

“Airway Management Devices: Past, Present, and Future”



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Background

B.S. – Biomedical Engineering

Ph.D., M.S. – Mechanical Engineering

Interests: Medical Imaging,
Medical Devices,
Biomaterials



Learning Objectives:

By the end of this session, the listener should be able to...

- ◆ Identify the history, advancements, and future directions in airway management.
 - ◆ Discuss the current limitations of airway technology and how they affect current practices.
- ◆ Recommend improvements to airway tools and workflows within their respective area(s) of practice.

Airway Management:

Airway management is the assessment, planning, and series of medical procedures required to maintain or restore an individual's ventilation, or breathing.

By maintaining an open airway, air can flow from the nose and mouth into the lungs.”

Devices

Suction Devices

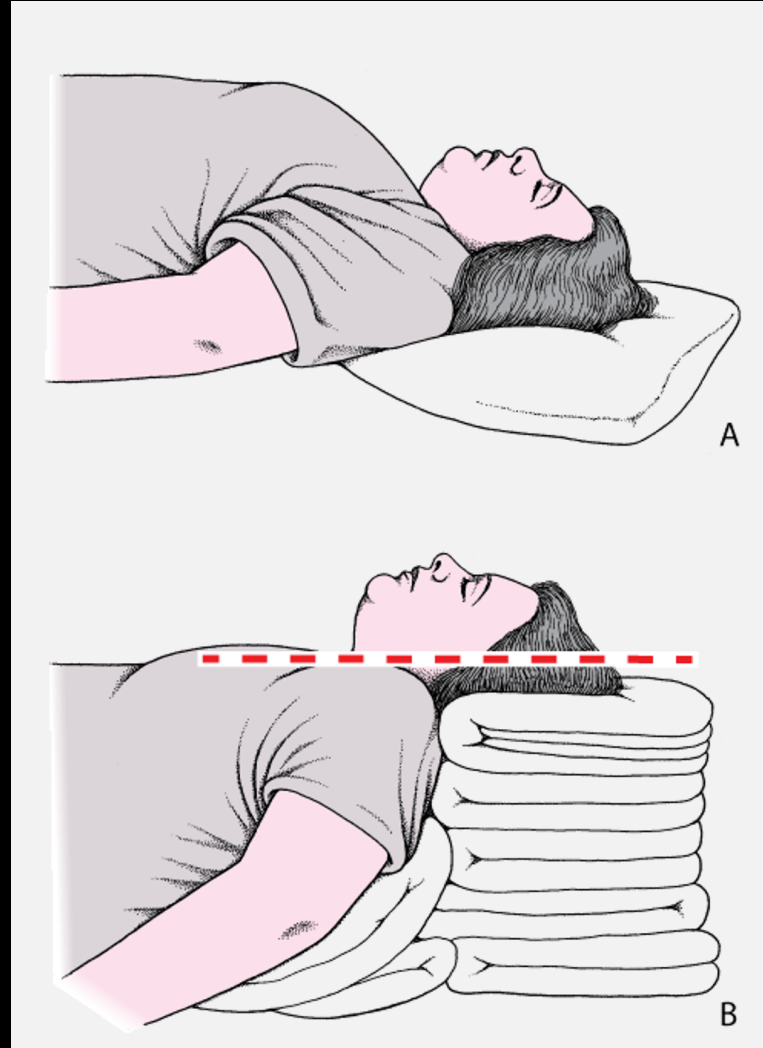
Airway Devices + Adjuncts

Mechanical Ventilators

Laryngoscopes

...among others!

Not all Devices are “High Tech” ...



Past

When did airway management start? Depends who you ask...

The early evolution of airway management techniques and equipment for anesthesia was largely driven by **surgical need**, the requirement for **airway protection**, and the **treatment of infectious diseases**, such as polio and diphtheria.

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The “Difficult Airway”

The concept of a “difficult airway” was appreciated by the first practitioners of anesthesia with London-based anesthesiologist **Joseph Clover** (1825-1882) carrying his homemade difficult airway equipment with him to every case.

<https://www.woodlibrarymuseum.org/museum/hewitt-airway/>



Clover Inhaler (1877)
“Portable ether inhaler”

Hewitt's Airway (1908)

“a circular metal ring, with an internal diameter of half an inch, and a deep groove in its outer circumference to allow the ring being held firmly by the teeth.”



Dr. Frederic W. Hewitt (1857-1916)

Source: *Hagberg & Benumof's Airway Management, 5th Edition (2023)*

Early plastic tube with inflatable cuff

Circa 1958



Past – Suction

The first conventional aspirator was introduced by a cardiologist named Pierre Carl Edouard Potain in 1869.

His aspirator was a manual machine that used a pump to drain abscesses and fluid buildup in the chest, with the goal of preventing heart failure.



Reflection 1:

How has *your practice* of airway management changed during your professional career, if at all?

