





ETAT DE CHOC Quelle cible thérapeutique?

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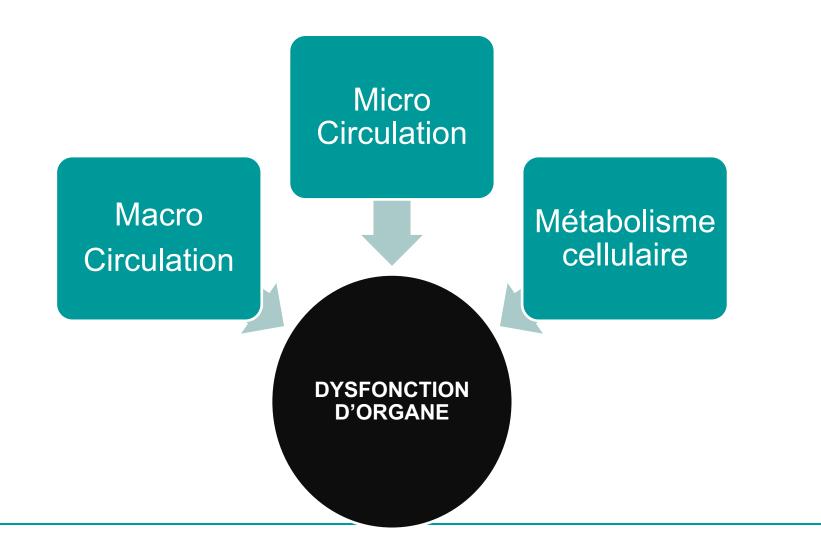
Liens d'intérêt

- Leo Pharma
- Fisher Paykel
- Air Liquide
- Addmedica

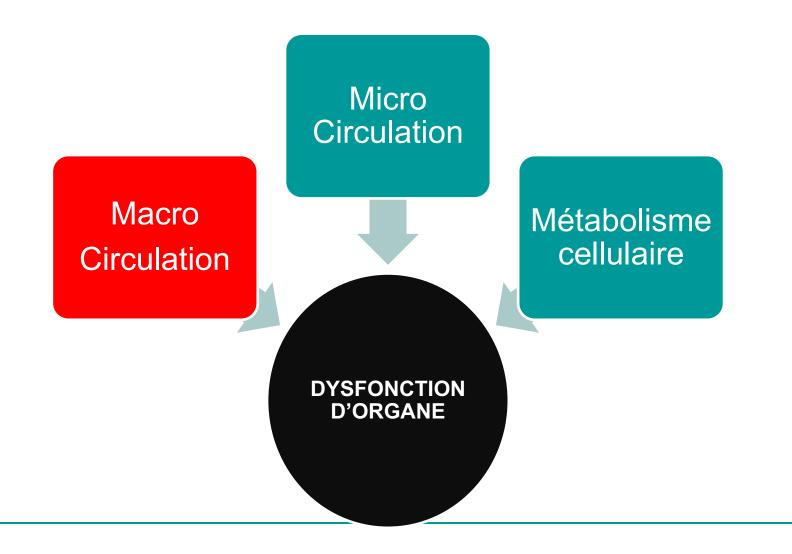
ETAT DE CHOC

Quelle(s) cible(s) thérapeutique(s)?

