomes, as occurred with the hospitalization rate in the SABA-free asthma center.[7] Unfortunately, Montero Arias and colleagues showed that specialist care does not prevent SABA overprescription.[3] Indirectly, they showed that specialist care does not necessarily translate into better outcomes when SABA prescribing persists.

The most notable findings were substantial reductions in severe asthma exacerbations. Patients at the SABA-free asthma center received fewer courses of systemic corticosteroids (SCS) and had fewer emergency department visits compared with their counterparts in primary care who used SABAs. This indicates that combining a bronchodilator with inhaled corticosteroids (ICS), together with specialist follow-up, not only stabilizes asthma control but also reduces the burden on healthcare systems by minimizing acute exacerbations. The percentage of severe asthma cases that might require referral to an asthma specialist was significantly reduced compared with SABA users. Even more importantly, SABA users tended to overestimate asthma severity. Furthermore, the study highlights the effectiveness of the ReferID questionnaire in identifying uncontrolled asthma; however, excessive SABA use and overprescription may lead to an overestimation of the proportion of patients with severe asthma. This tool proved effective both in primary care and in the specialized center. However, the substantial improvement in patient outcomes observed at the SABA-free asthma center underscores the benefits of integrated specialist care combined with innovative management strategies.

Nevertheless, preventable asthma-related admissions and mortality continue to pose a public health challenge in Argentina.[8] The purpose of publishing this real-world experience was to disseminate optimized care strategies among local healthcare providers who lack direct access to these medications. According to GINA guidelines, Track 2 is the appropriate therapeutic pathway for Argentina, given its status as a developing nation.[1] Evaluating the ReferID tool was not our primary objective; however, the collected data proved highly effective for identifying and addressing entrenched clinical practices in Argentine primary care.

The elimination of SABAs in favor of a combined ICS/formoterol regimen is aligned with the latest recommendations of the Global Initiative for Asthma (GINA).[1] The findings support a paradigm shift in asthma management, advocating the abandonment of SABA monotherapy due to its associated risks of exacerbations and mortality. These findings have significant implications for clinical practice, suggesting that transitioning to SABA-free protocols may optimize patient outcomes.

Limitations

Although the ReferID tool has not undergone extensive psychometric validation comparable to the Severe Asthma Questionnaire (SAQ), it has been adapted and translated into 21 languages and is being implemented in more than 30 countries, suggesting strong face validity and clinical utility.[4]

The comparative analysis of ReferID in two distinct clinical settings introduces potential limitations related to contextual heterogeneity. Differences in healthcare infrastructure, staff training, patient demographic characteristics, and asthma management protocols may influence the performance and interpretation of the tool. Temporal bias was significant in the context of the pandemic. However, this favored our results because during 2020-2021 there was a marked reduction in asthma exacerbation rates; in this regard, it could be speculated that without the pandemic, the SABA group would have had

even worse outcomes.[9] Finally, the lack of pulmonary function testing and validated asthma questionnaires, such as the Asthma Control Test (ACT) must be considered.

CONCLUSION

This study provides further evidence that replacing short-acting beta-2 agonists with budesonide/formoterol, combined with specialized follow-up, improves asthma control and reduces severe asthma exacerbations in a low-income country. The complete elimination of salbutamol exceeds current guidelines and also offers an alternative approach to improving the quality of life of patients with asthma in Argentina.[6]

Conflict of interest

LJN received speaker fees from Novartis and AstraZeneca, and travel support from Boehringer Ingelheim and AstraZeneca. MS received fees for participating in medical education programs from AstraZeneca, GlaxoSmithKline, Sanofi, and ELEA. DP received fees as a speaker and for participating in advisory boards for GlaxoSmithKline, AstraZeneca, Sanofi, and ELEA. NB and OMF have no conflicts of interest to declare.

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PERSPECTIVES

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Integrated Diagnostic Approach in Pulmonology: Imaging, Volumetric Quantification, and Pulmonary Function Tests

El trípode diagnóstico en neumonología: Radiología, cuantificación volumétrica y función pulmonar

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Three complementary views of the same lung

In the evaluation of parenchymal lung disease, we have traditionally worked with two approaches: the expert eye of the radiologist, who identifies morphological patterns, and the objective measurements of the physiologist, who quantifies function. Both are indispensable, but they often remain isolated: the radiologist describes an "accentuation of the interstitium," the spirometer shows an FVC (forced vital capacity) of 67%, and we ask ourselves: do these two findings actually explain each other?

For years, we attributed this gap to the inherent complexity of correlating imaging and function. The issue is less complexity than **dimensionality**: radiologists have a two-dimensional, qualitative perspective that favor pattern recognition, while computational analysis provides a three-dimensional, quantitative perspective that enables volumetric measurement. These approaches are not mutually exclusive, but complementary: **radiologists see what the algorithm cannot recognize, and the algorithm measures what the human eye cannot quantify.**

Integrated diagnostic approach in action

This integrated approach is not merely theoretical: we have been using it systematically in our department, and results have altered therapeutic decisions in complex cases. The key concept is to recognize that:

- **Radiologists SEE but cannot measure:** they identify morphological patterns (honeycombing, ground-glass opacities, emphysema), recognize spatial distributions, and define phenotypes. However, they cannot quantify volumes or percentages with millimeter precision.
- **The algorithm MEASURES but cannot see:** based on voxel-by-voxel Hounsfield values, it identifies normal parenchyma, infiltrates, vascular structures, emphysema, and collapse, and calculates the volume of each compartment by lobe, segment, or region with digital precision. It quantifies total and compartmental volumes, calculates objective regional distributions, and enables reproducible numerical follow-up over time. However, it does not diagnose etiologies or recognize subtle morphological patterns: it cannot distinguish whether an infiltrate rep-

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resents fibrosis, pneumonitis, sarcoidosis, or edema.
– **Physiologists INTEGRATE:** they correlate structure (what is seen and what is measured) with the actual functional impact, guide therapeutic timing, and assess treatment response.

No perspective is superior to another: they are complementary, and all three are necessary when confronting complex phenotypes.

Index case: when no single perspective is enough

66-year-old male patient, 183 cm tall, 120 kg (BMI 35.8), former smoker with a 136 pack-year history presented with progressive dyspnea. Spirometry showed an FVC of 67% of the predicted value, FEV1 (forced expiratory volume in the first second) of 81%, and an FEV1/FVC ratio of 119%: a moderate restrictive pattern without obstruction.

First Perspective – Radiology (two-dimensional/qualitative)

The radiologist identified two relevant patterns: -Thickening of the subpleural interlobular interstitium is noted within the posterior segments of both upper and lower lobes. Additionally, there are scattered centrilobularand paraseptal low-attenuation areas in the upper lobes, consistent with centrilobular emphysema.

This description is precise and clinically relevant: radiologists **SEE the mixed pattern** (emphysema plus basal/posterior interstitial thickening). However, they cannot answer the following questions: how much of each component is present? Is it sufficient to explain an FVC of 67%?

Second Perspective – Quantification (three-dimensional/quantitative)

– We processed the same CT scan using volumetric segmentation (Lung CT Segmenter, 3D Slicer):
– Total lung volume: 4,118 ml
– Functional parenchyma: 3,254 ml (79.0%)
– Infiltration: 791 ml (19.2%)
– Emphysema: 521 ml (12.6%)
– Atelectasis/collapse: 643 ml (15.6%)
– Regional distribution: Ventral 13.1% vs. dorsal 24.2% infiltration

The algorithm **MEASURES** the volume of each compartment with precision. However, it cannot distinguish whether that "infiltration" represents fibrosis, pneumonitis, sarcoidosis, or edema: the algorithm measures, but it does not diagnose.

Third Perspective – Pulmonary Function

– FVC: 67% of the predicted value
– FEV1/FVC: 119% (without obstruction)
– Pure restrictive pattern

Integrating the Three Perspectives

No single perspective was sufficient on its own:
– **Radiology alone:** identifies the mixed pattern but does not quantify its functional impact.
– **Quantification alone:** measures volumes but does not define etiology or morphological pattern.
– **Pulmonary function alone:** documents restriction but does not explain the underlying structural mechanism.

Complete integrated diagnosis:

1. **Morphological pattern (radiology):** centrilobular emphysema plus basal/posterior interstitial thickening → the radiologist identifies **CPFE** (Combined Pulmonary Fibrosis and Emphysema)
2. **Quantitative correlation (volumetry):** Infiltration 19.2% + collapse 15.6% + emphysema 12.6% = 47.4% total involvement → **the numbers mathematically explain the FVC of 67%.**
3. **Functional phenotype (spirometry):** pure restriction without obstruction → consistent with a predominant restrictive mechanism.
4. **Clinical synthesis:** Defined CPFE with restrictive predominance. The ventral/dorsal gradient (13% vs. 24%) suggests a gravitational component of interstitial lung disease (ILD), rather than solely mechanical atelectasis related to obesity.

