Birleşik Havayolları Hastalıkları ve Nebulizasyon Tedavilerine Güncel Bakış

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Birleşik Havayolu Hastalıkları - Tanım

Astım ve rinit beyinden burun ve akciğere inen sekresyonlar nedeniyle oluşur.’ *Claudius Galenus (129-216)*

Solunum yolları inflamasyonu

Üst ve Alt Havayollarının altta yatan tek hastalığı Tedavi benzer olmalı

Giavina-Bianchi P et al. *J Asthma Allergy*.2016;9:93-100.

Neden Birleşik Havayolları Konsepti?

- Astım öncesi rinit görülür
- Rinit semptomları astım kontrolünü zorlaştırır
- **Astım belirtileri alerjik rinit ağırlığından etkilenir.**
- Nazal semptomlar da alt solunum yolu tutulumundan etkilenir.

Passalacqua G, Ciprandi G, Canonica GW. Curr Opin Allergy Clin Immunol. 2001;1:7-13

Neden Birleşik Havayolları Konsepti?

Tek millet, iki devlet

Tek illet, iki havayolu!

Giavina-Bianchi P et al. *J Asthma Allergy.*2016;9:93-100

ARIA

Allerjik rinit sıklıkla astımla birliktelik gösterir veya öncesinde görülür. WHO tarafından desteklenen Allergic Rhinitis and Its Impact on Asthma (ARIA), yaklaşımı Allerjik rinitin astım için bir risk faktörü oluşturduğunu ve ayrıca her alerjik rinitli hastada astım da düşünülmesi gerektiğine dikkat çekmektedir.

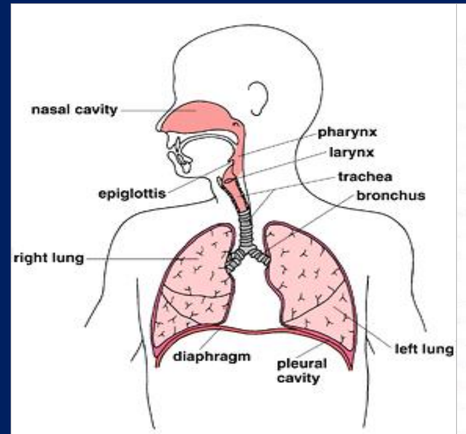
Bousquet J, van Cauwenberge P. J. Allergy Clin. Immunol. 2001;108(Suppl. 5):S23–S35.

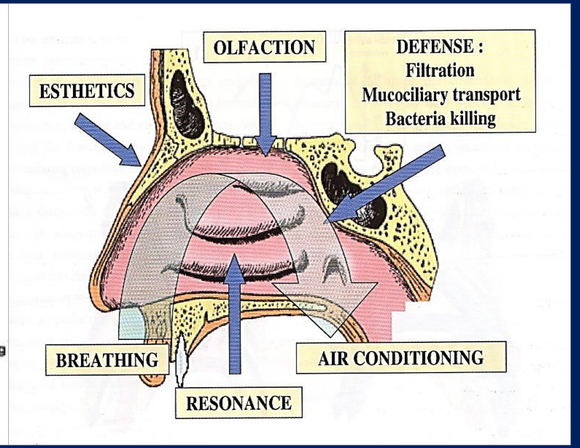
ARIA 2016: Care pathways implementing emerging technologies for predictive medicine in rhinitis and asthma across the life cycle

ARIA 2001

1. Semptomların ağırlık ve kalıcılığına göre yeni bir alerjik rinit sınıflaması
2. Astım ve allerik rinitin morbiditesine dikkat çekmek
3. Rehberler geliştirmek
4. Tüm dünyada bu anlayışı hakim kılmak

Anatomik, yapısal ve işlevsel benzerlikler





Üst ve alt solunum yollarının benzerlikleri

Yapısal:

- Burun ve bronş mukozaları bazal membran üzerinde psödo- stratifiye silyalı kolumnar epitelden oluşur.
- Bazal membranın altında damar, salgı bezleri, yapısal hücreler ve sinirlerin olduğu submukoza vardır. nerves.

İşlevsel:

Her ikisi de akciğere havanın girip çıkmasını sağlar.

Her ikisi de partikülleri tutarak savunmada rol alır.

5-10um boyutlarındaki partiküller burunda tutulur,

Daha küçük olanlar alt solunum yoluna iner.

Epidemiyolojik veriler

Benzerlikler:

Üst ve alt havayolları bir bütünlük içinde uzanırlar.

Differences:

Aynı yapılardan oluşurlar (silyalı epitel, bazal membran, lamina propria, salgı bezleri ve goblet hücreleri –birleşik havayolunu oluşturur.

- **Farklılıklar:**
- Nazal mukoza, kemiğe yapışıktır ve damarlardan zengindir. Bronş mukozası ise kıkırdağa yapışıkıtır ve düz kas hücrelerinden zengindir.
- Öz. Allerjik yanıtın erken evresinde: Üst havayolları obstrüksiyonunun ana nedeni vazodilatasyon ve ödemdir. Alt solunum yolu obstrüksiyonu düz kasların kasılmasından kaynaklanır.

Okano M et al. Allergol Int. 2015;64(2):131-138.

Birleşik Havayolu Hastalığı

- Allerji çocuklarda yaygın
  - Okul çağı astımlı çocukları %80-90'ı
  - *"Treat the sneeze - prevent the wheeze"* ~ E. Bronsky
- Allerjinin varlığı daha ağır ve persistan astım ile ilişkili

Allerjik olsun olmasın rinit yeni astım gelişimi ve astımın uzun sürmesi için bir risk faktörü [1,2]

690 hasta, 23 yıllık izlemde

Rinitli hastada astım görülme insidansı %10.5

Riniti olmayanada astım görülme riski %3.6. [3]

1. Shaaban R et al. Lancet 2008;372:1049–57.
2. Rochat MK et al. J Allergy Clin Immunol. 2010;126(6):1170-5
3. Settipane RJ et al. Allergy Proc.1994;15(1 71-5.

Astımda alerjinin rolü

- Üst ve alt havayolları arasında etkileşim var.
- Astımlıların %**80**'inde rinit var. Rinitlilerin %10-40'ında astım var. – 'Tek havayolu, tek hastalık'
- Allerjik astımlıların %98.9'unda, non-alerjik astımlıların %78.4'ünde rinit semptomları var.

Bousquet J et al. Allergy 2008;63(Suppl 86):8-160.

Allerjik olsun olmasın rinit yeni astım gelişimi ve astımın uzun sürmesi için bir risk faktörü [1,2]

690 hasta, 23 yıllık izlemde

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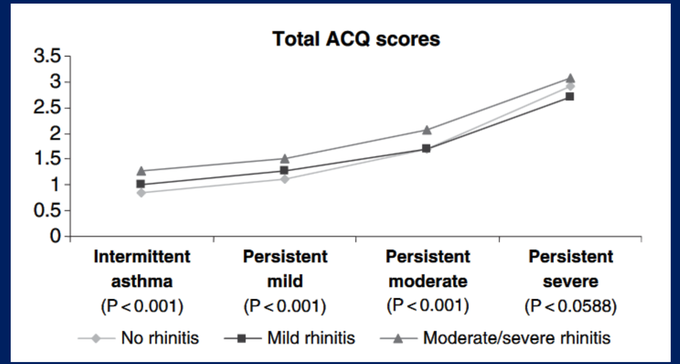
3. Settipane RJ et al. Allergy Proc.1994;15(1 71-5.

Astımlı hastalarda alerjik rinitin rolü



Magnan A et al. Allergy 2008;63:292-298.

Patofizyolojik veriler

Solunum alerjisinin doğal seyri genellikle üst solunum yollarından başlayıp alt solunum yoluna dönüşmektedir.

Allerjik hastalar tüm solunum yollarını tutup değişik hastalıklara neden olan genel bir inflamatuar tablo gösterirler.

