



European Society of
Regional Anaesthesia
& Pain Therapy

ESRA ITALIA

ESRA *Cè*

XXIX

CONGRESSO NAZIONALE

ESRA Italian Chapter
CESENA, Cesena fiere

Presidente del congresso
Vanni Agnoletti
Domenico Pietro Santonastaso
Andrea Tognù

7-9
Novembre
2024



 **MZ**
EVENTS



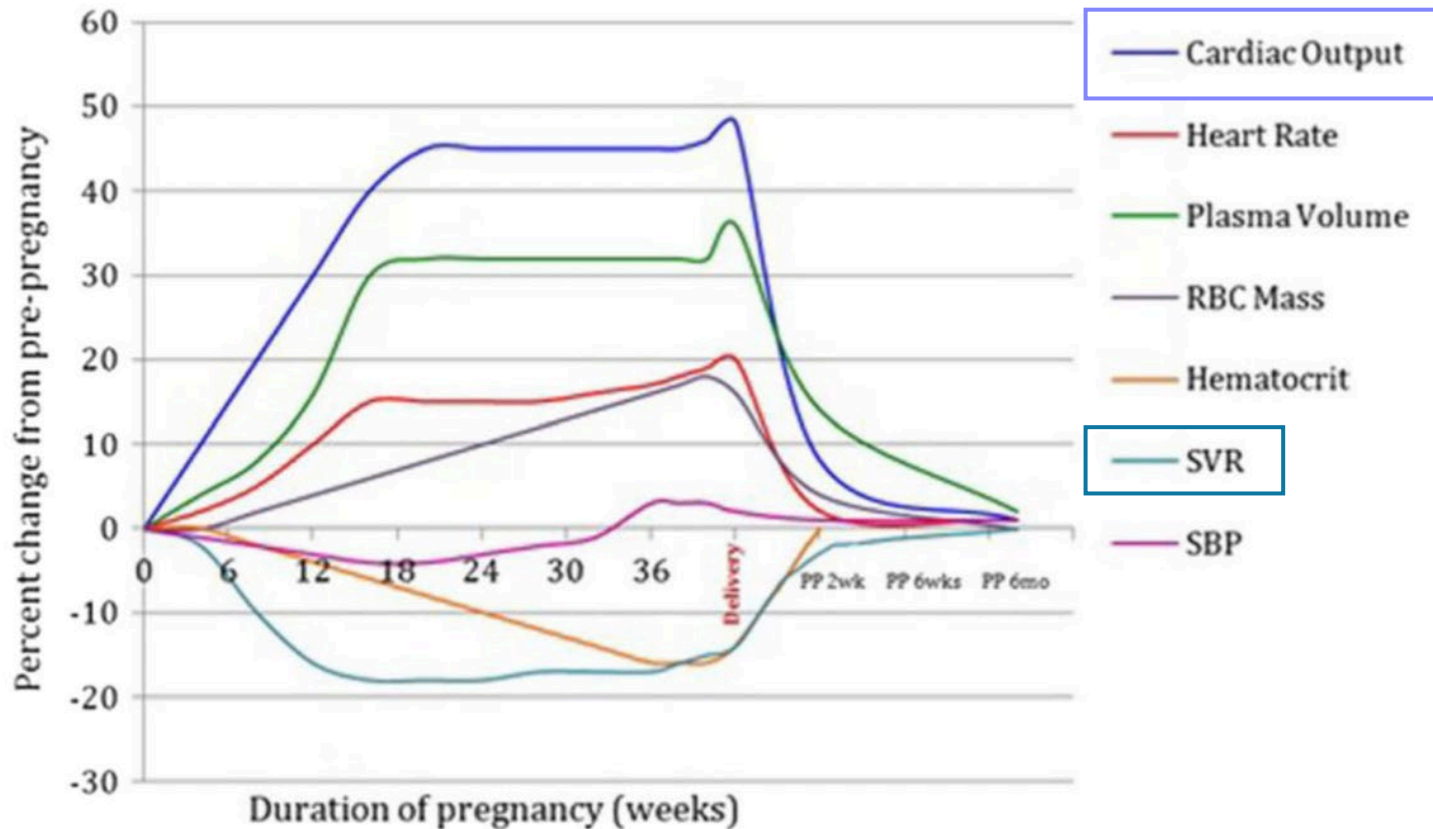
Il monitoraggio emodinamico in corso di TC

Maria Grazia FRIGO

UOSID Anestesia e Rianimazione Ostetrica ,
Ospedale Isola Tiberina, Gemelli Isola, Roma