Integrated conclusion: The patient requires referral to a specialized ILD center for evaluation of antifibrotic therapy. This is not simply "obesity plus a subtle nonspecific pattern."

The integrated diagnostic approach worked because each pillar contributed unique and irreplaceable information: - The radiologist saw the pattern that defines the phenotype (CPFE). - Quantification measured the structural burden that correlates with function. -Spirometry objectively established the degree of functional impairment that guides therapeutic timing.

No single perspective replaces the others: they mutually enhance each other.

Why we need the third pillar (quantification) now

Descriptive terms ("accentuation," "multiple," "patchy") are valid for communicating patterns, but they do not allow for:

– **Quantitative structure–function correlation:** How many milliliters of infiltration are needed to reduce FVC by 10%?
– **Objective phenotyping in borderline cases:** Is 12% emphysema CPFE, or emphysema-dominant disease with minimal fibrosis?
– **Precise evolutionary follow-up:** Did the infiltration increase from 450 mL to 800 mL over 12 months, or is it simply interobserver variability?
– **Decisions based on therapeutic thresholds:** Have we crossed the cutoff point that justifies antifibrotic therapy according to clinical trials?

It's not that radiologists *must* measure: when we need the numbers to correlate with function or enable quantitative longitudinal follow-up, qualitative assessment (however precise) falls short.

Computational analysis does not replace the radiologist; rather, it complements their assessment with a dimensionality that morphological description alone cannot achieve.

Barriers to implementing the complete triad in Argentina

Volumetric lung quantification is not an experimental technology. The software is open source (3D Slicer), the segmentation techniques are internationally validated, and the regional analysis algorithms have been published. Nevertheless, its clinical adoption is minimal in our country.

Identified barriers:

1. **Absence of standardized Argentine protocols:** What slice thickness should be used? Which reconstruction kernel? Maximum inspiration or tidal breathing?
2. **Lack of consensus metrics:** Should we report absolute volume (mL), percentage (%), or mass (grams)? Should compartments be defined by HU density thresholds or by texture analysis?
3. **No population-based reference values:** There are no Argentine nomograms of normal lung volumes by CT according to age, sex, and height, adjusted for the ethnic characteristics of our population.
4. **Absence of explicit QA/QC (quality assurance/quality control) procedures:** How do we ensure the segmentation has no "leakage" into the mediastinum or chest wall?
5. **Limited professional training:** Diagnostic Imaging Departments don't have specific training in volumetric quantification.
6. **Inadequate acquisition for 3D reconstruction:** Many centers provide only a single plane (typically axial) or images in JPG/PNG format. **Volumetric analysis requires multiplanar acquisition (axial, sagittal, coronal) and delivery of the original DICOM files** that preserve the complete three-dimensional information. Without this minimum standard, volumetric quantification is impossible.

These barriers are not technical, but organizational and protocol-related. **We can address them through concerted, interdisciplinary effort. I invite readers to collaborate in establishing a formalized working group with the support and collaboration of the Argentinian Association of Respiratory Medicine (AAMR), which has been informed of this project this publication.**

Final notes

This editorial arises from direct clinical experience in using the diagnostic triad in complex cases. The objective is not to promote a specific technology, but to encourage a conceptual shift: moving from isolated disciplinary approaches toward systematic quantitative integration.

The interdisciplinary call is genuine: the success of this initiative depends on pulmonologists, radiologists, and physiologists working **as equals** in the construction of standards, rather than one discipline imposing its vision on the others.

Conflict of interest

The author has no conflict of interest to declare in relation to the content of this article. The software mentioned (3D Slicer) is open source and freely accessible, with no commercial affiliation.

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CASE REPORT

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Leukocytoclastic Vasculitis Associated with Pleural Tuberculosis. Case Report

Vasculitis leucocitoclástica asociada a tuberculosis pleural. Reporte de caso

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ABSTRACT

Tuberculosis remains a common disease in our setting and may involve various organs, including the pleura and, rarely, the skin. Leukocytoclastic vasculitis is an uncommon cutaneous manifestation that may represent an immune response secondary to infections such as tuberculosis. Although pleural tuberculosis is one of the most common extrapulmonary forms, it can be difficult to diagnose in the absence of direct bacteriological confirmation. We report the case of a 21-year-old immunocompetent male with no significant medical history who presented with exertional dyspnea, intermittent fever, and right-sided chest pain. Imaging studies revealed moderate right pleural effusion. The physicochemical analysis of the pleural fluid showed exudative characteristics with a predominance of lymphocytes and elevated levels of adenosine deaminase (ADA).

During the course of the illness, the patient developed rapidly progressive painful and pruritic skin lesions on the extremities. Skin biopsy confirmed leukocytoclastic vasculitis. Antituberculous therapy combined with tapering corticosteroid treatment was initiated, resulting in a favorable clinical evolution.

Although uncommon, the association between pleural tuberculosis and leukocytoclastic vasculitis has been reported as an immune-mediated manifestation secondary to tuberculosis infection. Early recognition of this association allows appropriate therapeutic management and may prevent complications.

Key words: pleural tuberculosis | leukocytoclastic vasculitis | adenosine deaminase | skin manifestations

RESUMEN

La tuberculosis continúa siendo una enfermedad frecuente en nuestro medio y puede comprometer diversos órganos, incluyendo la pleura y, en raras ocasiones, la piel. La vasculitis leucocitoclástica es una manifestación cutánea poco común, que puede representar

una respuesta inmunológica secundaria a infecciones, entre ellas la tuberculosis. Si bien la tuberculosis pleural es una de las formas extrapulmonares más frecuentes su diagnóstico puede dificultarse en ausencia de confirmación bacteriológica directa.
Se presenta el caso de un paciente masculino de 21 años, inmunocompetente y sin antecedentes patológicos, que consultó por disnea de esfuerzo, fiebre intermitente y dolor torácico en el lado derecho. Los estudios por imágenes evidenciaron derrame pleural en el lado derecho de grado moderado. El análisis físico químico del líquido pleural arrojó características de exudado con predominio linfocitario y niveles elevados de adenosina deaminasa (ADA).
Durante la evolución, el paciente desarrolló lesiones cutáneas dolorosas y pruriginosas de rápida aparición en extremidades. La biopsia cutánea confirmó el diagnóstico de vasculitis leucocitoclástica. Se inició tratamiento antifímico asociado a corticoterapia en dosis descendentes, con evolución clínica favorable.
La asociación entre tuberculosis pleural y vasculitis leucocitoclástica es infrecuente, pero ha sido descrita en la bibliografía como una manifestación inmunológica secundaria a la infección tuberculosa. El reconocimiento precoz de esta relación permite ajustar la conducta terapéutica y evitar complicaciones.

Palabras clave: Tuberculosis pleural | vasculitis leucocitoclástica | adenosina deaminasa | manifestaciones cutáneas

INTRODUCTION

Tuberculosis is an infectious and contagious disease, known as the "great imitator," and caused by *Mycobacterium tuberculosis*. It is considered one of the leading causes of infectious morbidity worldwide. Although the pulmonary form is the most common presentation, extrapulmonary involvement accounts for approximately 20% of cases; pleural tuberculosis is one of the most frequent forms.

The pleural form results from the spread of *Mycobacterium tuberculosis* to the pleural space, either due to rupture of a subpleural focus or via hematogenous dissemination. It typically presents as a unilateral pleural effusion with exudative characteristics and a predominance of lymphocytes. In many cases, direct microbiological confirmation is not obtained, and so the diagnosis is based on the integration of clinical, epidemiological, radiological, and biochemical findings, including the measurement of adenosine deaminase in pleural fluid, as well as molecular tests of the fluid or pleural biopsy. Early diagnosis is essential to prevent long-term sequelae.

On the other hand, leukocytoclastic vasculitis (LCV) is a histopathological entity characterized by the inflammation of small vessels with neutrophilic infiltrate, red blood cell extravasation, and leukocytolysis. Clinically, it presents with purpuric lesions, some raised and palpable, on the lower extremities, and may be triggered by infections, drugs, neoplasms, or autoimmune diseases. Leukocytoclastic vasculitis draws attention because it is often regarded as an isolated problem, or interpreted as a reaction of unknown cause, or in any case related to the use of medications (drug eruption).

Inflammation of small-caliber vessels may be associated with chronic diseases or persistent infections, such as tuberculosis, which induce immune system responses that are difficult to regulate. In this clinical context, immune complexes are formed and deposited, and as they accumulate, they generate tissue damage. In the presence of vasculitis with purpuric lesions, especially if accompanied by respiratory symptoms or pathological findings in complementary studies, it is essential to consider differential diagnoses.

