



LINET

Continuous, Individualized Ventilation Care

By Platform Base Tilt and Electric Impedance Tomography



Multicare X & Multicare

Open Lungs Carefully and Keep It Open

Pre-Prone and Pre-Recruitment Maneuver Care

ALT – EIT

For patient safety and caregiver confidence

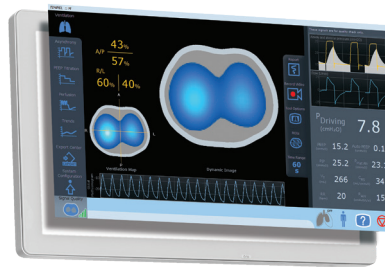
Goals

ALT-EIT helps improve medical care in mechanically ventilated patients.

Typically:

Lung consolidation	Lung Contusion	Pneumonia	Obesity	ALI/ARDS
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Concept



EIT Monitor
Provides continuous, real-time ventilation imaging.

Confirm EFFECT

Adjust TILT & PEEP



ALT bed
Precise, individualised tilt allows to control ventilation distribution and enhances lung opening.

ALT (Automatic Lateral Therapy)

An interventional tool. Lateral tilting significantly influences the distribution of pleural and trans-pulmonary pressure. Lateral tilt with adequate PEEP can control ventilation distribution (see later). ALT can also trigger lung opening at lower pressures compared to current care (0)

EIT (Electrical Impedance Tomography)

A monitoring tool that provides continuous real-time visualization of patients' mechanical ventilation. This is crucial in guiding ALT and ventilator setting.

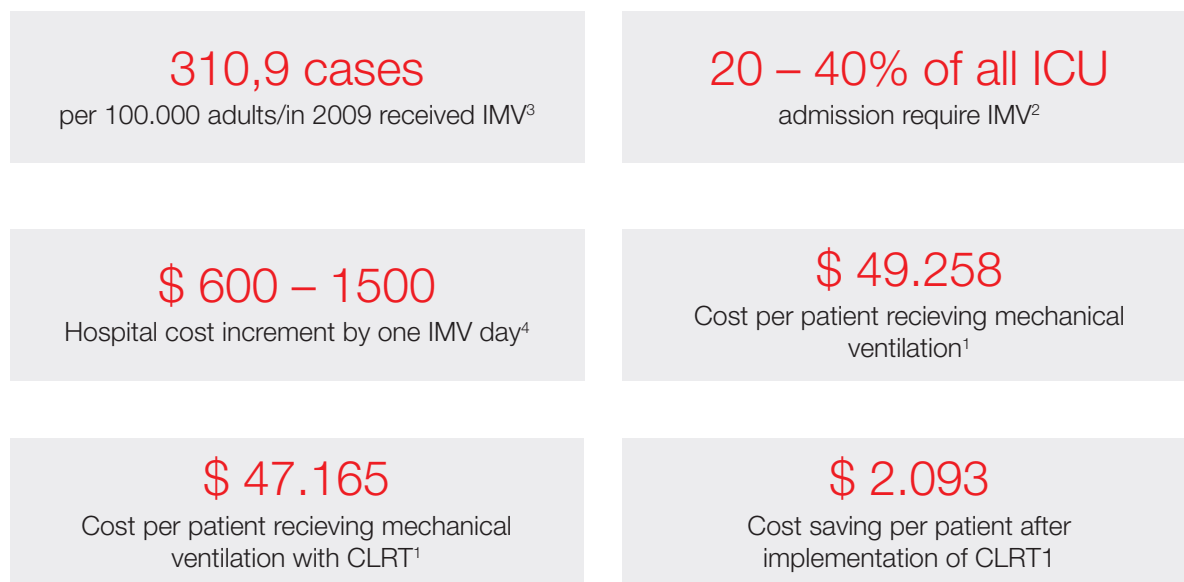
ALT guided by EIT

Allows precise ventilation management that is:

- Individualized
- Timely
- Continuous
- Targeted
- Careful
- Radiation-free

Invasive Mechanical Ventilation (IMV) in the USA

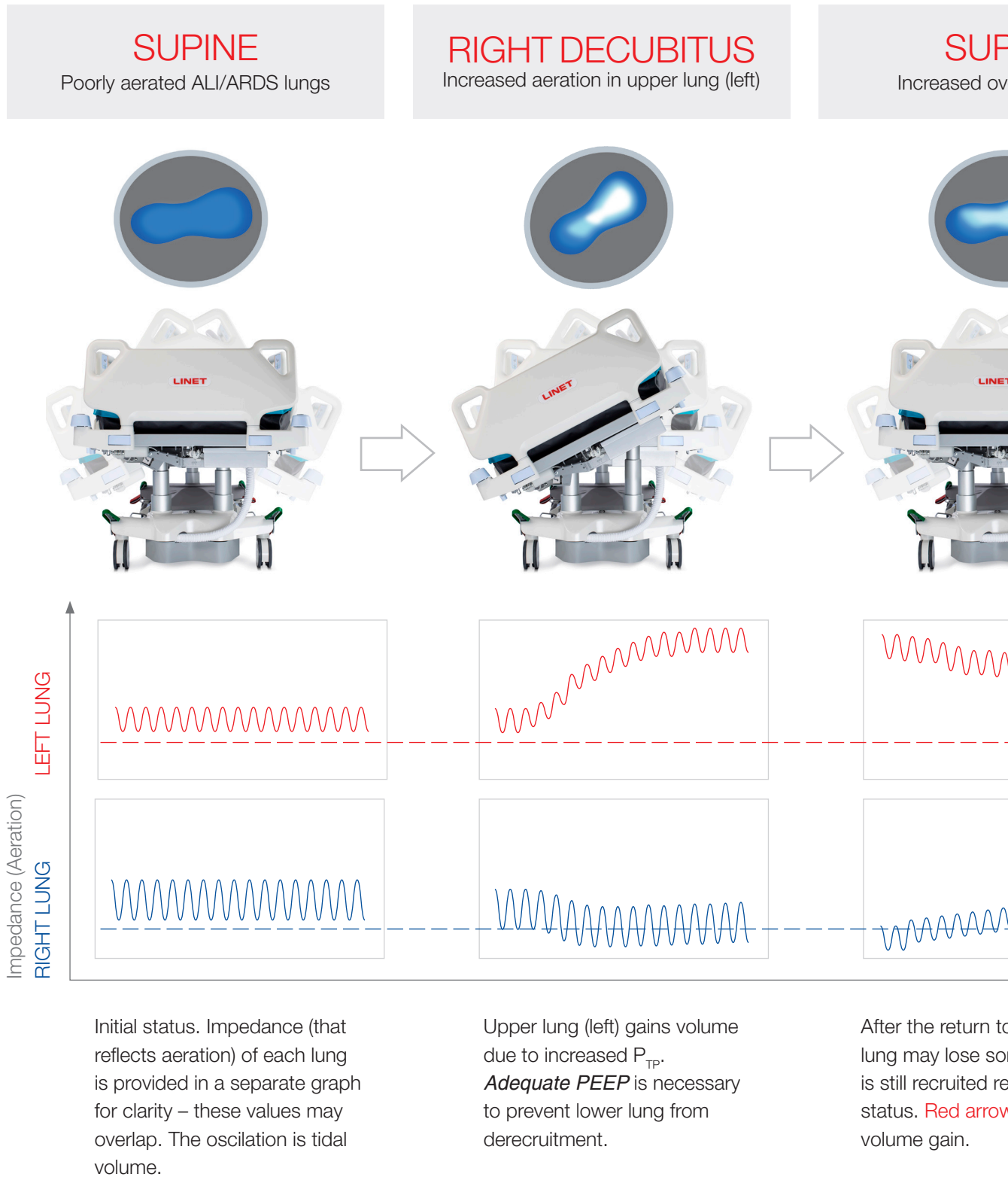
IMV represent high morbidity and mortality cohort of patients that are associated with significant cost to healthcare system.