Hemodynamic changes occurring in normal pregnancy

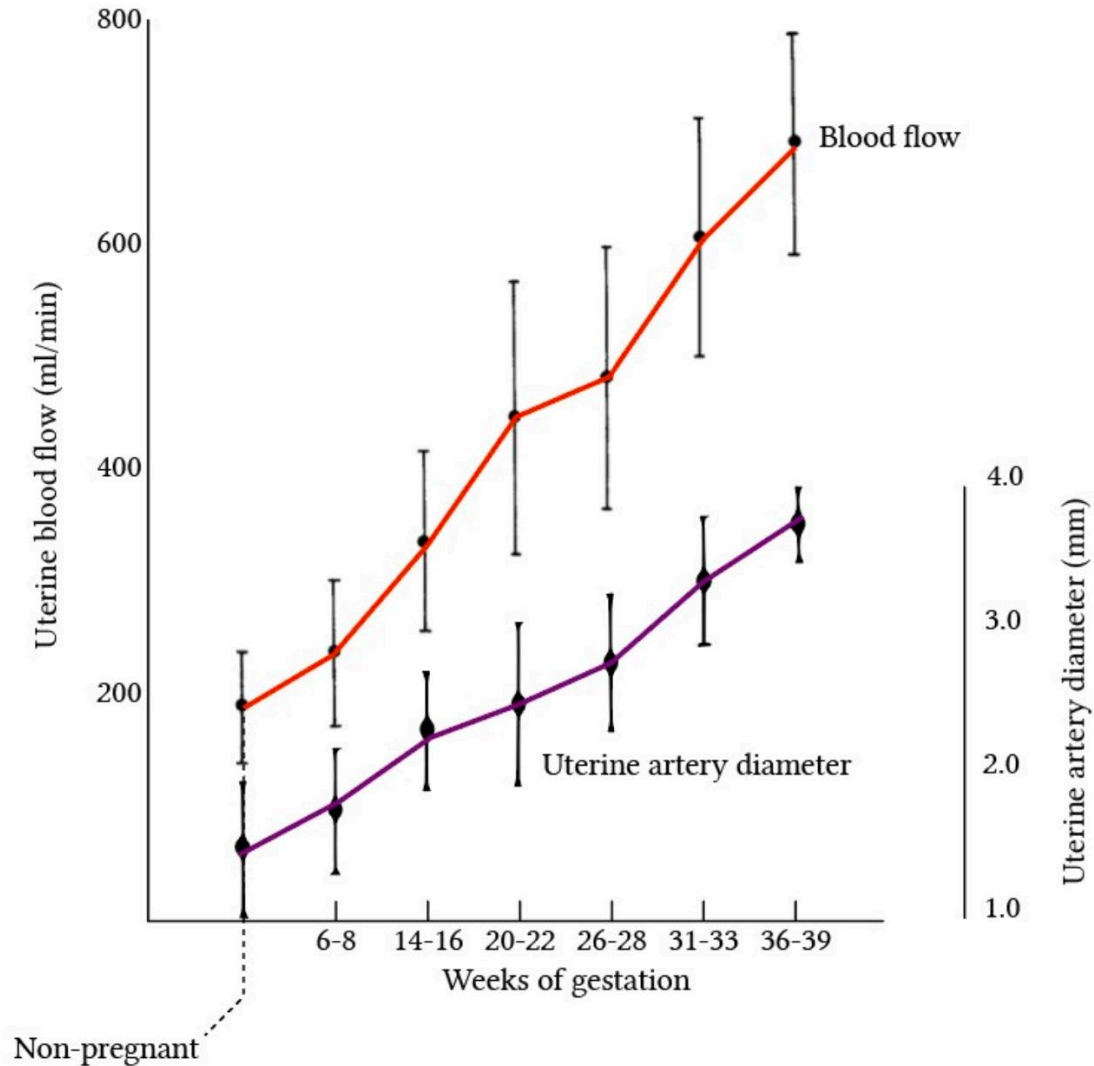


Circolo con
ALTA GITTATA
e
BASSE RESISENZE



**Two circulatory system in parallel
(foetoplacental and
maternoplacental)**

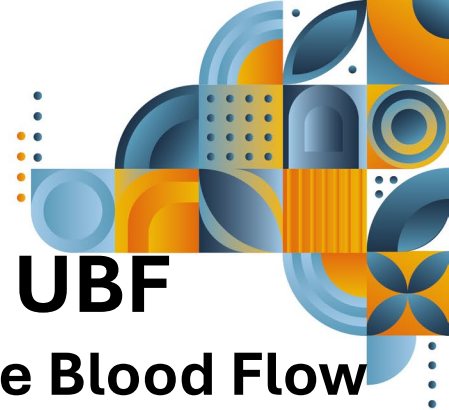
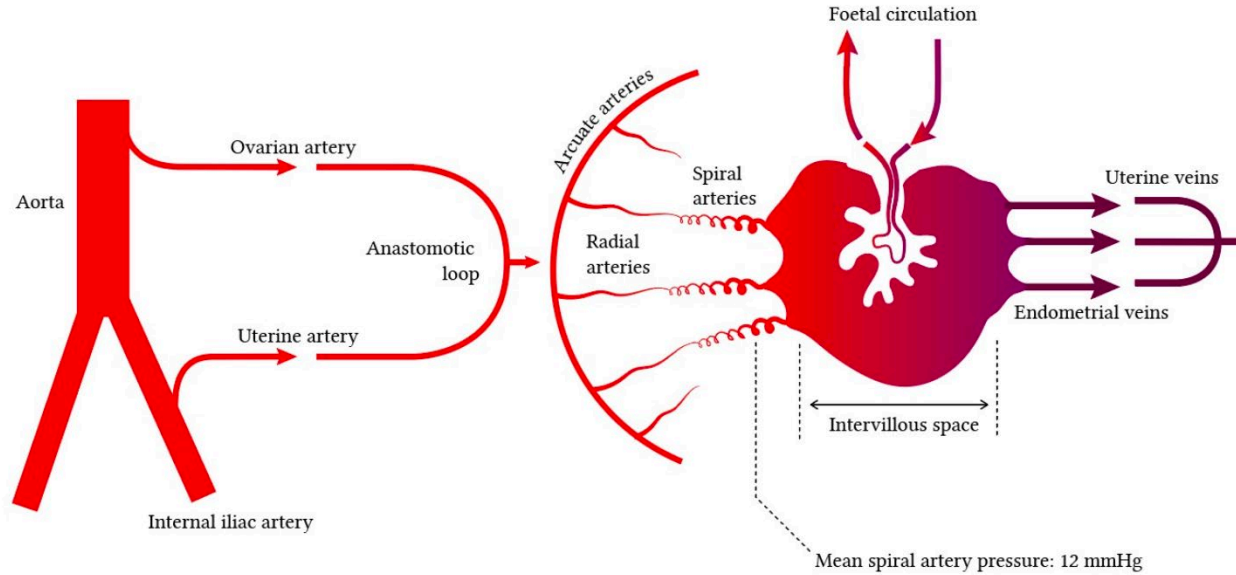
**The maternoplacental circulatory
system has no arterioles
(NO autoregulation)**



L'afflusso di sangue all'utero è di circa 200ml/min, Ovvero il 3-4% della Gittata Cardiaca

A fine gravidanza il diametro delle arterie uterine è più che raddoppiato e il flusso sanguigno aumenta fino a 700ml/min, ovvero il 14-15% della gittata Cardiaca

Circa il 90% di questo flusso nutre la placenta, il restante rifornisce il miometrio ipertrofico



UBF
Uterine Blood Flow



Pa – Pv

R

UBF: Non-pregnant, 200ml/min (3-4% of cardiac output)

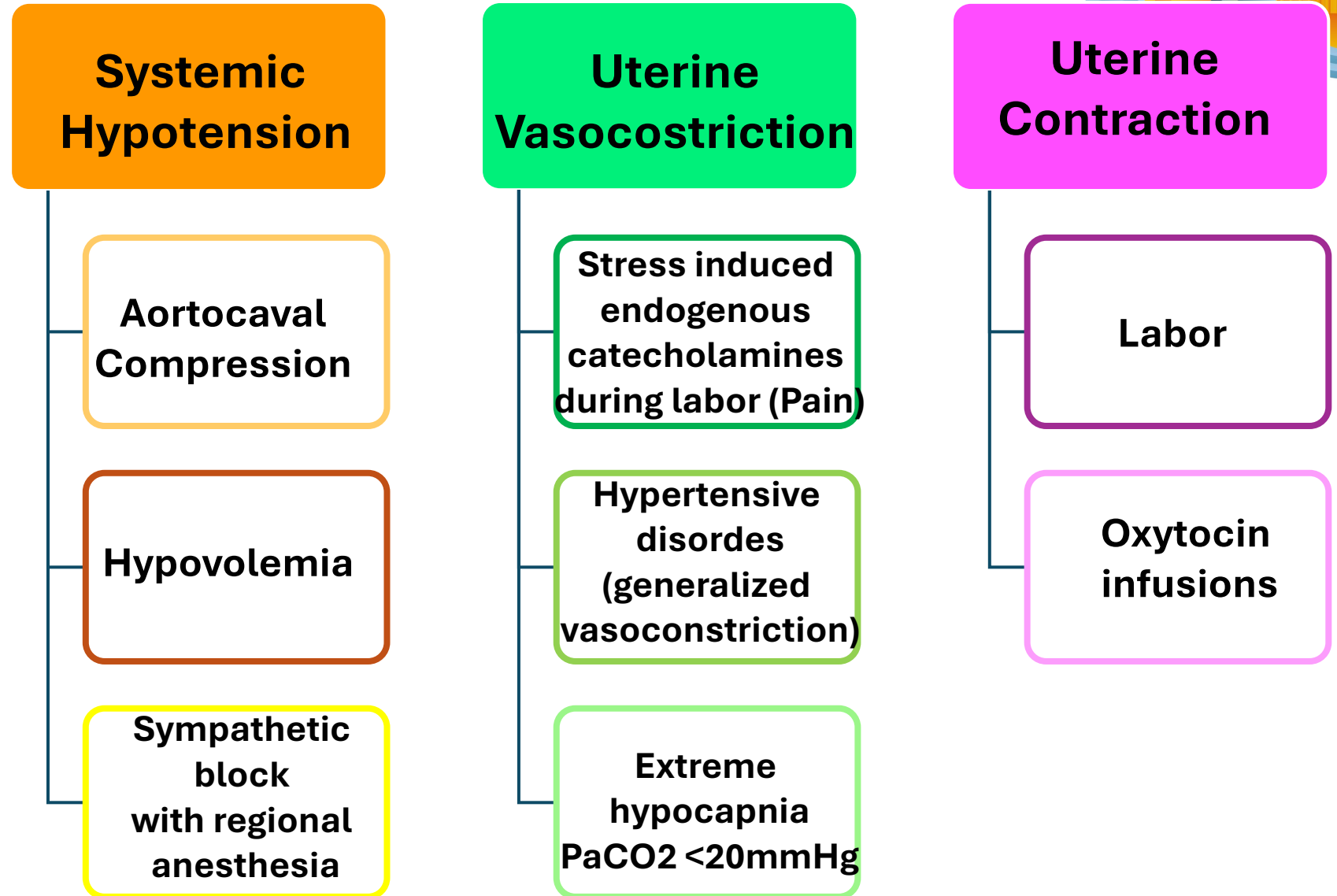
At term, 700-800ml/min (15% of total cardiac output).

About 90% of this blood flow nourishes the placenta, and the rest of it supplies the hypertrophied myometrium)

UBF: Direttamente proporzionale alla differenza tra PA uterina e PV uterina

Inversamente proporzionale alla Resistenza Vascolare Uterina

3 major factors
↓ uterine blood flow
during labor





ALTERAZIONI EMODINAMICHE

Quali?

