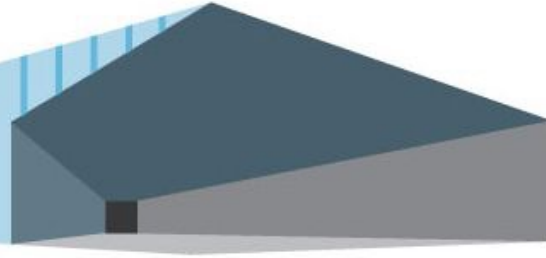


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# Evaluation of microcirculation in septic shock and Covid-19 patients

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# Introduction

- **Sepsis** is life-threatening organ dysfunction caused by a dysregulated host response to infection (e.g., bacteria, virus(COVID-19), fungi etc.)
- Sepsis can lead to septic shock, and it is characterized with microcirculation disturbance.

# Introduction

## First-line therapy – fluid and vasopressor therapy

Open Access Systematic Review

### Effects of Fluids on the Sublingual Microcirculation in Sepsis

by Rachael Cusack<sup>1,2</sup>, Susan O'Neill<sup>2</sup> and Ignacio Martin-Loeches<sup>1,2,\*</sup>

<sup>1</sup> School of Medicine, Trinity College, Pearse Street, D02 R590 Dublin, Ireland

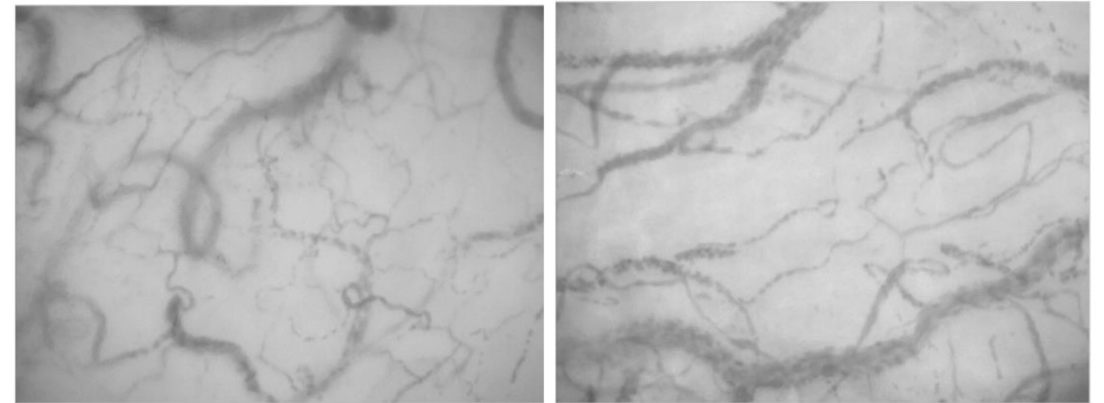
<sup>2</sup> Intensive Care Unit, St James's Hospital, James's Street, D08 NHY1 Dublin, Ireland

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*J. Clin. Med.* 2022, 11(24), 7277; <https://doi.org/10.3390/jcm11247277>

## 5. Conclusions

This systematic review of the literature has failed to identify good evidence that intravenous fluid can improve the sublingual microcirculation, measured using a HVM




**Figure 2.** Sublingual microcirculation images from patients with sepsis, displaying characteristic heterogeneity of recruited vessels and reduced capillary density.

# Introduction

Optimization of systemic hemodynamic does not necessary indicate therapeutic effect on microcirculation due to loss of hemodynamic coherence.

Research | [Open Access](#) | [Published: 20 November 2018](#)

## Microcirculatory perfusion disturbances in septic shock: results from the ProCESS trial

[Michael J. Massey](#), [Peter C. Hou](#), [Michael Filbin](#), [Henry Wang](#), [Long Ngo](#), [David T. Huang](#), [William C. Aird](#), [Victor Novack](#), [Stephen Trzeciak](#), [Donald M. Yealy](#), [John A. Kellum](#), [Derek C. Angus](#) & [Nathan I. Shapiro](#)  [for the ProCESS investigators](#)

*Critical Care* **22**, Article number: 308 (2018) | [Cite this article](#)



## Monitoring coherence between the macro and microcirculation in septic shock

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*Jan Bakker<sup>a,b,c,d</sup> and Can Ince<sup>a</sup>*

