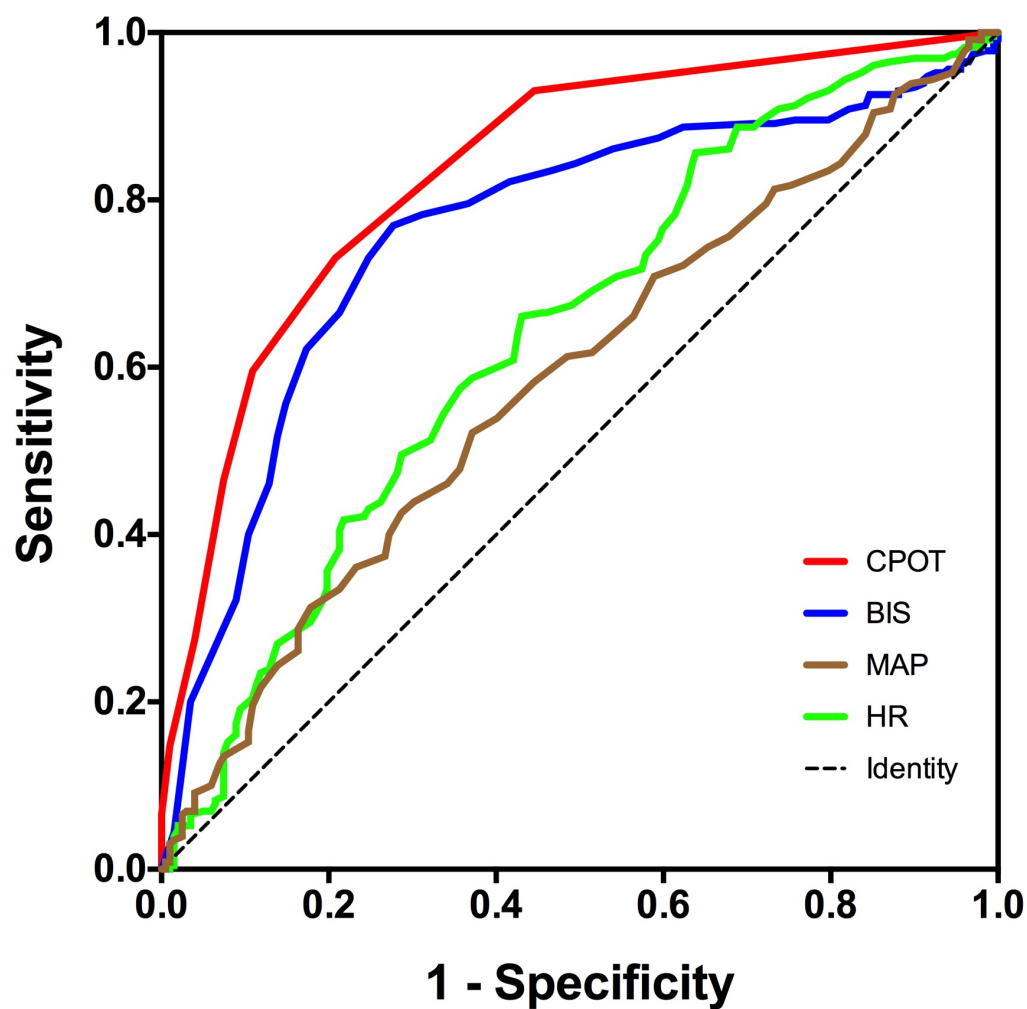**Use of the Critical-Care Pain Observation Tool and the bispectral index for the detection of pain in brain-injured patients undergoing mechanical ventilation: a STROBE-compliant observational study**

Kai Shan, Wei Cao, Yuan Yuan, Jing-Jing Hao, Xiu-Mei Sun, Xuan He, Gui-Yun Li, Yu-Mei Wang, Jian-Xin Zhou

Supplemental Digital Content 2: Figure S1

Figure S1. Receiver operating characteristic curve analysis in patients being able to self-report pain

Instruments	AUC (95% CI)	P	Cut-off value	Sensitivity	Specificity
CPOT	0.84 (0.80 – 0.88)	<0.001	2	0.73	0.79
BIS	0.76 (0.72 – 0.81)	<0.001	88	0.77	0.72
HR (beats/min)	0.64 (0.59 – 0.69)	<0.001	101	0.66	0.57
MAP (mmHg)	0.59 (0.53 – 0.64)	0.002	99	0.52	0.63

