Shock

Ηρακλής Τσαγκάρης

Καθηγητής Πνευμονολογίας – Εντατικής Θεραπείας ΕΚΠΑ

Διευθυντής Β’ Κλινικής Εντατικής Θεραπείας

- Κυκλοφορική καταπληξία (shock) σημαίνει ανεπαρκής ιστική οξυγόνωση, λόγω κακής αιμάτωσης των ιστών και/ή αδυναμίας χρήσης του διά του αίματος μεταφερόμενου οξυγόνου.

Ως (Shock) ορίζεται ένα οξύ, απειλητικό για τη ζωή σύνδρομο, που συσχετίζεται με καταπληξία αποδεδειγμένη κλινικά και εργαστηριακά ιστική υποάρδευση, με τελικό αποτέλεσμα την δυσλειτουργία των οργάνων.

<u>εμμένουσα υπόταση (ΣΑΠ<90mmHg) για >30 λεπτά</u>

+

σημεία ιστικής υποάρδευσης

(π.χ ψυχρά άκρα, ολιγουρια, ληθαργος, αυξημένο γαλακτικό οξύ)

Αναερόβιος μεταβολισμός γλυκόζης:

- γλυκόζη→ πυροσταφυλικό → γαλακτικό (lactic acid) +**2** mol ATP (**67** KJ ενέργεια)

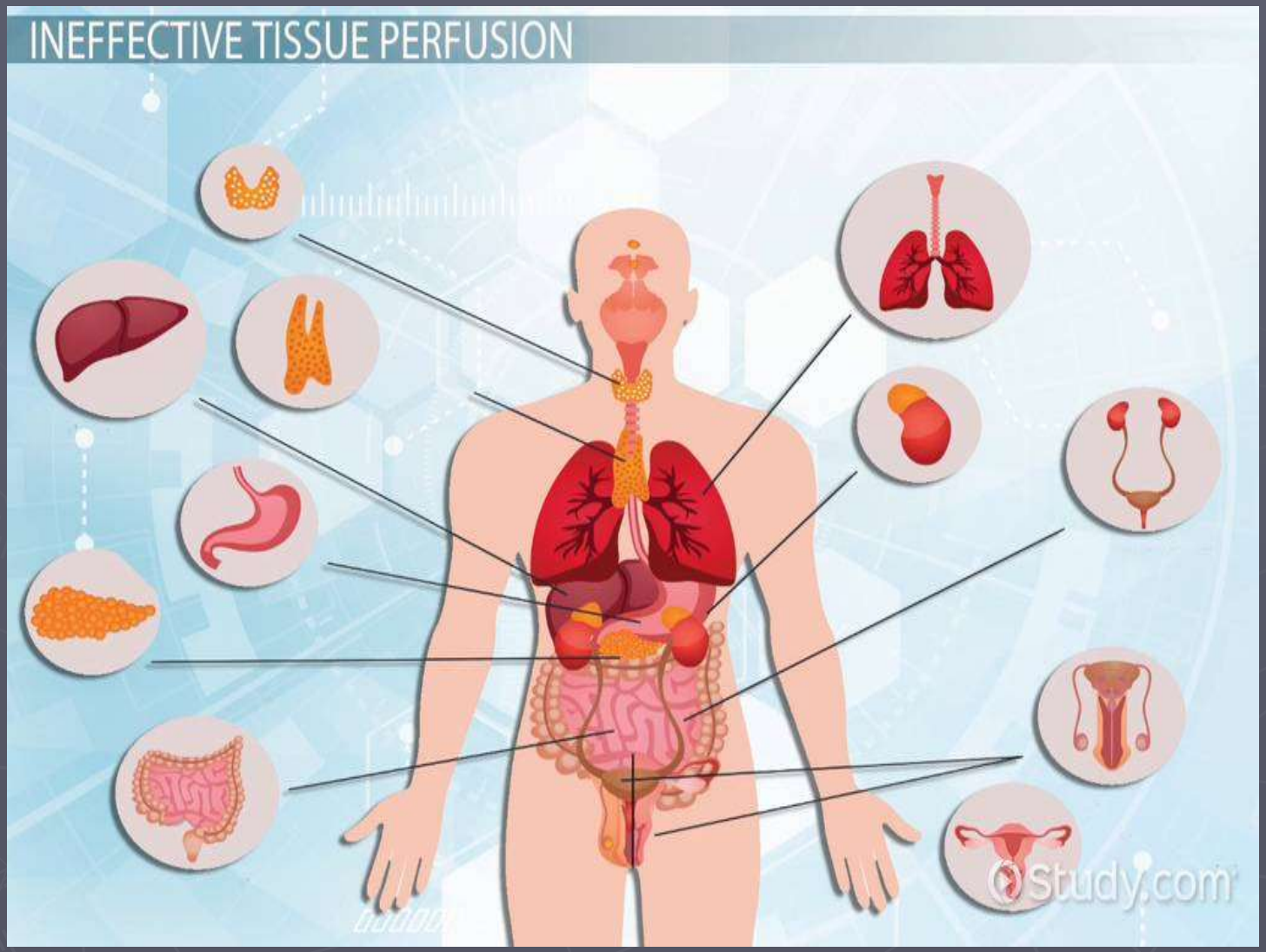
Αερόβιος μεταβολισμός γλυκόζης:

- γλυκόζη→ πυροσταφυλικό → CO_2 +H_2O +**38** mol ATP (**1270** KJ ενέργεια)

SHOCK

Ο ασθενής σε shock διατρέχει κάθε στιγμή τον κίνδυνο:

- Θανάτου από καρδιακή ανακοπή.
- Δημιουργίας σοβαρών βλαβών ζωτικών οργάνων (εγκεφάλου,νεφρών,ήπατος,καρδιάς,κ.λ.π) λόγω ανεπαρκούς ιστικής οξυγόνωσης.


INEFFECTIVE TISSUE PERFUSION
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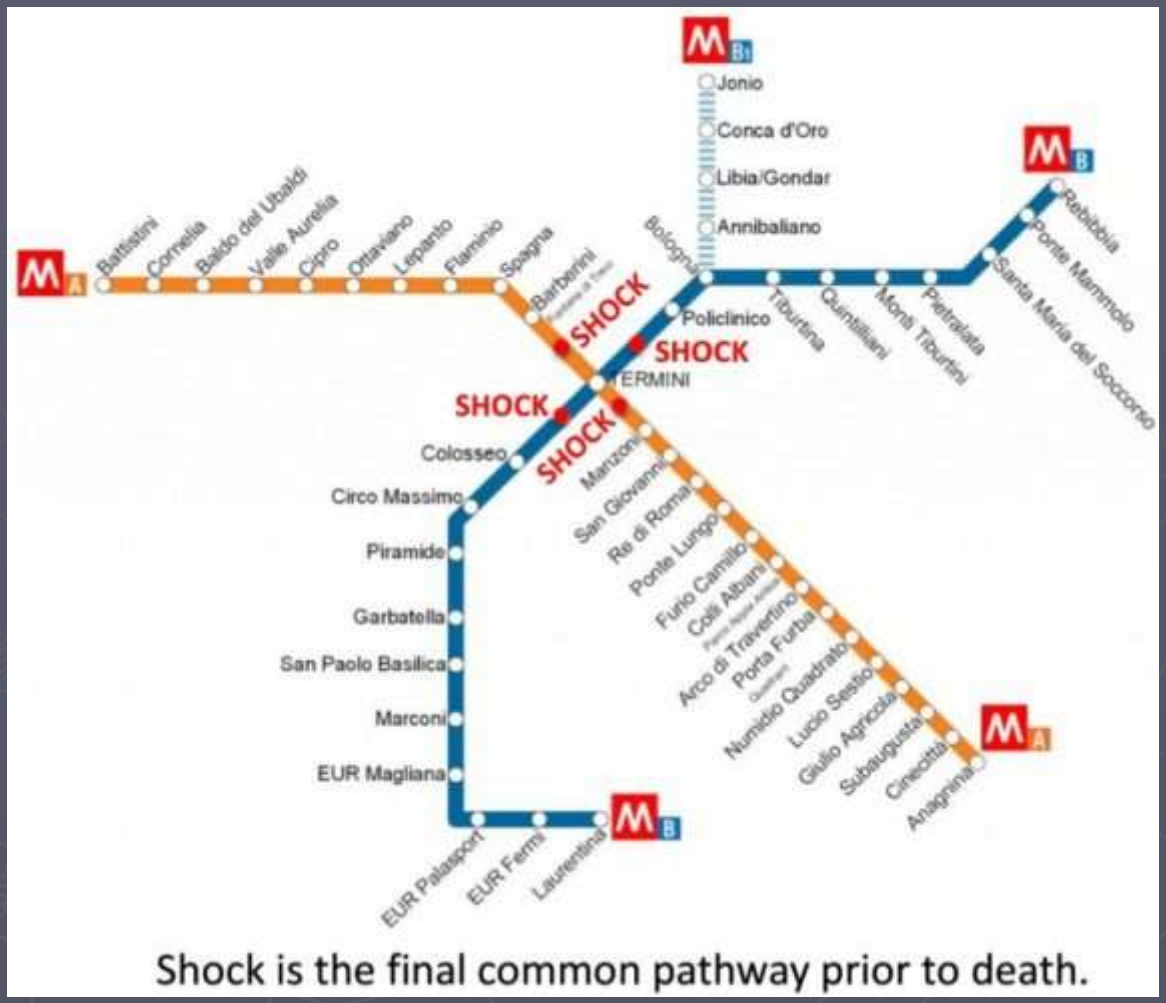
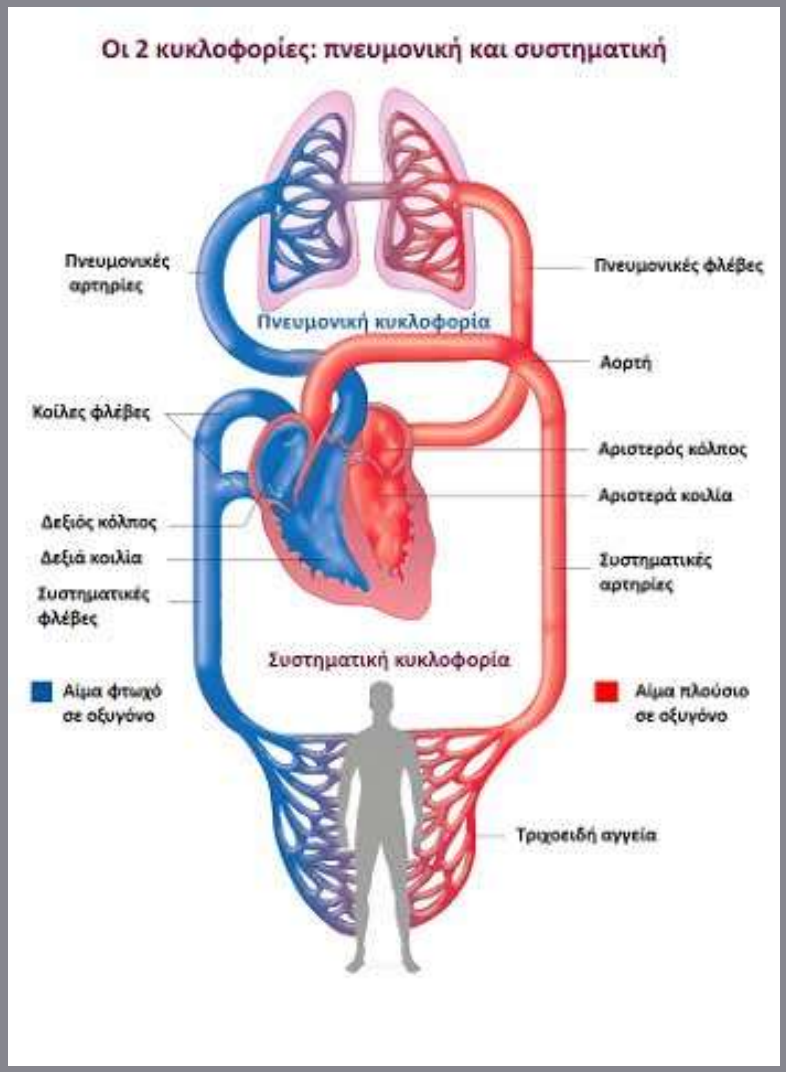
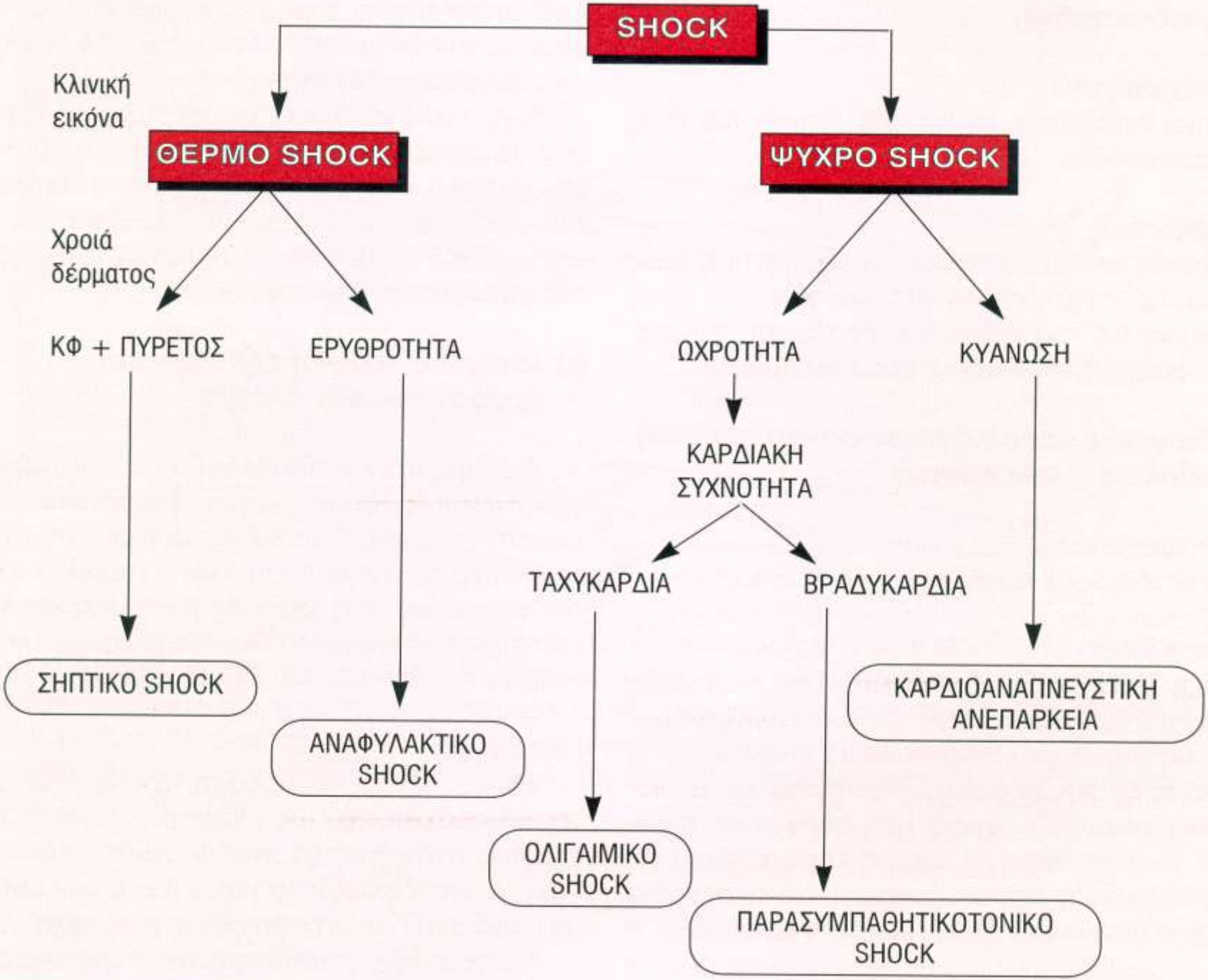