Present – Airway Tools



Laryngoscope



Glidescope®

Present – Artificial Airways

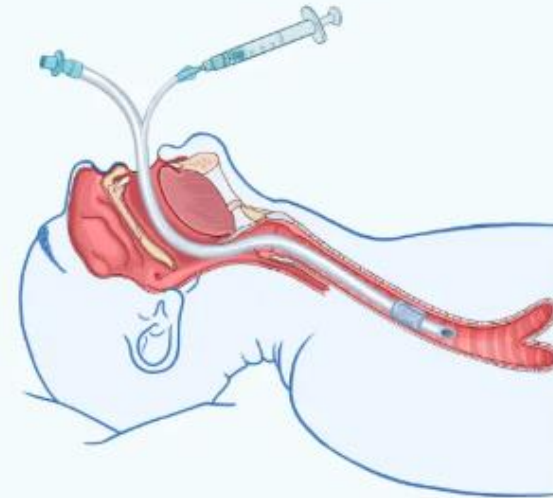
TYPES of ARTIFICIAL AIRWAYS



OROPHARYNGEAL
AIRWAY (OPA)



NASOPHARYNGEAL
AIRWAY (NPA)



ENDOTRACHEAL AIRWAY (ETA)
with INTUBATION

Present – Portable Suction



Laerdal LCSU 4,



SSCOR Quickdraw®

Reflection 2:

What shortcomings in:

- *Technology*

- *Procedures*

- *Training*

...do you see in your practice?

Current Challenges: Prehospital



◆ *Powerful,
portable suction*

◆ *Definitive
Airway*



Current Challenges: Military

- ◆ *Powerful, portable suction*
- ◆ *Definitive Airway*
- ◆ *Multiple lines (?)*

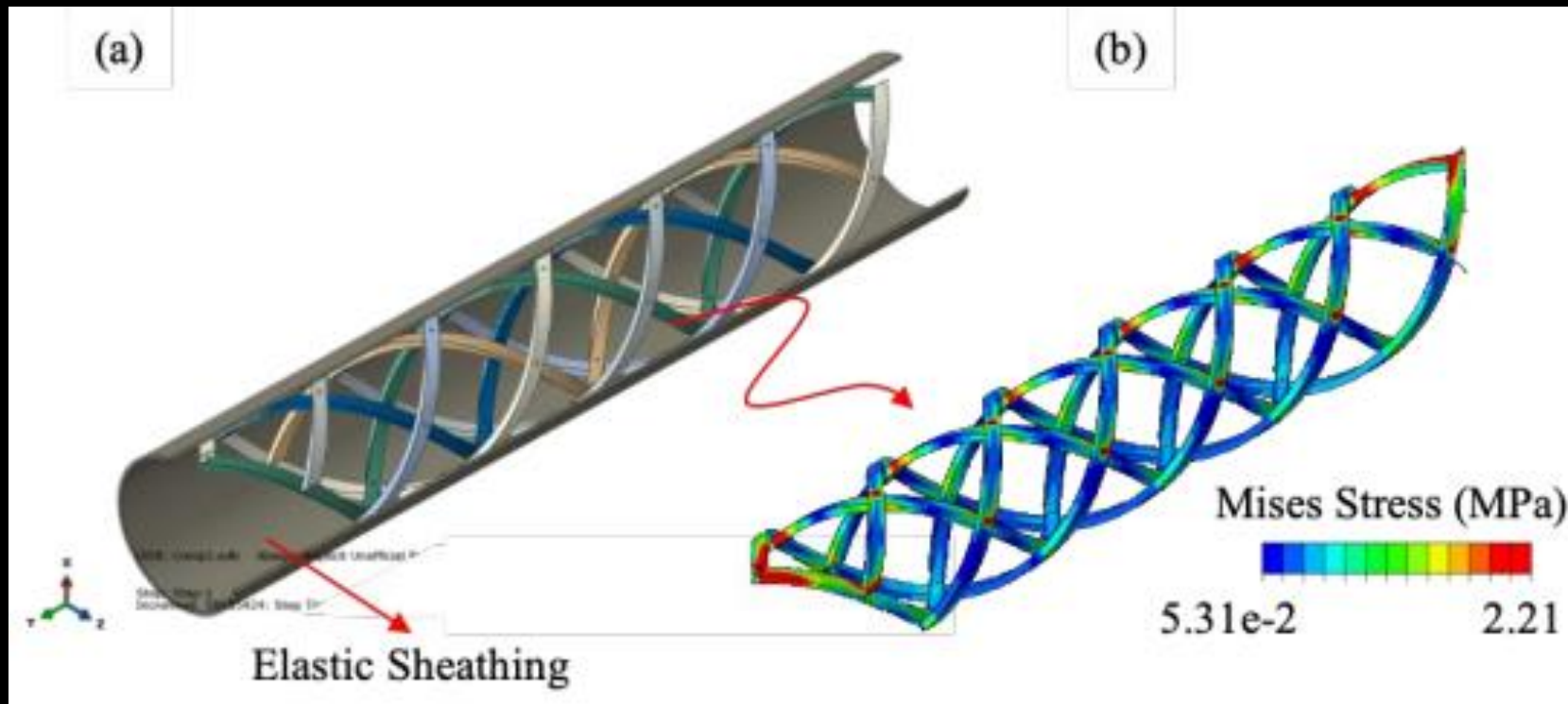


Current Challenges: Education

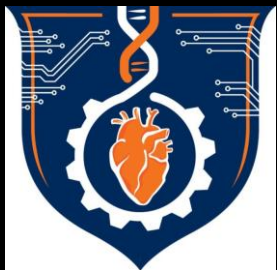
- ◆ *Direct vs. Video Laryngoscopy*
- ◆ *Training tools*



