ABYLCAP

C O_2 REMOVAL

The therapeutic strategy aimed at protective ventilation

Simplicity and Safety

Prevention

Efficiency and Biocompatibility

ABYLE®

Acute Bellco Line

bellco

The right therapy way

ABYLCAP

CO_2 REMOVAL

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The right therapy way

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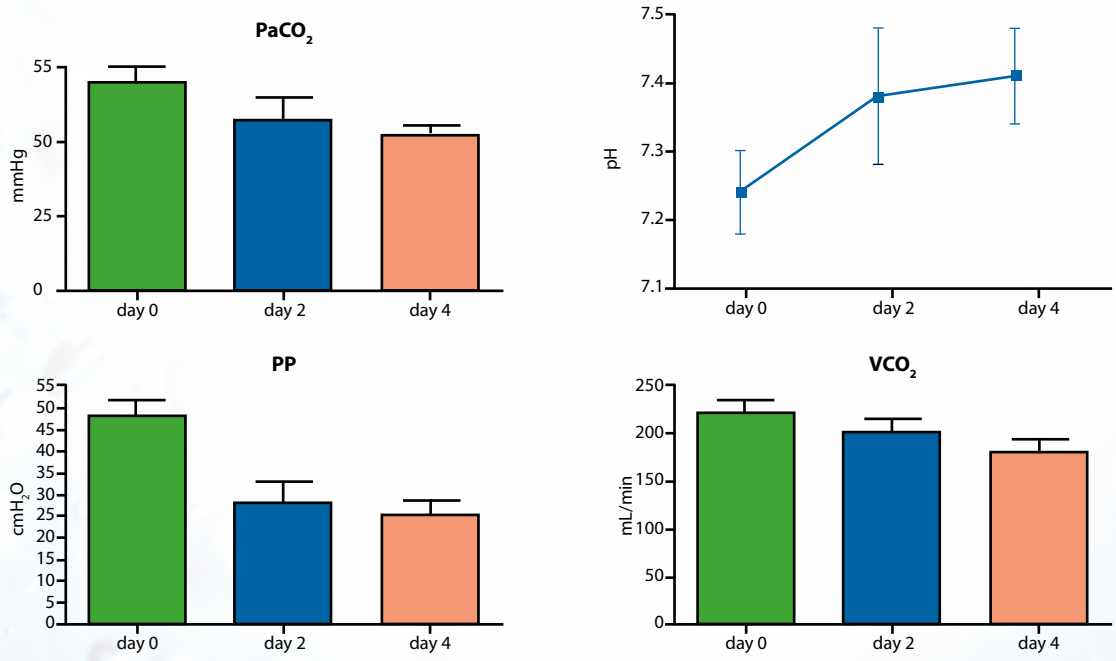
Efficiency

$ECCO_2$ removal may be a useful support in patients with difficult respiratory weaning. The aim of this study was to evaluate ABYLCAP system regarding clinical safety, cardiorespiratory indices and CO_2 removal.
Ten patients were enrolled. Before starting with $ECCO_2$ removal all patients were ventilated with TV <6 mL/kg, peak pressure >35 cm H_2O and pH <7,25. $ECCO_2$ removal was initiated using a modified continuous venovenous hemofiltration system with a membrane oxygenator (ABYLCAP; Bellco, Mirandola, Italy; membrane surface area: 0,67 m^2, blood flow 280 to 350 mL/minute, phosphorylcholine coated).
All patients had $ECCO_2$ for 4 days. During the $ECCO_2$ removal the patients were ventilated with TV ≤6 mL/kg and peak pressure <30 cm H_2O.

	day 0	day 2	day 4
pH	7,24±0,06	7,38±0,1	7,41±0,07*
$PaCO_2$ (mmHg)	70±5	57±8	52±3*
PP (cmH_2O)	48±4	28±4*	25±4
VCO_2 (mL/min)	220±15	201±14	180±13*

* p< 0,05 vs. T0

The CO_2 removal ranged from 56 to 37 mL/minute. All patients survived 4 day treatment duration and 7/10 were weaned from the ventilator at the end of CO_2 removal. Only one oxygenator was used for each patient without clotting of the circuit or any major bleeding problem.



Modified from Turani F, Martini S, Marinelli A, et al.
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ABYLCAP

C O_2 R E M O V A L

THE THERAPEUTIC STRATEGY AIMED AT PROTECTIVE VENTILATION

Abylcap removes CO_2 quickly, easily and effectively with utmost safety while at the same time optimizing mechanical ventilation and protecting the patient's lungs. Bellco proposes this method to treat patients suffering from ALI (Acute Lung Injury) and ARDS (Acute Respiratory Distress Syndrome) triggered by other diseases such as sepsis, MOF (Multi Organ Failure), COPD (Chronic Obstructive Pulmonary Disease) and multi-trauma.