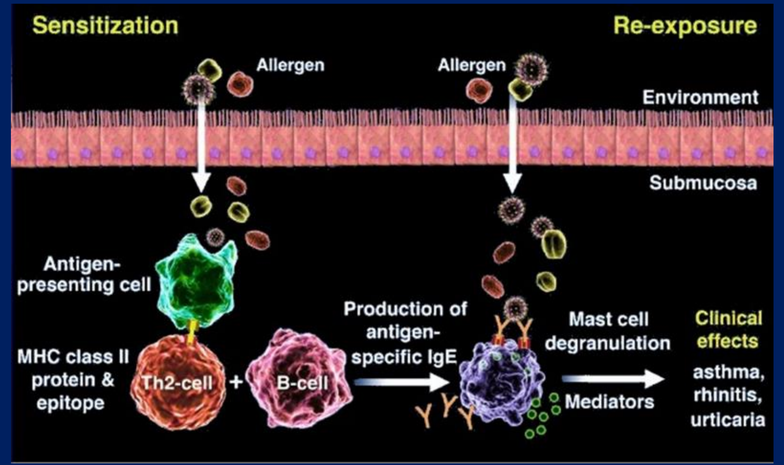
Ciprandi G et al. Allergy Asthma Immunol Res. 2012;4(4):171-177.

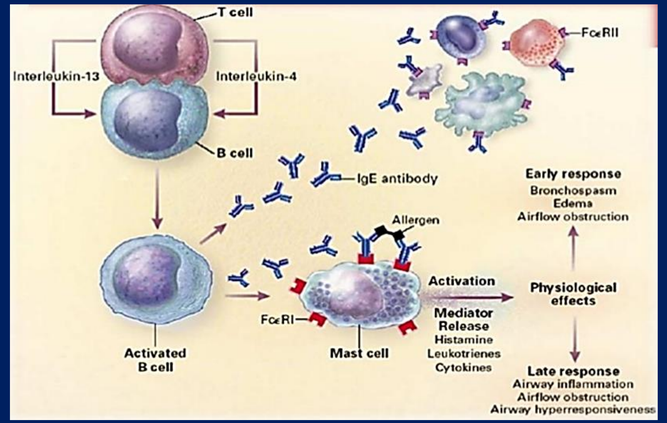
Astım ve alerjik rinit

Ortak immünolojik mekanizmalar

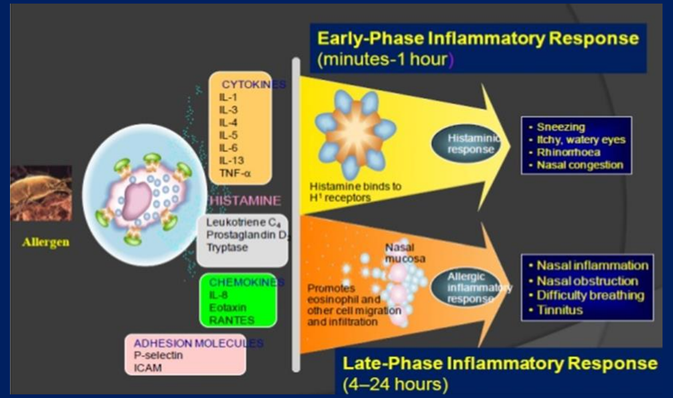
Benzer özellikleri paylaşırlar:

Ortak tetikleyicileri vardır.
Benzer inflamatuar akış şeması gösterirler.
Benzer erken ve geç faz reaksiyonları vardır.
Aynı inflamatuar hücrelerin infiltrasyonu vardır.
They have potential connecting pathways

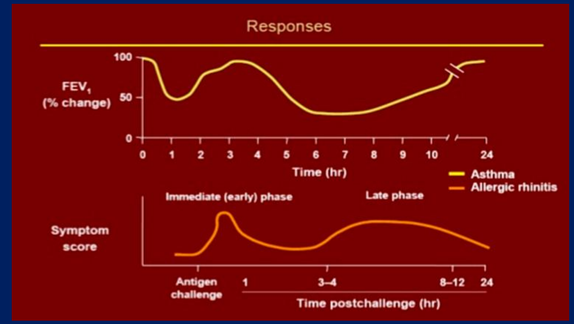




Allerjik rinit ve astımın ortak patofizyolojisi

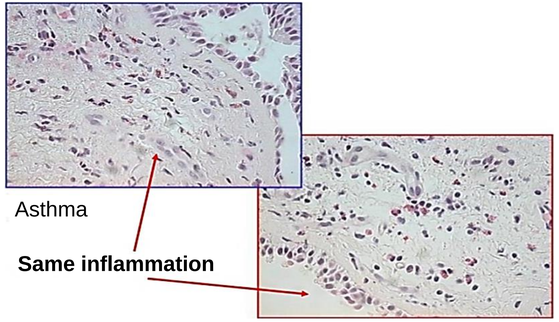


Allerjik Rinit ve astımda benzer erken ve geç faz reaksiyonlar var.



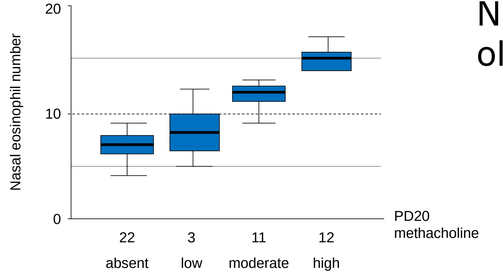
Adapted from Varner AE, Lemanske RF Jr. In: Asthma and Rhinitis. 2nd ed. Oxford: Blackwell Science, 2000:1172-1185.
Togias A. J Allergy Clin Immunol. 2000;105(6 pt2): S599-S604.

Bronchial biopsies after specific provocation



Crimi E et al. J Appl Physiol 2001;91(3):1029-34.

Nazal Inflamasyon and Bronş hiperreaktivitesi (BHR)



Nazal mukozada yüksek sayıda eozinofili olan hastlarda daha ağır BHR görülmektedir.

Ciprandi G. et al. Int Arch Allergy Immunol 2004;133(1):14-8.

United Airways Concept
What Does it Teach Us about Systemic Inflammation in Airways Disease?

Gert-Jan Braunstahl[1]

Proc Am Thorac Soc Vol 6. pp 652–654, 2009

TABLE 2. SIMILARITIES AND DIFFERENCES IN ALLERGIC RHINITIS AND ASTHMA

		Nose	Bronchi
Epithelium	Shedding	0 to +	+++
	Metaplasia	0 to +	0
Basement membrane	Pseudo-thickening	0 to +	++ to +++
	Collagen deposition	0 to +	++ to +++
Submucosa	Eosinophils	+++	+++
	Lymphocytes (CD4+)	+ to ++	+ to ++
	Vascular network	+++	+
	Smooth muscle	0	++
	(Myo)fibroblast	0 to +	++ to +++
	Mast cells	MC_{TC}	MC_T

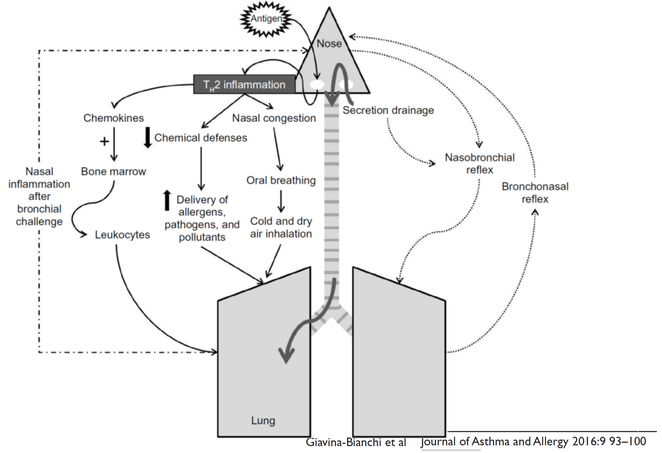
Definition of abbreviations: MC_T = tryptase-positive mast cell; MC_{TC} = tryptase/chymase-positive mast cell.

Birleşik Havayolları Hastalığı: Son yaklaşımlar

’Airconditioning’

Inflamasyon

Nöral refleksler



Giavina-Bianchi et al Journal of Asthma and Allergy 2016:9 93–100

Figure 1 United airway disease: pathophysiological interaction.

Burun ve Akciğer: Birleşik Havayolu Hastalığı?

