

Executive Summary

Retia Medical is a NY manufacturer of critical care monitors used by doctors and nurses to guide fluid therapy. Proper fluid therapy has been shown to:

- 1. Reduce time that patients (such as COVID-19) spend on mechanical ventilation by 30 – 50%, increasing turnover**
- 2. Reduce cardiac arrhythmias by 54% and potential mortality after weaning off ventilation¹**

Regular bedside monitors often do not provide enough information to implement evidence-based protocols to optimize fluid management. Retia's FDA cleared Argos Cardiac Output Monitor can help guide resuscitation from circulatory shock associated with acute respiratory distress syndrome (ARDS), which occurs frequently in COVID-19 patients. The monitor is already in use at three of the top five hospitals in the US and several other leading hospitals.

Retia's monitor is streamlined for rapid setup (< 1 minute) and does not require clinicians to exit critical care areas for disposables, reducing consumption of limited PPE and lowering potential for infection. Where on-site installation and training support is not feasible, we will provide virtual (remote) training and support for clinical protocol implementation with our clinical consulting partners.

Clinical Application: Using the Argos Cardiac Output Monitor to Guide Management of COVID-19 Patients

COVID-19 patients are at-risk for acute respiratory distress syndrome (ARDS), sepsis, heart failure, and acute kidney injury.² Of those who are placed in intensive care, most will experience circulatory shock (hypotension).

- **Optimal intravenous (IV) fluid therapy to treat shock during ARDS can reduce the need for ventilation.³**
- Conventional bedside monitors, which track continuous blood pressure (BP), do not provide enough information to implement protocols to optimize IV fluid therapy.⁴
- When weaning patients from the ventilator, an excess of fluids has been associated with weaning failure, renal failure, cardiac arrest and increased mortality.⁶
- **Result: Too much fluids can extend the duration of mechanical ventilation in ARDS patients by up to 3X.⁵**

Using parameters provided by Retia's Argos Hemodynamic monitor, doctors and nurses can optimize therapy via evidence-based protocols to improve outcomes.⁷ The Argos monitor calculates hemodynamic parameters using the continuous BP signal acquired digitally from the existing bedside monitor (no contact with patient). The Argos monitor can be set up in 1 minute and its utilization can be maximized by moving it from patient to patient for spot checks without any added infection risk or use of additional PPE.

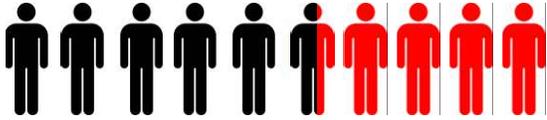
References:

1. Liu J, Shen F, Teboul JL, Anguel N, Beurton A, Bezaz N, Richard C, Monnet X. Cardiac dysfunction induced by weaning from mechanical ventilation: incidence, risk factors, and effects of fluid removal. *Crit Care*. 2016 20:369.
2. Zhou F *et al*. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *The Lancet*. March 11, 2020.
3. Griffiths MJD *et al*. Guidelines on the management of acute respiratory distress syndrome. *BMJ Open Respir Res*. 2019;6(1)
4. Marik PE, Monnet X, Teboul JL. Hemodynamic parameters to guide fluid therapy. *Ann Intensive Care* 2011;1:1
5. van Mourik N, Metske HA, Hofstra JJ, Binnekade JM, Geerts BF, Schultz MJ, *et al*. Cumulative fluid balance predicts mortality and increases time on mechanical ventilation in ARDS patients: An observational cohort study. *PLoS ONE*14(10): e0224563.2019
6. Vignon P. Cardiovascular failure and weaning. *Ann Transl Med* 2018;6(18):354.
7. Latham HE, Bengston CD, Satterwhite L, Stites M, Subramaniam D, Chen GJ, Simpson SQ. Stroke volume guided resuscitation in severe sepsis and septic shock improves outcomes. *Journal of Critical Care* 42 (2017) 42-46.