At the same time, the diagnostic approach to pleural tuberculosis is strengthened by the use

of biomarkers such as ADA, which have proven useful in complex clinical contexts where conventional microbiology does not always provide conclusive results.

In this context, the objective of the present study is to describe a case report of pleural tuberculosis in a young patient whose associated manifestation was biopsy-confirmed leukocytoclastic vasculitis, a rare association. Likewise, it intends to highlight the importance of maintaining a comprehensive clinical perspective, epidemiologically contextualized and supported by appropriate diagnostic tools, in order to identify unconventional presentations of this respiratory disease.

CASE REPORT

A 21-year-old male patient was admitted in January 2025 to the Internal Medicine Department due to exertional dyspnea, intermittent fever of 38°C, right-sided pleuritic chest pain, and radiological findings consistent with moderate-to-severe right pleural effusion, with no significant past medical history. He was an immunocompetent patient; HIV serology was negative, and had no history of immunosuppression or use of immunosuppressive drugs.

During hospitalization, a diagnostic thoracentesis was performed. The fluid obtained had a cloudy yellow appearance and became clear after centrifugation. The analysis showed: glucose 63 mg/dL, LDH (lactate dehydrogenase) 401 U/L, and total protein 5.5 g/dL.

Pleural fluid cytology showed predominance of lymphocytes.

It was interpreted as an uncomplicated exudate. Pleural fluid cultures were negative for tuberculosis, fungal infections, parasites, and common bacteria. Given these findings, empirical antibiotic treatment was started with amoxicillin/clavulanic acid for six days, followed by piperacillin/tazobactam for another six days. The patient was subsequently discharged from the hospital.

Seven days after discharge, he attended a follow-up visit at the pulmonology outpatient clinic due to persistent fever associated with dyspnea. He reported close contact with a coworker who had been diagnosed with smear-positive pulmonary tuberculosis, establishing a positive epidemiological link. Close contact history had not been disclosed during hospitalization. On physical examination, the patient was afebrile, hemodynamically stable, alert, with good ventilatory mechanics, and oxygen saturation of 98% while breathing room air. Auscultation revealed hypoventilation at the right lung base.

Chest X-ray showed a homogeneous opacity in the lower third of the right hemithorax with blunting of the costophrenic angle; chest CT scan revealed loculated pleural effusion with underlying partial lung collapse and pleural thickening (Figure 1).

Given the imaging findings, persistence of symptoms, and confirmation of the epidemiological link, pleural puncture was repeated for ADA determination, which yielded a value of 39 U/L.

Based on the integration of the clinical, epidemiological, and biochemical findings, it was decided to start empirical antituberculous treatment (there was no bacteriological confirmation from the pleural fluid) with a four-drug regimen consisting of isoniazid (300 mg/day), rifampin (600 mg/day), pyrazinamide (1500 mg/day), and ethambutol (1200 mg/day).

The patient also reported the appearance of rapidly progressive pruritic and painful skin lesions on the upper and lower limbs, with distal-to-proximal distribution.

Physical examination revealed erythematous papules with a pale halo purpuric pattern, many of which were confluent, forming annular lesions (Figure 2). The patient had not yet started antituberculosis treatment.

A skin biopsy of the lesions with direct immunofluorescence was performed. At the same time, treatment with oral prednisone 20 mg/day was started, with a tapering regimen and weekly follow-up.

The histopathology report showed preserved epidermis, mixed perivascular infiltrate with neutrophils, eosinophils, and lymphocytes, fibrinoid necrosis in the wall of small-caliber vessels, and red blood cell extravasation. Direct immunofluorescence was negative. The definitive diagnosis was leukocytoclastic vasculitis.

After ten days of combined treatment with antituberculosis drugs and corticosteroids, clear improvement in the skin lesions was observed, with reduction of erythema, disappearance of the purpuric halo, and progressive clearing of the skin (Figure 3).

DISCUSSION

We present the clinical case of a young patient with no significant medical history who developed pleural tuberculosis associated with a rare dermatological manifestation. The clinical presentation began with nonspecific symptoms, fever, and dyspnea, accompanied by imaging findings consistent with right pleural effusion and characteris-

Figure 1. Chest CT scan. Right pleural effusion with loculations and pleural thickening.

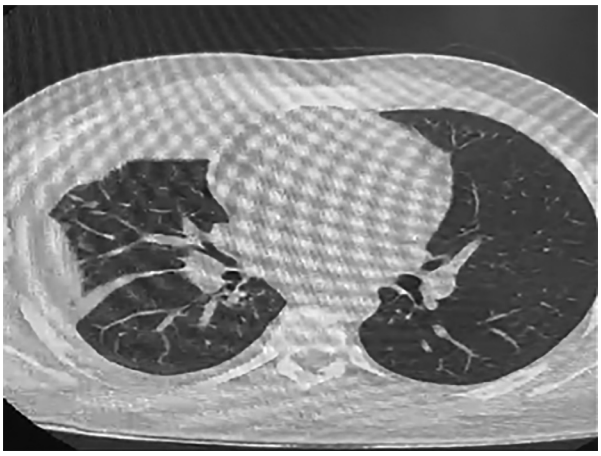

Figure 2. Active skin lesions (acute phase of vasculitis).

tic pleural fluid. Although the pleural fluid culture did not yield positive results, it showed parameters compatible with an uncomplicated exudate. This led to the inclusion of ADA measurement as an auxiliary diagnostic tool. With a value of 39 U/L (cutoff point 20 U/L), it was well above the threshold generally accepted in the medical literature for suspecting tuberculosis in lymphocytic effusions. This finding was interpreted together with

Figure 3. Skin lesions in clinical resolution.

Table 1. Clinical course of the case

Moment	Clinical event
Days 1-3	Hospitalization due to dyspnea, fever and chest pain Moderate right pleural effusion Thoracentesis: lymphocytic exudate
Days 4-10	Amoxicillin/clavulanic acid
Days 11-16	Piperacillin/tazobactam
7 days after discharge	Persistence of symptoms and imaging findings consistent with pleural effusion Epidemiological link to tuberculosis; ADA testing is requested
14 days after discharge	Presents with ADA result of 39 U/L. Initiation of antituberculosis treatment was decided (not yet started) Appearance of skin lesions Dermatologic evaluation
15 days after discharge	Biopsy: leukocytoclastic vasculitis
Treatment	Prednisone + antituberculosis treatment
Disease course	Progressive resolution of lesions

the rest of the symptoms to justify the decision to initiate antituberculous treatment, as mentioned by Zhang[1] and Porcel.[2]

The usefulness of ADA is further reinforced by the persistence of symptoms and the presence of a positive epidemiological link. For this reason, several authors emphasize that cases with compatible symptoms, elevated ADA levels, and known exposure can be treated even in the absence of confirmatory bacteriological tests, according to statements by Garzón et al[3] and Carabalí-Isajar.[4]

As the patient's clinical course progressed, an unexpected, highly clinically relevant finding emerged: painful, pruritic, rapidly progressive skin lesions developed on the upper and lower limbs. Following clinical evaluation and a biopsy, leukocytoclastic vasculitis was diagnosed. It is a type of vascular inflammation that affects the small vessels of the dermis and in many cases is associated with hypersensitivity reactions mediated by immune complexes. These complexes form and deposit in the vascular walls triggering an acute inflammatory response, a mechanism that has been described in both drug-related settings and chronic infectious conditions, as explained by Hernández-López.[5]

Specifically, the association between tuberculosis and cutaneous vasculitis has been documented in case reports and clinical reviews that identify *Mycobacterium tuberculosis* as an agent capable of generating persistent antigenic stimuli that trigger sustained activation of the immune system, involving T lymphocytes, macrophages, and cytokines such as TNF-α and IFN-γ. These mediators not only contribute to tissue damage at the primary site of disease, such as the pleura in this case, but may also provoke inflammation at distant sites, as reflected in the vasculitic skin lesions. Some authors consider this phenomenon an indirect manifestation of the systemic activity of the disease, as indicated by Arsanios[6] and Herrera.[7]

The favorable clinical response observed after the administration of antituberculosis treatment, together with the use of corticosteroids (tapering doses are always used to avoid secondary adrenal insufficiency), suggests that the vasculitis had a secondary origin linked to the active disease and did not correspond to a primary autoimmune or idiopathic entity.

Recent studies explain how the resolution of the disease often leads to spontaneous or accelerated remission of dermatological manifestations when accompanied by appropriately adjusted immunomodulatory treatment, as seen in this patient, who showed progressive improvement both in respiratory symptoms and in the appearance and sensitivity of the skin lesions, as demonstrated by Corrêa.[8]

The beta-lactam antibiotics initially administered (amoxicillin/clavulanic acid and piperacillin/tazobactam) have been reported as potential triggers of hypersensitivity-induced leukocytoclastic vasculitis. Therefore, their role in the development of the skin lesions cannot be completely ruled out. However, the persistence of the lesions after discontinuation of these antibiotics, together with their subsequent resolution after initiation of antituberculosis treatment, more strongly suggests an immunological mechanism secondary to active pleural tuberculosis.

