The Laser-assisted Optical Rotational Cell Analyzer (LORCA)

RBC deformability was determined using ektacytometry. This technique is based on the diffraction of a laser beam passing through an RBC-PVP solution under stress, analysis of which provides an estimate of deformability.

The ektacytometer used in our study, the LORCA, works on the basis of the Couette flow principle. This law of physics refers to the flow of a viscous fluid in the space between two surfaces, one of which is moving tangentially relative to the other. To achieve this, the device basically consists of a fixed inner cylinder and a moving outer cylinder. Knowing the rotational speed of the external cylinder, the distance between the two cylinders and the viscosity of the fluid, the shear stress applied to the RBCs can be determined. A laser beam (wavelength 670 nm) is projected by the inner cylinder perpendicular to the RBC solution. The diffraction pattern thus generated is captured by a CCD (*Charge Coupled Device*) camera. The elongation index (EI) of the RBC can then be calculated using the following formula: EI = (a-b) / (a+b), where *a* corresponds to the length and *b* to the width of the RBC. The higher the EI value is, the better the deformability (9).

Results were obtained in the form of an EI – shear stress curve. To facilitate interpretation of this 12-point curve, mathematical simplifications have been proposed by the manufacturer and validated for RBCs from healthy volunteers. These simplifications include the EI_{max} (EI obtained when an infinite shear stress is applied to the suspended RBC solution) and the $SS_{1/2}$ (the shear stress necessary to obtain half of the EI_{max}). The $SS_{1/2}$ / EI_{max} relationship allows normalization of the $SS_{1/2}$ to the different EI_{max} values observed in each group of participants (9).

Table S1: Diagnosis at ICU admission in non-septic patients

Diagnosis	Number of patients (n = 20)
Admission for neurological pathology	7
Post-operative monitoring	4
Admission for medication intoxication	3
Admission for pulmonary pathology	2
Admission for abdominal pathology	2
Admission for metabolic disorder	1
Admission for cardiac arrest	1

Table S2: Diagnosis at ICU admission in septic patients

Diagnosis	Number of patients (n = 20)
Sepsis of pulmonary origin	9
Sepsis of urinary origin	3
Sepsis of soft tissue origin	3
Sepsis due to a meningitis	2
Sepsis of gastrointestinal origin	2
Sepsis due to mediastinitis	1

Table S3: Baseline red blood cell deformability in the healthy volunteers / non-septic / septic patients as assessed by the elongation index (EI) at different shear stresses (SS), the EImax, the SS1/2 and the SS1/2 /EImax ratio

Shear stress (Pa)	**Healthy volunteers (n=26) EI**	**Non-septic patients (n=20) EI**	**Septic patients (n=20) EI**	***p***
0.3	0.0593 ± 0.0138	0.0577 ± 0.0184	0.0523 ± 0.0139	0.3
0.48	0.113 ± 0.013	0.114 ± 0.014	0.109 ± 0.018	0.55
0.76	0.165 ± 0.013	0.168 ± 0.013	0.164 ± 0.023	0.71
1.21	0.228 ± 0.014	0.229 ± 0.017	0.224 ± 0.028	0.73
1.93	0.300 ± 0.016	0.301 ± 0.020	0.294 ± 0.033	0.63
3.07	0.379 ± 0.015	0.376 ± 0.024	0.366 ± 0.034	0.21
4.89	0.443 ± 0.013	0.435 ± 0.024	0.423 ± 0.034*	0.03
7.78	0.495 ± 0.012	0.484 ± 0.024	0.470 ± 0.032 *	0.004
12.39	0.533 ± 0.012	0.523 ± 0.023	0.508 ± 0.032 *	0.002
19.72	0.565 ± 0.011	0.555 ± 0.022	0.540 ± 0.032 *	0.002

31.4	0.594 ± 0.01	0.584 ± 0.021	0.566 ± 0.032 *$	< 0.001
50	0.620 ± 0.009	0.610 ± 0.020	0.584 ± 0.064 *	0.005

	Healthy volunteers (n=26)	**Non-septic patients (n=20)**	**Septic patients (n=20)**	***p***
$SS_{1/2}$	1.80 ± 0.35	1.64 ± 0.56	1.51 ± 0.52	0.14
EI_{max}	0.656 ± 0.01	0.653 ± 0.022	0.633 ± 0.048*	0.04
$SS_{1/2}/EI_{max}$	2.75 ± 0.57	2.54 ± 0.97	2.43 ± 0.91	0.41

* : *vs* healthy volunteers $: *vs* non-septic patients

Table S4. Red blood cell deformability before and after preconditioning of 5 Pa as assessed by the elongation index (EI) at different shear stresses (SS) in healthy volunteers (HVs), septic (S) and non-septic (NS) patients

SS (Pa)		**EI before preconditioning**	**EI before preconditioning**	***p***
0.3	HVs	0.059 ± 0.014	0.062 ± 0.015	0.15
	NS	0.058 ± 0.018	0.060 ± 0.015	0.61
	S	0.052 ± 0.014	0.067 ± 0.048	0.24
0.48	HVs	0.113 ± 0.013	0.118 ± 0.011 *	0.013
	NS	0.114 ± 0.014	0.116 ± 0.013	0.47
	S	0.109 ± 0.018	0.115 ± 0.012	0.34
0.76	HVs	0.165 ± 0.013	0.171 ± 0.013 *	0.02
	NS	0.168 ± 0.013	0.172 ± 0.013	0.07
	S	0.164 ± 0.023	0.164 ± 0.018	0.96