*Amelia Licari, Riccardo Castagnoli, Chiara Francesca Denicolò, Linda Rossini, Alessia Marseglia and Gian Luigi Marseglia**

Front. Pediatr. 5:44.
doi: 10.3389/fped.2017.00044

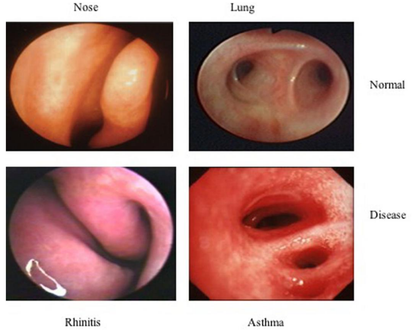


FIGURE 1 | Macroscopic pathological characteristics.

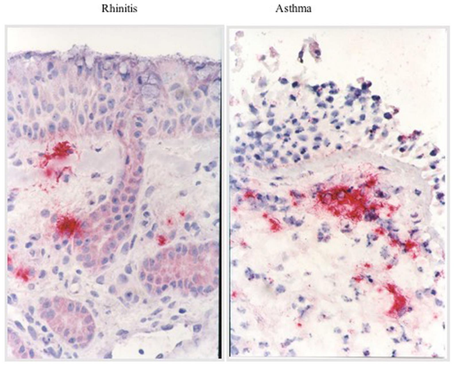
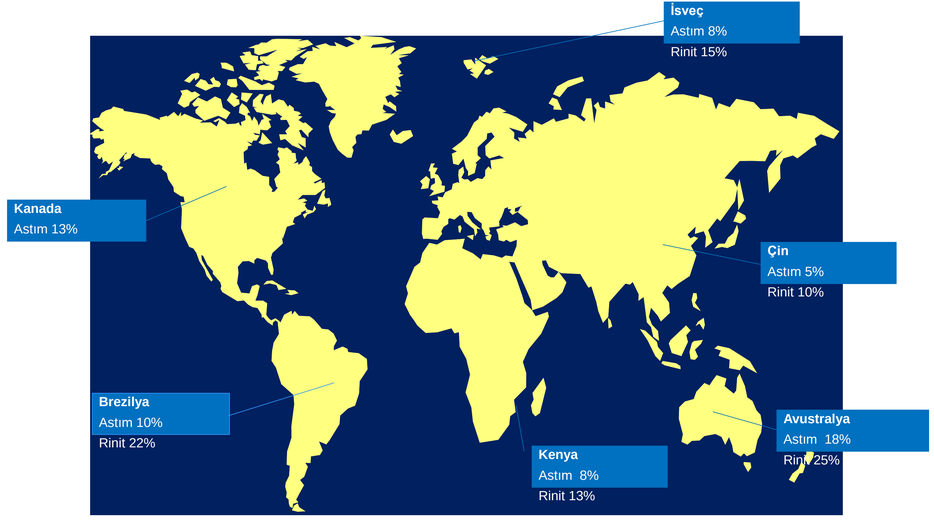


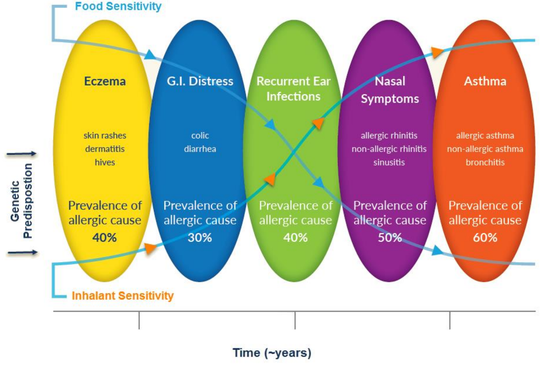
FIGURE 2 | Histological appearance.

International Study of Asthma and Allergies in Childhood (ISAAC): Worldwide prevalence



Beasley R. Lancet 1998;351:1225–1232

Allerjik yürüyüş



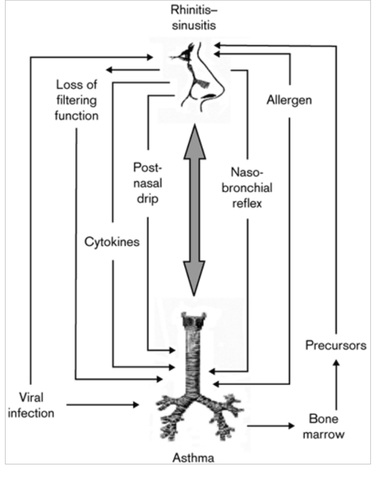
Allerjik yürüyüş

Burun ve bronşlar arasında sistemik bağlantı:

Nazal challenge sonrası kemik iliğinde IL-5 reseptörlerine hassas eosinoiflik öncül hücre üretimi.

Allerjenle nazal challenge IL-5 seviyesi artar.

IL-5 de eosinofil sayısını arttırır.



Curr Opin Allergy Clin Immunol. (2004) Lippincott Williams & Watkins.

Association and management of eosinophilic inflammation in upper and lower airways

Mitsuhiro Okano [a, *], Shin Kariya [a], Nobuo Ohta [b], Yoshimasa Imoto [c], Shigeharu Fujieda [c], Kazunori Nishizaki [a]

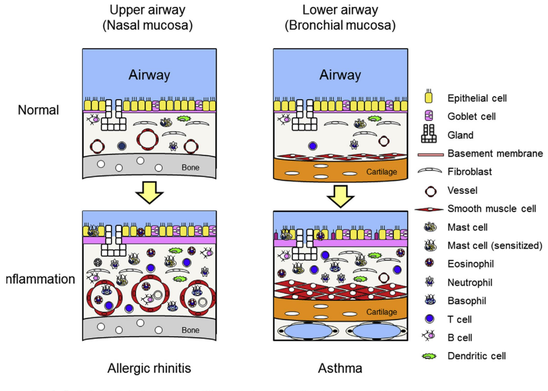


Fig. 1. Pathological similarities and differences between allergic upper and lower airway inflammation.

Recent Developments in United Airways Disease

Giorgio Ciprandi,[1]* Davide Caimmi,[2] Michele Miraglia del Giudice,[3] Mario La Rosa,[4] Carmelo Salpietro,[5] Gian Luigi Marseglia[2]

Bronş challenge testinden 24 saat sonra nazal semptom ve inflamasyon tetiklenebilir.

SFT'de 4-6 saat sonra düşüş olabilir.

Rinosinüzit astımın direkt tetikleyicisidir.

Allergy Asthma Immunol Res. 2012 July;4(4):171-177.

MicroRNA in United Airway Diseases

Zheng Liu [1,†], Xin-Hao Zhang [1,†], Borja Callejas-Díaz [2] and Joaquim Mullol [2,*]

Int. J. Mol. Sci. **2016**, *17*, 716; doi:10.3390/ijms17050716

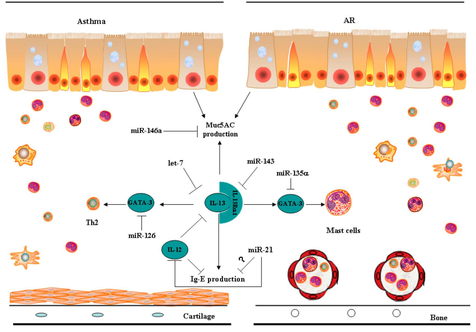


Figure 1. A summary of miRNAs potentially involved in the common pathways in allergic rhinitis and asthma. Effects of induction or stimulation (black arrows), repression or inhibition (T arrows) or indirect repression or inhibition (question mark) are shown.