Diagnosis of pleural tuberculosis

The diagnosis of pleural tuberculosis can be established through microbiological or histological confirmation; however, in a considerable number of cases, direct demonstration of *Mycobacterium tuberculosis* in pleural fluid is not possible. In these scenarios, the diagnosis may be supported by the integration of clinical, epidemiological, radiological, and pleural fluid biochemical criteria, which are widely described in the literature.

Among the most suggestive findings are the presence of unilateral pleural effusion, pleural fluid with exudative characteristics and lymphocytic predominance, elevated ADA levels, compatible constitutional symptoms, and the existence of an epidemiological link with active tuberculosis.

In this case, the patient exhibited several of these diagnostic criteria: intermittent fever, exertional dyspnea, and pleuritic chest pain; right-sided unilateral pleural effusion with pleural thickening on imaging studies; pleural fluid with exudative characteristics and lymphocytic predominance; an ADA value of 39 U/L; and a history of close contact with a case of smear-positive pulmonary tuberculosis.

The integration of these clinical, epidemiological, and biochemical findings made the diagnosis of pleural tuberculosis highly probable, prompting the initiation of empirical antituberculous treatment even in the absence of direct bacteriological confirmation. This diagnostic approach has

been supported by several studies that highlight the value of ADA in pleural fluid as a complementary tool in lymphocytic pleural effusions, particularly when interpreted together with the patient's clinical and epidemiological context.

Leukocytoclastic vasculitis

Leukocytoclastic vasculitis is a small-vessel vasculitis histopathologically characterized by neutrophilic infiltrate, leukocytoclasia, fibrinoid necrosis, and red blood cell extravasation. It typically manifests clinically as palpable purpura, erythematous papules, or purpuric lesions, predominantly on the limbs, though presentations can vary.

In this case, the patient developed rapidly progressive pruritic and painful skin lesions on the upper and lower limbs. Skin biopsy showed preserved epidermis, mixed perivascular infiltrate with neutrophils, eosinophils, and lymphocytes, fibrinoid necrosis of small-caliber vessels, and red blood cell extravasation, all consistent with leukocytoclastic vasculitis. Direct immunofluorescence was negative, which does not exclude the diagnosis, since it was established based on clinicopathological correlation.

The beta-lactam antibiotics initially administered (amoxicillin/clavulanic acid and piperacillin/tazobactam) have been reported as potential triggers of hypersensitivity-induced leukocytoclastic vasculitis. Therefore, their role in the development of the skin lesions cannot be completely ruled out. However, the persistence of the lesions after discontinuation of these antibiotics, together with their subsequent resolution after initiation of antituberculosis treatment, more strongly suggests an immunological mechanism secondary to active pleural tuberculosis.

Immunological mechanisms

The association between tuberculosis and cutaneous vasculitis is uncommon, but it has been described in the literature. It has been proposed that tuberculous infection may act as a persistent antigenic stimulus capable of inducing the formation and deposition of immune complexes in the walls of small vessels, with complement activation and neutrophil recruitment, thereby triggering the vascular damage characteristic of leukocytoclastic vasculitis.

In addition, the immune response to *Mycobacterium tuberculos*is involves activation of T lymphocytes, macrophages, and the release of proinflammatory cytokines, including TNF-α and IFN-γ, which may contribute not only to infection control but also to distant inflammatory phenomena. In this context, the cutaneous manifestations may be interpreted as a secondary immunological expression of the active disease and not necessarily as the result of direct dissemination of the microorganism to the skin.

Therapeutic response

The patient's clinical course was favorable following initiation of antituberculous therapy associated with oral corticosteroid treatment in tapering doses. After ten days of combined treatment, a clear improvement in the skin lesions was observed, with reduction of erythema, disappearance of the purpuric halo, and progressive clearing of the skin.

Treatment response is a clinically relevant element in the interpretation of the case. Although it does not by itself prove causality, the improvement of the lesions in parallel with the treatment of pleural tuberculosis supports the hypothesis of leukocytoclastic vasculitis secondary to the underlying infectious process. The concomitant use of corticosteroids likely contributed to more rapid control of the cutaneous inflammation.

Comparison with the literature

The association between pleural tuberculosis and leukocytoclastic vasculitis is uncommon. Most available reports describe cutaneous vasculitis associated with pulmonary or extrapulmonary tuberculosis, interpreted as secondary immunological phenomena. In this regard, this case is consistent with previously published reports by demonstrating a vasculitic manifestation in the setting of active tuberculosis, without evidence of systemic autoimmune disease and with favorable evolution after specific treatment.

This case is of additional interest because it involves a young immunocompetent patient with highly probable pleural tuberculosis from a clinical, epidemiological, and biochemical standpoint, associated with histologically confirmed leukocytoclastic vasculitis. The coexistence of both entities requires consideration not only of

infectious and pharmacological diagnoses, but also of the possibility of uncommon immunological manifestations of tuberculosis.

CONCLUSION

In this case, leukocytoclastic vasculitis was interpreted as an immune manifestation secondary to pleural tuberculosis.

Early recognition of this association enables timely diagnosis and initiation of appropriate antituberculosis treatment, potentially leading to a favorable clinical course.

Conflict of interest

The authors have no conflict of interest to declare.

Ethical considerations

The project was approved by the Ethics Committee of each institution, and the participant provided informed consent to take part in the study.

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CASE REPORT

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Diagnostic Challenges. Case Report: Deadly Triad of Tuberculosis, Aspergillosis and Squamous Cell Carcinoma of the Lung

Desafíos diagnósticos. Reporte de caso: Tríada mortal por tuberculosis, aspergilosis y carcinoma escamoso de pulmón

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ABSTRACT

Pulmonary tuberculosis remains a prevalent disease in Latin America and can coexist with other serious respiratory conditions, including lung cancer and opportunistic fungal infections. The overlap of these entities poses a diagnostic and therapeutic challenge, especially in patients with constitutional symptoms and hemoptysis. We present the case of a 62-year-old man with a three-month history of cough, hemoptysis, fever, night sweats, and weight loss. Chest computed tomography scan revealed an irregular mass of 4.2 × 6 cm in the right upper lobe with mediastinal lymphadenopathy. Bronchoscopy revealed friable, bleeding, exophytic endobronchial lesions that hindered visualization of segments I and II. Bronchoalveolar lavage detected Mycobacterium tuberculosis by Xpert MTB/RIF assay with high bacterial load and no rifampicin resistance. Cytological and histological studies confirmed squamous cell carcinoma of the lung. During the course of the illness, pulmonary cavitation was observed with imaging findings suggestive of aspergilloma, confirmed by Aspergillus spp. using galactomannan in bronchoalveolar lavage. Despite the initiated antituberculous and antifungal treatment, the patient experienced tumor progression and died three months after the initial diagnosis. This case illustrates the diagnostic challenges posed by coexisting tuberculosis, lung cancer, and pulmonary aspergillosis, underscoring the need to consider concomitant diagnoses in cases of atypical clinical presentation.

Key words: Pulmonary tuberculosis | Lung cancer | Pulmonary aspergillosis | Coinfection | Bronchoscopy | Hemoptysis

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RESUMEN

La tuberculosis pulmonar continúa siendo una enfermedad prevalente en América Latina y puede coexistir con otras patologías respiratorias graves, incluyendo cáncer de pulmón e infecciones fúngicas oportunistas. La superposición de estas entidades representa un desafío diagnóstico y terapéutico, especialmente en pacientes con síntomas constitucionales y hemoptisis. Presentamos el caso de un varón de 62 años con tres meses de evolución de tos, hemoptisis, fiebre, sudoración nocturna y pérdida de peso. La tomografía computarizada de tórax evidenció una masa irregular de 4,2 × 6 cm en el lóbulo superior derecho con adenopatías mediastinales. La broncoscopía mostró lesiones endobronquiales exofíticas friables y sangrantes que dificultaron la observación de segmento I y II. El lavado broncoalveolar detectó Mycobacterium tuberculosis mediante Xpert MTB/RIF con alta carga bacilar y sin resistencia a rifampicina. Los estudios citológicos e histológicos confirmaron carcinoma escamoso pulmonar. Durante la evolución se observó cavitación pulmonar con imágenes sugestivas de aspergiloma, confirmándose Aspergillus spp. mediante galactomanano en lavado broncoalveolar. A pesar del tratamiento antituberculosis y antifúngico instaurado, el paciente presentó progresión tumoral y falleció tres meses después del diagnóstico inicial. Este caso ilustra la complejidad diagnóstica de la coexistencia de tuberculosis, cáncer pulmonar y aspergilosis pulmonar, así como la importancia de considerar diagnósticos concomitantes ante evolución clínica atípica.

