Conversion equations of fractional exhaled nitric oxide (FeNO) levels measured by two portable and a stationary analyzers.

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Abstract

Background: Fractional exhaled nitric oxide (FeNO) levels have been more widely accepted as noninvasive useful markers to diagnose and control bronchial asthma properly. In Japan, two stationary and two portable FeNO analyzers are now available. We previously compared the FeNO levels measured by two stationary (NOA280i, Sievers, Boulder USA and NA623N, CHEST Inc. Tokyo, Japan) and one portable (NIOX MINO, Aerocrine, Solna, Sweden) analyzer and derive a conversion equations (Munakata M 2005, Saito J 2010).
Purpose: The purpose of this study is to compare FeNO levels measured by a stationary FeNO analyzer (NA623N) and two portable analyzers (NIOX MINO, and NObreath, Bedfont, UK) and derive conversion equations.
Methods: Thirty-two subjects (14 non-treated asthma cases, 13 asthma cases treated with inhaled corticosteroids, 5 healthy subjects) were enrolled in the study.
Results: There was a strong positive correlation between FeNO(NObreath) and FeNO(CHEST (r=0.969, p<0.001), and MINO (r=0.973, p<0.001). However, when FeNO (CHEST) and FeNO(MINO) were compared in all subjects, the levels of FeNO(MINO) were significantly lower than those of FeNO(CHEST) (p<0.001). But the levels of FeNO(NObreath) were not significantly lower than those of FeNO(CHEST). The following conversion equations were derived; FeNO(CHEST) = FeNO(MINO) x 1.16 + 4.578, FeNO(CHEST) = FeNO (NObreath) x 0.953 + 5.779.
Conclusion: When FeNOs are measured by different analyzers, differences in measured levels among each devices should be taken into consideration.

Background

- Fractional exhaled nitric oxide (FeNO) levels have been more widely accepted as noninvasive useful markers to diagnose and control bronchial asthma properly[1-3].
- In Japan, two stationary and two portable FeNO analyzers are now available.
- We previously compared the FeNO levels measured by two stationary (NOA280i®, Sievers, Boulder USA and NA623N®, CHEST Inc. Tokyo, Japan) and one portable (NIOX MINO®, Aerocrine, Solna, Sweden) analyzer and derive a conversion equations[4, 5].

FeNO (NOA280i®, Sievers) = FeNO (NA623N®, CHEST) x 0.994 – 0.431 [4]
FeNO (NA623N®, CHEST) = FeNO (NIOX MINO® , Aerocrine) x 1.278 + 3.065 [5]

Purpose

The purpose of this study is to compare FeNO levels measured by a stationary FeNO analyzer (NA623N®) and two portable analyzers (NIOX MINO®, and NObreath®, Bedfont, UK) in the same subjects, and to derive conversion equations.

Stationary FeNO analyzers

NOA280i®, Sievers (made in USA)

NA623N®, CHEST Inc. (made in Japan)

Portable FeNO analyzers

NIOX MINO®, Aerocrine (made in Sweden)

NObreath®, Bedfont (made in UK)

Methods

Subjects ; From September 2009 to November 2009, thirty-two subjects were enrolled in the study.(14 non-treated asthma cases, 13 asthma cases treated with inhaled corticosteroids, 5 healthy subjects). All subjects consented to the study.

Measurement ; They were measured twice by three analyzers (NObreath®, NIOX MINO®, NA623N®) ,and we analyzed the mean of each FeNO levels.
order : ① NObreath® → ② NIOX MINO® → ③ NObreath®
→ ④ NIOX MINO® → ⑤ NA623N® → ⑥NA623N®

Results

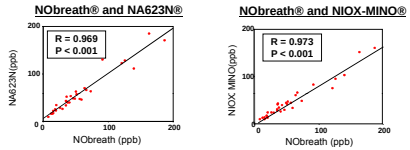
Tab.1 Characteristics

	Healthy (n=5)	Non-treated BA(n=14)	Treated BA (n=13)
Gender (M/ F)	4 / 1	6 / 8	7/ 6
Age (yr)	34.0 (26.5- 41.5)	45.7 (35.8- 55.6)	59.0 ¶ (51.0- 67.0)
Height (cm)	168.3 (159.5- 177.1)	161.3 (154.9- 167.6)	162.8 (157.0- 168.6)
Body Weight (kg)	62.3 (55.6- 69.0)	58.7 (50.0- 67.3)	65.1 (58.0- 72.1)
FeNO (ppb)			
NA623N®	29.3 (7.77- 50.8)	64.3 (39.6- 89.0)	64.5 (33.4- 95.6)
NIOX-MINO®	23.4 (7.18- 39.6)	52.3 (28.8- 75.7)	50.0 (26.5- 73.4)
NObreath®	25.0 (7.87- 42.1)	66.8 (38.3- 95.4)	55.6 (28.1- 83.2)

¶ ; p < 0.05 (vs Healthy)
Data were shown as geometric mean and 95% confidence intervals

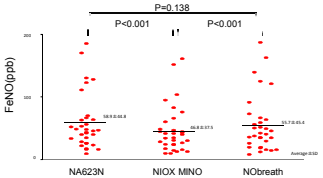
Age was significantly higher in treated BA group than healthy group.
FeNO was higher in BA group than healthy group, but not significantly.

Fig.1 Relationship of FeNO levels



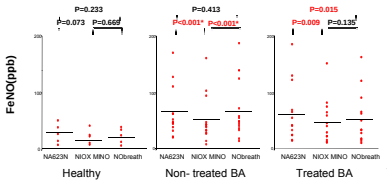
There was a strong positive correlation between FeNO(NObreath) and FeNO(NA623N, and NIOX MINO).

Fig.2 FeNO levels in all subjects



The levels of FeNO(MINO) were significantly lower than those of others.
But the levels of FeNO(Nobreath) were not significantly lower than FeNO(NA623N).

Fig.3 FeNO levels in each subject group



In healty subjects, the levels of FeNO(NIOX MINO) were not siginificantly lower than others.
In non-treated BA, the levels of FeNO(NIOX MINO) were siginificantly lower than others.
In treated BA, the levels of FeNO(NIOX MINO) were siginificantly lower than FeNO(NA623N).

Summary of the result and conversion equation among different FeNO analyzers

FeNO(NA623N®) = FeNO(NIOX-MINO®) x 1.278 + 3.065

FeNO(NA623N®) = FeNO(NObreath®) x 0.953 + 5.779

FeNO cut off levels for the diagnosis of asthma

FeNO (NA623N®)	> 40 ppb [1-3]
FeNO (Sievers®)	> 40 ppb
FeNO (NObreath®)	> 36 ppb
FeNO (NIOX MINO®)	> 29 ppb

Conclusion

When FeNOs are measured by different analyzers, differences in measured levels among each devices should be taken into consideration.

References
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