New Anesthesia Delivery Systems

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DISCLOSURES
None financial

I have learned some information from Anesthesia Machine Observations at public meetings outside the USA
Anesthesia Delivery System, past
1846 Morton Ether Inhaler

Ether Dome at Massachusetts General Hospital (MGH)
1846 version
keep upright
use two hands
This 1850 version worked horizontal with no hands required
Open Circuit Inhaler

Open Circuit = Non-rebreathing
Patient breathes in the ether vapor, breathes ether out (and it is discarded)
Breathes in new ether vapor
Breathes it out again (discarded)
Blood picks up enough to anesthetize the brain
Partial Rebreathing

Don’t throw all the exhaled vapor away
Reuse it
Somehow
Rebreathe vapor
Absorb CO2
Only Anesthesia Care Providers are allowed to care for patients with re-breathing systems
Electronics in the ADS

Boston Anesthesia System
1976
Prototype
Electronic
ADS
(MGH)
Boston
Anesthesia
System
Electronic,
with agent
injector
vaporizer
1990
Integrated Monitors and Data Recording

Ohmeda (now GE)
Central Display ADS

BWH Clinical Partner.
CD ADS won Ohmeda President’s Award
~ Year 1998

New Clinical Demands

Better Ventilation for difficult patients
  FGF-independent ventilation
  Compensate for circuit leaks and compliances
  Compensate for our lack of understanding
ICU Modes (Pressure, Synchronization)
GE SmartVent®, Draeger E-Vent Piston

New features
  Electronic Vaporizers (GE, Maquet)
  Automatic Pre-Use Check (GE, Draeger, Maquet)
  Flow Reflector agent conservation (Maquet)
  Electronic data for eCare data recording
Fresh Gas Flow Independent of Ventilation

1998 - WYSIWYG What You Set Is What You Get
Set Tidal Volume - patient receives what you set

Two ways to achieve this

Fresh Gas Compensation - compensate for FGF
Active, feedback control of inspired tidal volume
GE

Fresh Gas Decoupling – FGF goes elsewhere in I
Passive separation of FGF during inspiration
Draeger
Two Companies

GE-Datex-Ohmeda Aestiva and all others

Draeger Fabius and all others
GE-Datex-Ohmeda Aestiva

Draeger Fabius GS

1998 State-of-the-art
GE-Datex-Ohmeda ADU - had been ahead of its time
2012 state-of-the-art USA

GE Aisys

Draeger Apollo GS
Better ventilation for difficult patients

FGF-independent ventilation
Compensate for circuit leaks
Compensate for circuit compliance
ICU Modes (Pressure, Synchronization)
New Ventilation Mode

Pressure-cycled, Volume-controlled

Pressure Ventilation but delivers the Tidal Volume you set
Useful in Laparoscopy where compliance changes

First two
GE Pressure Control Volume Guarantee (PCV – VG)
Draeger Volume Ventilation with Auto-Flow (V V - Auto Flow)
Others with other names
Maquet Electronic Vaporizer

Liquid Fuel Injector technology
Therefore must compensate for altitude with all agents
Same for Iso, Sevo, and Des
unlike Variable Bypass designs

Vaporizer is off except in the active phase of inspiration
when the fuel injector injects
At this time, Flow-i compensates for exhaled anesthetic
agent recovered from the patient
~ Year 2008 World ADS not USA

Control of Insp. and Exp. Agent and Oxygen

TCGVD = Target-Controlled-Gas & Vapor Delivery

Draeger Zeus (control ET Agent, Insp O₂) 2008 Successor to Physioflex 1998 similar ADS)

GE Aisys ET Control (control ET Agent and O₂) 2010
Penlon Prima SP3
5 mL Tidal Volume for neonates

Simply measures compliance during pre-use check and compensates bellows during ventilation
2013 new to US Market
Philips AX 700

Volume support ventilation

FGF enters downstream of Inspiratory valve
Maquet Flow-i

Agent reflector
No moving parts ventilator
Intermittent flow vaporizer during Insp only
Maquet Flow-i

New to USA Market

Flow-i was built starting with Siemen’s Servo

Vaporizer is a liquid injection system

Inspiratory-only vaporizer use

Unique agent reflector in Ventilator mode

No piston or bellows in the ventilator

Oxygen-driven volume reflector

Stores agent and oxygen in a long-path storage element
Maquet Electronic Vaporizer

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Other new ADSs
Oricare A9800
Oricare

Air-O2 mixer
Oricare

Mixed Gas out
Common Gas Outlet
SpaceLabs Arkon
SpaceLabs Arkon

ADS expands
SpaceLabs Arkon

Accessory O2 lights up when on
AGO (Axillary Gas Outlet). Lights up when active.
SpaceLabs Arkon

 Auxiliary
 AC power
 USB power
 Ethernet
 Illumination
Mindray A5

Mechanical O2 and Air flow controls and meters with standard resolution
Mindray A5 (not FDA approved Oct 2013)
Mindray A7 (not FDA approved)

Mechanical needle valves hidden and available
Mindray A7 (not FDA approved)

Mechanical needle valves appear when needed
Mindray A7 (not FDA approved)

Virtual flow meters
Mindray A7 (not FDA approved)

Display of Delivered (not inspired) gas concentrations
Mindray A7 (not FDA approved)

Prominent display of delivered oxygen concentration
Mindray A7 (not FDA approved)

Trackpad backup in case of keyboard failure
Thank you