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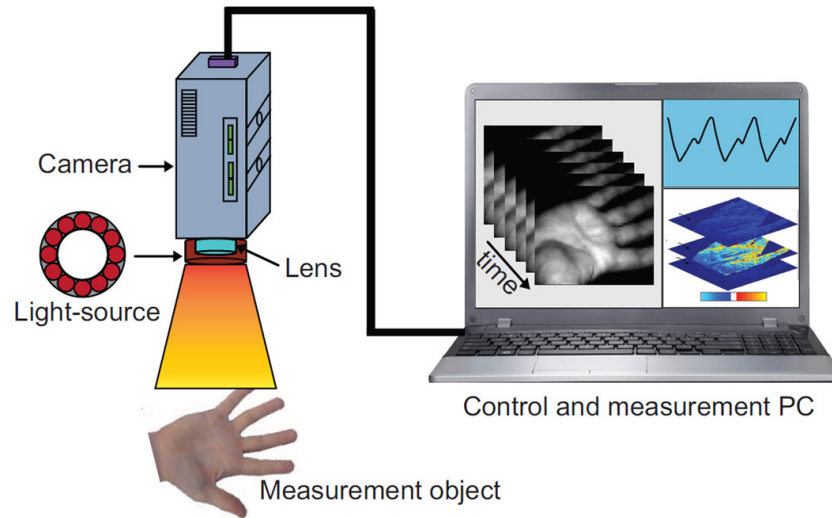
The improvement in macrohemodynamics during the resuscitation is not consistently followed by subsequent changes in the microcirculation. This may result in both over-resuscitation and under-resuscitation leading to increased morbidity and mortality. In this article the principles of coherence and the monitoring of the microcirculation are reviewed.

# Introduction

## Methods of microcirculation assessment

- Near-Infrared spectroscopy (NIRS)
- Laser Doppler
- Videomicroscopic techniques
- Photoplethysmography
- Orthogonal spectral polarization
  
- Serum lactate levels
- Capillary refill time

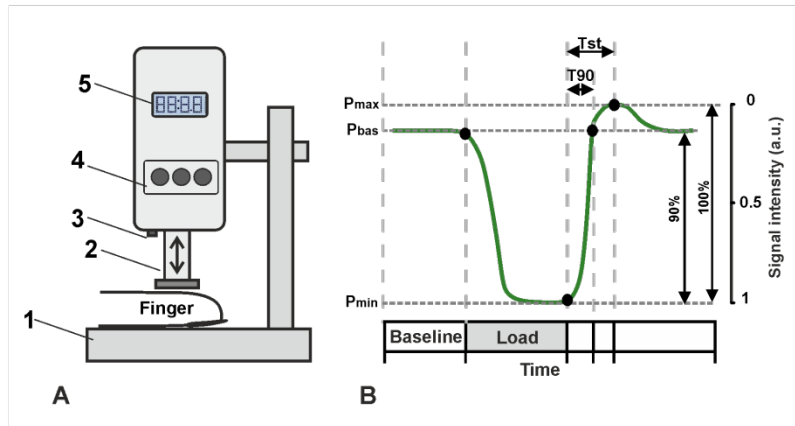
# Remote photoplethysmography (rPPG)



- rPPG- contactless technique for blood volume pulsation detection.
- The distance between the palm and lamp was approximately 1 meter.
- Using 540nm green light filter, camera was adapted for monitoring changes in the patient's palm.

Sun Y, Thakor N. Photoplethysmography Revisited: From Contact to Noncontact, From Point to Imaging. IEEE Transactions on Bio-medical Engineering. 2016 Mar;63(3):463-477. DOI: 10.1109/tbme.2015.2476337. PMID: 26390439; PMCID: PMC4822420.

# Automated capillary refill time (aCRT)



aCRT measurement is performed by applying and removing of apr 1kg on skin area, while recording signal intensity at 525nm illumination

Automated objective capillary refill time measurement technique(aCRT).