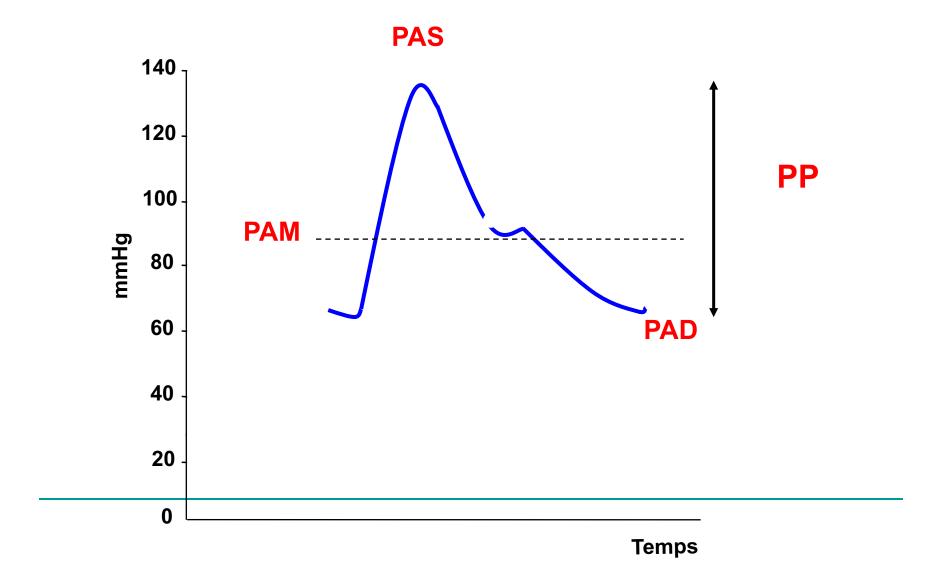
Théories de la dysfonction d'organe



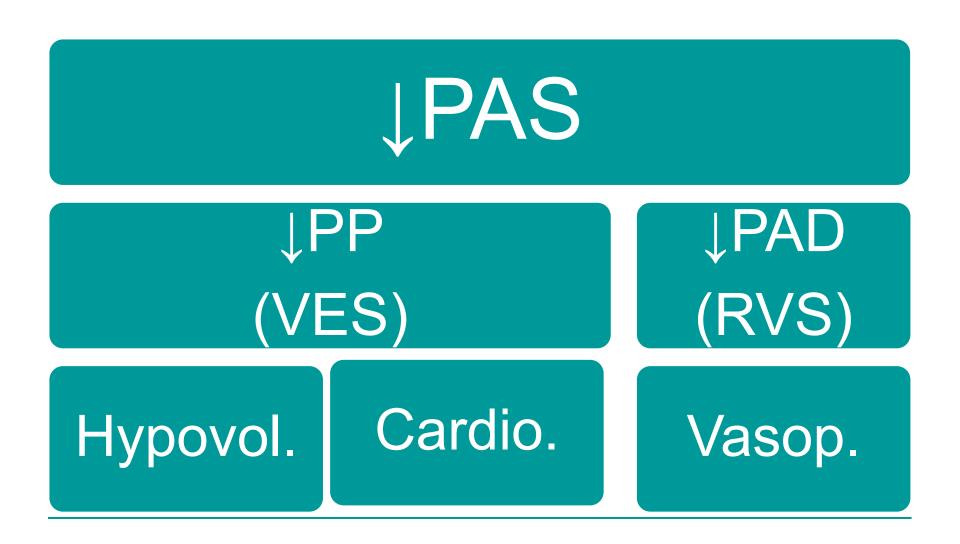
Théories de la dysfonction d'organe



Hypotension artérielle



Orientation étiologique



PAM variable régulée

$$PAM = (Qc x RVS) + Psm$$

$$VES x FC$$
Poiseuille
$$Vtd x FE$$

$$Inotropisme$$

Distribution spatiale de la pression

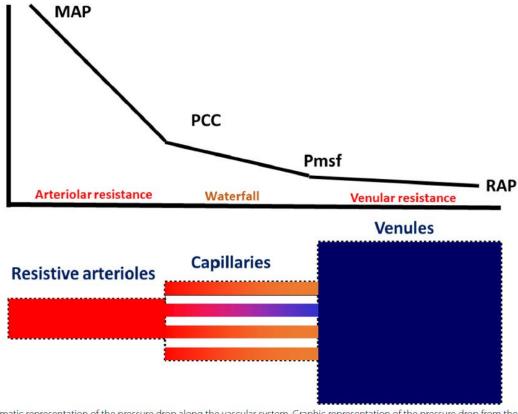
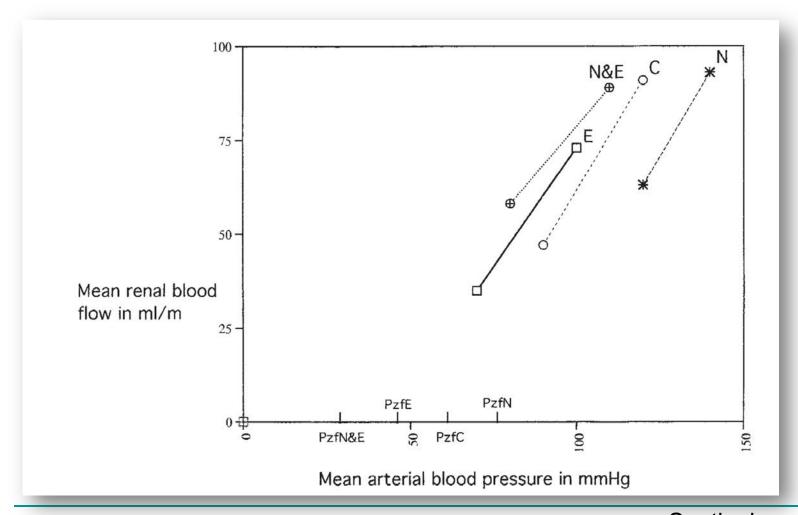