AUC = area under the curve, CI = confidence interval, BIS = bispectral index, CPOT = Critical-Care
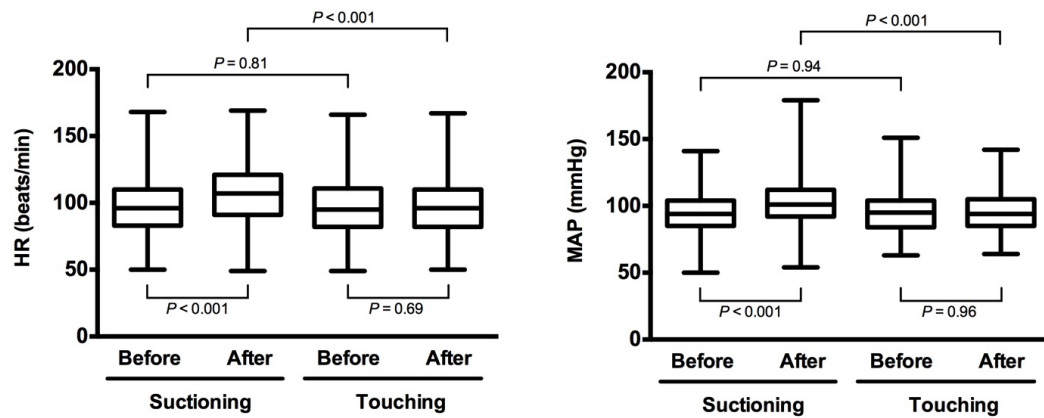Pain Observation Tool, HR = heart rate, MAP = mean arterial pressure

Use of the Critical-Care Pain Observation Tool and the bispectral index for the

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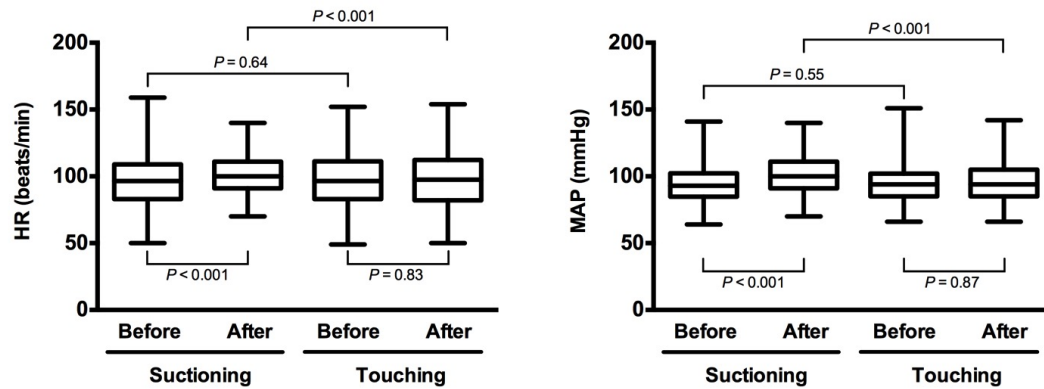Kai Shan, Wei Cao, Yuan Yuan, Jing-Jing Hao, Xiu-Mei Sun, Xuan He, Gui-Yun Li, Yu-Mei

Wang, Jian-Xin Zhou

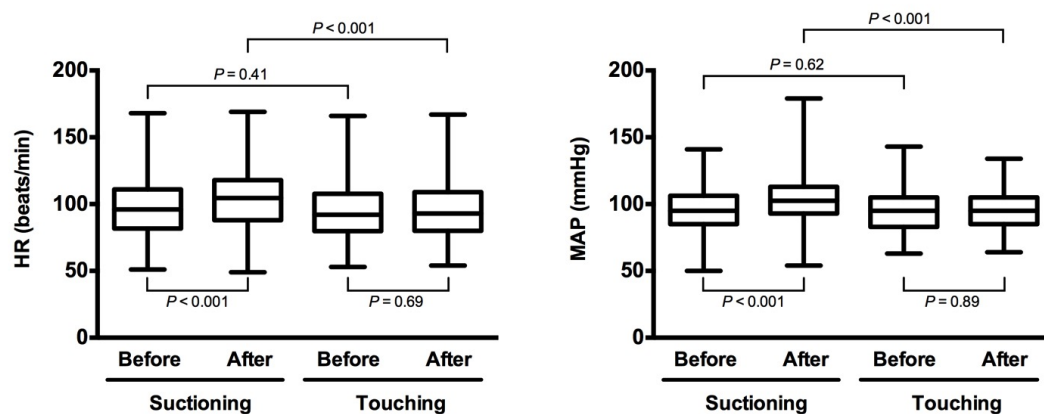**<u>Supplemental Digital Content 3: Figure S2 and Figure S3</u>**