Clinical Phenotypes of Nasal Polyps and Comorbid Asthma Based on Cluster Analysis of Disease History

J ALLERGY CLIN IMMUNOL PRACT
MONTH 2017

Dawei Wu, MD[a], Benjamin S. Bleier, MD[b], Lun Li, MD[c], Xiaojun Zhan, MD, PhD[a], Lichuan Zhang, MD[a], Qianwen Lv, MD[e], Jianting Wang, MD, PhD[d], and Yongxiang Wei, MD, PhD[a] *Beijing, PR China; and Boston, Mass*

https://doi.org/10.1016/j.jaip.2017.09.020

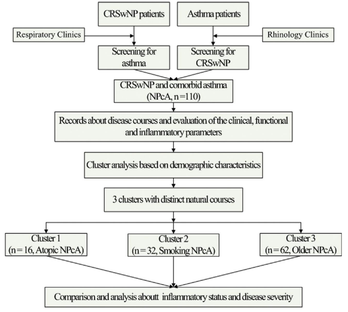


TABLE III. Disease severity in total cohort and by clusters

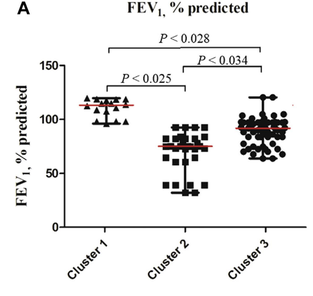
Characteristic	Total cohort N = 110 NPcA	Cluster 1 N = 16 Atopic NPcA	Cluster 2 N = 32 Smoking NPcA	Cluster 3 N = 62 Older NPcA	*P* value among clusters
FEV1 (% predicted), median (IQR)	83.90 (73.20-97.40)	114.80 (103.28-118.33)	75.05 (61.55-82.20)	91.90 (83.90-97.30)	.017
FVC (% predicted), median (IQR)	100.20 (90.10-113.00)	112.00 (100.13-118.12)	97.95 (79.73-112.13)	103.90 (91.90-111.60)	.026
FEV1/FVC ratio (% predicted), median (IQR)	67.72 (62.23-79.56)	82.01 (80.67-87.40)	63.08 (57.06-66.90)	74.91 (62.92-79.05)	.023
PEF (% predicted), median (IQR)	95.40 (81.40-111.80)	120.9 (117.28-128.90)	82.85 (62.43-92.93)	103.50 (89.10-110.70)	.015
LM score, mean ± SD	21.44 ± 2.30	17.59 ± 1.72	21.44 ± 2.30	16.42 ± 2.21	.038

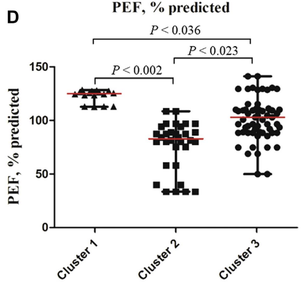
FEV1, Forced expiratory volume in 1 second; *FVC*, forced vital capacity; *FEV1/FVC*, the ratio of FEV1 to FVC; *IQR*, interquartile range; *LM score*, Lund-Mackay score; *NPcA*, nasal polyps and comorbid asthma; *PEF*, peak expiratory flow; *SD*, standard deviation.

TABLE II. Inflammatory characteristics of subjects in total cohort and by clusters

Characteristic	Total cohort N = 110 NPcA	Cluster 1 N = 16 Atopic NPcA	Cluster 2 N = 32 Smoking NPcA	Cluster 3 N = 62 Older NPcA	*P* value among clusters
Dmin value, median (IQR)	0.47 (0.25-6.25)	0.30 (0.13-0.62)	0.29 (0.057-3.80)	2.60 (1.39-3.42)	.031
Total IgE, median (IQR)	60.00 (30.00-132.00)	54.00 (31.00-95.00)	136.00 (57.75-280.25)	30.00 (21.00-52.50)	<.000
FeNO, median (IQR)	85.00 (53.00-110.00)	79.00 (53.00-107.00)	106.50 (84.25-163.75)	36.30 (27.90-52.00)	.000
Blood eosinophil percentage (%), median (IQR)	5.40 (2.50-9.10)	5.50 (2.30-6.20)	7.30 (5.43-11.00)	3.15 (2.70-4.48)	.024
Tissue eosinophils (n), median (IQR)	17.54 (11.27-29.43)	16.71 (9.85-24.20)	22.45 (10.21-32.7)	9.46 (6.82-15.39)	<.000
Blood neutrophil percentage (%), median (IQR)	58.90 (52.50-62.90)	58.60 (51.90-61.80)	54.55 (52.43-59.90)	75.20 (63.10-80.90)	.039
Eosinophilia phenotypes of upper airway, n (%)	51 (46.36)	9 (56.25)	22 (68.75)	20 (32.26)	.002
Eosinophilia phenotypes of lower airway, n (%)	50 (45.45)	8 (50.00)	20 (62.50)	22 (35.48)	.014
Severe asthma, n (%)	45 (40.91)	3 (18.75)	18 (56.25)	24 (38.71)	<.000

Dmin, Cumulative dose of inhaled methacholine measured at the inflection point at which respiratory conductance started to decrease; *FeNO*, fractional exhaled nitric oxide; *IQR*, interquartile range; *NPcA*, nasal polyps and comorbid asthma.





Pediatric Allergic Rhinitis and Asthma: Can the March be Halted?

Olympia A. Tsilochristou · Nikolaos Douladiris · Michael Makris · Nikolaos G. Papadopoulos

Pediatr Drugs (2013) 15:431–440

Table 1 Cross-sectional epidemiologic data on allergic rhinitis and asthma prevalence

Study	Year conducted	Number of subjects included	Age of subjects (in years)	AR (%)	Asthma (%)
ISAAC [9]	Mid 1990s	257,800	6–7	0.8–14.9	4.1–32.1
ISAAC [9]	Mid 1990s	463,801	13–14	1.4–39.7	2.1–32.2
SCARPOL [11]	1992	988	5–7	5	8.8
SCARPOL [11]	2001	1,274	5–7	4.6	7.4
BAMSE [12]	1998–2000	2,024	4	5.4	7.5
BAMSE [12]	2002–2004	2,024	8	14	7.3

AR allergic rhinitis, *BAMSE* Barn/Children, Allergy/Asthma, Milieu, Stockholm, Epidemiologic, *ISAAC* International Study of Asthma and Allergies in Childhood, *SCARPOL* Swiss Surveillance Programme on Childhood Allergy and Respiratory symptoms with respect to Air Pollution

Table 2 Similarities and differences between the nasal and bronchial inflammatory mucosa

	Nasal mucosa	Bronchial mucosa
Structural changes	Minimal epithelial damage	Extended epithelial damage
	No evidence of vascular remodeling	Proliferation of blood vessels
	Minimal collagen and fibrous deposition	Subepithelial fibrosis from deposition of collagen and proteoglycans under the basement membrane
	No smooth muscles	Airway smooth muscle hypertrophy and hyperplasia
Cytology		
Eosinophils	Increased	Increased
Neutrophils	Low numbers	Increased in severe asthma
T-cells	CD4+ increased	CD4+ increased
CD68	Possibly increased numbers	Often increased numbers

Erken yaşta alerjik rinit daha sonraki astım yükünü azaltabilir.

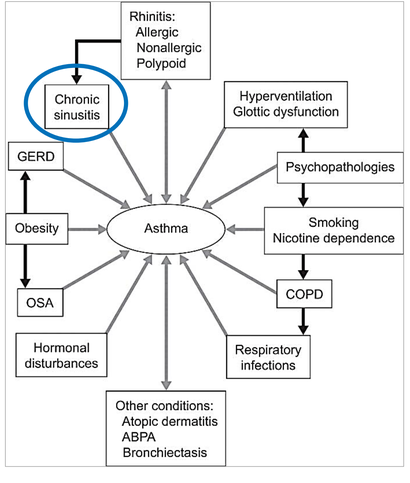
Fırsat penceresi ?

Özet olarak

- Üst ve alt havayolları histoloji, fizyoloji ve patoloji açısından benzerlik gösteren tek bir sistemin parçasıdır.
- Birleşik Havayolu Hastalığı, TH2 immün yanıtın hakim olduğu bir inflamatuar durumdur. Nazal mukozadan bronşiyollere kadar etkiler.

- Ağır rinit olması astım riskini arttırmaktadır.
- Rinit tedavisi alt solunum yollarınıın tedavisine katkı sağlar.
- Tedavisi zor astımda rinit mutlaka düşülmesi gerekn bir komorbiditedir.

Antonicelli L et al. Allergy. 2007;62(9):1064-1070.
Halpern MT et al. J Asthma. 2004;41(1):117-126.
Greisner WA, 3rd et al. Allergy Asthma Proc. 2000;21(6):371-375.
Giavana-Bianchi P et al. Clinics (Sao Paolo) 2010;65(9):905-918.



Boulet LP. Eur Respir J. 2009;33(4):897-906.