Fig. 1 Schematic representation of the pressure drop along the vascular system. Graphic representation of the pressure drop from the mean arterial pressure (MAP) to the critical closing pressure (P_{cc}), and from the mean systemic filling pressure (P_{msl}) to the right atrial pressure (P_{msl}). The pressure gradient between P_{cc} and P_{msl} constitutes the "vascular waterfall". The precise location of P_{msl} is not well defined. The presence of a vascular waterfall indicates there are two separate but sequential vascular resistances (arteriolar resistance and venular resistance) which determine the pressure drop, rather than a unique total systemic vascular resistance

La PAM comme pression de perfusion



Importance de la PAM

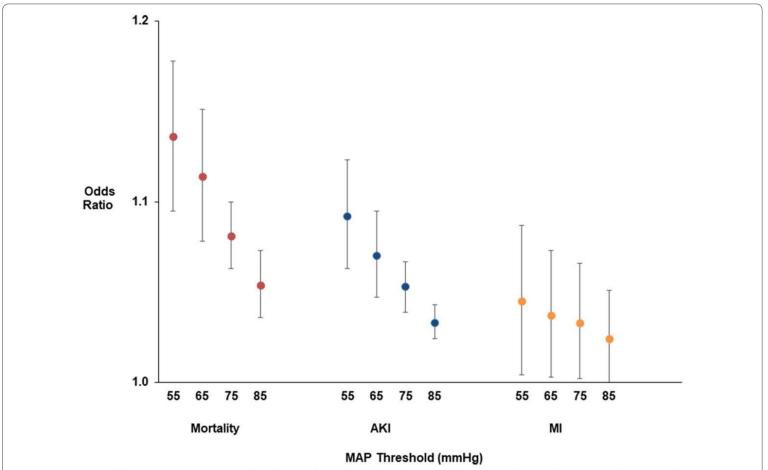
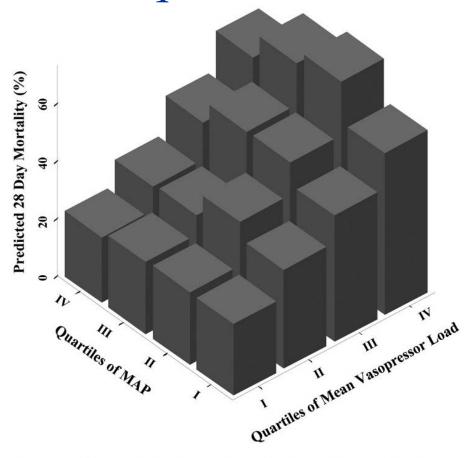


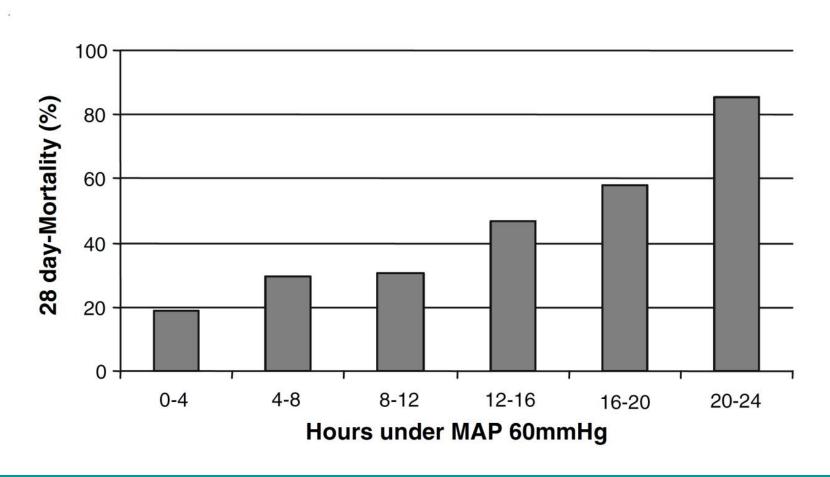
Fig. 2 Association of hypotension exposure with in-hospital mortality, AKI and myocardial injury. Adjusted odds ratios and 95% confidence intervals for a 1 mmHg increase in TWA-MAP, below different thresholds are shown for the primary outcome of in-hospital mortality and secondary outcomes of acute kidney injury and myocardial injury

Rôle pronostique de la PAM

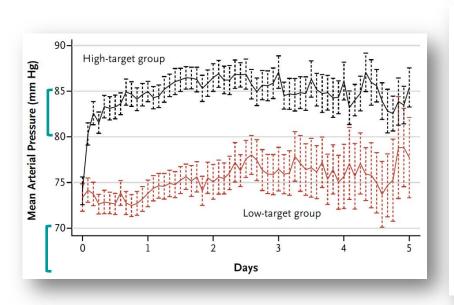


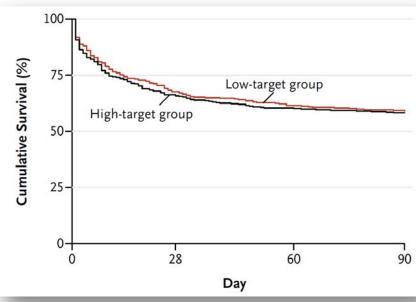
28-day mortality by MAP and mean vasopressor load quartiles as predicted by the adjusted logistic regression model. Mean arterial blood pressure (MAP) quartile I = 70 to 74.3 mmHg; MAP quartile II = 74.3 to 77.8 mmHg; MAP quartile III = 77.8 to 82.1 mmHg; MAP quartile IV = 82.1 to 99.7 mmHg.