- $T_{90}$  - time when 90% of capillary refill is over
- $T_{st}$  -time when capillary refill is fully over
- Temperature

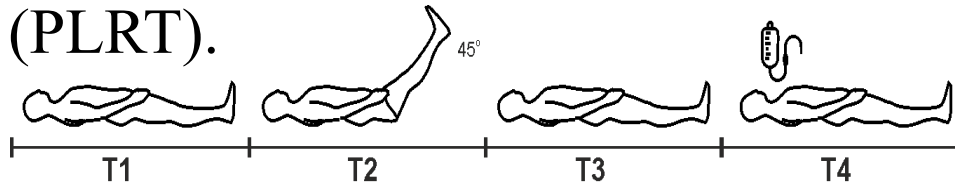
# Introduction

- Single center prospective study at Pauls Stradins CUH
- **The aim:** Assess microcirculation using remote photoplethysmography and automated capillary refill time technique in COVID-19 and Septic shock patients



# Materials and methods

- 34 patients with positive passive leg raising test were divided into 2 groups – COVID-19 and BSS
- Fluid responsiveness was evaluated using the **passive leg raising test (PLRT)**.



*Passive leg raising test T1- before PLRT, T2- During PLRT, T3-after PLRT, T4- after fluid expansion.*

**At each time interval (T1-T4)** collected:

- Hemodynamic parameters (MAP)
- Manual capillary refill time (mCRT),
- Automated capillary refill time (aCRT) (T90, Tst, Temp),
- Perfusion index (PPI) detected using rPPG
- **T1 and T4**
- serum lactate levels

# Results

## Table 1 Patients characteristics.

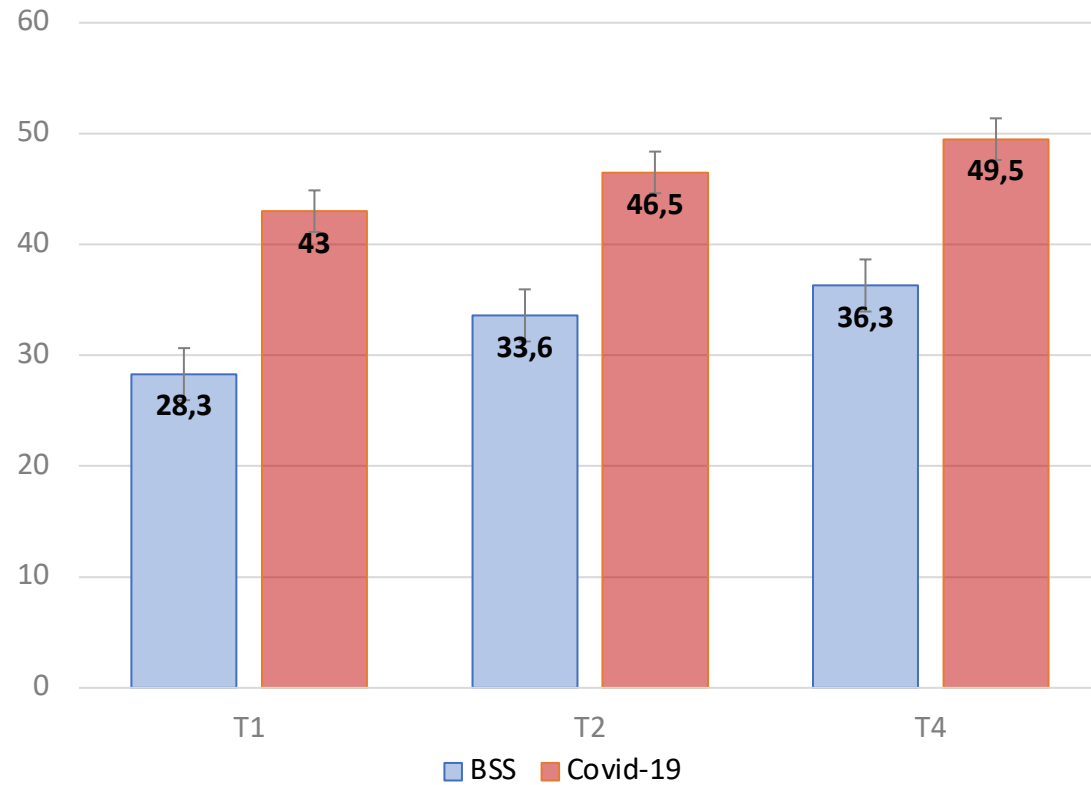
The table displays the mean values  $\pm$  standard deviation for the group (n=34).

Statistically significant differences ( $p < 0.005$ ) are indicated by an asterisk (\*).