- Ipotensione post ALR
- Shock Ipovolemico/Emorragico
- Pz patologiche
(es: cardiopatiche, PE-E,..)

PREVENIRE

RICONOSCERE

TRATTARE



Hemodynamic monitoring in the pregnant woman could help to:



- Management hypotension
- Identify patients with the highest risk of maternal and fetal complications
- Once circulatory shock has established, identify the hemodynamic problem and establish a specific therapy



ALTERAZIONI EMODINAMICHE

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(es: cardiopatiche, PE-E,..)

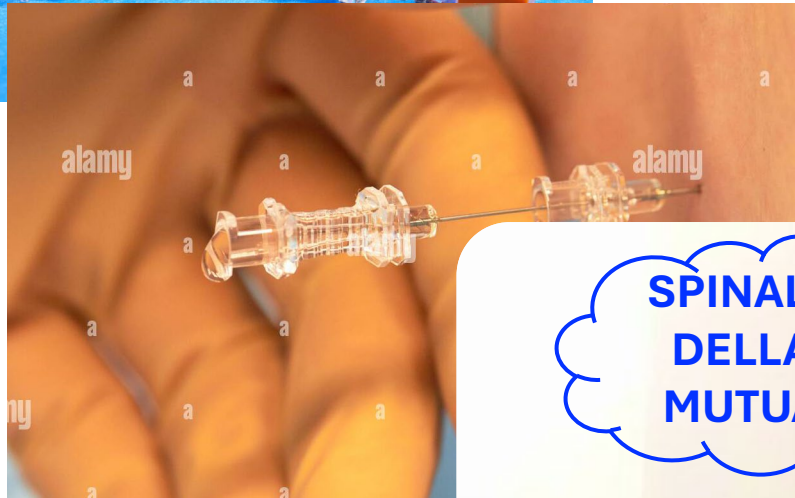
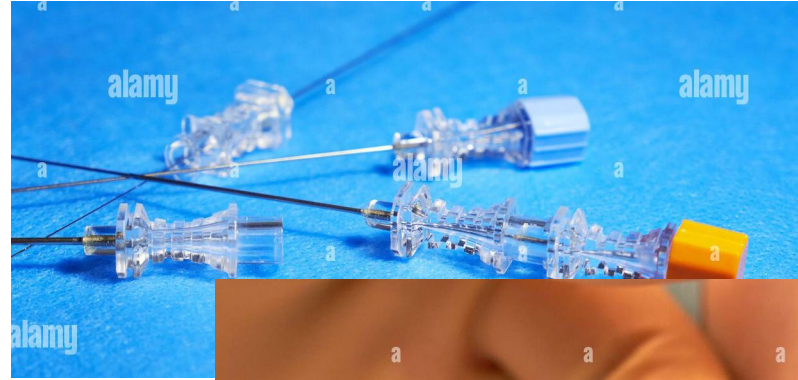
PREVENIRE

«quale tecnica e quali farmaci
per il miglior outcome
materno-feto-neonatale?»

Tailored



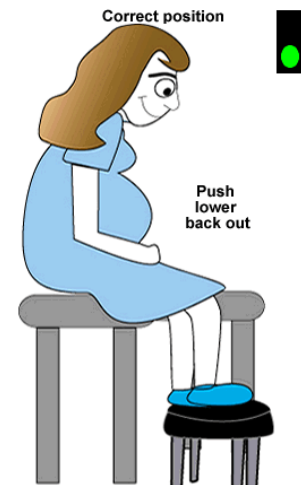
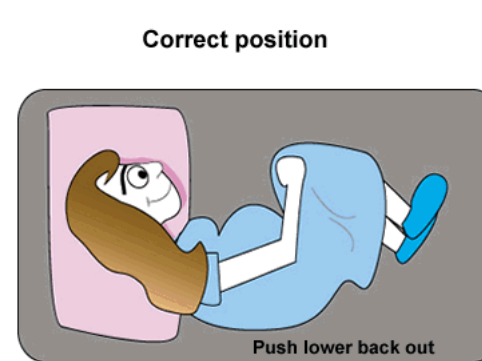
COMBINATA
SPINO
EPIDURALE



SPINALE
DELLA
MUTUA



Spinale
Single
Shot





Combined spinal epidural anaesthesia is better than spinal or epidural alone for Caesarean delivery

J.S. Ranasinghe · J. Steadman · T. Toyama · M. Lai

- ✓ Spinal anaesthesia is simple to institute, rapid in its effect and produces excellent operating conditions. Continuous epidural analgesia is more titratable, may produce less haemodynamic swings, and can be topped up if surgery is prolonged or postoperative pain relief is required.
- ✓ Combined Spinal–Epidural Anaesthesia (CSEA) offers benefits of both spinal and epidural anaesthesia.
.....reducing the anaesthetic failure rate to only a fraction of either technique used alone.



Guidelines for intraoperative care in cesarean delivery: Enhanced Recovery After Surgery Society Recommendations (Part 2)

DECEMBER 2018 **American Journal of Obstetrics & Gynecology**

Combined spinal epidural anesthesia may allow for a more rapid motor recovery than spinal anesthesia,
... presence of an epidural catheter provides a capability to extend or prolong an inadequate spinal block.

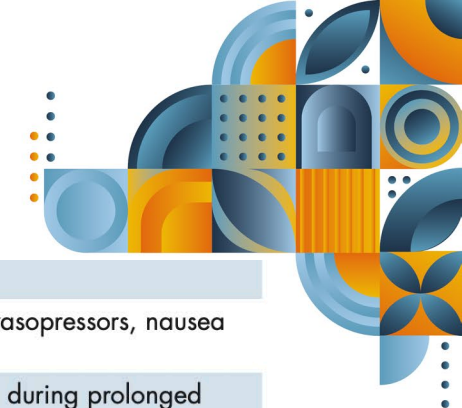


Combined spinal epidural for labour analgesia and caesarean section: indications and recommendations

2020

Emilia Guasch^a, Nicolas Brogly^a, and Fernando Gilsanz^b

- CSE showed the best success rate of the neuraxial block: **epidural block failed in 6.2%** of the cases, versus **1,5%** for spinal anaesthesia and only **0.6% for CSE**
- CSE **permits the reduction of intrathecal dose** with good safety conditions for the parturients
- The use of low dose of spinal anaesthetic is recommendable, with an **optimization of haemodynamics**. Ultra-low doses are not advisable because of an increase of incomplete blocks.
- When low or ultra-low dose of spinal local anaesthetic are used, the insertion of an epidural catheter allows a **complementation of the block in case of insufficient level or prolonged surgery**
- The maintenance of the **epidural catheter** allows the parturient to receive **neuraxial analgesia in the postoperative period**



Caesarean section

Low-dose spinal anaesthesia

Low-dose local anaesthesia improves haemodynamics, requirements of vasopressors, nausea and vomiting

Risk of prolonged surgery and risk of reintervention

CSE makes possible the administration of local anaesthetic top up doses during prolonged surgery or if a reintervention must be performed.

Programmed caesarean section

As opposed to category I CS, CSE is indicated in nonemergent surgery because of its longer time of performance

Postoperative analgesia

CSE give the possibility of administering opioids and local anaesthesia in the postoperative period



High cardiac risk

The possibility of titrating neuraxial block with CSE makes of this technique an excellent option, and even better than continuous spinal anaesthesia, because of a better reliability.



Preeclampsia grave

Cardiopatía congénita



Obese patient

CSE improves the success rate of spinal component, avoiding a GA. It permits to top up the block in case of incomplete neuraxial block or prolonged surgery (more frequent in this category of patients).

CSE, combined spinal epidural; CSF, cerebrospinal fluid; CS, caesarean section; GA, general anaesthesia; VBAC/TOLAC, vaginal birth after caesarean/trial of labour after caesarean.

Caesarean section

Performance of the CSE in the midline

A good training in CSE is important to obtain the best results, given that lateral deviation of the needle is associated with higher failure of CSE

Administer low spinal dose of local anaesthetic

When a CSE is performed, low-dose spinal is recommended to decrease the side effects of the technique

Control hypotension with vasopressors

The administration of vasopressors permits to control sympathetic block. Special attention should be paid not to decrease excessively the local anaesthesia dose, given that the ED95 is increased with phenylephrine infusion.