Nebulizatörler

Ana hatlar

1. Nebulizer reçete ederken istediğimiz özellikler?
2. Üst ve alt havayoluna yönelik tedavi ve cihazlara bakış
3. Yeni nebulizerler, ‘mesh’ teknoloji
4. Türkiye’de güncel durum ve sorunlar

Nebülizatör- Kime?

Ara maske ile inhaler kullanamayan hastalar

Ağır hastalığı olan, yoğun tedavi gerektiren hastalar

Akut atakta koopere olamayan hastalar

İlaç alırken oksijen de alması gereken hastalar

İyi nebulizer nasıl olmalı?

Hızlı nebülizasyon

Verilen ilaçta minimum kayıp

Haznede kalan miktarın az olması

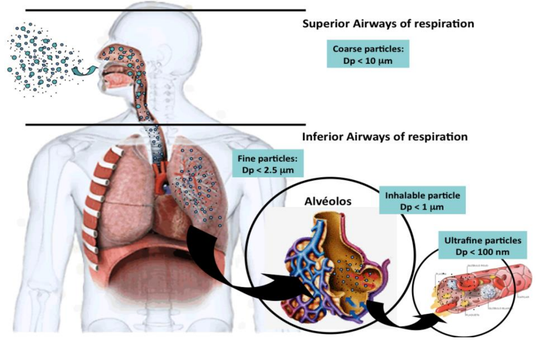
İyi tanımlanmış partikül büyüklüğü

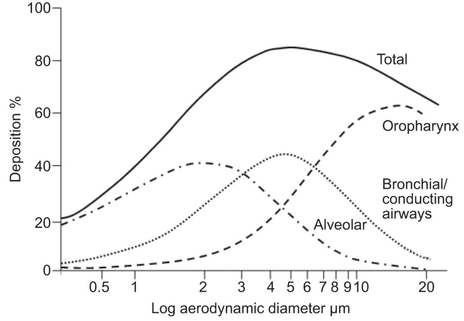
İnhalasyon tedavilerinde cihazların özellikleri çok önemli !

Avrupa Birliği standartlarına uymalı

Partikül büyüklüğüne göre dağılım

- MMAD* >10 µm: Ağız ve üst solunum yolları
- MMAD 5–10 µm: Büyük havayolları ve orofarenks.
- <5 mikron: Küçük havayolları





*MMAD - mass median aerodynamic diameter

Köbrich R et al. *Ann Occup Hyg* 1994; **38**:15–23.

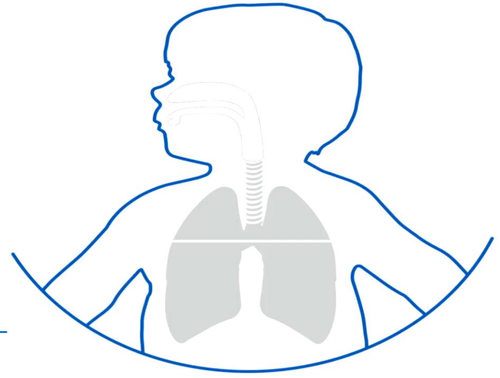
Inhalasyon tedavisi

Hastalık	Üst Havayolları	Alt Havayolları
Krup	+++	+/-
Rinit	+++	+/-
Bronşiyolit	Nazal duş	+
BPD/CLD	-	++
SÇ wheezing	Nasal duş	+++
Astım	Rinit varsa	+++
Kistik fibroz	+	+++
Primer silyer diskinezi	++	++

Hedeflenen bölgeye doğru ve etkin tedavi

Ipper Airways

'is, Sinusitis and Pharyngitis,
'itis, Laryngitis, Common Cold.



Lung deposition in various diseases in infants.

Author	Disease	Mean age (months)	n	Lung deposition (%)
Chua *et al.* (1994)	CF	9	12	1.3
Mallol *et al.* (1996)	CF	12	5	2.0
Fok *et al.* (1996)	BPD	3	13	1.7
Wildhaber *et al.* (1999)	Asthma	33	8	5.4
Amirav *et al.* (2002)	Bronchiolitis	8	12	1.5

BPD: Bronchopulmonary disease; CF: Cystic fibrosis.

Amirav I and Newhouse MT, Expert Rev. Resp. Med. 598 2(5), (2008)

Behavior and lung deposition.

Author	Mean age (months)	Deposition during crying (%)	Deposition without crying (%)
Tal *et al.* (1996)	15	0.3	2.0
Murakami *et al.* (1990)	0–24	Neglible	Unknown
Wildhaber *et al.* (1999)	24	1.3	5.4
Iles *et al.* (1999)	13	0.1*	0.4*
Amirav *et al.* (2003)	8	High URT–GIT	Low URT–GIT

*By urine analysis.
GIT: Gastrointestinal tract; URT: Upper respiratory tract.

Amirav I and Newhouse MT, Expert Rev. Resp. Med. 598 2(5), (2008)

Thorax 1997;52(Suppl 2):S92–S101

Selecting and using nebuliser equipment

A H Kendrick, E C Smith, R S E Wilson

Table 3 Examples of nebuliser/compressor combinations for antibiotic therapy

Compressor	*Nebuliser chamber*
Medic-Aid CR60	Respirgard II
Medic-Aid Porta-Neb	Medic-Aid Ventstream
Medic-Aid CR50	Medic-Aid Sidestream, MicroCirrus, Raindrop, Hudson UD II
AFP Tourer, AFP Classic, AFP Aquillon, AFP Ultima	Medic-Aid Ventstream, MicroMist, MicroNeb III, MicroCirrus, Medic-Aid Sidestream
Pari TurboBoy	Pari LC Plus, Pari LC Plus Filter
Pari JuniorBoy	Pari LC Plus Junior, Pari LC Plus Filter

Table 4 Recommended nebuliser/compressor combinations for rhDNase therapy

Compressor	*Nebuliser chamber*
Pulmo-Aide	Hudson T Up-draft II Airlife Misty A11
Pari InhalierBoy	Pari LL, Pari LC
Pari TurboBoy	Pari LC Plus
Aiolos	Aiolos
Medic-Aid Porta-Neb	Medic-Aid Sidestream
Medic-Aid CR50	Medic-Aid Sidestream
Medic-Aid CR60	Medic-Aid Sidestream
AFP Aquillon	MicroMist

Table 5 Examples of nebuliser/compressor combinations suitable for corticosteroid therapy

Compressor	*Nebuliser chamber*
Medic-Aid Porta-Neb	Medic-Aid Ventstream Medic-Aid Sidestream Cirrus Hudson Turret
Medic-Aid Freeway	Medic-Aid Ventstream
Medic-Aid CR60/CR50	Cirrus, A11 DeVilbiss 646 Hudson Up-draft II Turret
AFP Aquillon	MicroMist
AFP Tourer	Medic-Aid Sidestream
AFP Ultima	Medic-Aid Sidestream
Pari TurboBoy	Pari LC Plus, LC Plus Junior
Pari JuniorBoy	Pari LC Plus, LC Plus Junior

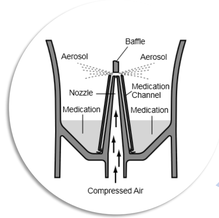
Jet Nebulizatör

1) Kompresörden Basınçlı havanın etkisiyle çalışır.

2) Buharlaştırıcı başlıkta basınca neden olur bu da ilacın yukarıya doğru verilmesini sağlar.

3) İlaç yukarıya giderken basınçlı hava ile karışarak kitin ucundaki parçaya çarpar.

4) Bu da karışımın aerosole dönüşüme neden olur.

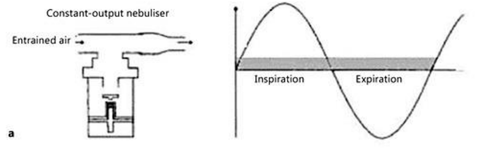


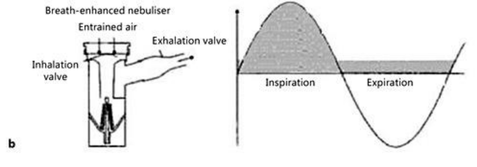
Jet Nebulizatörler

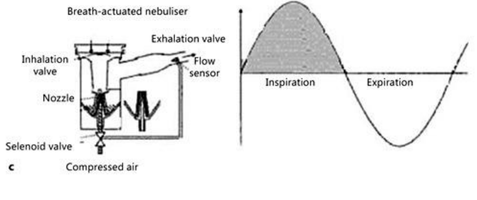
a Sürekli çıkışlı pnömatik jet nebulizatör.

b Nefesle güçlenen jet nebulizatör.

c Nefesle aktive olan jet nebulizatör.







