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Research Letter

Comparison of 2005 and 2021 American Thoracic Society/ European Respiratory Society Criteria for Bronchodilator Response

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In 2021, the American Thoracic Society (ATS)/European Respiratory Society (ERS) statements were revised, and the criteria for bronchodilator response (BDR) test were changed.[1] The 2005 criteria (old criteria) were ≥12% and ≥200 mL in forced expiratory volume in 1 second (FEV1) and/or forced vital capacity (FVC) from baseline;[2] however, the 2021 criteria (new criteria) are >10% of the predicted value in FEV1 and/or FVC. The major limitation of the old criteria is that the absolute and relative changes in FEV1 and FVC are inversely proportional to baseline lung function and are associated with height, age, and sex in both health and disease.[1] The change was to reduce the association of baseline lung function (sex, age, and height differences) in assessing BDR by using the change in FEV1 and/or FVC relative to predicted values. It is unclear how changing from the old to the new criteria would change the patient population with BDR in clinical practice. This study compared cases meeting the old and new criteria in asthma patients in clinical practice. The subjects included 190 asthma patients who underwent BDR tests using short-acting β2 agonist (30 μg procaterol) inhalation according to a previous methods[3] at our hospital from April 2014 to March 2018. Bronchodilator response tests were accumulated and compared for cases meeting the old and new criteria. The Shizuoka General Hospital ethics committee approved this study (approval number: SGHIRB#2021035, date: August 26, 2021) and permitted the use of the information in the database. The data acquired were kept anonymized. Since this was a retrospective study, the Board waived patient approval or informed consent.

Among 190 patients (mean age ± standard deviation 60 ± 15 years; 106 females; median (interquartile range) body mass index, 22.9 (21.0-26.8) kg/m^2) who underwent the BDR test, 38 (20.0%) were positive by the old criteria and 34 (17.9%) by the new criteria. Thirty-one patients were positive by both old and new criteria. Table 1 and Figure 1 show the patients with negative or positive conversions between 2005 and 2021 ATS/ERS BDR criteria, that is, 2005, ≥12% and 200 mL in

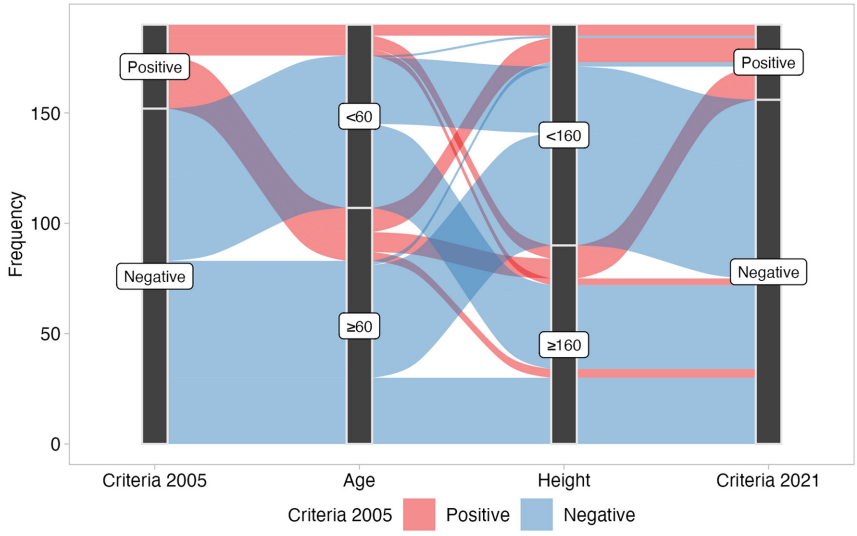

Figure 1. River plot of the relationship between positive or negative bronchodilator response, age (years), and height (cm).

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Table 1. Patients with Negative or Positive Conversions Between 2005 and 2021 American Thoracic Society /European Respiratory Society Bronchodilator Response Criteria

						2005 BDR					
						Changes in FVC		Changes in FEV1		2022 BDR	
Age, years		Sex	Height, cm	Weight, kg	BMI, kg/m²	mL	%	mL	%	FVC, %	FEV1, %
Negative conversion											
1	53	Male	173	60.4	20.2	10	0.2	**300**	**12.6**	0.2	8.5
2	65	Male	168	76.0	27.1	**270**	**13.6**	**240**	**24.7**	7.3	7.9
3	62	Male	165	79.3	29.2	60	2.0	**240**	**12.5**	1.6	8.0
4	59	Male	169	58.1	20.5	−30	−1.3	**230**	**14.1**	−0.8	7.1
5	70	Male	165	98.8	36.3	**200**	9.3	**200**	**12.7**	5.8	7.1
6	16	Male	176	93.0	30.1	**420**	**17.9**	**320**	**19.3**	9.2	7.6
7	75	Male	162	55.6	21.2	**310**	**21.2**	20	**2.2**	9.7	0.8
Mean, n = 7	57	NA	168*	74.5	26.4	177	9.0	221	14.0	4.7	6.7
Positive conversion											
1	70	Female	156	49.7	20.4	**250**	10.0	190	**13.9**	**10.4**	**10.1**
2	69	Female	150	59.2	26.5	**330**	11.1	140	5.0	**11.1**	5.5
3	63	Male	157	49.3	19.9	140	8.0	190	**16.4**	6.0	**10.0**
Mean, n = 3	67	NA	154	52.7	22.4	240	9.7	173	11.8	9.2	8.5
Overall mean, n = 190	60	84/106	160	62.6	24.4	79	2.8	65	4.9	2.5	2.6

The bold values meet positive criteria.
ATS, American Thoracic Society; BDR, bronchodilator response; BMI, body mass index; ERS, European Respiratory Society; FEV1, forced expiratory volume in 1 second; FVC, forced vital capacity; NA, not applicable.
*$P < .007$ compared to the overall mean value.

FEV1 and/or FVC from baseline, and 2021, >10% of the predicted value in FEV1 and/or FVC, respectively. Seven patients who were positive by the old criteria but negative by the new criteria were taller and younger than the overall mean. Three patients who were negative by the old criteria but positive by the new criteria were shorter and older than the overall mean. The new criteria are based on predicted values as denominators, which become smaller in lower-height and older subjects, leading to larger BDRs.[4] A positive conversion from the old criteria to the new criteria in 3 patients was caused by this effect.

The new criteria are more stringent because the denominator is the predicted FEV1 (L), which considers height and age. Some cases went from positive to negative and vice versa. Some were negative in the FEV1 evaluation but positive in the FVC evaluation. Bronchodilator response in FVC, rather than FEV1, has been shown to better reflect the physiological processes of air trapping.[5-8] It is essential to evaluate BDR not only by FEV1 but also by FVC.

The new criteria are affected by height and age, so caution should be taken in interpreting the results. The ability of an acute response to bronchodilators to predict future clinical status other than survival is unclear, and BDR does not accurately differentiate between types of airway diseases.[9] Further evidence is needed to determine whether BDR is associated with outcomes other than survival.

Ethics Committee Approval: This study was approved by Ethics Committee of Sizuoka General Hospital, (SGHIRB#2021035, Date: August 26, 2021).

Informed Consent: Since this was a retrospective study, the Board waived patient approval or informed consent.

Peer-review: Externally peer-reviewed.

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