Rôle pronostique de la PAM

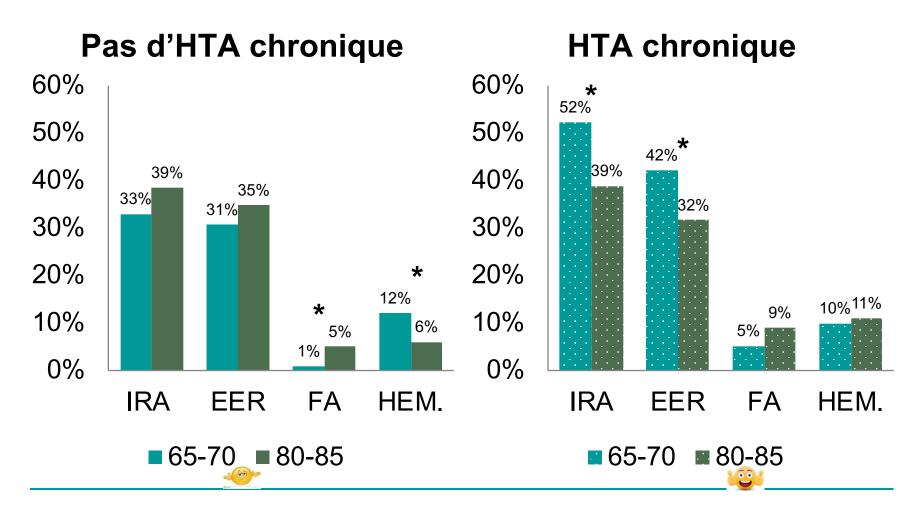


Cible de PAM





Individualisation de la cible de PAM



Robustesse de la PAM comme cible

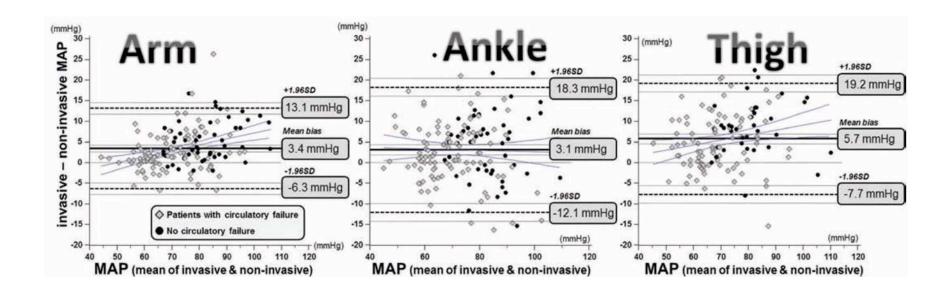
Variable régulée

 Quasi-constante dans les artères de gros calibres

 Pression motrice de perfusion de la plupart des organes

Objectif thérapeutique: >65 mmHg

La pression brassard est-elle fiable?



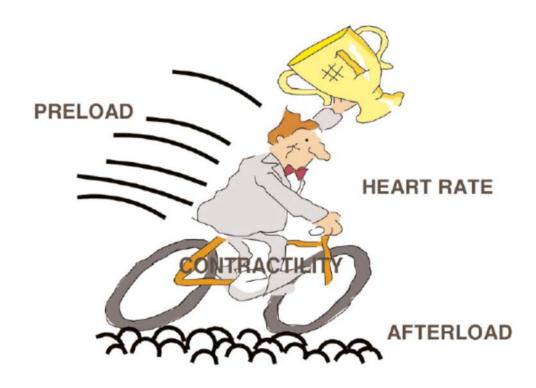
La PAM comme pression de perfusion

Table 1 Perfusion pressure for different organs

Organs	Inflow pressure	Outflow pressure (whichever is higher)	Perfusion pressure
Brain	MAP	CVP or intracranial pressure (ICP)	MAP—CVP or ICP
Heart	Diastolic BP	CVP or intrathoracic pressure (ITP)	Diastolic BP—CVP or ITP
Kidney	MAP	CVP or intra-abdominal pressure (IAP)	MAP—CVP or IAP
Bowel	MAP	CVP or intra-abdominal pressure (IAP)	MAP—CVP or IAP