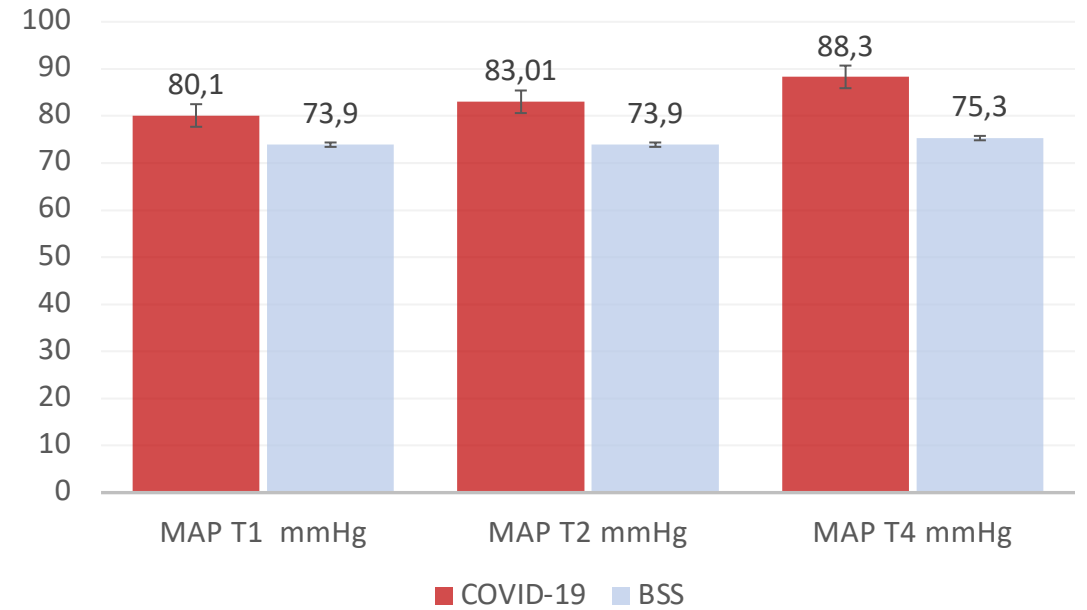
Table - 1		
Baseline characteristics of study patients		
	COVID-19 (n=18)	Bacterial septic shock (n=16)
Age, years	60 (29-80)	66 (82-22)
Men, n (%)	13 (72)	13 (81)
Height, cm	176 (150 - 190)	180 (150 - 180)
Weight, kg	85 (61 - 130)	76 (50 - 140)
SOFA, points	6.00 (2.0 – 8.0)	6.50 (2.0 – 6.0)
Noradrenaline mcg/kg/min	0.1 (0.1)*	0.19 (0.4)*
Midazolam, mcg/kg/min	1.1 (0.29)*	0.88 (0.37) *
Fentanyl, mcg/kg/min	0.22 (0.07)*	0.015 (0.06)*
Propofol, mcg/kg/min	19.7 (13.3) (n=12)	24.2 (n=1)

# Results

## Mean PPI in Covid-19 and BSS group.



## Hemodynamics



# Remote photoplethysmography (rPPG)



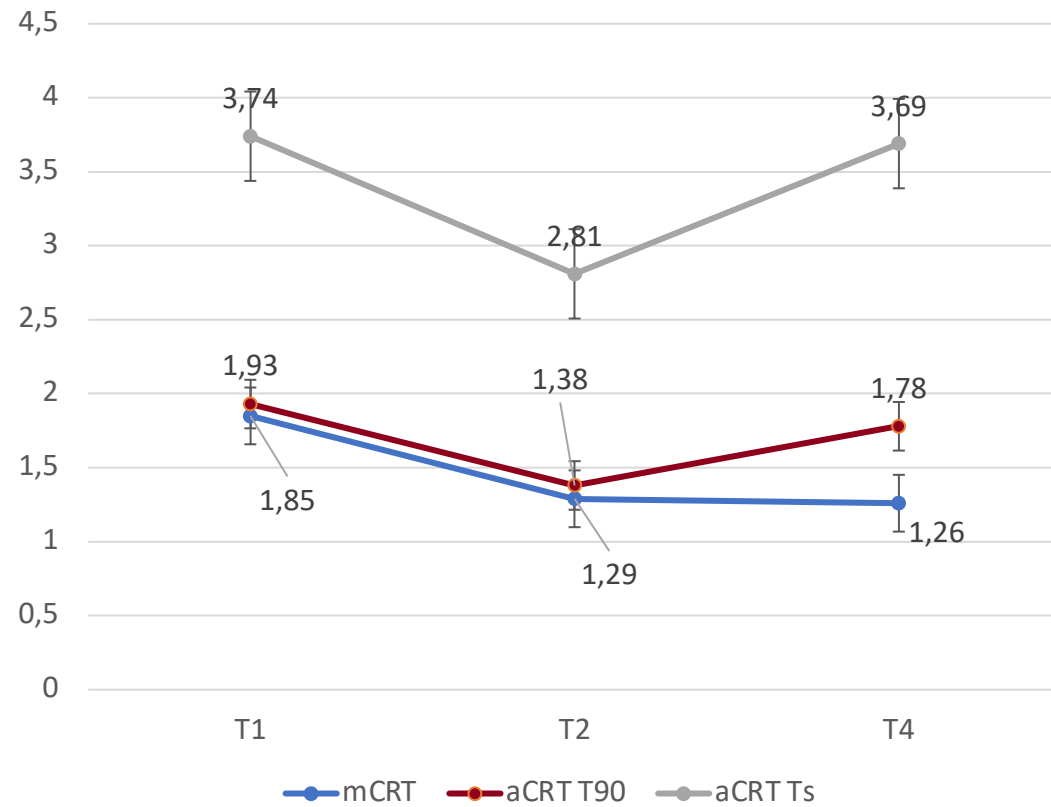
Preprints are preliminary reports that have not undergone peer review.  
They should not be considered conclusive, used to inform clinical practice,  
or referenced by the media as validated information.