Palabras clave: Tuberculosis pulmonar | Cáncer de Pulmón | Aspergilosis pulmonar | Coinfección | Broncoscopia | Hemoptisis

INTRODUCTION

Tuberculosis (TB) continues to be a major infectious disease in Latin America and worldwide. An estimated 1.7 billion people are infected with *Mycobacterium tuberculosis*.[1] Clinical suspicion of the disease generally includes: cough for 2 to 3 weeks, lymphadenopathy, fever, night sweats, weight loss, and hemoptysis, together with epidemiological history of exposure to the disease. The diagnosis of the disease is definitively established through the isolation of *Mycobacterium tuberculosis*.[2] Among imaging studies, chest X-ray may be performed; however, chest computed tomography (CT) is more sensitive for detecting early parenchymal and lymph node involvement not apparent on radiographs.

Aspergillosis encompasses several forms of disease, including chronic pulmonary aspergillosis (CPA), caused by the proliferation of microorganisms of the *Aspergillus spp*. genus in the lungs of individuals with structural lung disease. Its prevalence varies greatly worldwide; for example, it is estimated at 43 cases per 100,000 people in the Democratic Republic of the Congo and Nigeria.[3] Because CPA often develops late, colonizing residual cavities left by tuberculosis, its burden is greater in regions with a high incidence of TB.[4] The main forms of presentation of CPA are aspergillomas and *Aspergillus spp*. nodules.

Lung cancer continues to be the leading cause of cancer-related death worldwide, according to the World Health Organization (WHO).[5] WHO classification defines pulmonary squamous cell carcinoma by immunohistochemistry studies that currently allow for more precise subtyping through molecular testing, guiding therapeutic decision-making and improving prediction of clinical outcomes.

Diagnosis is fundamentally based on obtaining histological samples through biopsy, since most patients present with advanced stages of the disease and are not candidates for surgical treatment.

Although the coexistence of tuberculosis, lung cancer and pulmonary aspergillosis is rare, it is clinically relevant due to its impact on prognosis and therapeutic decision-making. Clinical overlap among these entities –persistent cough, hemoptysis, fever and weight loss can hinder early diagnosis and delay initiation of appropriate therapy.

We present a case that illustrates the diagnostic and clinical-course challenges associated with the

coexistence of these three entities, which we refer to as a "deadly triad."

CASE REPORT

62-year-old man, with no biomass exposure, denied any history of smoking and had no prior medical or surgical history, but had an epidemiologic history of exposure to a tuberculosis-endemic area.

He presented with a three-month history of persistent cough, hemoptysis of approximately 10 mL daily, diaphoresis, fever up to 38.6°C, night sweats, and a 12-kg weight loss.

Initial physical examination revealed mucocutaneous pallor, blood pressure of 100/80 mmHg, tachycardia of 110 beats per minute, respiratory rate of 22 breaths per minute, and arterial O_2 saturation of 78% on room air, at an altitude of 3,600 meters above sea level. Additionally, the patient presented with 1st-degree jugular venous distension. Pulmonary chest examination showed decreased vocal fremitus, crackles, and rhonchi predominantly in the right interscapular region, with relative dullness to percussion. The remainder of the physical examination was unremarkable.

Complementary examinations

Laboratory findings: complete blood count showed hematocrit: 37%; hemoglobin: 12 g/dL; white blood cell count: 11,000 cells/mm³, and 92% neutrophils; elevated PCR; and the remaining blood chemistry values within normal limits, with a negative rapid HIV test.

Imaging: the patient underwent an admission chest X-ray, which showed a heterogeneous radiopacity with irregular borders in the apical region of the right lung field (Figure 1). High-resolution contrast-enhanced computed axial tomography revealed a 4.2 × 6 cm irregular mass in the right upper lobe invading the middle lobe, obstructive atelectasis, and lymphadenopathy in stations 4R, 7, 10R, and 11, as well as a pleural effusion of approximately 150 mL (Figure 2).

Diagnostic and therapeutic **flexible bronchoscopy** was performed for control of pulmonary bleeding upon hospital admission. The procedure findings highlighted the following: Right upper lobe with irregular mucosa, friable exophytic papillary formations that bled on contact, and elevated bronchial mucosa hindering visualization of segments I and II; in the middle lobe, extrinsic compression observed at the 3 o'clock position (Figure 3).

An 80 cc cold saline lavage was performed for bleeding control, followed by biopsy and cytology sampling with bronchoalveolar lavage (**BAL**). Finally, tranexamic acid was instilled for bleeding control.

Figure 1. Posteroanterior chest radiograph showing heterogeneous radiopaque image in the apical and lateral region of the right lung field.

Figure 2. Contrast-enhanced computed axial tomography image, lung window, showing irregular mass with poorly defined borders in the right upper lobe.

BAL was positive for Mycobacterium tuberculosis by Xpert MTB/RIF, with high bacillary load and no rifampicin resistance detected. BAL culture was positive for *Streptococcus pneumoniae* sensitive to cephalosporins, and the cytological and histological report was compatible with squamous cell carcinoma of the lung. Immunohistochemistry demonstrated expression of p40, p63, and CK6, confirming non-keratinizing squamous cell carcinoma.

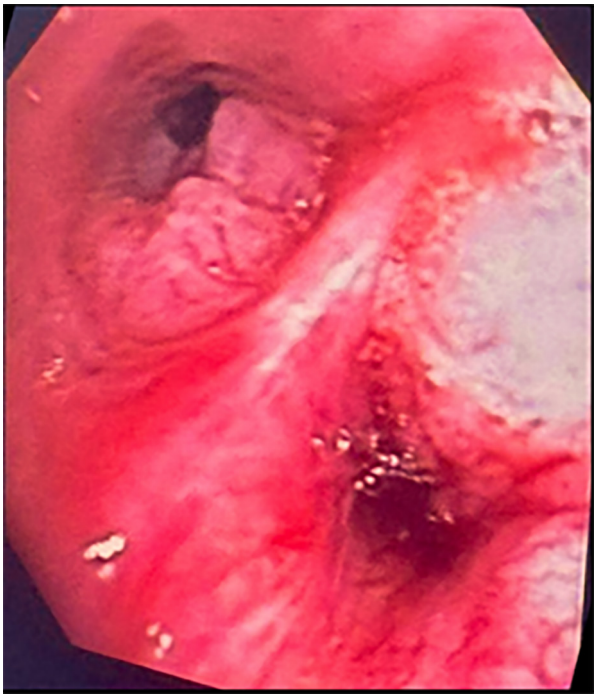

Figure 3. Video fibrobronchoscopy image showing right upper lobe and segments I and III with friable, exophytic papillary lesions with bleeding, obstruction of segment II, and irregular bronchial mucosa.

Figure 4. Computed axial tomography image, lung window, at the right lower lobe level, showing cavitary lesions with the air crescent sign (arrow) and an Aspergillus nodule. Mild right pleural effusion also observed.

Antituberculous treatment was initiated with the standard regimen of isoniazid, rifampicin, ethambutol, and pyrazinamide, together with third-generation cephalosporin for 7 days due to the isolation of *Streptococcus pneumoniae*. Oncology evaluation determined advanced stage IV disease. As the patient was not a candidate for surgical treatment, palliative systemic therapy was suggested, with chemotherapy sessions to be initiated after resolution of the infectious processes.

At three months, the patient presented clinical deterioration, with progressive grade III dyspnea and hemoptysis of 18 cc within 24 hours. A follow-up tomography scan was performed, revealing tumor growth, with an 8.4 × 9.6 cm mass in the right upper lobe invading toward the inferior vena cava, as well as cavitary nodular formations in the right lower lobe suggestive of aspergilloma, with the air crescent sign (meniscus sign). (Figure 4)

A new bronchoscopy was performed due to suspected pulmonary aspergillosis and for partial control of bleeding. BAL analysis for galactomannan confirmed the presence of *Aspergillus spp*. Systemic antifungal treatment with voriconazole was initiated, and maintenance tuberculosis treatment (isoniazid and rifampicin) was continued at doses per kilogram of weight, with poor tolerance. Despite the therapeutic measures initiated, the patient experienced an unfavorable clinical course with tumor progression, and died three months after being diagnosed with tuberculosis, chronic pulmonary aspergillosis, and squamous cell carcinoma of the lung.