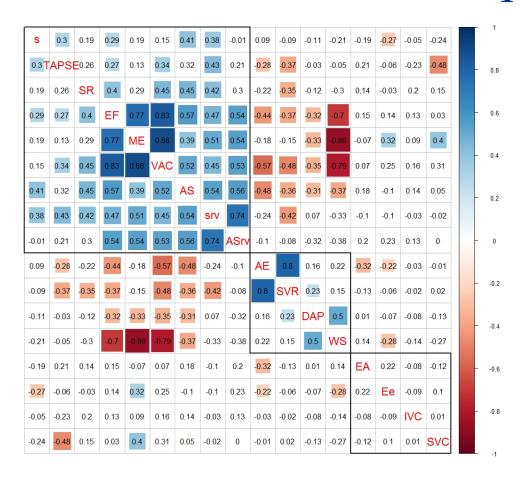
MAP mean arterial pressure, BP blood pressure, CVP central venous pressure

Débit cardiaque

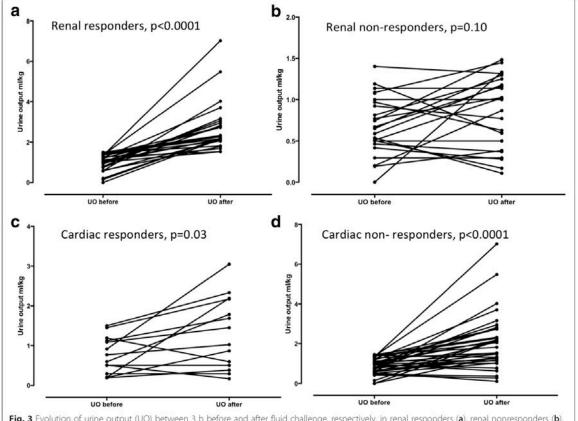


Four determinants of cardiac output, using an analogy to the speed of a bicycle.

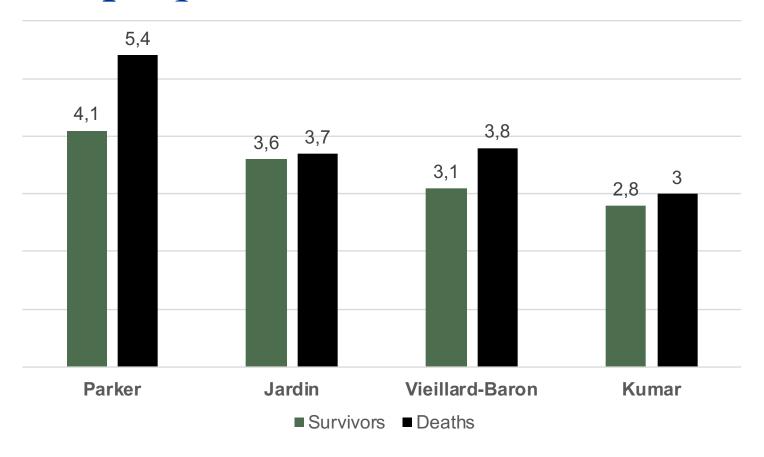
Interactions complexes entre déterminants du débit cardiaque



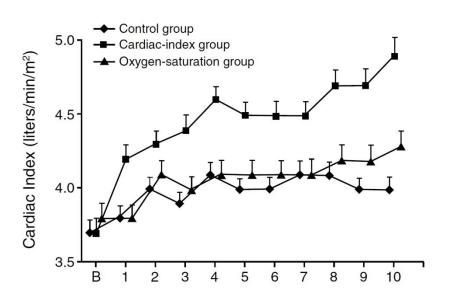
Dissociation entre débit cardiaque et perfusion d'organe

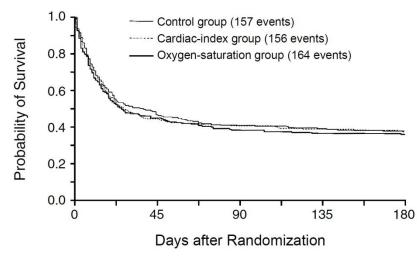


Rôle pronostic paradoxal au cours du choc septique



Optimisation systématique du débit cardiaque questionnable





Optimisation systématique du débit cardiaque questionnable

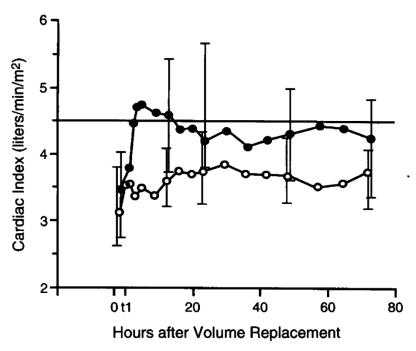


Figure 1. Median Cardiac Index in the Treatment and Control Groups.