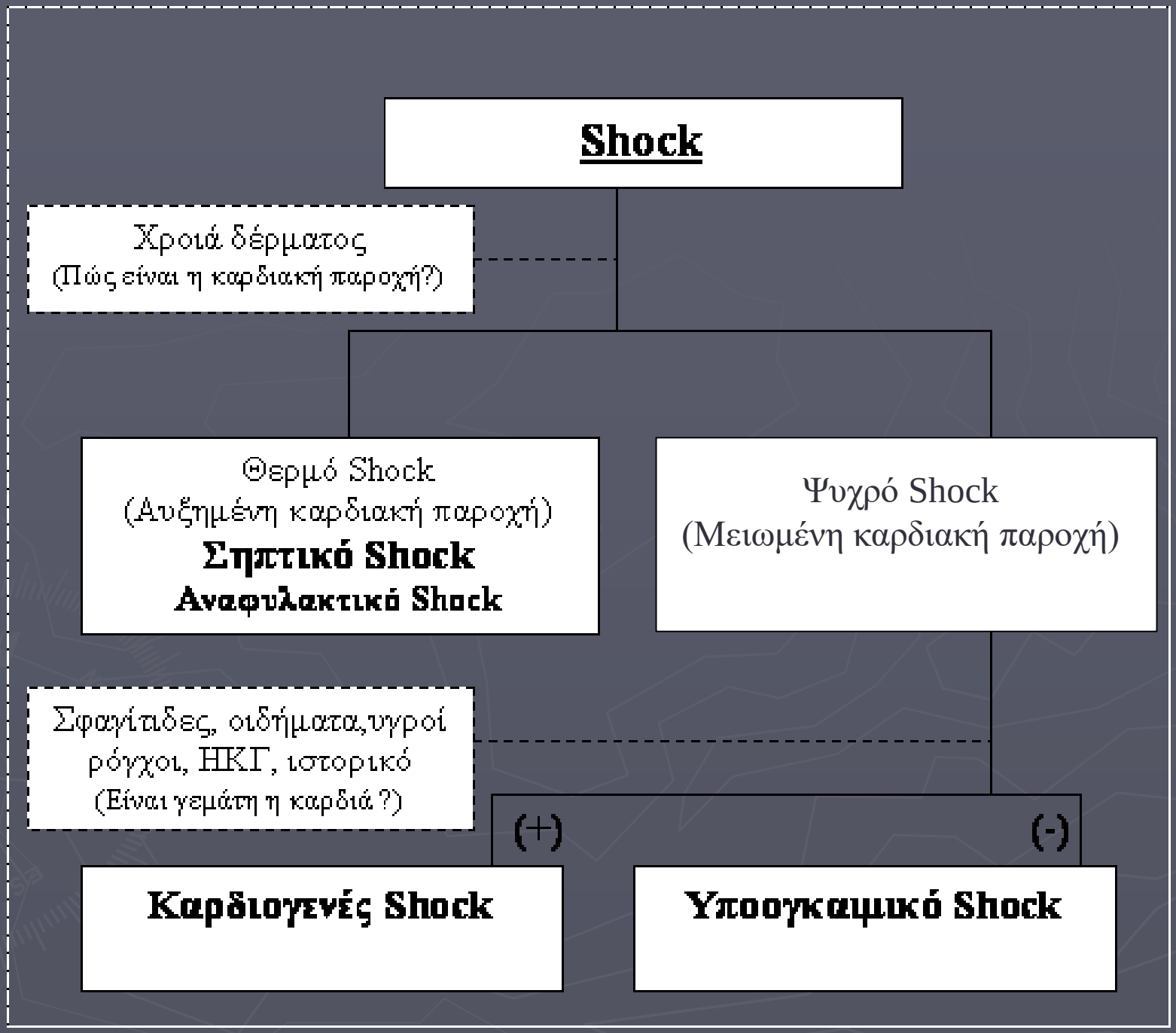
Shock is the final common pathway prior to death.