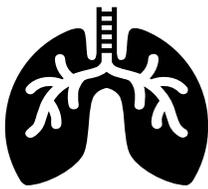
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Fluid Optimization as part of a COVID-19 Treatment Strategy



54% of COVID-19 patients experience respiratory failure¹ (respiratory failure is the second most frequently observed complication)



ARDS was observed in **31%** of all patients (98% in non-survivors).¹

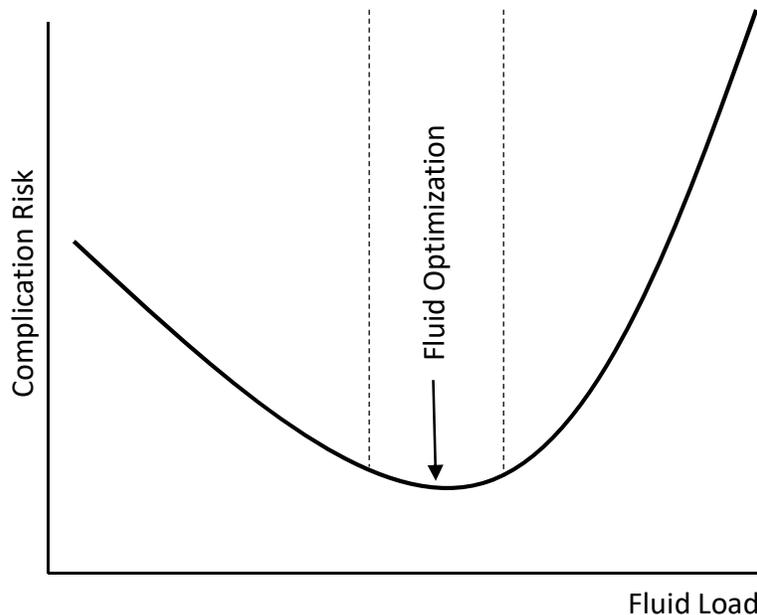
ARDS patients are at a high risk requiring prolonged mechanical ventilation.²



Under-/over-resuscitation can exacerbate existing gas-exchange abnormalities and extend the requirement for mechanical ventilation.

Too Little Fluid [Hypovolemia]

Tissue Hypoperfusion
Tissue Hypoxia
Organ Failure
Insufficient Perfusion



Too Much Fluid [Hypervolemia]

Tissue Edema
Organ Failure
Increased ICU/
Ventilator Days
Increased Mortality



A goal-directed fluid management strategy guided by SVI/CI has been shown to decrease time on mechanical ventilation.³ See attached information about the Argos Cardiac Output Monitor.



Continued focus on interventions to reduce duration of mechanical ventilation are both clinically and operationally significant during a time when ventilator demand is anticipated to exceed supply.

1 Zhou F *et al.* Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *The Lancet.* March 11, 2020.
2 Wunsch H, Linde-Zwirble WT, Angus DC, Hartman ME, Milbrandt EB, Kahn JM. The epidemiology of mechanical ventilation use in the United States. *Critical Care Medicine.* 2010; 38:1947-53.
3 Data on file.

The Argos Cardiac Output Monitor

Use the existing radial arterial line with *no additional disposables*



Single cable connection to the bedside monitor

Consistently accurate^{1,2} hemodynamic profile in seconds

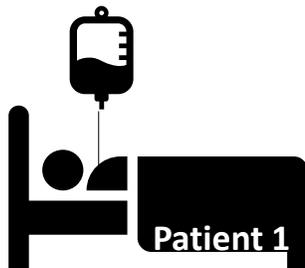
Compatible with different patient monitors



Argos Monitor input



Easy setup to *quickly* meet the monitoring needs of each COVID-19 patient



- 1 Saugel B *et al.* Cardiac output estimation using multi-beat analysis of the radial arterial blood pressure waveform: a method comparison study in patients having off-pump coronary artery bypass surgery using intermittent pulmonary artery thermodilution as the reference method. *Journal of Clinical Monitoring and Computing.* August 5, 2019.
- 2 Greiwe G *et al.* Cardiac output estimation using multi-beat analysis of the radial arterial blood pressure waveform versus intermittent pulmonary artery thermodilution: a method comparison in patients treated in the intensive care unit after off-pump coronary artery bypass surgery. *Journal of Clinical Monitoring and Computing.* August 5, 2019.