The Science Guiding Selection of an Aerosol Delivery Device

Timothy R Myers MBA RRT-NPS FAARC

RESPIRATORY CARE • NOVEMBER 2013 VOL 58 NO 11

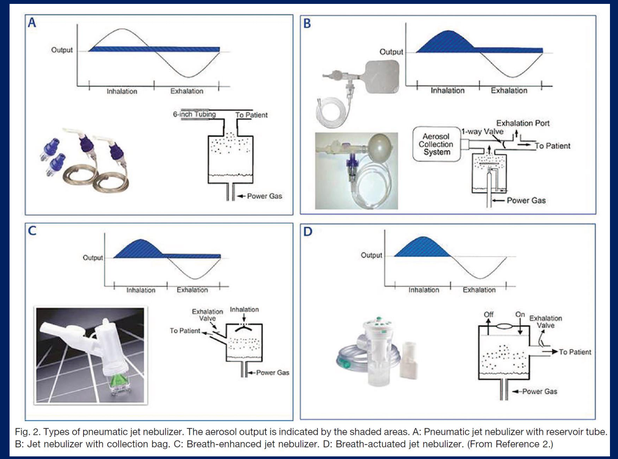


Fig. 2. Types of pneumatic jet nebulizer. The aerosol output is indicated by the shaded areas. A: Pneumatic jet nebulizer with reservoir tube. B: Jet nebulizer with collection bag. C: Breath-enhanced jet nebulizer. D: Breath-actuated jet nebulizer. (From Reference 2.)

Thorax 1997;**52**(Suppl 2):S31–S44

The science of nebulised drug delivery

Christopher O'Callaghan, Peter W Barry

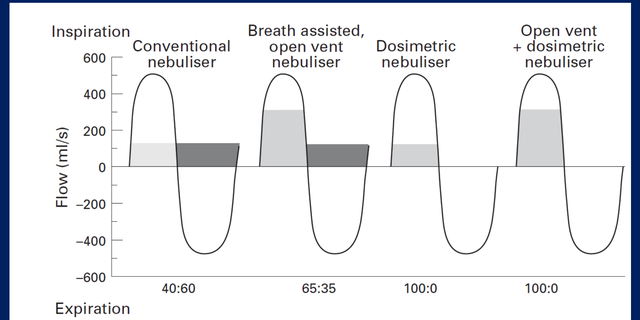


Figure 6 Schematic presentation of identical flow-time traces with nebuliser drug output adapted to a nebuliser/compressor flow of 6 l/min. The nebulised drug output is indicated by the shaded areas. The improvement in potential drug delivery from the new open vent nebulisers is clearly seen. Modified from Nikander[104] with permission.

Nebulization Therapy for Asthma: A Practical Guide for the Busy Pediatrician

Michael J. Welch, MD, FAAP, FAAAAI

Clinical Pediatrics
Volume 47 Number 8
October 2008 744-756

Table 3. Recommended Nebulizers and Compressor Systems

Type	Recommendation
Compressor-driven (present technology)	
Continuous	Sidestream nebulizer (Respironics, Murrysville, Pennsylvania) with Inspiration compressor (Respironics)
	Nebmist nebulizer (Hudson, Temecula, California) with PulmoAide compressor (DeVilbiss, Carslbad, California)
Breath-enhanced	PARI LC Plus or PARI LC Sprint (PARI, Midlothian, Virginia) with PRONEB Ultra II compressor (PARI)
	Ventstream Pro (Respironics) with Inspiration compressor (Respironics)
	NebuTech (Salter Labs, Arvin, California) with AIRE Plus compressor (Salter)
Breath-activated	
Mechanical	AeroEclipse (Monaghan Medical Corp, Plattsburgh, New York)
	PARI LC Plus, PARI LC Sprint (PARI) with PRONEB Ultra II compressor with thumb valve (PARI; Figure 2)
Electronic Portable (battery operated)	Prodose AAD system (Respironics)
	PARI LC Sprint nebulizer with TrekS compressor (PARI; Figure 1)
	CompAir Elite (Omron Healthcare, Bannockburn, Illinois)
	Traveler (DeVilbiss)
Non–compressor-driven (new technology)	
Ultrasonic	MicroAir Ultrasonic Model NE-UO3V (Omron Healthcare)
	Lumiscope (Lumiscope, Piscataway, New Jersey)
Vibrating mesh	
Spontaneous breathing	eFlow (PARI)
	MicroAir NE-U22 (Omron Healthcare)
	Aeroneb Go (Nektar, San Carlos, California)
Controlled breathing	I-Neb AAD (Respironics)
	Akita (Inamed, Gauting, Germany)

Note: AAD = adaptive aerosol delivery.

Eur Respir J 2001; 18: 228–242
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European Respiratory Journal
ISSN 0903-1936

ERS TASK FORCE

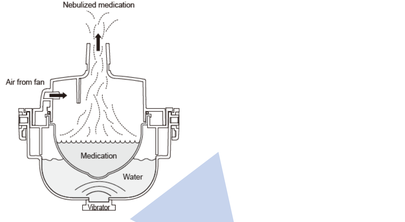
European Respiratory Society Guidelines on the use of nebulizers

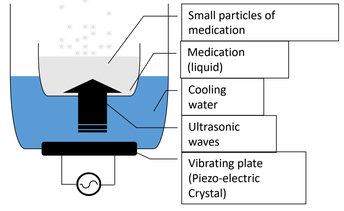
Table 1. – Site of action of commonly nebulized drug aerosol therapies and the droplet size thought ideal for maximum clinical benefit

Drug	Target airway site	Special considerations
β_2-agonists acute Adults and children	Central-peripheral	Use O_2 as driving gas unless there are concerns about CO_2 retention
β_2-agonists chronic Adults and children	Central-peripheral	Reduce nebulization time for treatment compliance
Anti-cholinergic Adults and children	Central	Mouthpiece (preferable) or tight sealing face mask (Mouthpiece for glaucoma patients)
Corticosteroid Children and adults	Central-peripheral	Minimize skin and eye exposure Mouthpiece (preferably) (or tightly sealed face mask)
Amino-glycosides or Colomycin Adults	Central-peripheral	Mouthpiece Filter or exhaust exhaled gases Pretreat with β-agonist when necessary
Pentamidine Adults	Peripheral	Mouthpiece Pretreat with nebulized β-agonist Filter or exhaust exhaled gases
Amphotericin Adults	Central	Dilute with water not saline Filter or exhaust exhaled gases
rhDNase	Central	Mouthpiece

Ultrasonik Nebülizatör

1) Piezo-elektrik kristal yüksek frekanslı titreşimler yapar (2 ~ 3 milyon/sn).
2) Titreşimler su aracılığıyla ilaca iletilir (su soğutmayı sağlar).
3) Güçlü titreşimler sıvı ilaç sütunu oluşturur ve küçük partiküller oluşur.
4) Oluşan partiküller küçük bir fan aracılığıyla hastaya iletilir.
5) Süspansiyon şeklindeki ilaçları verirler, 1-6 mikron çapında partikül üretirler. Sessizdir.





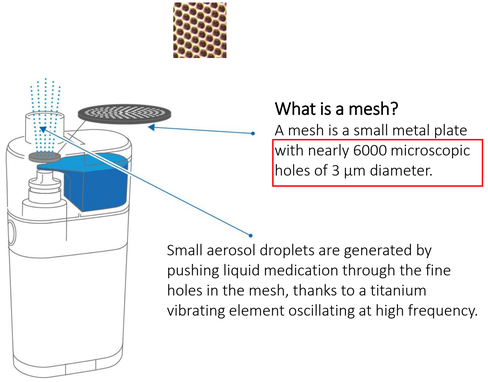
‘Mesh’ Ultrasonik nebülizatör

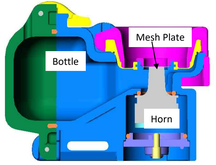
1)Piezo-elektrik başlık Transducer ultrasonik frekansla titreşim verir.