Future – Airway Devices



Novel Endotracheal Tube System(s)



Future – Robotic Intubation

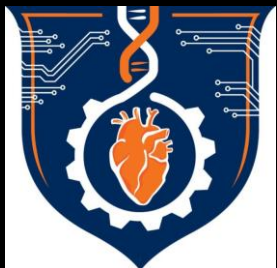


Source: <https://newatlas.com/worlds-first-intubation-robot-tested-on-human-subjects/18440/>

Future – Suction Devices



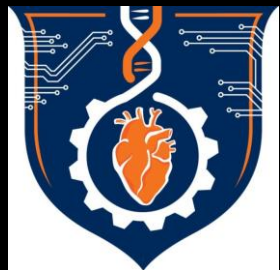
Orientation-Independence



Future –Suction Devices (cont.)

Integrated suction + artificial airway (?)

*Multiple high-power (500+ mmHg)
suction lines?*



Reflection 3:

As a professional in airway management...

Which improvements are actionable?

What near- and long-term visions do I have for my team's ability to manage the airway?

“The quiet part out loud”: Why the lone wolf fails

Scientists/Engineers:

- Tech looking for a problem; don't understand workflow

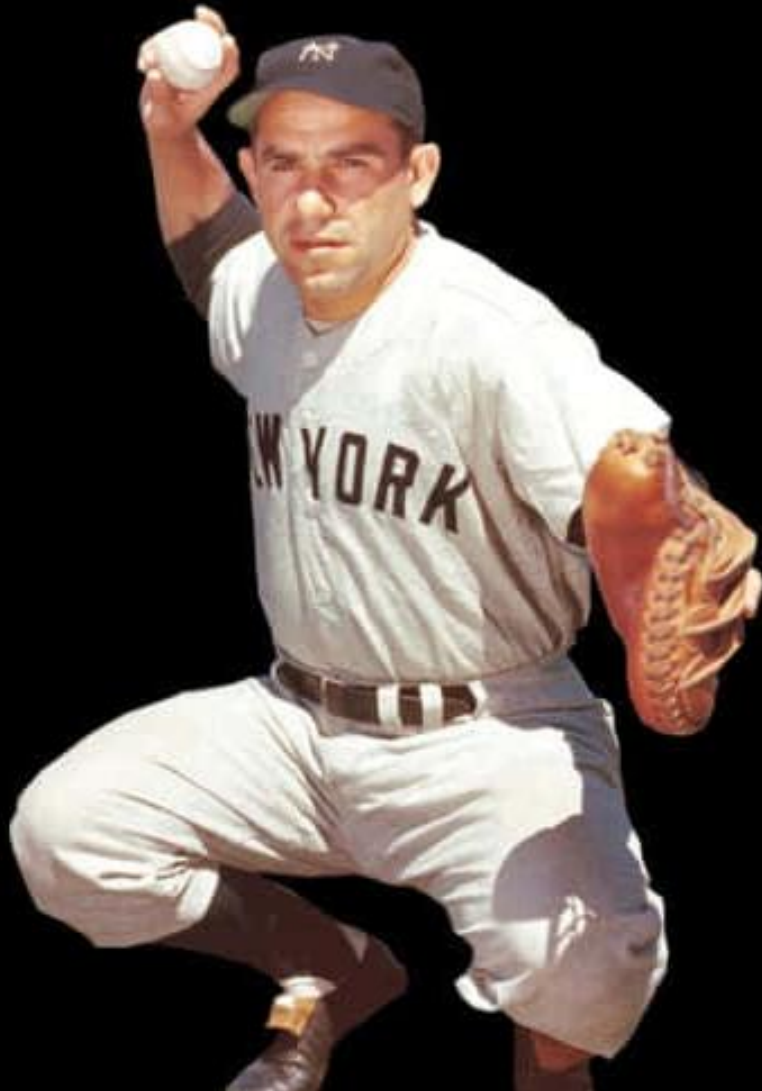
Clinicians:

- Half-baked idea; not enough time to do all testing, writing, etc.

+ Why collaborations fail:

- ◆ Lack of momentum – no leader(s)

Engineers, Take Note:



“You can **observe** a lot
by **watching.**”

- *Yogi Berra*

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Questions?

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