## **Assessment of Peripheral Perfusion in Severe Acute Respiratory Syndrome Coronavirus 2 (Sars- cov-2) Infection: An Exploratory Analysis With Near- infrared Spectroscopy**

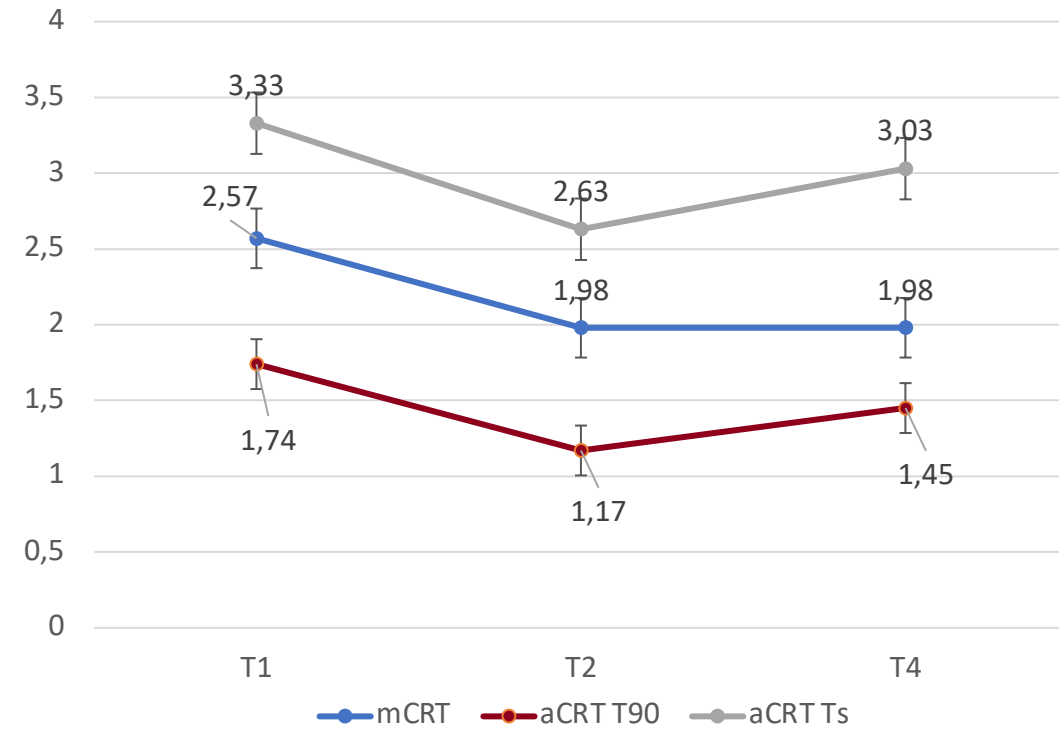
**PPI was higher in COVID-19 patients  
compared with control group.**

