A Patient's Perspective on Nebulizers

An overview of the pros and cons of the different Nebulizers

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Nebulizers

DISCLAIMER

- I am not endorsing or recommending any specific brand, product, or device. I am simply reviewing some of the products available and what some of the pros and cons are for each type of equipment or device.
- You should consult your doctor, health insurance, fellow patients, and your "pocketbook", as to what nebulizer is best for you.

Nebulizers

What is a Nebulizer?

It is a drug delivery device used to administer medication in the form of a mist inhaled into the lungs. It converts a liquid, or semi-liquid, medication into an aerosol that can be inhaled into the lungs.

Nebulizers

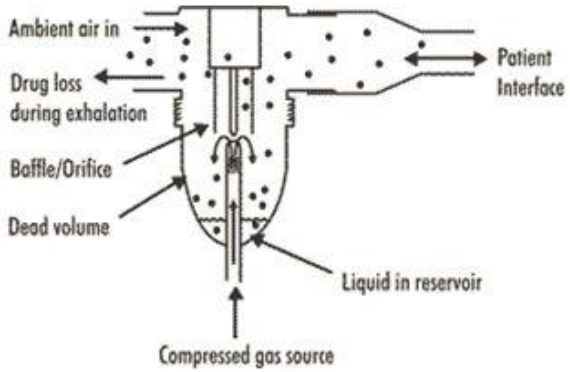
- Jet, Ultrasonic, and Mesh Nebulizers: An Evaluation of Nebulizers for Better Clinical Outcomes, Arzu Ari, Georgia State University, aari1@gsu.edu, 2014
- Delivery Efficacy of a Vibrating Mesh Nebulizer and a Jet Nebulizer under Different Configurations, Laurent Pitance, Laurent Vecellio, Teresinha Leal, Gregory Reychler, Herve Reychler, and Giuseppe Liistro, Published Online:1 Dec 2010https://doi.org/10.1089/jamp.2010.0816
- Chest. 1994 Dec;106(6):1788-92, A Comparison of Commercial Jet Nebulizers, Loffert DT1, Ikle D, Nelson HS.
- Drug Delivery Comparison using the Breathing Matters Recovery Concentrator on a Ventilated Human Model, Aerosol Research and Engineering Laboratories, 2016
- Product Classification Analysis: Recovery Concentrator, Biologics Consulting, April 2018
- Personal Experience and Qualitative Observations

Nebulizers

Jet

Compressed air atomizes liquid

Figure 1: Functioning of Pneumatic Jet Nebulizer



Ultrasonic

Sound waves atomize liquid

Figure 3: The Ultrasonic Nebulizer

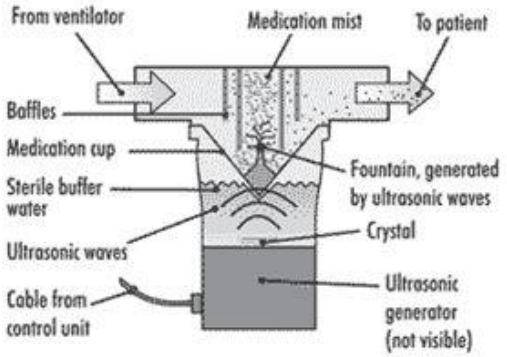
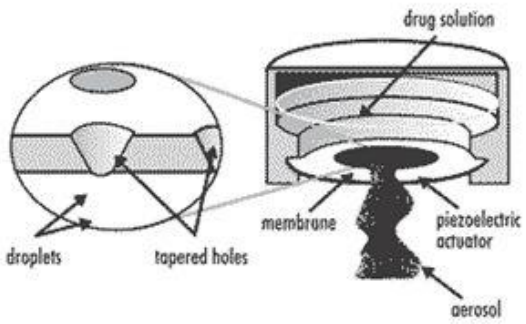