Consider EVE

In specific cases, EVE is an option, when very low doses of local anaesthesia should be used for high-risk patients.





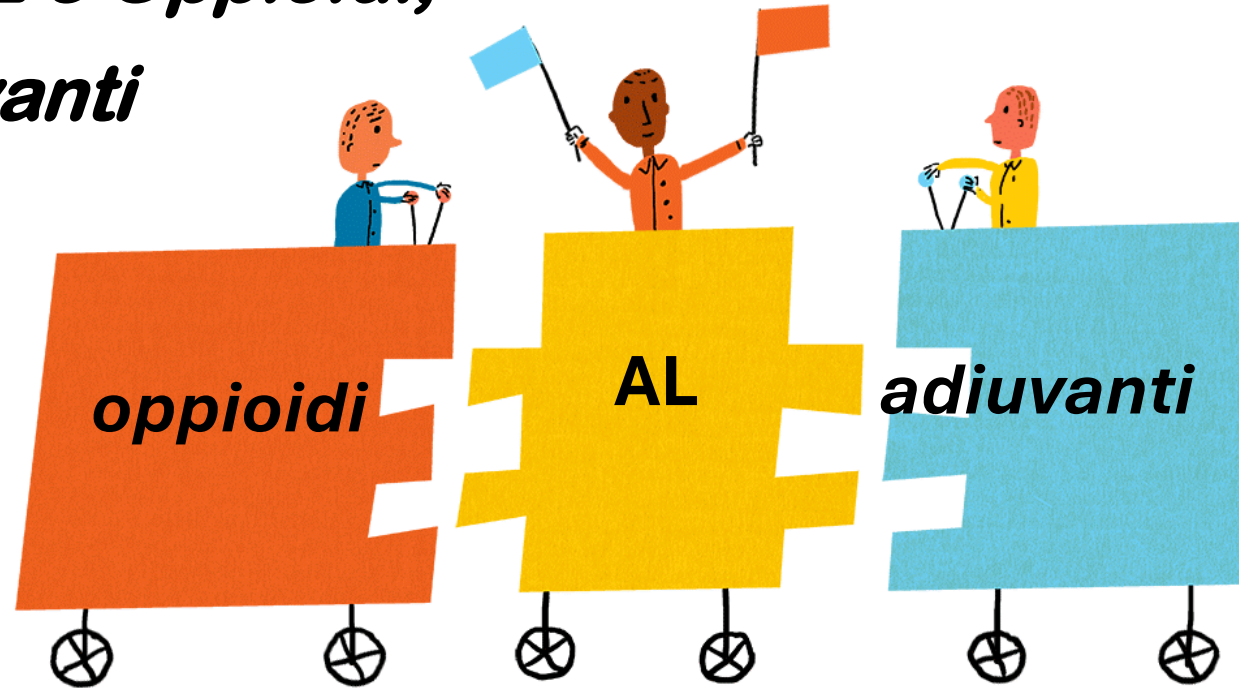
Low dose sequential combined spinal- epidural

peripartum cardiomyopathy
catecholamine-sensitive ventricular tachycardia,
Severe primary pulmonary hypertension,
Mitral stenosis
Aortic stenosis and coronary artery disease
Cardiac disease: Tetralogy Fallot
.....

- By combining the reliability of intrathecal blockade with the flexibility of an epidural catheter, a titratable, cardiovascularly stable anaesthetic can be achieved.
- Two-stage technique.....
Multi compartmental synergistic block
- A deliberately small intrathecal dose is administered to provide an initially low block. The epidural catheter then allows the block to be extended or prolonged as required. Extending the block whilst maintaining haemodynamic stability requires time



Associazione AL e Oppioidi,e Adjuvanti



- Minimizzare gli effetti collaterali degli AL: IPOTENSIONE, BLOCCO MOTORIO
- Minimizzare gli effetti collaterali degli Oppioidi: PRURITO, NAUSEA, SEDAIONE, DEPRESSIONE RESPIRATORIA



Consensus on the Southeast Asian management of hypotension using vasopressors and adjunct modalities during cesarean section un

Grace Anne B. Herbosa^{1*}, Ng Cong Quyet Thang⁵

Table 1 Key recommendations for

Conclusions: This consensus statement advocates proactive management of maternal hypotension during cesarean section after spinal anesthesia, which can be detrimental for both the mother and fetus, supports the choice of phenylephrine as a first-line vasopressor and offers a perspective on the use of prefilled syringes in the Southeast Asian region, where factors such as healthcare features, availability, patient safety, and cost should be considered.

Key recommendations	Recommendations
Hypotension during SA needs prompt recognition and treatment, since it is frequent and has adverse effects on the mother and the fetus	High
A systolic NIBP of < 80% of baseline is considered hypotension, and SBP must be maintained at > 90% of baseline	High
Vasopressor should be used to manage SA-associated hypotension	High
Phenylephrine should be used as the first-line of vasopressor treatment to maintain the desired SBP in the absence of bradycardia	High
Phenylephrine can be given prophylactically to reduce the risk of hypotension and nausea and vomiting after SA	High
Phenylephrine may be administered as an infusion titrated at 25–50 µg/min after administration of SA, depending on blood pressure and heart rate with additional IV boluses if needed	High
Phenylephrine can be administered as a bolus of 50–100 µg on SA administration. For immediate management of hypotension, IV bolus of phenylephrine has a faster onset than an infusion	High
Phenylephrine and ephedrine bolus should be administered using prefilled syringe since it prevents medication errors, creates less waste, improves patient safety, and allows long-term cost savings	High
Intermittent IV boluses of 5–15 mg ephedrine must be administered in the presence of bradycardia and hypotension, but the cumulative dose before delivery should not exceed 15 mg to minimize fetal acidosis	High
Leg compression devices, manual left uterine displacement, wedge for left uterine displacement, and administration of 5HT3 antagonists (e.g., ondansetron) may be used as prespinal measures to prevent hypotension after SA	Medium
Crystalloid co-loading should commence together with prophylactic administration of vasopressors	Medium
Noradrenaline (norepinephrine) infusion (starting rate can be 0.1 µg/kg/min) or bolus (5–10 µg) may be used in limited-resource areas (using a central line or temporarily in large-bore peripheral line)	Low
An anticholinergic agent (glycopyrrolate or atropine) may be used for significant bradycardia with hypotension	Low





Efficacy of ondansetron for spinal anesthesia during cesarean section: a meta- analysis of randomized trials

- ...Ondansetron is a potent, highly selective serotonin (5-HT₃) receptor antagonist. It can prevent the combination of 5-HT released by activated platelets with 5-HT₃ receptors in the vagal nerve endings of the left ventricle, attenuate Bezold–Jarisch reflexes produced by left ventricular mechanoreceptors stimulated by 5-HT, inhibit further expansion of peripheral blood vessels, and increase venous return, thereby reducing the incidence of hypotension.
- ...It can block vomiting reflexes caused by the 5-HT₃ receptor-induced vagal stimulation and inhibit 5-HT release in the fourth ventricle caused by vagal excitement, effectively controlling vomiting.



Comparative dose-response study on the infusion of norepinephrine combined with intravenous ondansetron versus placebo for preventing hypotension during spinal anesthesia for cesarean section: a randomised controlled trial

Zhi-min Sheng, MD^a, Heng-qiu Sun, MD^b, Jun-qin Mao, MD^a, Jie Liu, MD^a, Gang Liang, MD^a, Zhong Mei, MD^{c,*}

2023

«...The results revealed that the ED50 and ED90 of prophylactic norepinephrine infusion for the prevention of SAIH were reduced by approximately 36% and 35% with the use of intravenous 0.1 mg/kg ondansetron administered 10 min before spinal anaesthesia in parturients undergoing elective caesarean section....»



ALTERAZIONI EMODINAMICHE

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PREVENIRE

RICONOSCERE

correggiamo la

MAP
???