1.21	HVs	0.228 ± 0.014	0.232 ± 0.013	0.11
	NS	0.229 ± 0.017	0.233 ± 0.014 *	0.03
	S	0.224 ± 0.028	0.224 ± 0.022	1
1.93	HVs	0.300 ± 0.016	0.303 ± 0.012	0.26
	NS	0.301 ± 0.02	0.303± 0.018	0.15
	S	0.294 ± 0.033	0.293 ± 0.029	0.67
3.07	HVs	0.379 ± 0.015	0.382 ± 0.011	0.31
	NS	0.376 ± 0.024	0.377 ± 0.021	0.49
	S	0.366 ± 0.034	0.364 ± 0.031	0.52
4.89	HVs	0.443 ± 0.013	0.443 ± 0.011	0.76
	NS	0.435± 0.024	0.433 ± 0.023	0.14
	S	0.423 ± 0.033	0.418 ± 0.031	0.16
7.78	HVs	0.495 ± 0.012	0.494 ± 0.011	0.64
	NS	0.484 ± 0.024	0.479 ± 0.024 *	< 0.001
	S	0.470 ± 0.032	0.465 ± 0.031 *	0.04
12.39	HVs	0.533 ± 0.011	0.532 ± 0.012	0.35
	NS	0.523 ± 0.023	0.515 ± 0.024 *	<0.001
	S	0.508 ± 0.032	0.497 ± 0.035	0.07

19.72	HVs	0.565 ± 0.011	0.564 ± 0.012	0.25
	NS	0.555 ± 0.022	0.543 ± 0.034 *	0.03
	S	0.540 ± 0.032	0.534 ± 0.031 *	0.02
31.04	HVs	0.594 ± 0.01	0.592 ± 0.011 *	0.04
	NS	0.584 ± 0.021	0.578 ± 0.022 *	0.001
	S	0.566 ± 0.032	0.563 ± 0.031	0.24
50	HVs	0.620 ± 0.009	0.620 ± 0.010	0.47
	NS	0.610 ± 0.02	0.606 ± 0.022 *	0.02
	S	0.584 ± 0.064	0.571 ± 0.011	0.25

	before precond.	**after precond.**	***p***
$SS_{1/2}$ VS	1.795 ± 0.351	1.692 ± 0.381	0.08
$SS_{1/2}$ NS	1.642 ± 0.564	1.432 ± 0.364*	**0.01**
$SS_{1/2}$ S	1.513 ± 0.520	1.619 ± 0.863	0.43
EI_{max} VS	0.656 ± 0.019	0.658 ± 0.068	0.18
EI_{max} NS	0.653 ± 0.022	0.654 ± 0.019	0.7
EI_{max} S	0.633 ± 0.048	0.630 ± 0.067	0.76
$SS_{1/2}$ /EI_{max} VS	2.75 ± 0.57	2.582 ± 0.63	0.09
$SS_{1/2}$ /EI_{max} NS	2.54 ± 0.97	2.20 ± 0.60*	**0.02**
$SS_{1/2}$ /EI_{max} S	2.43 ± 0.91	2.68 ± 1.67	0.35

Table S5. Red blood cell deformability as assessed by the elongation index (EI) at different shear stresses (SS) after preconditioning (P) of 5 Pa and incubation with glutaraldehyde or *neuraminidase*

SS (Pa)	**before P**	**after P (5 Pa)**	**Glutaraldehyde**	**Neuraminidase**	***p***
0.3	0.069 ± 0.012	0.072 ± 0.007	0.064 ± 0.010	0.076 ± 0.023	0.62
0.48	0.11 ± 0.018	0.124 ± 0.011 *	0.086 ± 0.007	0.111 ± 0.009	**0.007**
0.76	0.159 ± 0.02	0.172 ± 0.016 *	0.135 ± 0.015	0.155 ± 0.008	**0.03**
1.21	0.217 ± 0.02	0.229 ± 0.019	0.191 ± 0.016	0.213 ± 0.016	0.06
1.93	0.284 ± 0.024	0.298 ± 0.017	0.265 ± 0.016	0.284 ± 0.012	0.13
3.07	0.362 ± 0.025	0.372 ± 0.015	0.346 ± 0.016	0.360 ± 0.014	0.26
4.89	0.423 ±	0.430 ±	0.407 ± 0.014	0.418 ± 0.013	0.23

	0.021	0.011			
7.78	0.474 ± 0.018	0.477 ± 0.005	0.457 ± 0.012	0.465 ± 0.013	0.14
12.39	0.513 ± 0.016	0.514 ± 0.004	0.496 ± 0.011	0.501 ± 0.013	0.13
19.72	0.547 ± 0.014	0.546 ± 0.003	0.529 ± 0.01	0.534 ± 0.014	0.11
31.4	0.576 ± 0.015	0.575 ± 0.003	0.559 ± 0.01	0.564 ± 0.015	0.15
50	0.605 ± 0.015	0.603 ± 0.004	0.589 ± 0.013	0.592 ± 0.015	0.24

* : *vs* glut