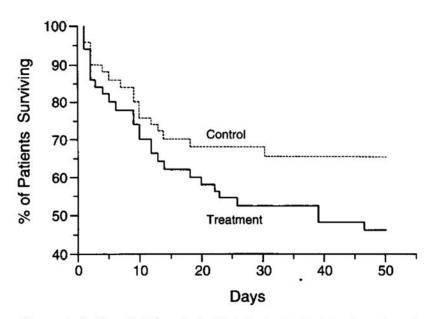


Figure 4. In-Hospital Survival of Patients in the Treatment and Control Groups.

Optimisation systématique du débit cardiaque questionnable

Dobutamine

Figure 4. In-Hospital Survival of Patients in the Treatment and Control Groups.

Levosimendan

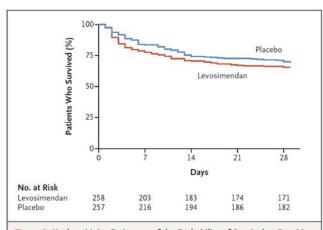
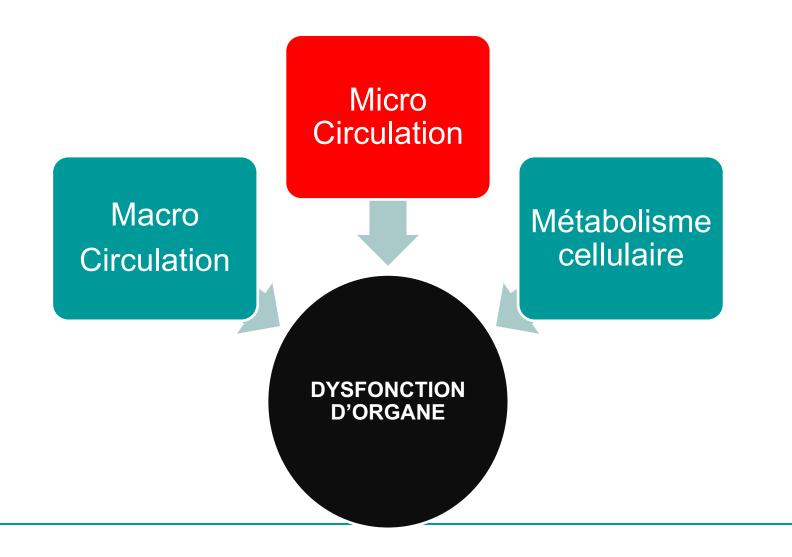


Figure 2. Kaplan–Meier Estimates of the Probability of Survival to Day 28. The adjusted hazard ratio for death in the levosimendan group, as compared with the placebo group, was 1.24 (95% CI, 0.91 to 1.67; P=0.17).

Théories de la dysfonction d'organe



Exploration de microcirculation

Table 1 Techniques used to evaluate the microcirculation at the bedside

	Variable measured	Main limitations
Techniques measuring microvascular perfo	usion	
Laser Doppler	Flow (relative), hemoglobin content/ microvascular reactivity test	Global flow to relatively large sampling volume (mixture of arterioles, capillaries, and venules)
Nailfold videomicroscopy	Vascular density, heterogeneity, flow	Restricted to fingers/sensitivity to temperature and vasoconstriction
OPS and SDF	Vascular density, perfusion heterogeneity, flow	Mostly restricted to semiquantitative scoring/limited sites to investigate/ movement and pressure artifacts
Techniques measuring tissue oxygenation	A.1	CLIII
SvO ₂	Adequacy of perfusion to flow	Global measurement
O ₂ electrodes	Tissue PO ₂	Global measurement in sampled volume (mixture of arterioles, capillaries, and venules)
NIRS	Tissue O ₂ saturation	Global measurement in sampled volume (mixture of arterioles, capillaries, and venules)
Reflectance spectroscopy	O ₂ saturation/microvascular reactivity test	Global measurement in sampled volume (mixture of arterioles, capillaries, and venules) unless SO ₂ histograms are provided
Gastric tonometry	Tissue CO ₂ (reflects inadequate perfusion and/or anaerobic metabolism)	Interference (feeding/reflux)/difficult discrimination between low flow and anaerobic metabolism
Sublingual capnometry	Tissue CO ₂ (reflects inadequate perfusion and/or anaerobic metabolism)	Availability limited/difficult discrimination between low flow and anaerobic metabolism
Microdialysis and equilibrium dialysis	Lactate/pyruvate	Time lag/limited sites to investigate

OPS orthogonal polarization spectral imaging technique; SDF sidestream dark field imaging technique; SvO_2 mixed-venous oxygen saturation; NIRS near-infrared spectroscopy; EMPHO Erlangen MicroPHOtometer