The maternoplacental
circulatory system
has no arterioles
(NO autoregulation)

*E' inutile correggere al monitor
valori numerici ai fini cosmetici*



Monitoraggio emodinamico personalizzato:

- Riconoscere e gestire l'ipotensione post ALR
- Valutazione costante pre, intra e post operatoria
- Paziente con comorbidità: una sfida per gli operatori
- Metodiche: operatore dipendente, risorse a disposizione



USCOM: rapida curva d'apprendimento, minimamente invasivo, ampiamente validato sulla popolazione ostetrica

NiCAS

HPI

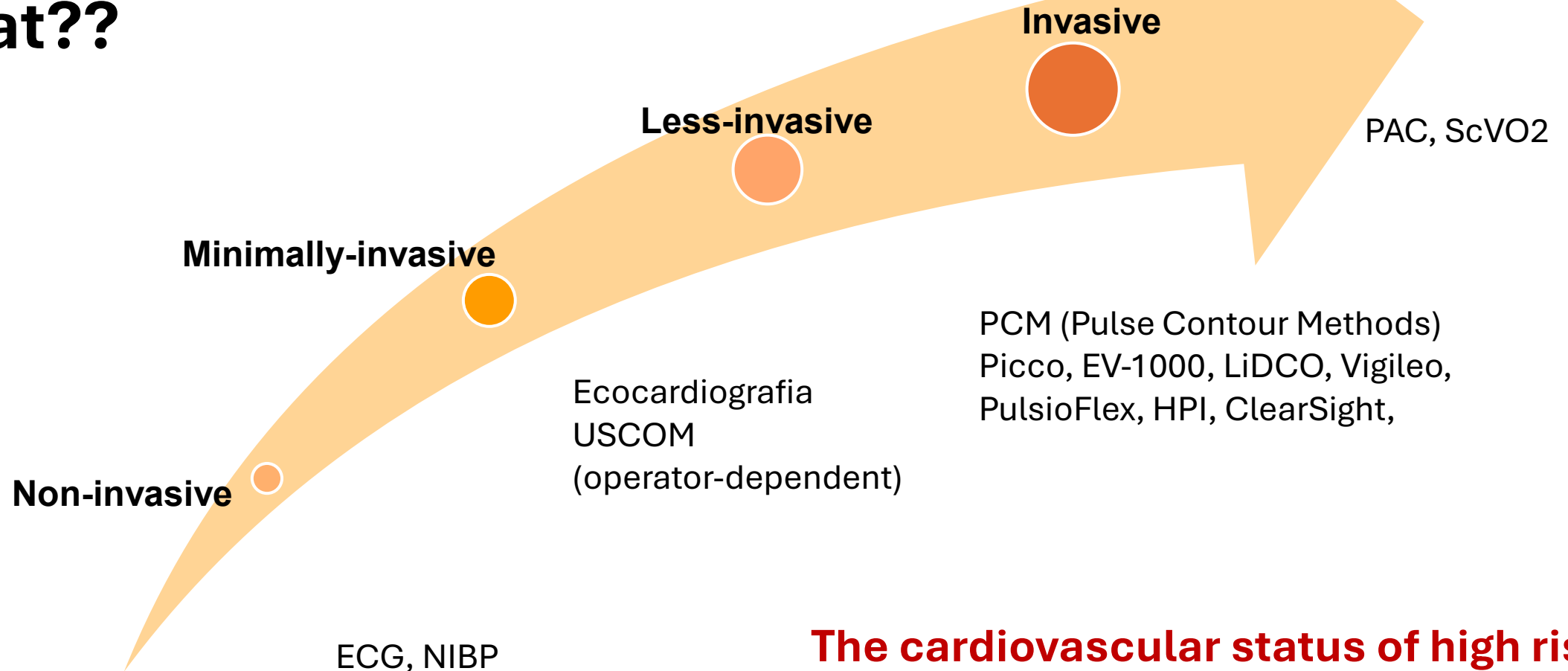
PI

PAC

ECOCARDIO: operatore dipendente, lenta curva d'apprendimento

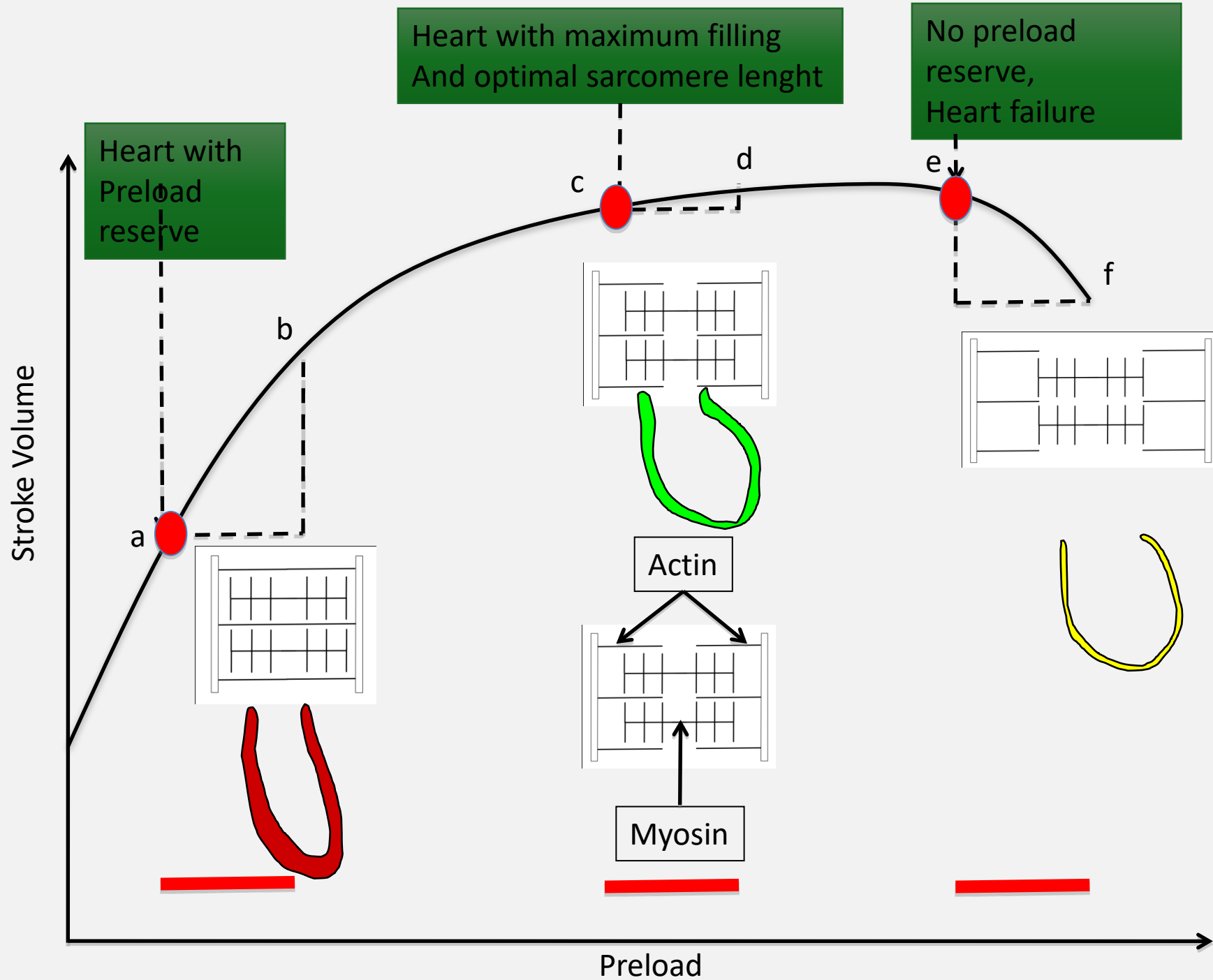


Hemodynamic Monitoring: What??