A: All patients

B: Patients able to self-report pain

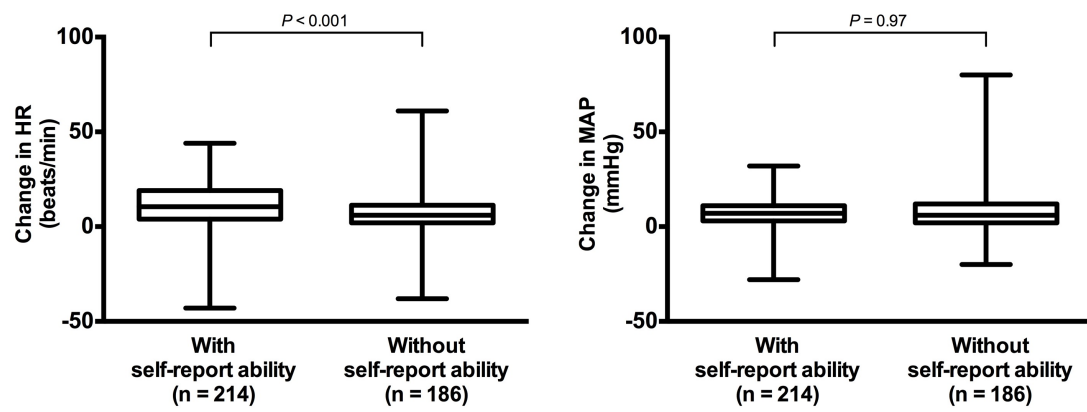## C: Patients unable to self-report pain

Figure S2. Heart rate (HR) and mean arterial pressure (MAP) before and after the two stimulations (endotracheal suctioning and gentle touching)

Pairwise comparisons are shown.

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Supplemental Digital Content 4: Figure S3

Figure S3. Changes in heart rate (HR) and mean arterial pressure (MAP) after suctioning in patients with and without the ability to self-report pain

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<u>Supplemental Digital Content 1: Table S1</u>

Table S1. Description of the Critical-Care Pain Observation Tool

Indicator	Score		Description
Facial expression	Relaxed, neutral	0	No muscle tension observed
	Tense	1	Presence of frowning, brow lowering, orbit tightening and levator contraction or any other change (e.g. opening eyes or tearing during nociceptive procedures)
	Grimacing	2	All previous facial movements plus eyelid tightly closed (the patient may present with mouth open or biting the endotracheal tube)
Body movements	Absence of movements	0	Does not move at all (doesn't necessarily mean absence of pain) or normal position (movements not aimed toward the pain site or not made for the purpose of protection)
	Protection	1	Slow, cautious movements, touching or rubbing the pain site, seeking attention through movements
	Restlessness/Agitation	2	Pulling tube, attempting to sit up, moving limbs/thrashing, not following commands, striking at staff, trying to climb out of bed
Muscle tension	Relaxed	0	No resistance to passive movements
Evaluation by passive	Tense, rigid	1	Resistance to passive movements
flexion and extension	Very tense or rigid	2	Strong resistance to passive movements or incapacity to complete them
of upper limbs when			
patient is at rest or			
evaluation when patient			
is being turned			
Compliance with the	Tolerating ventilator or	0	Alarms not activated, easy ventilation
ventilator	movement		
(intubated patients)	Coughing but tolerating	1	Coughing, alarms may be activated but stop spontaneously
or	Fighting ventilator	2	Asynchrony: blocking ventilation, alarms frequently activated
Vocalization	Talking in normal tone or no	0	Talking in normal tone or no sound
(extubated patients)	sound		
	Sighing, moaning	1	Sighing, moaning
	Crying out, sobbing	2	Crying out, sobbing

The Critical-Care Pain Observation Tool is composed of four behavioral domains, namely facial expression, body movements, muscle tension and compliance with the ventilator in intubated patients. Each item is rated on a 0-2 responsive score with a total score of 0-8.