VILI: Ventilator-Induced Lung Injury

Mechanical ventilation, a life-supporting therapy for critical patients suffering from acute respiratory failure (ARF), poses some potential (possibly irreversible) risks of lung injury induced by alveolar overdistention or by the inspiration/expiration cycle. These risks can lead to damage, such as barotrauma, volutrauma and atelectrauma. Further possible consequences are inflammation, not only of pulmonary tissue, but also of other organs - such as the liver and the kidneys - because of damage to the alveolar-capillary barrier.

These complications are collectively known as 'VILI' (ventilator-induced lung injury). In order to prevent potential injury - as demonstrated by clinical studies - mechanical ventilation can be used at low pressure values (plateau pressure < 30 cm H_2O) or exchange volumes (approx 6 mL/kg of ideal body weight). This type of treatment is now accepted for patients suffering from ARF (Acute Respiratory Failure); however, there is an associated risk of hypercapnia and respiratory acidosis.

To facilitate the removal of excess carbon dioxide, extra-pulmonary devices are used to help the lungs function and to maintain an acceptable alveolar gaseous exchange.

Why CO_2 removal systems

Hypercapnia derives from the intention to reduce pulmonary stress induced by ventilation. Adopting low tidal volumes associated with high ventilation frequencies allows operating with reduced switching pressures. Every intensive care operator should strive to guarantee the best gas exchange without harming the ventilated lung.

A correct CO_2 value, apart from determining acid-base balance, is an inescapable component of **cellular respiration** and contributes to short-term regulation of the **local tissue blood flow** (microcirculation), thereby ensuring and maintaining an **appropriate blood flow** and optimal perfusion of the organs.

Abylcap for the prevention of lung injury in patients in respiratory failure

Abylcap is intended for preventive CO_2 removal to reduce the aggressiveness of mechanical ventilation; limiting VILI, enabling transition off of mechanical ventilation and extubation; and reducing sedation days and risk of further complication. The treatment is suitable for patients that respond to oxygenation therapy but are unable to independently maintain a balanced CO_2.

Abylcap functions according to a simple and safe mechanism: the blood aspirated from the patient is directed to the oxygenator, which progressively removes CO_2 by means of a special phosphorylcholine-coated membrane, bringing levels down to optimal values. In addition, the heater in the system recovers the heat lost through oxygen expansion, thus preventing patient hypothermia.

The operator has the ability to remove CO_2 using a minimally-invasive treatment and the most suitable type of oxygenation protective low-volume ventilation (Pplat < 30 cm H_2O and VT = 6 mL/kg) or non-invasive ventilation (NIV).

ABYLCAP

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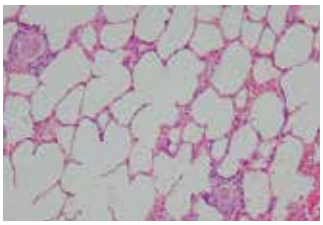
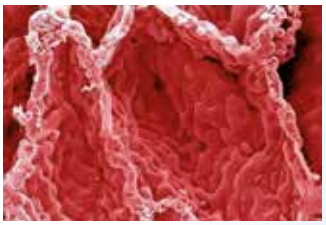
Abylcap integrates low ventilation volumes and CO_2 removal for the prevention of lung injury in patients suffering from respiratory failure

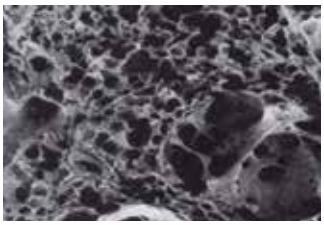
Abylcap is a therapeutic strategy aimed to reduce intubation incidence and time - important factors in improving patient survival. Reducing the need for orotracheal intubation also reduces related side effects, including, but not limited to: trauma of the upper airways; speech and swallowing impairment; and especially pneumonia, which has a 30% incidence on mortality.