Microperfusion cutanée

Table 1 Clinical methods used to measure peripheral perfusion

Method	Variable	Advantages	Limitations	Suggested cut-offs for higher mortality
Mottling of the skin	Absence/presence	Could be done by nurses	Lack of specificity	Δ.
	Mottling score	Easy to use and learn reproducible	Not useful in patients with dark skin	Score 4–5 (scoring from 0 to 5)
Capillary refill time (CRT)	Index CRT	Easy to use and learn ± reproducible	Inter rater variability	Critically ill > 5 s Septic shock > 2.4 s
	Knee CRT	Reproducible	Not useful in patients with dark skin	Septic shock > 4.9 s
Temperature gradient	Forearm-to-finger	Validated method	Requires more complex technology	>4 °C
	Central-to-toe	Validated method		>7 °C

Score de marbrures

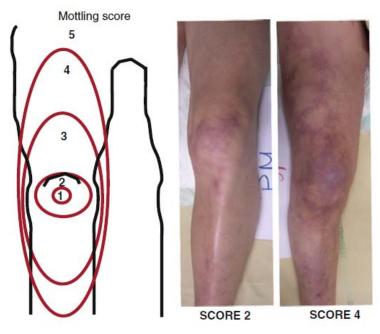


Fig. 1 *Left*: the mottling score is based on a mottling area extension on the legs. Score 0 indicates no mottling; score 1, a modest mottling area (coin size) localized to the center of the knee; score 2, a moderate mottling area that does not exceed the superior edge of the kneecap; score 3, a mild mottling area that does not exceed the middle thigh; score 4, a severe mottling area that does not go beyond the fold of the groin; score 5, an extremely severe mottling area that goes beyond the fold of the groin. *Right*: Examples of the mottling score

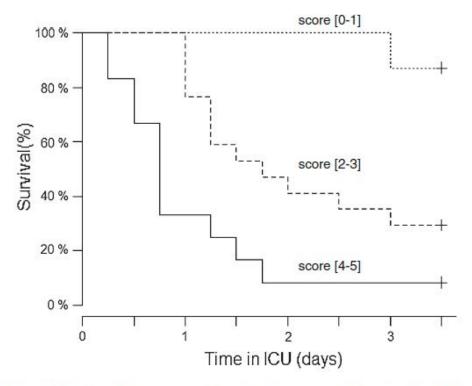


Fig. 2 Kaplan-Meier survival estimates according to the H6 mottling score. Larger mottling scores were associated with earlier death (p < 0.0001)

Temps de recoloration cutanée

Figure 1. Measuring capillary refill time on the finger. © Nazir Hamid.



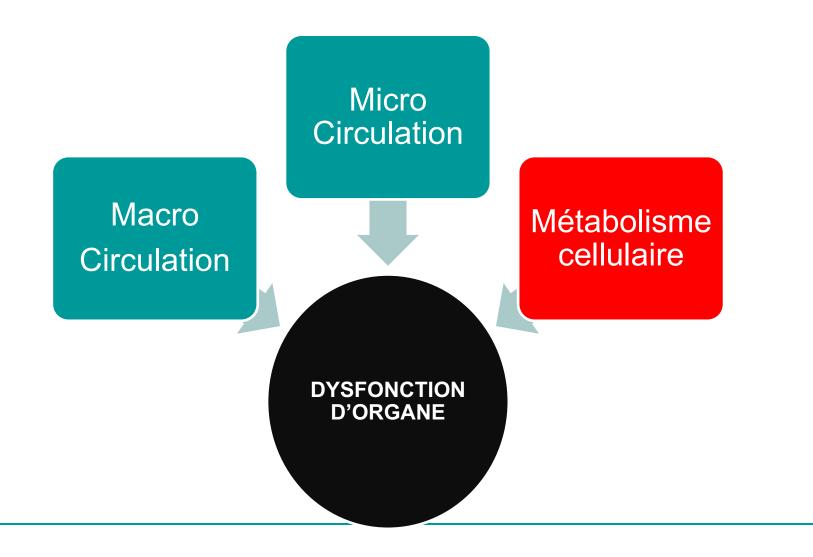


Applying blanching pressure to the ventral surface of distal phalanx of the index finger for 5-15 s (with a glass microscope slide)