# Results

## Capillary refill time in BSS group



## Capillary refill time in Covid-19 group

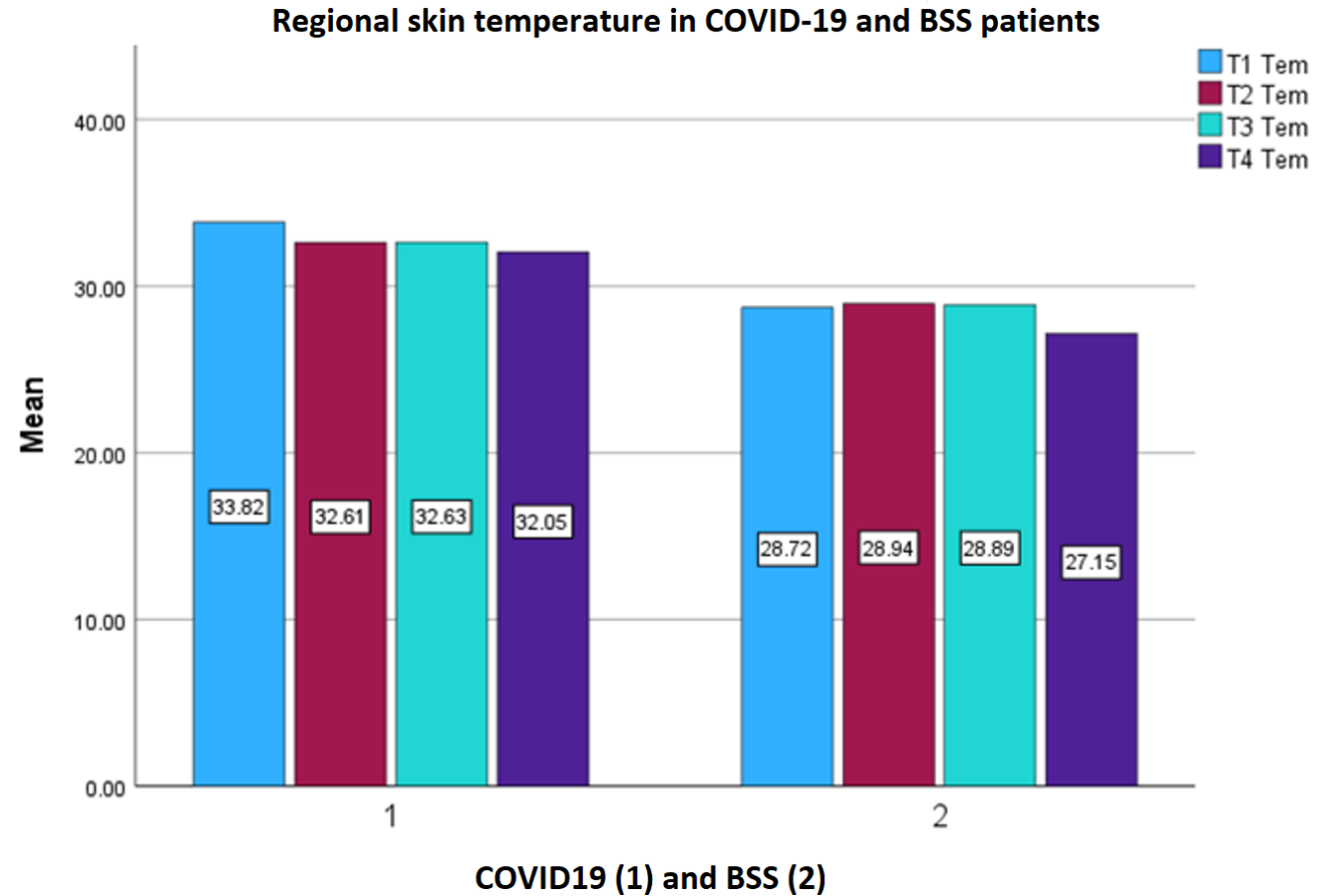


# Results

- Lactate levels decreased by 10% in both groups.
- Andromeda – shock trial suggests that a microcirculation guided strategy based on CRT might reduce organ failure and mortality compared to a lactate guided approach.
- Manual CRT is subjective method

# Results

- Significantly higher regional skin temperature was in COVID – 19 group.



# Conclusion

- This study suggests that rPPG and aCRT techniques show promise as tools for accurately evaluating peripheral perfusion changes during fluid resuscitation in septic shock and COVID-19 patients.
- However, further studies are required to reveal the applications of both methods in larger patient populations and to develop guidelines for their utilization.



Thank you for attention!