Οι 2 κυκλοφορίες: πνευμονική και συστηματική
Πνευμονικές αρτηρίες
Πνευμονικές φλέβες
Πνευμονική κυκλοφορία
Αορτή
Κοίλες φλέβες
Αριστερός κόλπος
Αριστερά κοιλία
Δεξιός κόλπος
Δεξιά κοιλία
Συστηματικές αρτηρίες
Συστηματικές φλέβες
Συστηματική κυκλοφορία
Αίμα φτωχό σε οξυγόνο
Αίμα πλούσιο σε οξυγόνο
Τριχοειδή αγγεία

Στο τμήμα επειγόντων περιστατικών

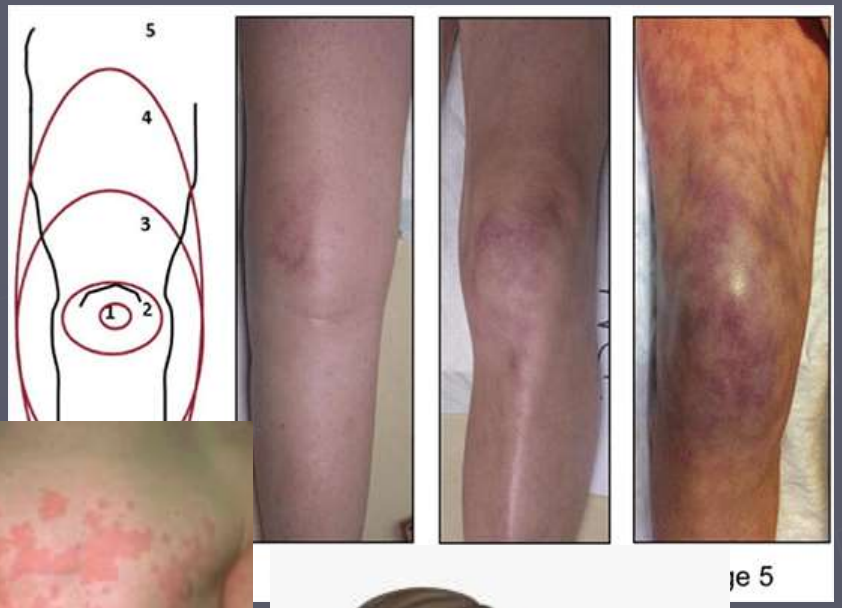
- Εξασφάλιση της βατότητας των ανωτέρων αναπνευστικών οδών, της οξυγόνωσης και του αερισμού.
- Εξασφάλιση της δυνατότητας ταχείας ενδοφλέβιας χορήγησης υγρών.
- Ακτινογραφία θώρακος και ΗΚΓ.
- Λήψη αίματος για τις απαραίτητες εργαστηριακές εξετάσεις.
- Εκτίμηση του ασθενούς για εισαγωγή στη ΜΕΘ ή μεταφορά σε άλλα ειδικά τμήματα (CT-scan,χειρουργείο,κ.λ.π).