ALT – EIT Lung Opening

In adequate PEEP

Rotation matters – Application of ALT EIT



PRONE

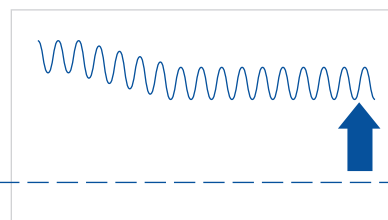
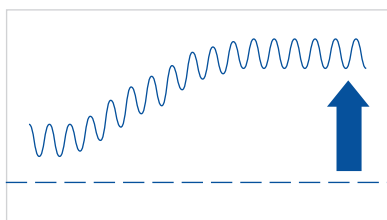
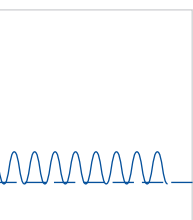
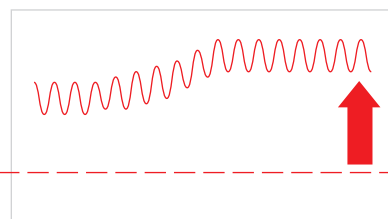
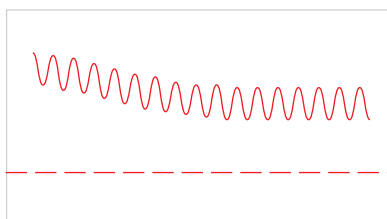
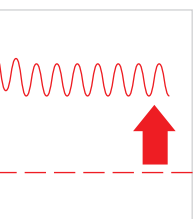
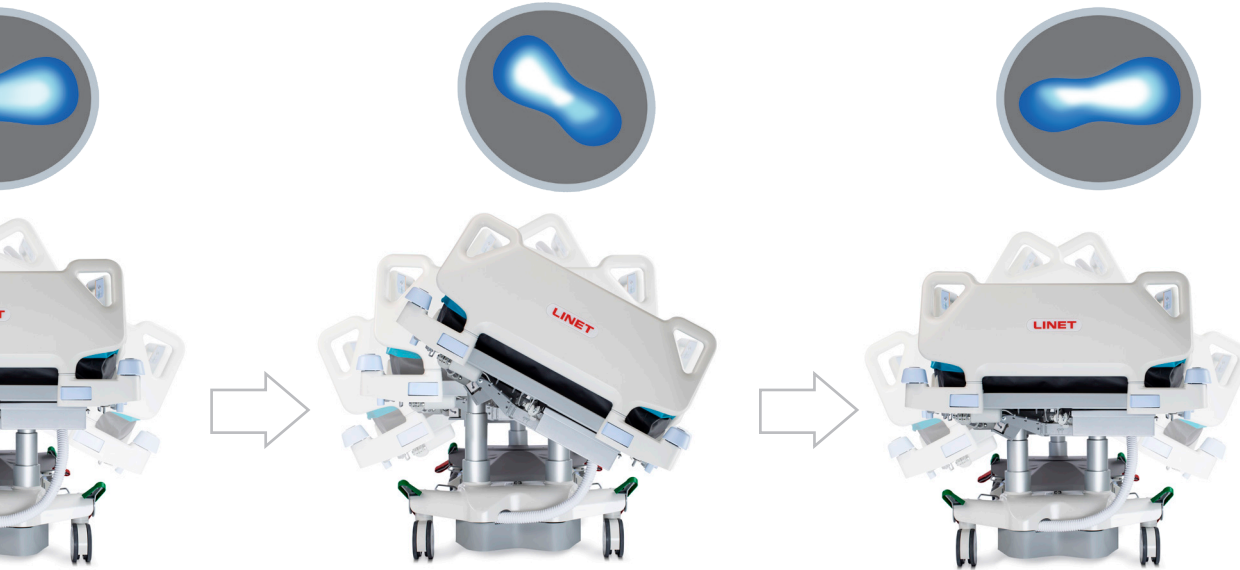
Overall aeration

LEFT DECUBITUS

Increased aeration in upper lung (right)

SUPINE

Increased overall aeration



LEFT LUNG

RIGHT LUNG

Impedance (Aeration)

Time

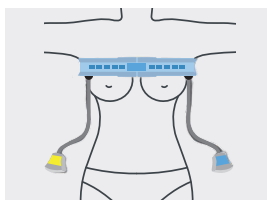
o supine, left
me volume but
relative to initial
v represents

Now the right lung is the upper lung and gains volume due to increased PTP. Blue arrow represents volume gain of the right lung relative to initial status.

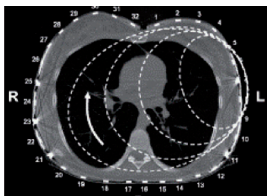
After the return to supine, both lungs may exhibit recruitment. Red and blue arrows represent volume gain.

Rotation matters – Application of ALT EIT

EIT (Electric Impedance Tomography)



32-electrode belt is placed circumferentially around. The thorax Electrical current (~5-10mA 30V) is injected through a pair of electrodes and chest impedance is measured by all remaining ones. This is repeated (at 50Hz) for all pairs of electrodes to generate one EIT image.