2) Kapiller etki ilacı mesh ile başlık arasına alır.

3) Aksiyel başlık titreşimleri sıvı ilacı metal meshin binlerce küçük deliğine doğru sıkıştırır.

4) İlaç meshi ince aerosol olarak terk eder.





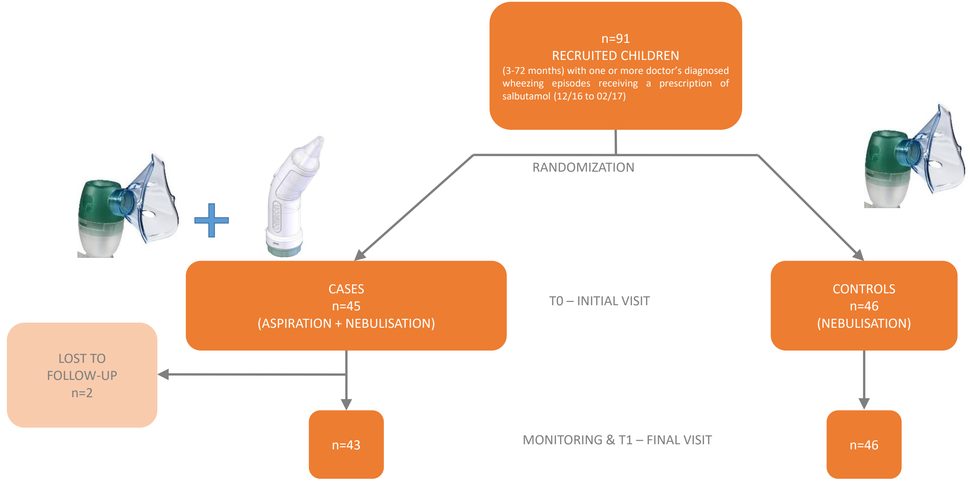
Yenilik

TEK KOMPRESÖR İKİ FONKSİYON

"Breathe-Free-Baby Study" - P.M. Matricardi, Charité Universitätsmedizin Berlin, Germany (Pizzulli A *et al.*, submitted)

Çalışmanın akış şeması

Aspirasyon işe yarıyor mu?



The impact of nasal aspiration with an automatic device on upper and lower respiratory symptoms in wheezing children: a pilot case-control study

Antonio Pizzulli[1], Serena Perna[2], Anja Bennewiz[3], Holger Roeblitz[4], Salvatore Tripodi[5], Jakob Florack[2], Petra Wagner[2], Stephanie Hofmaier[2] and Paolo Maria Matricardi[2*]

Italian Journal of Pediatrics (2018) 44:68

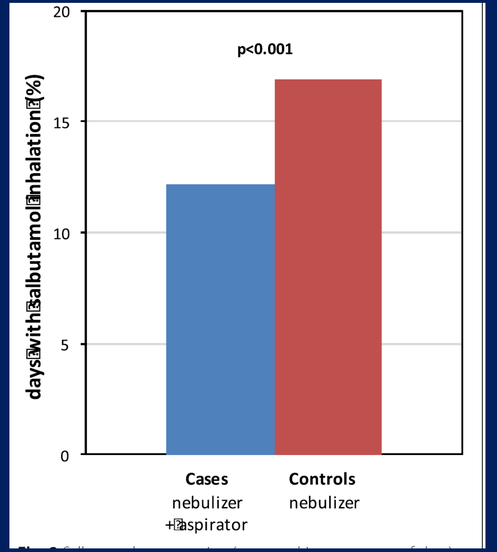


Table 4 Frequency of symptoms among patients using a DuoBaby nebulizer equipped (cases, *n* = 43) or not equipped (controls; *n* = 46) with a nasal aspirator[a]

	Cases *n* = 43		Controls *n* = 46		p[b]
	Median[a]	IQR	Median[a]	IQR	
Nasal symptoms in the last 24 h	25.0	*(14.5–43.6)*	46.4	(27.4–58.4)	**0.004**
Runny nose	21.0	*(10.6–37.3)*	39.5	*(22.5–48.3)*	**0.021**
Stuffy nose	15.3	*(6.4–32.1)*	24.0	*(7.5–44.6)*	0.160
Mucus	14.4	*(3.4–34)*	21.1	*(7.1–38.3)*	0.289
Crusts	1.5	*(0–15.6)*	6.7	*(0–20.1)*	0.485
Bronchial symptoms in the last 24 h	21.8	*(14.5–37.3)*	32.8	(16.8–50.3)	**0.022**
Dry cough	12.7	*(3.5–25.8)*	17.8	*(5.8–32.1)*	0.229
Productive cough	14.7	*(6.5–18.9)*	20.3	*(9.3–37.7)*	**0.033**
Wheezing	3.6	*(0–10.3)*	2.6	*(0–10.8)*	1.000
Difficult breathing	0.0	*(0–3.3)*	0.0	*(0–3)*	0.836

Table 5 Frequency of symptoms among patients using a DuoBaby nebulizer equipped (cases, *n* = 43) or not equipped (controls; *n* = 46) with a nasal aspirator stratified for the use of controller therapy (Inhaled Corticosteroid, ICS)

	Cases				Controls				p[b]	p[c]
	control therapy *n* = 6		no control therapy *n* = 37		control therapy *n* = 10		no control therapy *n* = 36			
	Median[a]	IQR	Median[a]	IQR	Median[a]	IQR	Median[a]	IQR		
Nasal symptoms in the last 24 h	40.4	*(30.8–74.9)*	23.2	*(13.3–41.2)*	54.2	*(49.3–57.9)*	39.7	*(24.9–58.5)*	0.020	0.011
Bronchial symptoms in the last 24 h	40.6	*(39.6–56.1)*	20.8	*(12.5–32.3)*	34.6	*(27.8–50.4)*	29.7	*(15–50.1)*	0.035	0.031

Efficacy and usability of a novel nebulizer targeting both upper and lower airways

Daniela Posa[1], Antonio Pizzulli[2], Petra Wagner[1], Serena Perna[1], Stephanie Hofmaier[1], Paolo Maria Matricardi[1] and Susanne Lau[1*]

Italian Journal of Pediatrics (2017) 43:89

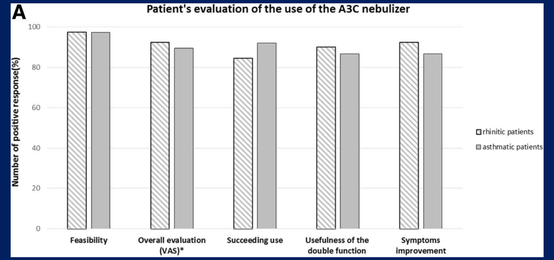


Table 2 Quantitative improvement of respiratory parameters in 39 rhinitic patients and in 38 asthmatic patient after drug administration with A3C nebulizer

	pre		post		*p*-value[a]
	mean	SD	mean	SD	
Rhinitic patients					
Total nasal inspiratory airflow (ml/s)	275	216	359	188	0.030
Asthmatic patients					
FEV 1 (l)	1.59	0.63	1.90	0.80	<0.001
Tiffeneau index (%)	78	11.0	87	10.1	<0.001
MMEF 25-75 (l/s)	1.32	0.50	2.01	0.85	<0.001

The Duo Baby nebulizatör (a) ve kullanım talimatı (b)

a)

b)

Compressor Nebulizer with Nasal Aspirator

DuoBaby

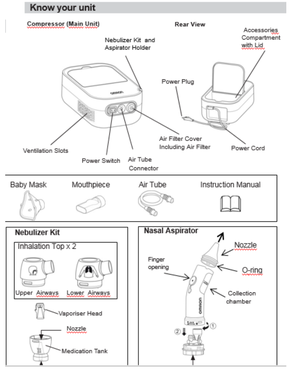
Intended use

Medical Purpose
The intended purpose of this product is:
- To allow for nebulization treatment of respiratory tract disorders.
- To remove mucus form the nasal cavities to ease breathing.