DISCUSSION

Post-primary tuberculosis among adults is common in our setting, particularly when there is prolonged exposure in an endemic area, such as this case. Symptoms and physical findings vary and may include: persistent cough for more than two weeks, fever, diaphoresis, hemoptysis, and weight loss. However, these findings are also associated with lung cancer, thus it is important to rule out one disease or the other. A CT scan of the chest is useful in patients with suspected TB and for detecting lung cancer, as it can reveal small lesions not visible on chest radiographs. It is particularly useful for detecting hilar or mediastinal lymphadenopathy, and the CT may also show consolidation, cavities, pleural effusions, and/or fibrotic lesions that cause distortion of the pulmonary parenchyma.[6] The association between TB and lung cancer has become increasingly evident. The National Cancer Institute of China found that pulmonary tuberculosis was related to an increased lung cancer risk –after active smoking and socioeconomic status– with an odds ratio of 2.1 (95% CI: 1.4-3.1).[7] Similarly, another meta-analysis study found that tuberculosis was associated with a

1.78-fold increase of lung cancer risk among non-smokers, with a relative risk of 1.6 (95% CI: 1.2-2.1).[8]

The diagnosis of squamous cell carcinoma of the lung is based on the identification of keratin production by tumor cells and/or the presence of desmosomes. Immunohistochemistry is compatible with this subtype when there is expression of markers such as p40, p63, and CK5/6. The variants include the keratinizing, non-keratinizing, and basaloid subtypes.[9] In this case, immunohistochemistry showed expression of p40, p63, and CK5/6, confirming the diagnosis of non-keratinizing squamous cell carcinoma.

Tumors are established by morphology as keratinizing (with keratinization); non-keratinizing (without keratinization), or basaloid (when this pattern comprises more than 50% of the tumor). In non-keratinizing carcinomas, immunohistochemistry is essential to differentiate between squamous cell carcinoma, solid adenocarcinoma, and large cell carcinoma. In this context, diffuse reactivity with squamous markers is recommended, with p40 as the most specific marker, as p63 may also be expressed in adenocarcinomas.

Squamous cell carcinoma of the lung classically presents with a central location and develops through a sequence of metaplasia, dysplasia, and carcinoma in situ; however, at present it may also occur as a peripheral lesion.[10] Both central and peripheral forms may show extensive necrosis with cavitation. A small subgroup of well-differentiated central tumors presents as exophytic papillary endobronchial lesions, which usually manifest with persistent cough, recurrent hemoptysis, or repeated respiratory infections secondary to airway obstruction. This latter form of presentation corresponds to this case, demonstrating from the onset of symptoms the association between tuberculosis and squamous cell carcinoma of the lung.

Chronic pulmonary aspergillosis is usually preceded by some form of structural lung disease, often with residual cavities, bullae, or scarring. Specific risk factors include pulmonary tuberculosis, which is the most important risk factor globally.[11] Madden Aeet et al found a combined prevalence of chronic pulmonary aspergillosis (CPA) of 13% after treatment for pulmonary tuberculosis.[12] The two forms of presentation of CPA include aspergilloma, which appears as a well-formed round mass within a preexisting cavity, commonly referred to as a "fungus ball" or "mycetoma." An aspergilloma may sometimes present with air pockets or calcification inside it and has the characteristic crescent shape known as the "air crescent sign," an image demonstrated in the clinical case; the other form of presentation is *Aspergillus* nodules, which form when fungi replicate locally in the pulmonary parenchyma, unlike aspergillomas, which develop within preexisting cavities.[13]

Finally, in this case, the high mortality rate associated with lung cancer must be considered, particularly when concomitant tuberculosis and chronic pulmonary aspergillosis coinfections are present, as these worsen the prognosis and may preclude systemic oncologic treatment.

CONCLUSION

The coexistence of pulmonary tuberculosis, squamous cell carcinoma of the lung, and pulmonary aspergillosis is uncommon but clinically relevant, posing a significant diagnostic challenge because of overlapping clinical manifestations and radiological findings. This concurrence may lead to diagnostic delays, negatively affecting patient outcomes and prognosis.

This case highlights the need to maintain a high index of suspicion and to perform a comprehensive diagnostic evaluation in patients with hemoptysis and complex pulmonary lesions, especially in settings with a high prevalence of tuberculosis. It also underscores the importance of considering concomitant diagnoses in the presence of atypical clinical evolution, while promptly incorporating microbiological, radiological, and histopathological diagnostic tools.

A timely multidisciplinary approach is essential to optimize therapeutic decision-making, improve clinical outcomes, and reduce the morbidity and mortality associated with these complex pathological interactions.

Conflict of interest

Authors have no conflicts of interest to declare.

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CASE REPORT

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Magnet-assisted Rigid Bronchoscopy for Removal of a Peripheral Metallic Airway Foreign Body in Pediatrics: A Case Report

Broncoscopia rígida asistida con imán para la extracción de un cuerpo extraño metálico periférico en pediatría: Reporte de caso

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ABSTRACT

Foreign body aspiration is a frequent pediatric emergency and may be associated with significant morbidity and mortality. The removal of metallic foreign bodies located in peripheral bronchial regions represents a technical challenge, particularly when conventional instruments do not allow adequate access. We report the case of a 7-year-old pediatric patient with aspiration of a metallic foreign body (pin) lodged distally in the right bronchial tree. Due to the inability to visualize and extract the object using standard bronchoscopic techniques, a handmade magnet-assisted device was introduced through a rigid bronchoscope under fluoroscopic guidance. This approach allowed complete removal of the foreign body in a short operative time and without complications. Magnet-assisted rigid bronchoscopy under fluoroscopic guidance represents a safe and effective alternative for the extraction of peripheral metallic foreign bodies in the pediatric airway, especially when conventional instrumentation proves insufficient.

Key words: rigid bronchoscopy | foreign body | pediatrics | airway | magnet

RESUMEN

La aspiración de cuerpos extraños en la vía aérea constituye una urgencia frecuente en pediatría y puede asociarse a una elevada morbimortalidad. La extracción de cuerpos extraños metálicos localizados en regiones bronquiales periféricas representa un desafío técnico, especialmente cuando los instrumentos convencionales no permiten un acceso adecuado. Se presenta el caso de una paciente pediátrica de 7 años con aspiración de un

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cuerpo extraño metálico (alfiler), localizado distalmente en el árbol bronquial derecho. Ante la imposibilidad de visualización y extracción mediante técnicas broncoscópicas habituales, se utilizó un dispositivo artesanal imantado introducido a través de un broncoscopio rígido bajo guía radioscópica, lo que permitió la extracción completa del objeto en un tiempo operatorio breve y sin complicaciones. La broncoscopia rígida asistida con imán guiada por radioscopia constituye una alternativa segura y eficaz para la extracción de cuerpos extraños metálicos periféricos en la vía aérea pediátrica, especialmente en situaciones en las que el instrumental convencional resulta insuficiente.

Palabras clave: broncoscopia rígida | cuerpo extraño | pediatría | vía aérea | imán

INTRODUCTION

Foreign body (FB) aspiration in the pediatric population is a major cause of morbidity and mortality and a common clinical emergency, particularly in children under 5 years. Factors such as immature swallowing mechanisms, absence of molar teeth, age-related oral exploratory behavior, and inappropriate habits such as playing with objects in the mouth contribute to its high incidence.[1,2]

Removal of FBs located in peripheral regions of the lung poses a considerable technical challenge, particularly when small metallic objects are involved. The narrow caliber of the pediatric bronchial tree and the high density of these objects predispose them to distal migration, hindering visualization and retrieval with conventional instruments.[1]

Rigid bronchoscopy has traditionally been considered the procedure of choice for FB extraction in pediatric patients because it provides adequate airway control and ventilation, while allowing the use of larger-caliber instruments. However, flexible bronchoscopy offers the advantage of accessing more distal airways, although its therapeutic utility is limited by the small diameter of the working channel, which in pediatric bronchoscopes may be as narrow as 1.2 mm.[3]

Extracting smooth, metallic FBs that are impacted or have migrated distally beyond the reach of forceps or retrieval baskets, is technically challenging and potentially hazardous.1 In the absence of commercially available magnet-assisted devices, some centers have developed improvised technical adaptations to facilitate retrieval of these objects.[1,4,5]

The aim of this report is to describe a combined technique using rigid bronchoscopy and magnet-assisted retrieval under fluoroscopic guidance for removal of a metallic foreign body lodged in the peripheral airway of a pediatric patient.

CASE DESCRIPTION

A 7-year-old girl presented with a history of metallic foreign body aspiration (pin). Imaging studies demonstrated the object lodged within the anterior segment of the right lower lobe (Figure 1). Therapeutic bronchoscopy was indicated. The procedure was performed under general anesthesia. Initial rigid bronchoscopy using a telescope followed by flexible bronchoscopy failed to visualize the FB, which was detectable only under fluoroscopic guidance. Given this situation, a custom-made retrieval device was assembled to facilitate extraction. The device consisted of a suction cannula with a magnet secured to its distal tip with adhesive tape. This design was intended to attract and mobilize the foreign body into a more proximal bronchial segment or achieve complete extraction. The device was firmly secured to the instrument to prevent detachment during the procedure. Before clinical use, an ex vivo preprocedural test confirmed device stability under loads exceeding those anticipated during the intervention, with no evidence of detachment. Under fluoroscopic guidance, the magnetized cannula was introduced through the rigid bronchoscope (Figure 2), and complete retrieval of the foreign body was achieved without the need for additional maneuvers or associated complications. Total procedural time, measured from insertion of the rigid bronchoscope to removal of the object, was

Figure 1. Chest radiograph. **A.** Anteroposterior projection: A linear metallic foreign body (arrow) is observed projecting over the right hemithorax at the level of the lower third of the lung field. **B.** Lateral projection: The foreign body is localized within the posterior lung field, consistent with a peripheral location in the right lower lobe.