EIT is contraindicated in pacemaker/ICD.



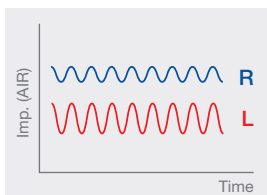
In an analogous principle to CT, thoracic impedance map is generated.

(This CT presents atelectasis in the left lung).



In EIT image, the lighter the color the higher the impedance, hence more air.

(This EIT presents less air in the left lung, that may reflect atelectasis).



For any chosen region, the impedance can be displayed graphically over time (Here R and L lung, R having more air).

ALT (Automatic Lateral Therapy)



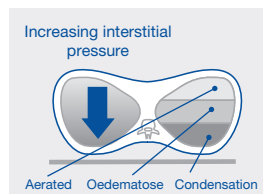
Method of patient lateral tilt developed based on experience with CLRT.

Bed platform based patient rotation in maximal angle of 60° (30°L/30°R).

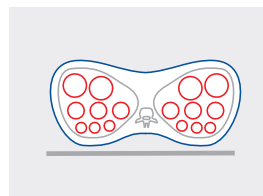


Safe patient stabilization system and stable ventilation circuit's fixation.

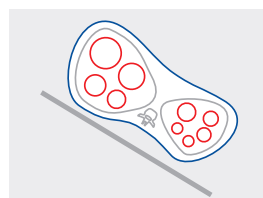
Tilt Physiology



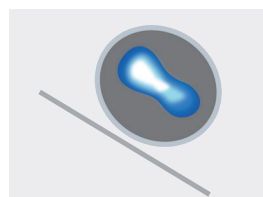
Due to gravity, vertical gradient of interstitial pressure exists, specifically in oedematous lungs.



Consequently, the alveoli in the lower (dependent) regions are less distended than ventral ones and may even collapse. On contrary the upper (nondependent) regions may be overdistended.

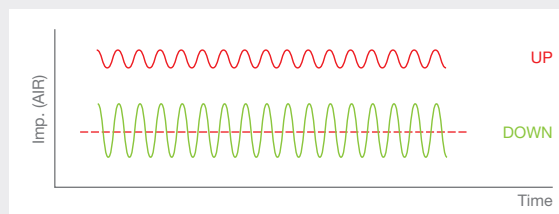
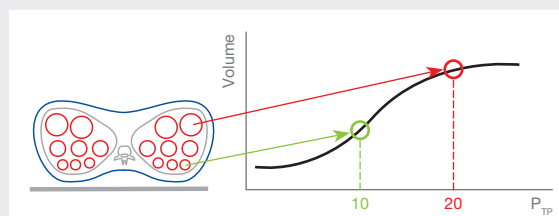


In Lateral tilt the same principles apply. Hence the **upper** lung tends to be **more distended**. (illustrated schematically and in EIT image) This distending pressure can serve as an opening maneuver. However, **adequate PEEP must be set** to prevent lower lung from collapse.