Figure 2: Principles of Mesh Nebulizer

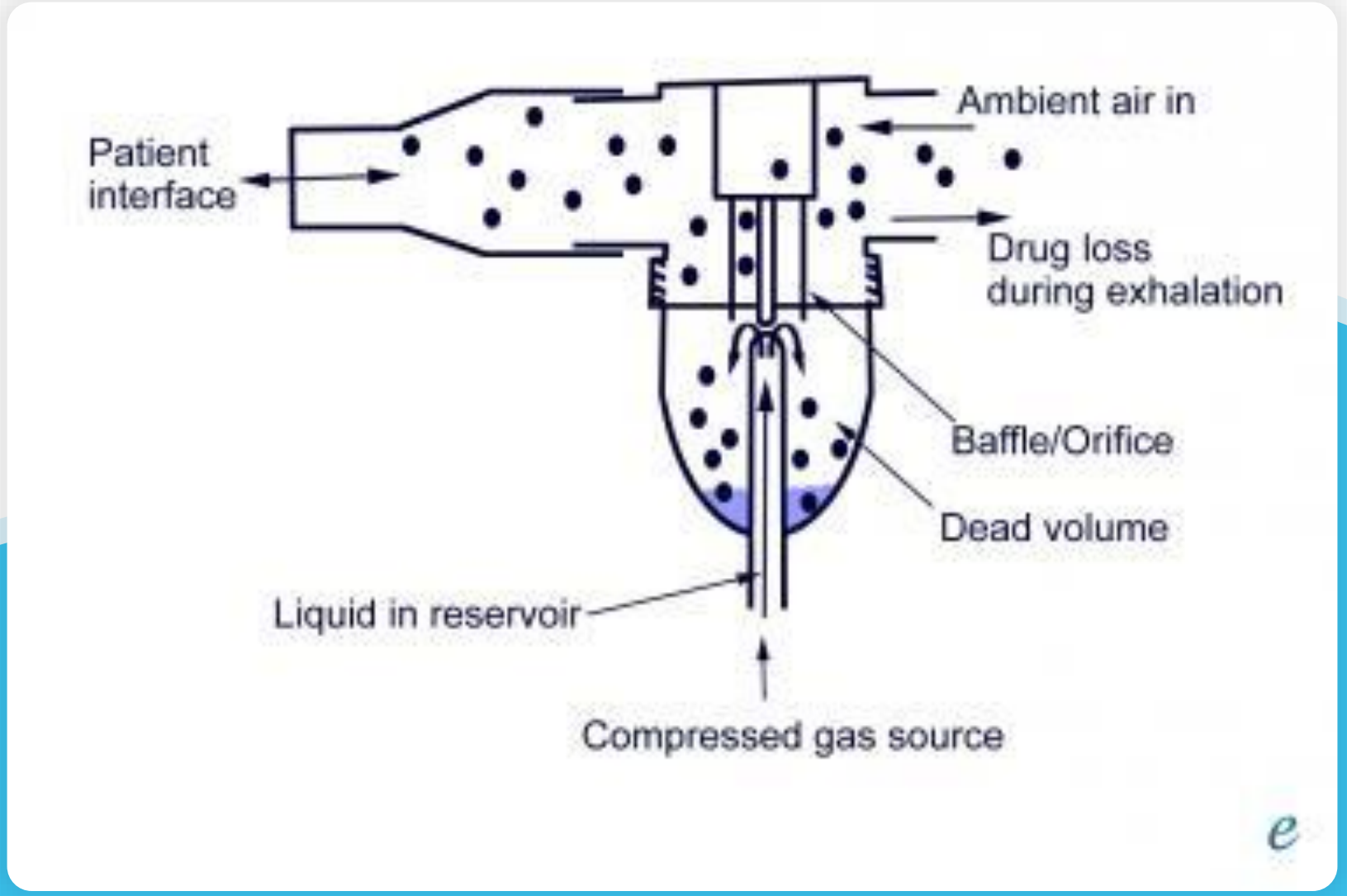


Vibrating Mesh

Laser drilled mesh vibrates to atomize liquid

Ibrahim M. et al. Med Devices: Evidence and Research. 2015;8:131-9
Images: http://omnisurge.co.za/what-are-nebulizers-and-how-do-they-work/

Jet Nebulizer



A Few Examples of Jet Nebulizers

T-Neb with corrugated tubing (open system)

Inexpensive, easy to clean and maintain, longer delivery times, noticeable drug loss.