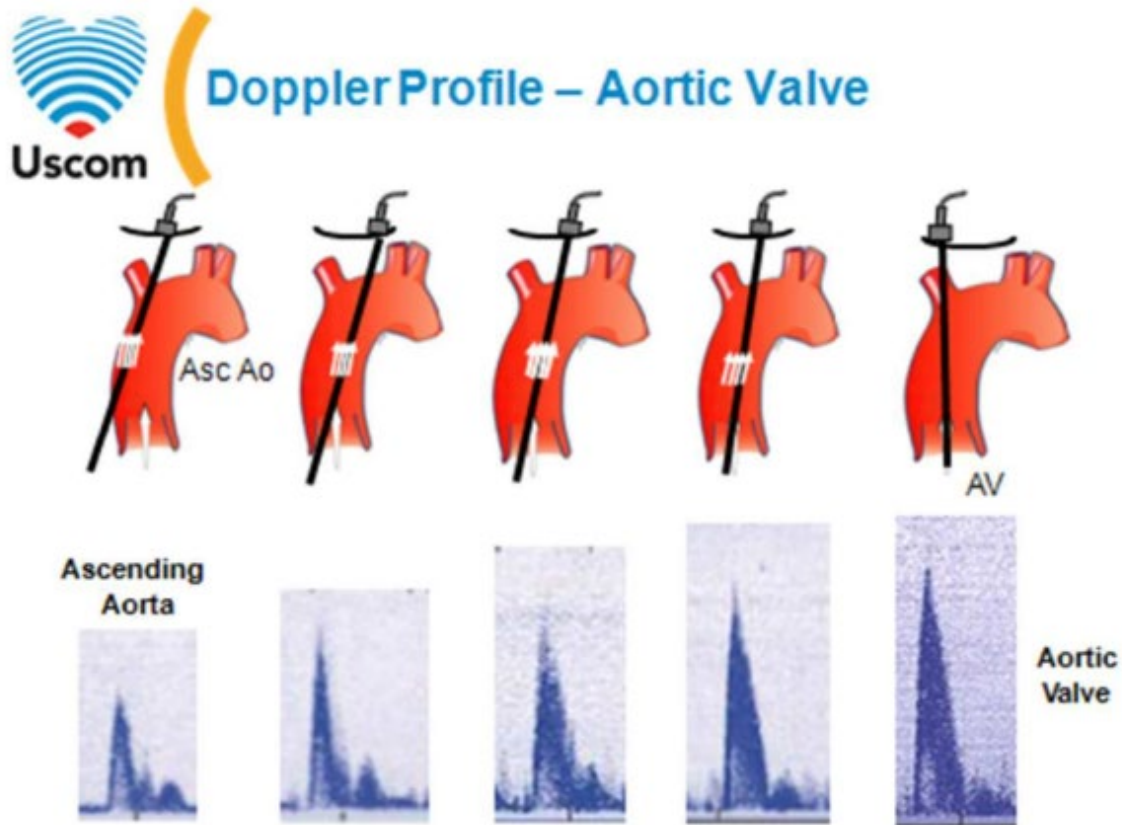
**The cardiovascular status of high risk
obstetric patients may change rapidly**

Legge di Frank-Starling





ULTRASONIC CARDIAC OUTPUT MONITORING



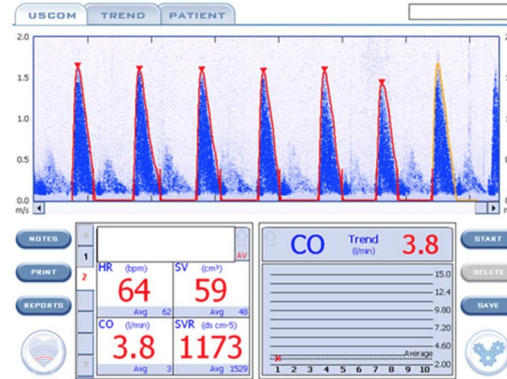
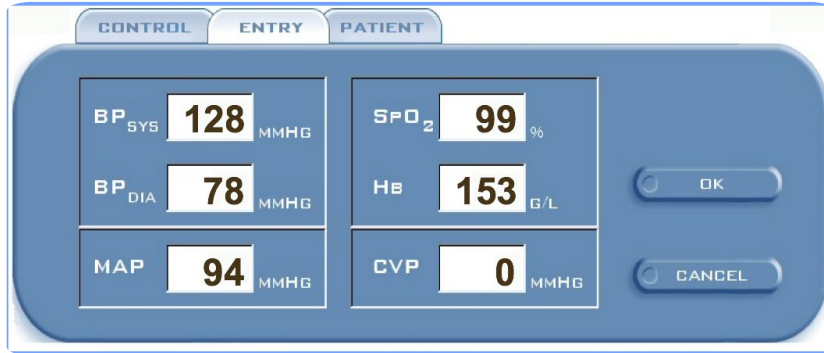
SVR e DO₂

7-9 Novembre 2024

CESENA, Cesena fiere



INO o SMII



	V	ΔV	Avg
MD (m/min)	10	0.00	10
FTc (ms)	383	0.00	383
SV (cm ³)	44	0.00	44
CO (l/min)	2.7	0.00	2.7
CI (l/min/m ²)	1.3	0.00	1.3
SVR (ds cm-5)	2271	0.00	2271
DO ₂ (ml/min)	412	0.00	412
INO (W/m ²)	0.76	0.00	0.76
PKR	49	0.00	47

**(Smith-Madigan
Inotropy Index):
INOTROPISMO/BSA**

Inserendo i valori della Pressione Arteriosa otteniamo un importante risultato: **SVR = RESISTENZE VASCOLARI PERIFERICHE**

BP = CO x SVR

SVR = BP / CO

Inserendo i valori di SpO₂ e Hb otteniamo un risultato fondamentale: **DO₂ = TRASPORTO DI OSSIGENO**

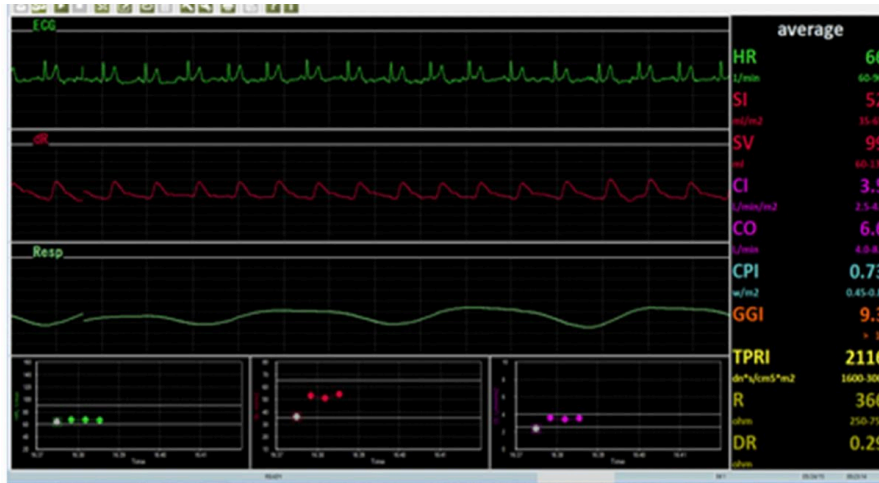
Adult clinical values:

- Positive fluid responsiveness: SVI < 35 ml/m² & SMII > 1.1 W/m²
- Negative fluid responsiveness: SVI < 35 ml/m² & SMII < 1.1 W/m²
- Heart failure: 0.4 – 1.0 W/m²
- SMII < 1.1 W/m² Inotrope is required to return hemodynamics to normal

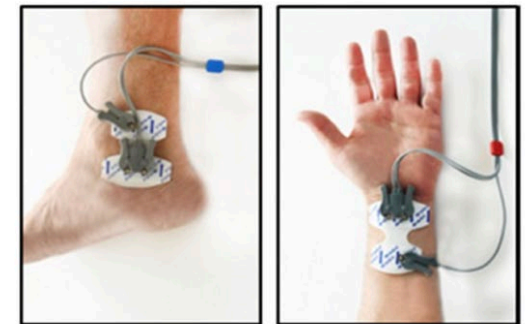


Maternal cardiovascular hemodynamics in normotensive versus preeclamptic pregnancies: a prospective longitudinal study using a noninvasive cardiac system (NICaS™)

Lavie et al. BMC Pregnancy and Childbirth (2018)



NICaS Monitor



Sensors location

Conclusions: The immediate postpartum period is accompanied by the most dramatic hemodynamic changes and fluid shifts, during which the parturient should be closely monitored. The NICaS™ device may help the clinician to customize the most optimal management for individual parturients. Our findings require validation by further studies on larger samples.