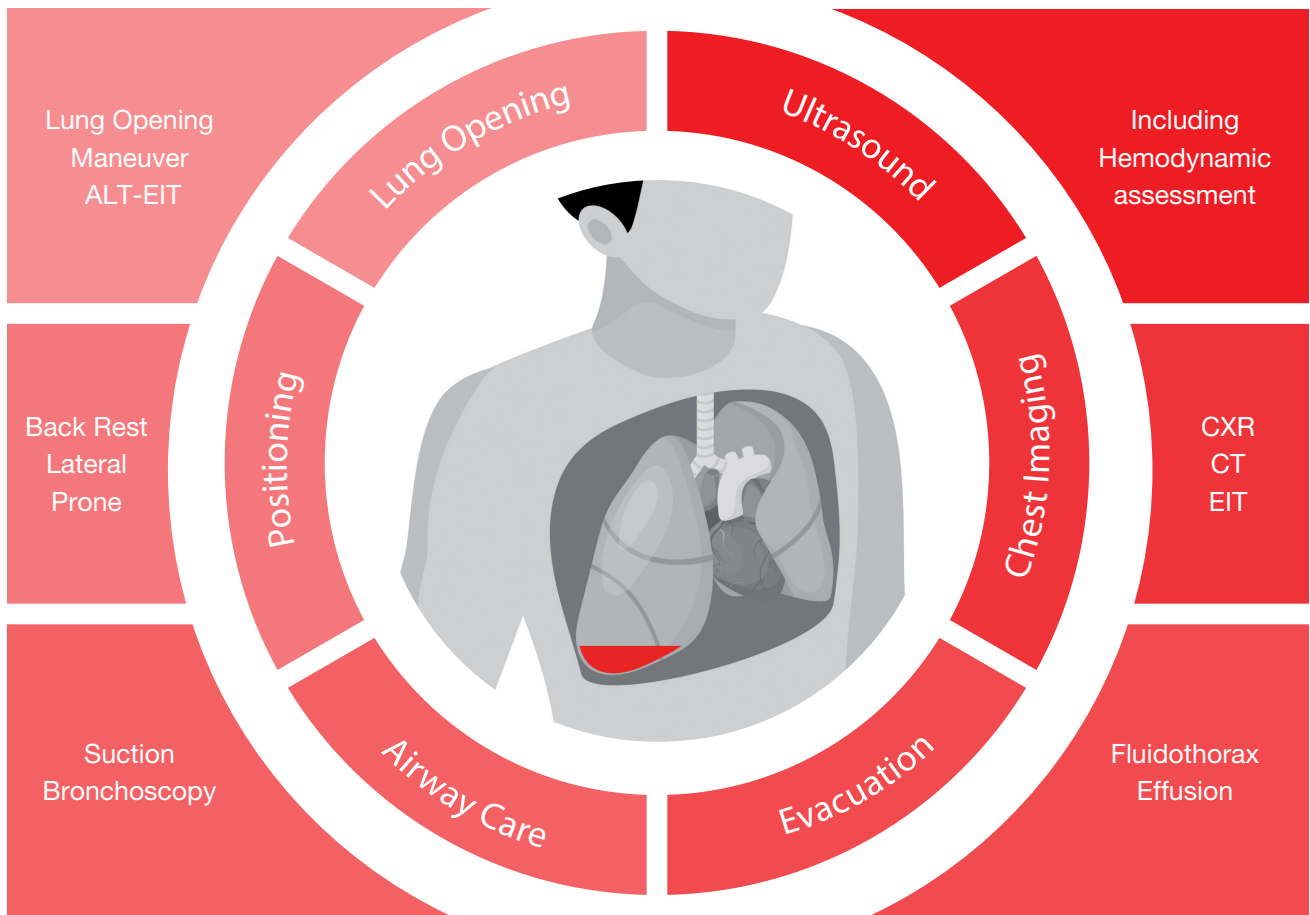
NOTE

Increased distension does not necessarily implicate increased ventilation. With increasing distension (i.e. P_{TP} – trans-pulmonary pressure) compliance and thus regional ventilation decrease. Ultimate example is over-distension with maximal local aeration but almost no local ventilation (red trace “UP” in the graph).



Comprehensive Individualized Care

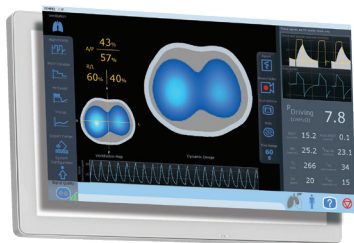
Respiratory failure is always challenging and requires systemic individualized approach to each patient. Precise differential diagnostics usually combines with several therapeutic interventions. The combination of lateral tilt and EIT method can only be effective if it is a component of such complete respiratory care.



References

0. Ongoing study
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2. Critical Care Statistics. Society of Critical Care Medicine [online]. 500 Midway Drive, Mount Prospect, IL 60056 USA: SCCM, 2019 [cit. 2019-09-27]. Available from: <https://www.sccm.org/Communications/Critical-Care-Statistics>
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4. Mechanical Ventilation in the Intensive Care Unit. THE AMERICAN ASSOCIATION FOR THE SURGERY OF TRAUMA [online]. 633 N Saint Clair St, Suite 2600, Chicago, IL 60611: AAST, 2019 [cit. 2019-09-27]. Available from: <http://www.aast.org/GeneralInformation/mechanicalventilation.aspx>

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Provides continuous,
real-time ventilation imaging.

Adjust TILT & PEEP

Confirm EFFECT



ALT bed
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LINET
Designed to help you care

LINET, spol. s r.o.
Želivčice 5 | 274 01 Slaný | Czech Republic
tel.: +420 312 576 400 | fax: +420 312 522 668 | e-mail: info@linet.com | www.linet.com

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