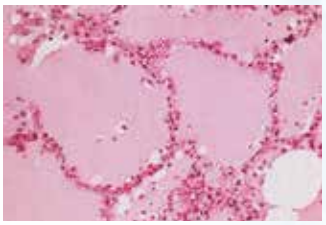
Healthy pulmonary tissue



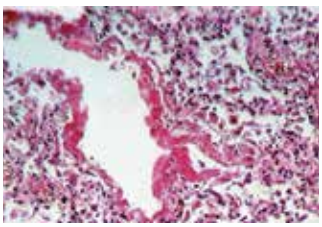
Healthy alveolus



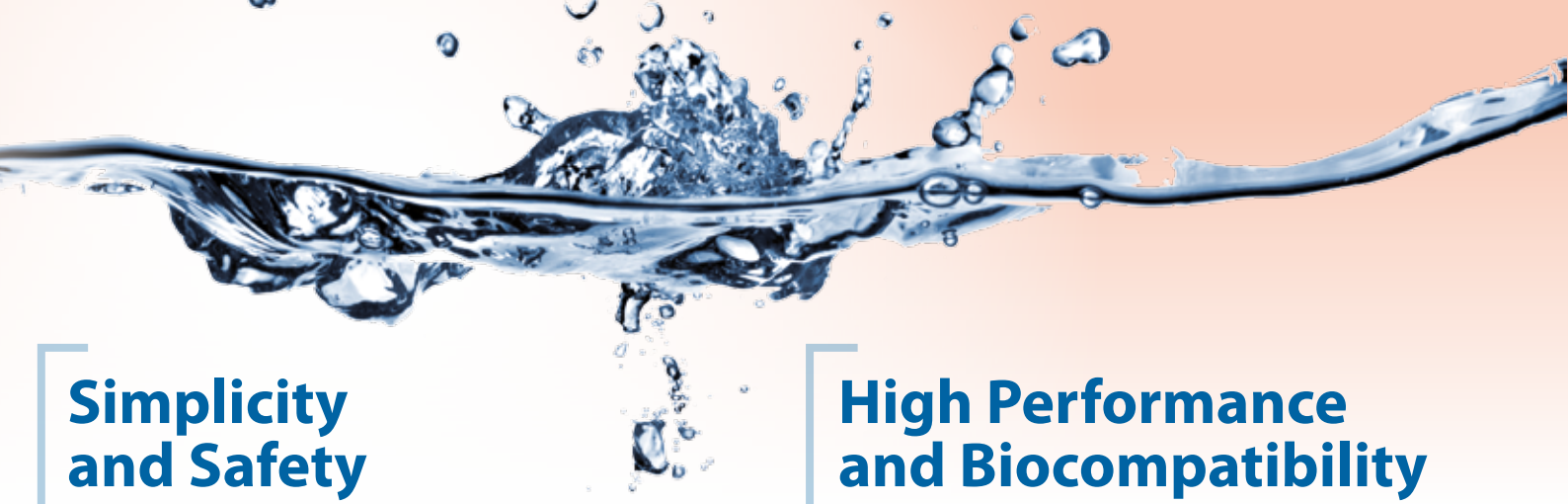
Pulmonary emphysema



Acute pulmonary emphysema



Exudative phase of ARDS where there is a loss of alveolarepithelial cells and intra-alveolar hyaline and neutrophil membranes are present



Simplicity and Safety

- **Preassembled kit system**
  Easy and fast installation, with reduced risk of error.
- **Blood flow**
  Blood flow rate is variable up to a maximum of 400 mL/min.
- **Fully automatic preparation**
  Priming, filling, rinsing and air removal from the circuit.
- **Continual HCT and SO_2 measurement**
  Hematocrit and oxygen saturation measurements can be read directly and continuously.
- **Real-time safety monitoring**
  Arterial pressure, reinfusion pressure and oxygenator input pressure trends at the inlet of the oxygenator are all graphically represented, allowing for continuous monitoring of monitor circuit efficiency and patient connection.
- **Plate heater**
  It allows recovery of the heat lost as a result of oxygen expansion and CO_2 removal on oxygenator membrane level.

Prevention

- **Minimally-invasive and personalised CO_2 removal**
- **Reduced need for intubation**
- **Containment of side effects**
- **Potential to improve survival**

High Performance and Biocompatibility

Oxygenator Lilliput 2 ECMO*, developed for carbon dioxide removal with a minimally-invasive approach

- **High biocompatibility**
  Polymethylpentene membrane coated with a phosphorylcholine-based biomimetic treatment (PH.i.S.i.O coating system) for greater membrane hemocompatibility and containment of thrombotic effects.
- **High gaseous exchange capacity**
  Gas transfer occurs by diffusion (not in direct contact with the blood) through a membrane not subject to hydrophilization. This membrane is as thick as the alveolar membrane.
- **Four consecutive days of treatment guaranteed**
  The system can conduct four consecutive days of treatment thanks to properties of the membrane that maintain its performance.

Lilliput 2 ECMO stands out for:

Low priming volume (90 mL)

Gas exchange surface area (0,67 m^2)

Heater surface area (0,02 m^2)

Reduced 'synthetic' surface area in contact with the blood

Reduced activation of the inflammatory response

Flexibility of use for a wide range of patients

Functionality and ease of use

*manufactured by Sorin Group Italia – Mirandola