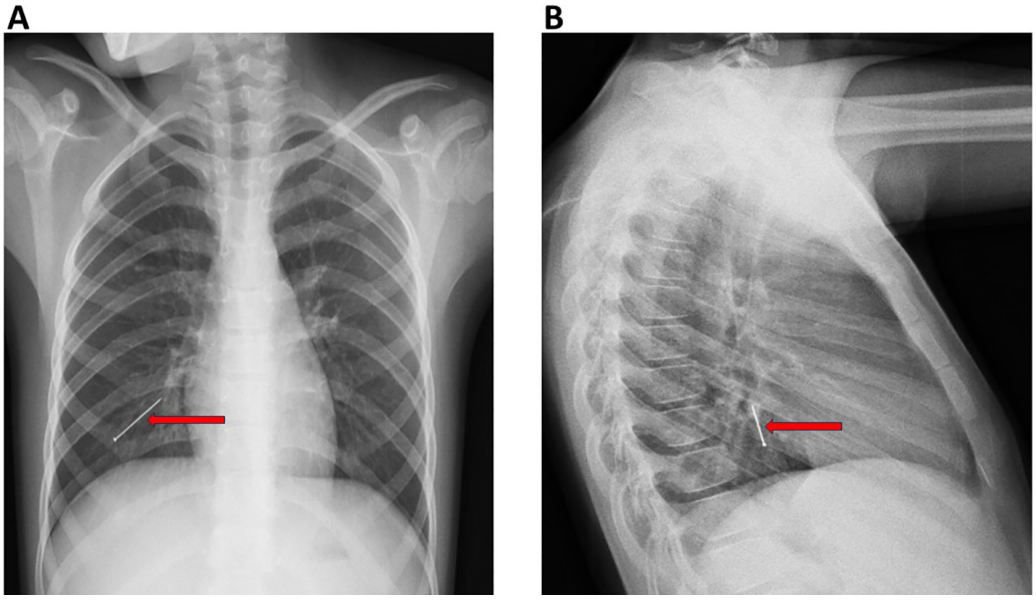
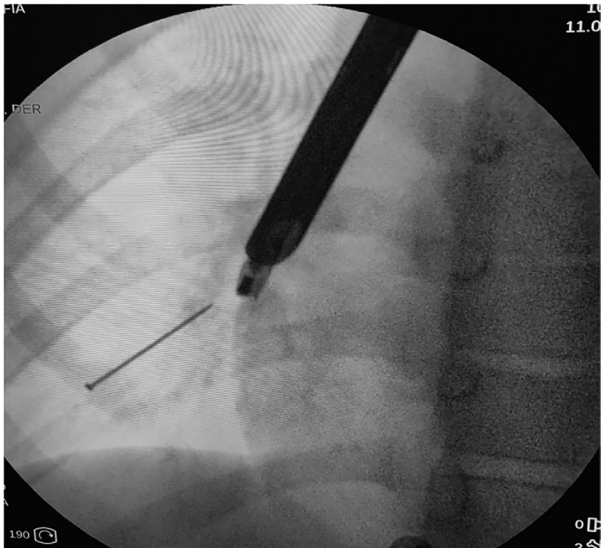


Figure 2. Intraoperative fluoroscopic image. A rigid bronchoscope is visualized within the airway. Through the bronchoscope, a suction cannula with a magnet attached to its distal tip can be identified. Inferior to and in direct relation with the magnet, a metallic foreign body consistent with a pin is observed. The spatial arrangement suggests effective magnetic attraction, with alignment of the foreign body toward the distal end of the device.



less than 1 minute. No bronchial mucosal injury or postoperative complications were observed.

Written informed consent for the procedure and publication of the case was obtained from the patient's parents.

DISCUSSION

Removal of metallic FBs lodged in peripheral regions of the airway remains a challenge in pediatric bronchoscopy. Limitations of conventional instruments, combined with the small bronchial caliber in children, may prolong procedural time and increase the risk of complications. Magnet-assisted rigid bronchoscopy offers an effective, accessible, and low-cost alternative in selected cases. Use of a magnet allows a traumatic mobilization of smooth metallic FBs that would otherwise be difficult to grasp using forceps or retrieval baskets, particularly when they cannot be directly visualized endoscopically.

Although previous reports have described the use of magnet-assisted devices for airway foreign body retrieval, their application in pediatric patients remains limited.[1,4,5] In the present case, the technique enabled rapid and safe extraction, thereby avoiding more prolonged or invasive procedures. The main limitations of this report include the description of a single case and the use of a custom-made device. Nevertheless, this experience suggests that the technique may be particularly useful in young children, in whom the dimensions of the bronchial tree restrict the use of conventional retrieval maneuvers. Magnet-assisted rigid bronchoscopy under fluoroscopic guidance represents a safe and effective technique

for removal of metallic foreign bodies lodged in peripheral regions of the pediatric airway. Its implementation may reduce operative time and help avoid more invasive procedures in selected cases.

Conflict of interest

Authors have no conflicts of interest to declare.

Funding

This study received no external funding.

Ethical considerations

Written informed consent for publication of the case was obtained from the patient's parents. Because this was a single case report, institutional ethics committee approval was not required.

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HIGHLIGHTS

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2026 SMNyCT Congress Comprehensive Treatment Of Dr-Tb

Congreso SMNyCT 2026 Tratamiento integral de la tuberculosis resistente

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[1]Medical Advisor at the Fundación Damien MDR-TB expert at the Instituto de Medicina Tropical de Amberes Provides technical assistance to National Tuberculosis Programs and conducts national and international courses on TB and MDR-TB.

The situation of drug-resistant tuberculosis (DR-TB) is dramatic. Worldwide, only 2 in 5 drug-resistant tuberculosis cases are diagnosed, with global coverage of molecular diagnostic testing remaining low at 54%. Operational management should include frequent monitoring of medications. The onset of the bactericidal activity varies among medications (bedaquiline takes about one week, whereas linezolid exhibits rapid onset). Half-lives also differ; some, such as bedaquiline, persist in the body for many months (5–6 months), and if patients discontinue therapy, there is a risk of developing resistance to this drug. Adverse events may also occur at different rates depending on the population. In Niger, nearly 30% of cases of severe myelotoxicity were reported, requiring a change in therapy. The 15-year experience with rifampicin-resistant tuberculosis control in Niger is a locally adapted strategy associated with high adherence rates and treatment success in that country. In Niger, the RR-TB control program began operating in 2008, in collaboration with the Fundación Damien and under national guidelines based on local evidence and a standardized approach for rifampicin-resistant tuberculosis (RR-TB). In 2014, Xpert machines were first introduced to diagnose rifampicin-resistant tuberculosis (RR-TB), and by 2019, 71 operational machines were distributed throughout the country, alongside 4 RR-TB treatment units. The therapies used have changed over time, but they are accompanied by nutritional supplements and frequent home visits by the healthcare professionals in charge. The fully oral bedaquiline/fluoroquinolone–streptomycin (BDQ/FQ-STR) regimen has replaced injectable-containing regimens since 2021 (including bedaquiline [BDQ], high-dose levofloxacin [Lfx], linezolid [Lzd], clofazimine [Cfz], high-dose isoniazid [Hh], prothionamide [Pto], and pyrazinamide [Z]). For pre-XDR TB, it includes delamanid (Dlm), BDQ, Lzd, Cfz, Hh, and Z. Dlm was used because pretomanid (Pa) was not available in Niger until April 2025. All RR-TB patients diagnosed in Niger between 2008 and 2022 (15 years) were evaluated. During that period, 872 patients were diagnosed with RR-TB, 725 (83.1%) started treatment, and 32 required retreatment. Diagnosis was made through different testing methods: between 2008 and 2013 (phenotypic testing), 2014 and 2018 (regional molecular testing), and 2019 and 2022 (decentralized molecular testing), the annual average number of RR-TB cases starting treatment increased from 22 to 50 and 85, respectively, while the mean time from

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diagnosis to first RR-TB treatment decreased from 260 to 17 and 11 days. The proportion of diagnosed cases that did not start treatment decreased from 34.1% to 12.8% and 12.6%. Loss to follow-up during treatment increased from 8.8% to 13.5% and 19.8%. Overall, 81.7% experienced successful treatment outcome (725 cases). Loss to follow-up during treatment was 18.3% and was associated with older age, female sex, low BMI, RR-TB/HIV coinfection, high baseline bacillary load, and treatment initiation between 2019 and 2022. This model of RR-TB management strategy in Niger over 15 years (2008–2022) has shown that the proportion of cases not entering treatment decreased over time, reflecting improved access to care. The implementation of Xpert MTB/RIF (Mycobacterium tuberculosis/rifampicin) drastically reduced diagnostic delays and the loss of patients waiting to start treatment. Treatment enrollment coverage for RR-TB was remarkable (83.1%), as was the treatment success rate (81.7%), which contrasts with global averages worldwide (50–65% during the same period). The experience described here could serve as a model for other countries, given its high treatment success. However, adherence improvement strategies should be considered specifically for female patients, older individuals, those with malnutrition, high baseline bacillary load, and HIV coinfection.