Mask (open system)

Pari LC Jet - Semi closed system – Inexpensive, limited drug loss, easy to clean, short delivery time, superior particle size performance and efficiency, need to replace med cup every 6 months.

A Few Examples of Jet Nebulizer Medicine Cups

Jet Nebulizers Need Compressed Air or Oxygen Source (2 to 10 L/min)

Easy carry, Rx is usually required, noisy, can not adjust pressure

Not easily portable, RX required, noisy, can adjust flow

Another Option for T-Neb Users

- Breathing Matters - Recovery Concentrator (RC)
- Invented by PAP patient Lloyd Courtney
- Patent number # 9,480,805,B2 – Nov. 1, 2016
- Recovery Concentrator is a Class 1 medical device, accessory to a medical device, and does not require a submission to FDA, 510(k) or PMA, prior to marketing and distribution.
- Tested by Aerosol Research & Engineering Laboratories in 2016 – when tested against a Hudson RCI 8900 T-Nebulizer showed a 251% increase in total drug delivery and 224% increase in total respirable (0.4 to 5 microns) mass delivered.
- Negligible drug loss, fast delivery time, easy to clean and maintain.

Ultrasonic and Vibrating Mesh (Membrane) Nebulizers

- Ultrasonic Nebulizer - uses a transducer horn to create high frequency sound waves that pass through a liquid to produce an aerosol.
  - ✓ Microair NE-U22 ®(Omron, Bannockburn, IL)
- Vibrating Mesh Nebulizer - use a piezo element that contracts and expands on application of an electric current and vibrates a precisely drilled mesh (membrane) in contact with the medication in order to generate an aerosol.
  - ✓ Aeroneb ® (Aerogen, Galway, Ireland) and the eFlow ® (PARI, Starnberg, Germany), I-Neb, (Phillips Respironics)

Note – both types use vibrations to produce an aerosol. Some ultrasonic products may be labeled as an "Ultrasonic Vibrating Mesh" nebulizer, which is a little confusing. However, when the term "ultrasonic" is used its primary vibration generator are sound waves, no matter how the product is labeled.

Examples of Ultrasonic Nebulizers

Omron Micro Air ~ $100

Soho Emporium ~$45

Examples of Vibrating Mesh Nebulizers

Rocket Neb ~$80

Pari eFlow ~$1,300

Summary Of Pros And Cons Of Different Nebulizer Types

Device	Pros	Cons
Jet Nebulizers	Cheapest, easy to use and clean, low maintenance, can handle thicker solutions.	Noticeable drug loss*, longer delivery time, less preferred respirable particle size produced, noisy, needs compressed air or O2, not easily transported. *A T-Neb used with a Breathing Matters Recovery Concentrator has negligible drug loss.
Ultrasonic Nebulizers	Quieter than either Jet or Mesh, faster delivery time than Jet, minimal drug loss compared to Jet, portable.	More expensive than Jet, harder to clean and maintain than Jet, may need to replace parts on a regular basis, should not be used with thick suspended solutions.
Vibrating Mesh (Membrane) Nebulizers	Most efficient at producing preferred respirable particle size, fast delivery time, minimal drug loss, quite, portable.	More expensive than Jet, difficult to clean, higher maintenance requiring regular replacement of components, depending on medication may need to adjust dose to avoid overdosing.

Closing Thoughts on Nebulizers

- There is a large variety of nebulizers on the market from which to choose.
- Costs vary widely, sometimes even for the same device.
- Costs range from about $30 for a cheaper jet nebulizer up to many thousands of dollars for a high end mesh nebulizer.
- Minimal drug loss is very important.
- Consult with your doctor and fellow patients for recommendations.