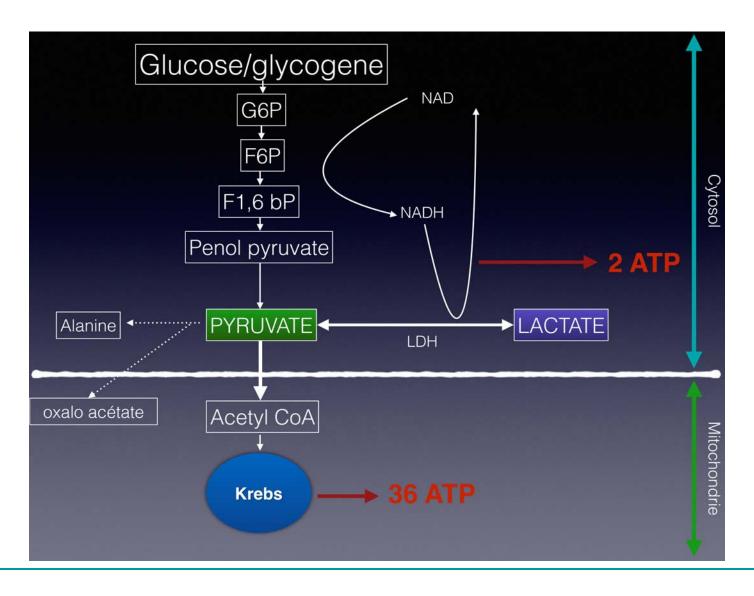
Use a <u>timer</u> (for example, a watch) to count the seconds it takes for the finger to regain its original colour

Normal <3-4 s

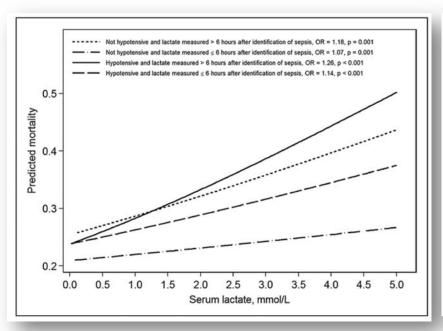
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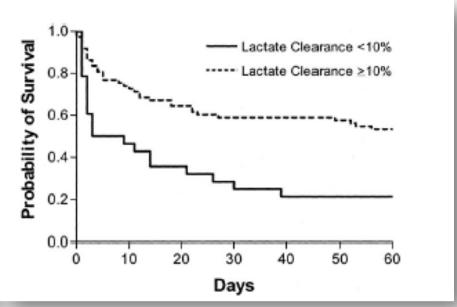


Production de lactates



Rôle pronostique des lactates



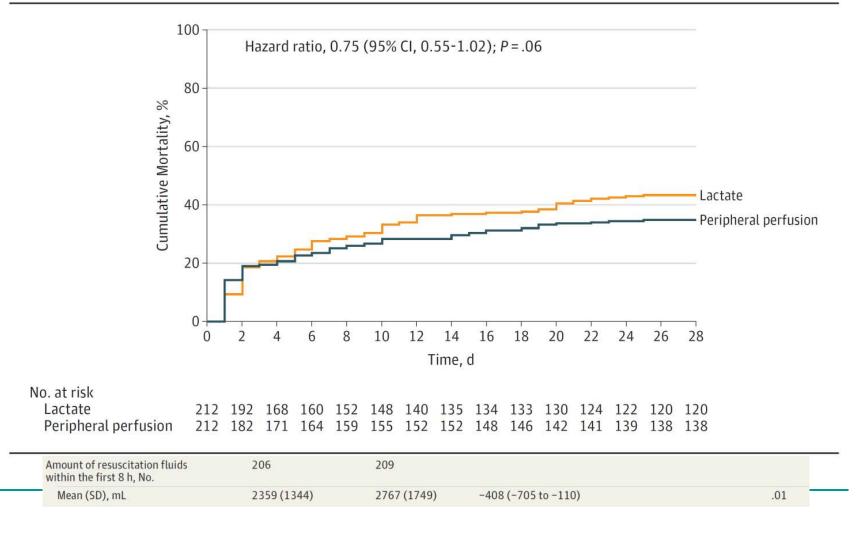


Acidoses lactiques sans choc

Baisse d'apport en oxygène sans état de choc	Hypoxémie profonde Anémie profonde Intoxication au monoxyde de carbone
Augmentation brutale de la demande en oxygène	Convulsion Exercice physique intense
Stimulation de la glycolyse aérobie	β2-mimétiques Intoxication à la cocaïne Phéochromocytome
Augmentation de l'activité glycolytique de la tumeur et hypoxie tissulaire tumorale	Cancer/ hémopathie
Interférence avec la phosphorylation oxydative	Intoxications :metformine, salicylates (ex : aspirine), alcool, méthanol, éthylène glycol, cyanure Syndrome de perfusion du propofol
Baisse de la clairance du lactate	Hépatopathies

TRC vs lactates

Figure 2. Kaplan-Meier Estimates of Cumulative Mortality Within 28 Days Among Patients Treated With Peripheral Perfusion-Targeted Resuscitation vs Lactate Level-Targeted Resuscitation



Conclusion: une cible à chaque échelon