Performance of the Hypotension Prediction Index With Noninvasive Arterial Pressure Waveforms in Awake Cesarean Delivery Patients Under Spinal Anesthesia

Luciano Frassanito, MD, Chiara Sonnino, MD, Alessandra Piersanti, MD, Bruno Antonio Zanfini, MD, PhD, Stefano Catarci, MD, Pietro Paolo Giuri, MD, Marco Scorzoni, MD, Gian Luigi Gonnella, MD, Massimo Antonelli, MD, PhD, and Gaetano Draisci, MD

Obstetric Anesthesiology



In conclusion, the HPI applied to noninvasive continuous hemodynamic data provides real time and accurate prediction of impending arterial hypotension in awake pregnant patients undergoing CD under SA.

....

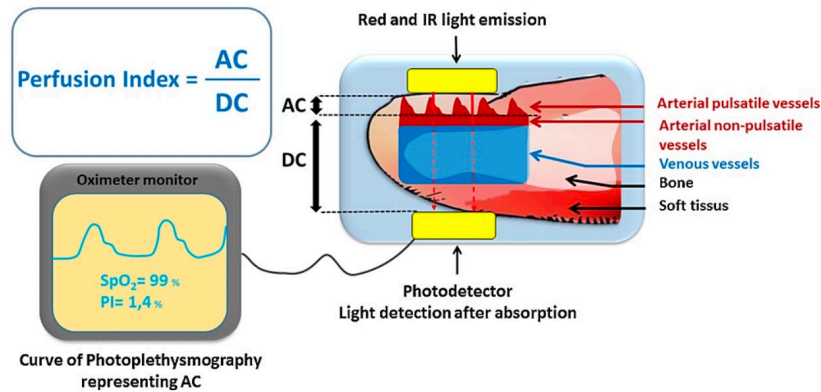
We found acceptable agreement for MAP measured by ClearSight with conventional NIBP monitoring method in patients undergoing CD





Perfusion index to predict post spinal hypotension in lower segment caesarean section

Perfusion index (PI) is a non-invasive, continuous, photo-plethysmographic pulse wave monitored from a pulse oximeter and can be used to assess peripheral perfusion dynamics due to changes in the peripheral vascular tone. It is defined as the ratio of pulsatile blood flow to non-pulsatile blood flow in peripheral vascular tissue and the value ranges between 0.02% and 20%.




Pregnancy is associated with increased total blood volume and a decrease in systemic vascular resistance resulting in reduced vascular tone, which corresponds to an increase in pulsatile component and higher PI values.

Sympathetic blockade after SA causes a further decrease in peripheral vascular tone and increased venous pooling and hypotension.

Thus, parturients with high baseline PI (>3.5) are at higher risk of developing exaggerated hypotension following SA



Echocardiography for the Pregnant Heart

Henrietta A. Afari, MD¹ 

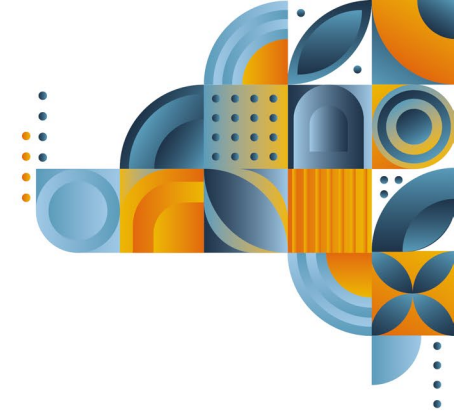
Esther F. Davis, MBBS, DPhil²

Amy A. Sarma, MD^{2,3,*}

Table 1. Normal physiologic changes on echocardiography during pregnancy

Unchanged in pregnancy	Increased in pregnancy	Normative in pregnancy
- Ejection Fraction	- LVEDD	- Pericardial effusion (often trace to mild)
- Fractional shortening	- LV mass	- Pseudodyskinesia
- Peak myocardial systolic velocity	- Cardiac Output	
- Average systolic SR	- RV diastolic area	
- E/E' ratio	- LA volume	
- RVSP	- LA size	
	- RA size	
	- Valvular annulus dimension	
	- Aortic and pulmonic VTI	

LVESD left ventricular end-systolic dimension, *LVEDD* left ventricular end-diastolic dimension, *LV* left ventricle, *RV* right ventricle, *LA* left atrium, *RA* right atrium, *SR* strain rate, *RVSP* right ventricular systolic pressure, *VTI* velocity time integral



Monitoring postpartum

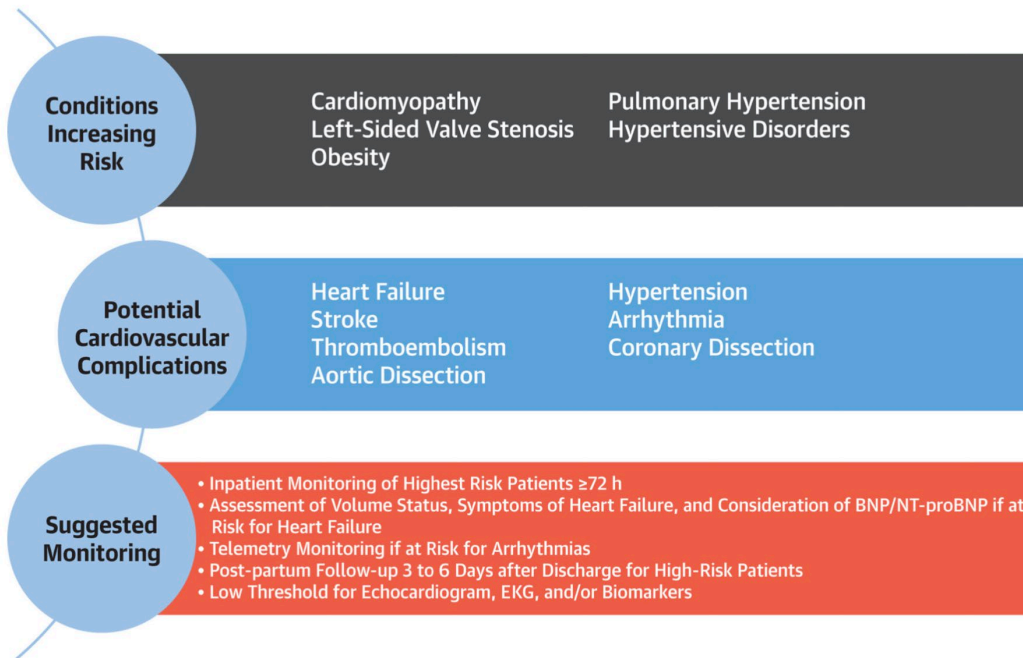


FIGURE 4. Postpartum Complications in Women with Cardiovascular Disease
Postpartum complications are more likely with certain cardiovascular conditions and additional postpartum monitoring may be needed. BNP = B-type natriuretic peptide; EKG = electrocardiogram; NT-proBNP = N-terminal pro-B-type natriuretic peptide.

Consider:

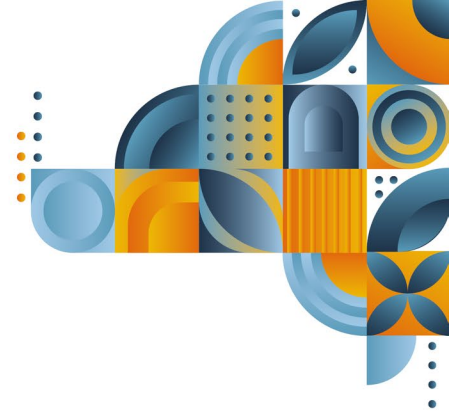
- Medical history
- Pregnancy
- Delivery
- Hospital organisation

Peripartum Red Flag Signs and Symptoms

Chest Pain	Tachycardia
Dyspnea	Non-Vagal Syncope
Orthopnea	Headache
Cough	Visual Changes
Edema	Hypotension/Hypertension

FIGURE 3. Signs and Symptoms Concerning for Cardiovascular Complications During or After Pregnancy

Patients and clinicians need to be aware of signs and symptoms that may signal cardiovascular complications during and after pregnancy.