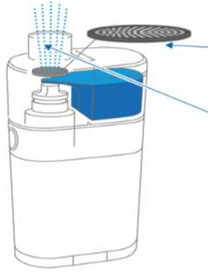
Intended User
• Patient and/or caregiver under the direction of legally certified medical experts, such as doctor, nurse and therapist or qualified medical experts for home treatment.
• The user should also be capable of understanding general operation of DuoBaby and the content of this instruction manual.

Intended Patients
Persons from the age of 1 month who suffer from upper airway conditions (such as blocked nose, cold, allergies) and/or lower respiratory conditions (such as asthma, bronchitis, bronchiolitis).

Environment
This product is intended for use in a general household.



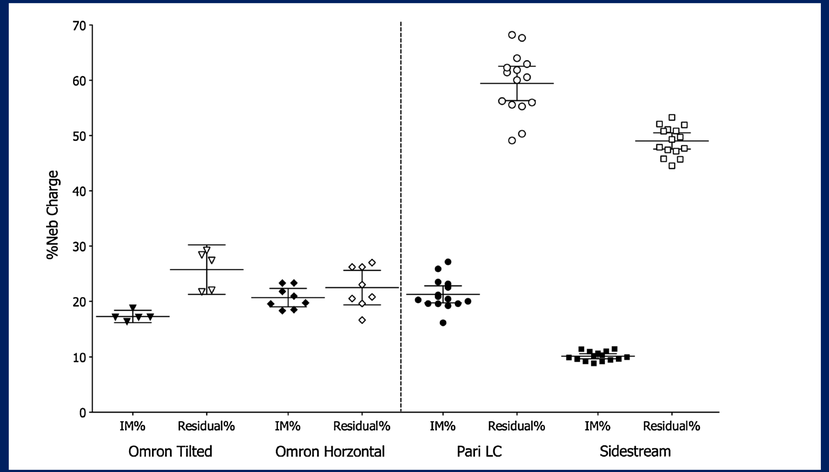
MESH nebulizatör



Omron NE U22: Comparison Between Vibrating Mesh and Jet Nebulizer

Shibu Skaria, M.D. and Gerald C. Smaldone, M.D., Ph.D.

JOURNAL OF AEROSOL MEDICINE AND PULMONARY DRUG DELIVERY
Volume 23, Number 3, 2010
© Mary Ann Liebert, Inc.
Pp. 173–180
DOI: 10.1089/jamp.2010.0817



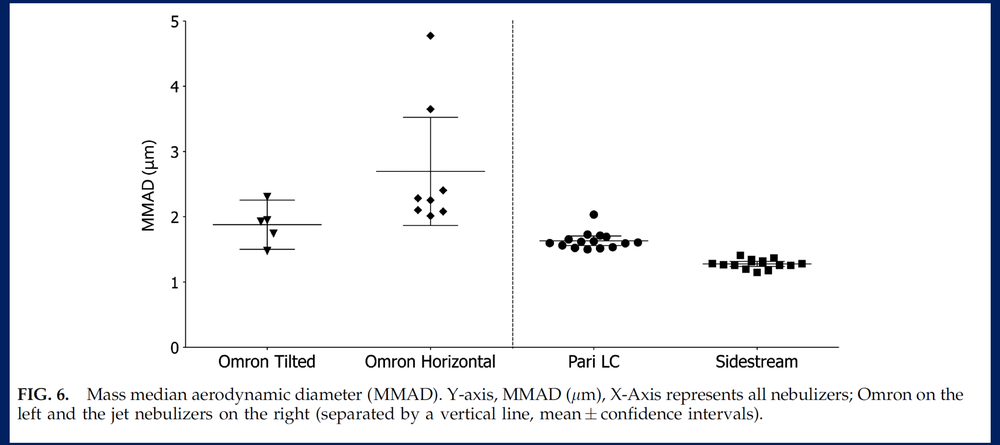


FIG. 6. Mass median aerodynamic diameter (MMAD). Y-axis, MMAD (μm), X-Axis represents all nebulizers; Omron on the left and the jet nebulizers on the right (separated by a vertical line, mean $\pm$ confidence intervals).

IN VITRO AERODYNAMIC CHARACTERIZATION OF THE DOSE EMITTED DURING NEBULIZATION OF TOBRAMYCIN HIGH STRENGTH SOLUTION BY NOVEL AND JET NEBULIZER DELIVERY SYSTEMS

M. Mashat[1], B. J. Clark[2], K. H. Assi[2] and H. Chystyn[3]

Pulmonary Pharmacology & Therapeutics

10.1016/j.pupt.2015.12.003

Table 1 Summary of mean (SD, n=10) aerosol particle size distribution characteristics during nebulization tobramycin high strength solution of by selected nebulizer delivery systems.

Nebulizer Device	MMAD µm	GSD µm	Fine Particles <5 µm (mg)	% FPF	VMD µm
Sidestream® Porta-Neb compressor	2.74± 0.3	2.456± 0.08	2.55 ± 0.22	47.55± 3.5	2.58± 0.24
Sidestream® (Flow rate 12L/min)	1.50 ± 0.01	2.20± 0.5	8.22± 0.57	68.78± 2.5	3.28± 0.37
Sidestream® (Flow rate 16L/min)	1.22± 0.08	2.52± 0.15	10.65± 1.58	77.64± 2.3	3.14± 0.23
Pari LC Plus® PariBoy compressor	1.87± 0.08	2.42± 0.05	7.41± 0.47	59.57± 0.8	3.28 ± 0.15
Aeroneb Go®	2.05± 0.1	2.05± 0.06	9.18± 1	58.97± 1.7	2.65± 0.21
NE-U22 Omron® (High frequency)	2.74 ± 0.3	2.28 ± 0.1	5.64± 0.41	47.34± 3.8	2.31± 0.25
NE-U22 Omron® (Low frequency)	2.28 ± 0.16	1.73± 0.12	2 ± 0.43	56.9± 4.4	1.57± 0.22

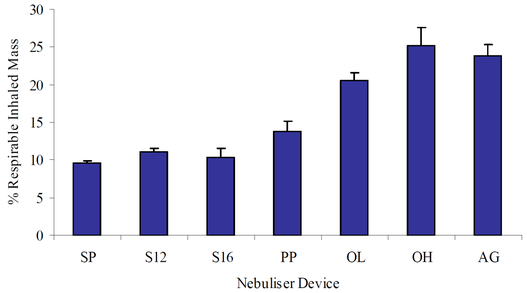


Figure 3 Mean (SD, n=10) respirable inhalation mass of tobramycin produced by different nebulizer systems during nebulization of high strength dose of tobramycin.

Sonuç

İnhalasyon tedavisinde cihaz ve yöntem seçimi ilaç seçimi kadar önemli!

Birleşik havayolu hastalığı konseptinde üst solunum yollarını gözardı etmeyelim!

Hastalara teknik konusunda eğitim vermeyi ihmal etmeyelim, ilaçları nasıl kullandıklarını bize göstermelerini isteyelim.

	OMRON DuoBaby	OMRON A3 Complete	OMRON NE-C28P	OMRON NE-C801KD	OMRON NE-C801	OMRON NE-C803	OMRON U22
TYPE	Compressor with Nasal aspirator	Compressor	Compressor	Compressor	Compressor	Compressor	Mesh
Nebulizer Type	✓						
Lung treatment	✓	✓	✓	✓	✓	✓	✓
Nose/mouth/throat treatment	✓	✓					
Portable							✓
Child accessories				✓			
Particle size (MMAD)	**Pos 1:** 9.0 µm **Pos 2:** 4.0 µm	**Pos 1:** 10.0 µm **Pos 2:** 5.0 µm **Pos 3:** 3.0 µm	3.0 µm	3.0 µm	3.0 µm	3.0 µm	4.2 µm
Nebulization Rate	**Pos 1:** min. 0.4 ml/min **Pos 2:** min. 0.2 ml/min	**Pos 1:** 0.7 ml/min **Pos 2:** 0.5 ml/min **Pos 3:** 0.3 ml/min	0.5 ml / min	0.3 ml / min	0.3 ml / min	0.3 ml / min	>0.25ml/min
Sound	63 dB	65 dB	60 dB	46 dB	46 dB	< 45 dB	< 5 dB
Power source	Mains	Mains	Mains	Mains	Mains	Mains	Batteries (2 x AA)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AstraZeneca


SALON B

Teşekkürler