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LETTER FROM THE PRESIDENT OF THE AAMR

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Halfway through: progress and challenges

A mitad de recorrido: avances y desafíos

Carlos Brescacin[1],

[1] President of the AAMR (Argentinian Association of Respiratory Medicine)

Dear colleagues,

It is an honor for me to write these lines addressed to all the readers of this prestigious review, but above all to have the opportunity to speak once again to the members of AAMR.

Six months of our administration have already passed, and I would like to take this opportunity, first of all, to thank all those who daily provide support and work tirelessly for the development and growth of the association, as well as to highlight some of the activities and guidelines that have shaped this first half of my term.

We continue to reaffirm our institutional commitment to taking a stand on the social issues that impact the quality of life of the population, especially the most vulnerable. We maintain as an active policy the provision of educational support aimed at professionals and the community on various topics such as: tuberculosis, new forms of nicotine consumption, awareness campaigns, among others.

We are working to support the participation of new professionals approaching the Association, even from their undergraduate training stage, to foster a suitable environment of continuity within the triad of University, Residency, and Scientific Society. To this end, we are managing an agreement with the Association of Medical Schools of the Argentine Republic (AFACIMERA), aimed at strengthening this interaction in the long term.

Likewise, our international relations are building new strategic ties that allow us to continue growing and positioning ourselves as leaders in respiratory health.

We have maintained active collaboration in analyzing the current challenges affecting the Public Health system through our participation in the Inter-Societies Forum, a space created to help build consensus on potential solutions for the State's decision-making bodies.

In the economic sphere, it is undeniable that we have witnessed a sudden and global shift in the dynamics of international relations, culminating, unfortunately, in the ongoing war in the Middle East.

This situation has had a strong impact on the global economy, with the prospect of a long-term recession. Internally, it has reinforced the need to maintain limited expenditures and highlighted the importance of reviewing and taking action regarding the economic and financial sustainability tools available to the Association.

Based on the consensus suggested by the Strategic Plan –an open tool for all members who wish to participate– we agreed to implement a qualitative platform for institutional strengthening. Through this platform, we have been working on a sequential challenge aimed at creating spaces for academic development, such as enhancing the existing educational and dissemination bodies, primarily through work and investment in RAMR, and seeking to adopt tools such as RedCap.

As a cardinal guideline of management, we decided to form the Pro-Institutional Headquarters Committee to conduct a theoretical analysis of the

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society's long-term needs and prepare a report with potential inclusion criteria to facilitate the timely acquisition of real estate.

We have chosen to study and analyze the update of our society's bylaws, with the objective of validating participatory tools that strengthen the federal development of the institution.

This is undoubtedly a brief overview of the main actions achieved to date, but one that proudly leads us to consider that all our efforts aim to build a strengthened and cohesive professional association in the face of the social context that challenges us daily—though there is still much ground to cover.

To all those who accompany us with effort and personal sacrifice, my deepest gratitude, for none of this would be possible without you.

Once again, AAMR is all of us.

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IN MEMORY

ISSN 1852-236X

Dr. Juan Carlos Figueroa Casas

Juan Carlos Figueroa Casas passed away peacefully at the age of 86 on February 17, 2026, at his home, surrounded by his beloved family, after a brave battle with his illness.

He was born on September 10, 1939, in Rosario, Province of Santa Fe. He was the son of Professor Pedro José Figueroa Casas, a pioneering figure and leading teacher of Argentine gynecology.

Juan Carlos earned his medical degree from the Faculty of Medical Sciences in Rosario in 1964.

For one year, he was a fellow at the Centro de Rehabilitación Respiratoria María Ferrer, directed by Professor Aquiles Roncoroni. Between 1965 and 1967, he completed a fellowship at Baylor University in Houston, Texas.

He was full professor of Medical Pathology at the Faculty of Medical Sciences in Rosario, and director of the Pulmonology specialty training at that University.

In addition to his roles as Head of Intensive Care and Pulmonology at the Hospital Centenario in Rosario, he was also in charge of the Department of Respiratory Medicine at the Sanatorio Británico and the Instituto Cardiovascular de Rosario.

He was the author of numerous works in his specialty, which were published in national and international journals; and he was a member of the editorial board of the Chest Journal in the United States.

He was a founding member of the Argentine Society of Intensive Care, which he presided over during 1976; Governor and Regent of the American College of Chest Physicians; and President of the Argentine Association of Respiratory Medicine.

Throughout his career, he had a distinguished role as a speaker at national and international conferences.

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Specialized in Intensive Care and Clinical Pulmonology, he was an opinion leader in the field; he pioneered advances in COPD management, and his teachings were embraced by his many disciples.

Juan Carlos dedicated more than 50 years to teaching Pulmonology and Intensive Care, where he inspired thousands of students and physicians with his passion for medicine and his unconditional support.

Retired from his academic and professional activities in recent years, he devoted himself to his family: his seven children –two of whom are distinguished physicians– 22 grandchildren, and 3 great-grandchildren.

Juan Carlos was a kind and considerate man, known for his gentle spirit and generosity. His family, friends, and all who knew him will deeply miss him.

The legacy of his leadership continues to be a beacon of inspiration for all of us who knew him.

Dr. Juan Antonio Mazzei
Academia Nacional de Medicina

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IN MEMORY

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Dr. Juan Carlos Figueroa Casas

With deep sorrow, the Argentine pulmonology community, through the Argentine Association of Respiratory Medicine (AAMR), bids farewell on February 17, 2026, to Dr. Juan Carlos Figueroa Casas, a pillar of the specialty in our country. He was a specialist in Pulmonology and Critical Care, Director of the Hospital del Centenario in Rosario, and also Head of the Intensive Care Unit for more than 20 years. He was Director of the post-graduate program in Pulmonology, where he trained generations of specialists. He was appointed a Member of the National Academy of Medicine in 2016, and also served as Head of the Chair of Medical Pathology at the Universidad Nacional de Rosario, as well as a member of the Board of the American College of Chest Physicians (ACCP) and of the Editorial Committee of the CHEST journal.

Those of us who write this tribute, having known Dr. Figueroa Casas both professionally and personally for more than 25 years –through the AAMR and even before its creation– bear witness to his work, and do so with pride, knowing that a warm and enduring friendship developed over time.

There is so much to say about him... so we will summarize his main achievements. First, he was an excellent organizer –meticulous and attentive to detail– who guided the work of his collaborators with respect, tolerance, and the strength of his own effort and example.

His second virtue was humility. He was a professor, respected by national and international peers for his knowledge, scientific contributions, and published work. He was a natural teacher. His presentations attracted large audiences, and despite that prestige, he remained approachable and friendly with everyone, always responding with respect and kindness. His third virtue was generosity, which helped many colleagues participate in international conferences. This is undoubtedly the most important sign of generosity, which in our field is unfortunately uncommon.

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He was a strong advocate of a more federal approach of the profession, and as a physician from outside the capital city, he sought to balance the devouring metropolis with doctors who, despite technical limitations, practice our specialty with a spirit of service in every corner of the country.

On a personal level, he was a great human being and friend. It was always a pleasure to speak with him about a wide range of topics—from AAMR matters to national news or the latest article in the New England Journal of Medicine, which he had, of course, already read. His beloved Gracie often accompanied him, reflecting the deep family affection that characterized his large and close-knit family.

We have lost a unique person—a natural leader with a remarkable human and academic character—who leaves us a great example to follow and sets a high standard for future generations of pulmonologists and AAMR leaders, who will look to the figure of Dr. Juan Carlos Figueroa Casas for inspiration. We will remember him as a great captain, steering the ship of our beloved AAMR to a safe harbor, and leading us—his crew—with firmness, conviction, and humility.

For all this and so much more, farewell forever, our CAPTAIN!!!

Dr. Eduardo Schiavi **Dr. Ana María López**