ALTERAZIONI EMODINAMICHE

Quali?

- Ipotensione post ALR
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(es: cardiopatiche, PE-E,..)

Ottenere il migliore

PREVENIRE

RICONOSCERE

TRATTARE

Materno-feto-neonatale



International consensus statement on the management of hypotension with vasopressors during caesarean section under spinal anaesthesia

S. M. Kinsella,¹ B. Carvalho,² R. A. Dyer,³ R. Fernando,⁴ N. McDonnell,⁵ F. J. Mercier,⁶
A. Palanisamy,⁷ A. T. H. Sia,⁸ M. Van de Velde^{9,10}, A. Vercueil¹¹ and the Consensus Statement
Collaborators

Hypotension is a very common consequence of the sympathetic vasomotor block caused by spinal anaesthesia for caesarean section.

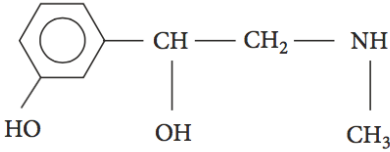
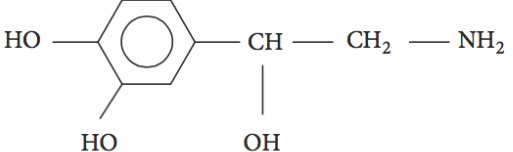
Maternal symptoms such as nausea, vomiting and dyspnoea frequently accompany severe hypotension...

Neonates of women with spinal-induced hypotension had significant acidosis, and hypotension of more than 2 min duration was associated with a significant increase in umbilical venous oxypurines and lipid peroxides, suggestive of ischaemia-reperfusion injury.

Duration of hypotension may be more important than severity. A transient $\geq 30\%$ decrease in blood pressure did not affect neonatal Apgar scores, incidence of meconium-stained amniotic fluid or the need for oxygen therapy in the neonate.

Hypotension for less than 2 min did not affect neonatal neurobehavioral outcomes, whereas more than 4 min of maternal hypotension was associated with neurobehavioral changes at 4–7 days of life



	Phenylephrine	Norepinephrine
Pharmacology	α_1, α_2	$\alpha_1, \alpha_2, \beta_1 \gg \beta_2$
Onset time	60 s	< 60s
Half time	5 min	1-2 min
Molecular structure		
Molecular weight	167 g/mol	169 g/mol
Metabolism	Deamination, glucuronidation, sulfation	COMT+MAO to VMA
Relative potency	1x	13x
Placental transfer	Minimal	Likely minimal too
Fetal metabolism stimulation	Lower than ephedrine	Lower than phenylephrine
MAP	↑	↑
HR	Dose dependently ↓	± or ↓
SV	±	± or ↑
CO	Dose dependently ↓	± or ↑
SVR	↑	↑
Venous resistance	↑	±
Venous return	±	±
Myocardial contractility	± or ↓	↑

COMT: catechol-O-methyltransferase; MAO: monoamine oxidase; VMA: vanillylmandelic acid; MAP: mean arterial pressure; HR: heart rate; SV: stroke volume; CO: cardiac output; SVR: systemic vascular resistance; ± indicates neutral effect.

- **EFEDRINA** (agonista diretto/indiretto sui recettori α/β): 5-10 mg
IIPOTENSIONE E BRADICARDIA
- **FENILEFRINA** (agonista α): 100 mcg
IIPOTENSIONE E TACHICARDIA
- **NORADRENALINA** 2.5 mcg/min



Recommendation	Action	Comments	Strength of recommendation	Level of evidence
(1) Prevent spinal anesthesia-induced hypotension	<ul style="list-style-type: none"> Maintain blood pressure at baseline Optimally managed with prophylactic vasopressor infusion, for example, phenylephrine (or norepinephrine) infusion 	<ul style="list-style-type: none"> Spinal anesthesia-associated hypotension is primarily an afterload-driven problem Goal is to prevent intraoperative nausea/vomiting after spinal anesthesia and maintain uteroplacental perfusion Vasopressor regimen may need to be modified in women with preeclampsia as the degree of hypotension with spinal anesthesia may be less than that in nonpreeclamptics Data are well supported in literature from the obstetric population 	Class I	Level A

LUD

Left Uterine Displacement

E' considerata la manovra più efficiente ed importante nel controllo della caduta pressoria materna dopo ALR

Minimizza la compressione aorto cavale

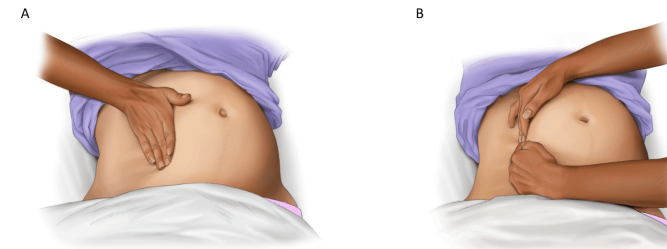
Mantiene un adeguato ritorno venoso

Mantiene il CO

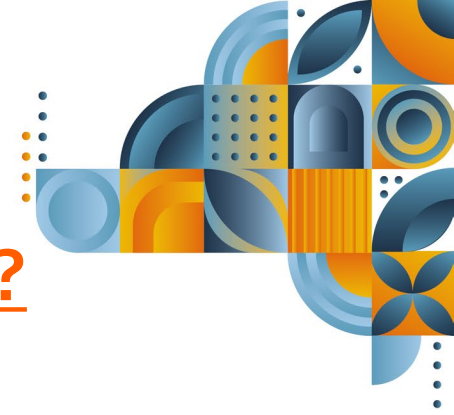
Evita l'aumento della pressione venosa uterina

Previene il decremento della pressione di perfusione dell'arteria uterina

Previene l'ipossia e l'acidosi fetale



A, Manual LUD, performed with one-handed technique. B, Two-handed technique during resuscitation.



PRELIEVO DA FUNICULO: ARTERIA, VENA O ENTRAMBI?



**OSSIGENAZIONE
FETALE**

**FUNZIONALITA'
PLACENTARE**

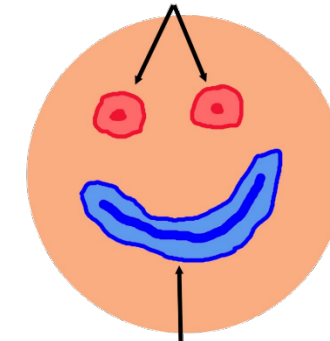
- *I valori più utili per l'interpretazione delle condizioni neonatali e la prognosi sono il pH e il valore di BE*
- *Un pH <7.0 e di BE <-12 è usato come valore soglia per definire l'acidemia fetale*
- *Il deficit di basi è usato per distinguere l'acidosi metabolica da quella respiratoria;*
- *inoltre ha una relazione lineare con l'accumulo di acido lattico e si correla con il rischio di alterazioni neurologiche neonatali*

ARTERIA OMBELICALE: metabolismo fetale
 VENA OMBELICALE: metabolismo placentare

	ARTERIA	VENA
pH	7,05 – 7,38	7,17 – 7,48
PCO ₂	20,5 - 27,5	21,4 – 25,7
BE	-2,5 -10,0	-1,0 -9,0

- In caso di asfissia di **breve durata** la differenza di BE arterioso e venoso è superiore a – 6 mmol/L
- In caso di ipossia di **lunga durata** la differenza di BE arterioso e venoso è inferiore a – 6 mmol/L

ARTERIE OMBELICALI



VENA OMBELICALE

L'ipoperfusione utero-placentare è la causa più importante sia di acidosi respiratoria che di acidosi metabolica nel feto, con una progressione dall'una all'altra se la riduzione del flusso utero placentare non è corretta.



TAKE HOME MESSAGE

- ✓ Understand hemodynamic change in pregnancy
- ✓ Regional anesthesia during c section: what strategy? «TAILORED»
- ✓ Monitoring hemodynamic : Personalized
- ✓ Management: obtain the best maternal feto neonatal outcome
- ✓ Pre existing or new onset pathologies
- ✓ Outcome Maternofetal
- ✓ Multidisciplinary team
- ✓ Urgency/Emergency: collaboration between specialist





Grazie