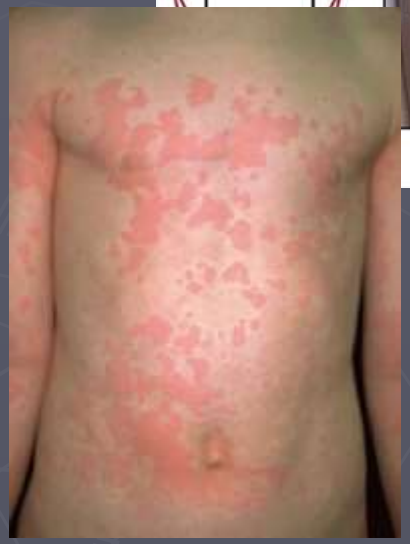

SHOCK
Κλινική εικόνα
ΘΕΡΜΟ SHOCK
ΨΥΧΡΟ SHOCK
Χροιά δέρματος
ΚΦ + ΠΥΡΕΤΟΣ
ΕΡΥΘΡΟΤΗΤΑ
ΩΧΡΟΤΗΤΑ
ΚΥΑΝΩΣΗ
ΚΑΡΔΙΑΚΗ ΣΥΧΝΟΤΗΤΑ
ΤΑΧΥΚΑΡΔΙΑ
ΒΡΑΔΥΚΑΡΔΙΑ
ΣΗΠΤΙΚΟ SHOCK
ΑΝΑΦΥΛΑΚΤΙΚΟ SHOCK
ΟΛΙΓΑΙΜΙΚΟ SHOCK
ΚΑΡΔΙΟΑΝΑΠΝΕΥΣΤΙΚΗ ΑΝΕΠΑΡΚΕΙΑ
ΠΑΡΑΣΥΜΠΑΘΗΤΙΚΟΤΟΝΙΚΟ SHOCK

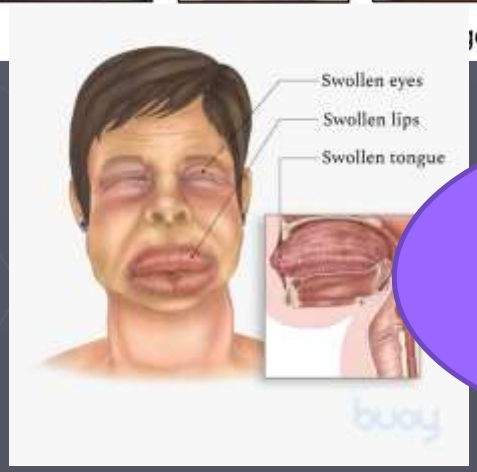

Shock
Χροιά δέρματος
(Πώς είναι η καρδιακή παροχή?)
Θερμό Shock
(Αυξημένη καρδιακή παροχή)
Σηπτικό Shock
Αναφυλακτικό Shock
Ψυχρό Shock
(Μειωμένη καρδιακή παροχή)
Σφαγίτιδες, οιδήματα,υγροί ρόγχοι, ΗΚΓ, ιστορικό
(Είναι γεμάτη η καρδιά?)
(+)
(-)
Καρδιογενές Shock
Υποογκαιμικό Shock

Clinical signs

- **Hemodynamics**
  - **Hypotension** (MAP<65 and/or significant drop from baseline).
  - **Tachycardia & elevated shock index** (HR/SBP)
  - **Bradycardia**
- **Low urine output (or dark urine)**
- **Skin perfusion**:
  - **Cool hands and knees**
  - **Mottling**
  - **Urticaria, angioedema, flushing, and pruritus (anaphylaxis)**
- **Delirium** (delirium tends to be a feature of *septic shock* rather than of cardiogenic shock).







Ψυχρά άκρα
↓ σπαργη δέρματος
Οίδημα ανά Σάρκα

bedside shock evaluation

monitor

- Narrow pulse pressure (<25% systolic) suggests low cardiac output
- Wide pulse pressure with diastolic hypotension suggests high-output shock

echocardiogram

- RV size & function (if suspect PE, check for DVT)
- LV size & function
- Mitral & aortic valve function (exclude severe regurgitation)
- IVC (if unable to see IVC, evaluate internal jugular vein)
- Pericardial effusion?

lung ultrasound

- Absent lung slide suggests tension pneumothorax
- Bilateral & diffuse anterior B-lines suggests cardiogenic edema with elevated filling pressures
- Patchy B-lines and/or consolidation suggests PNA

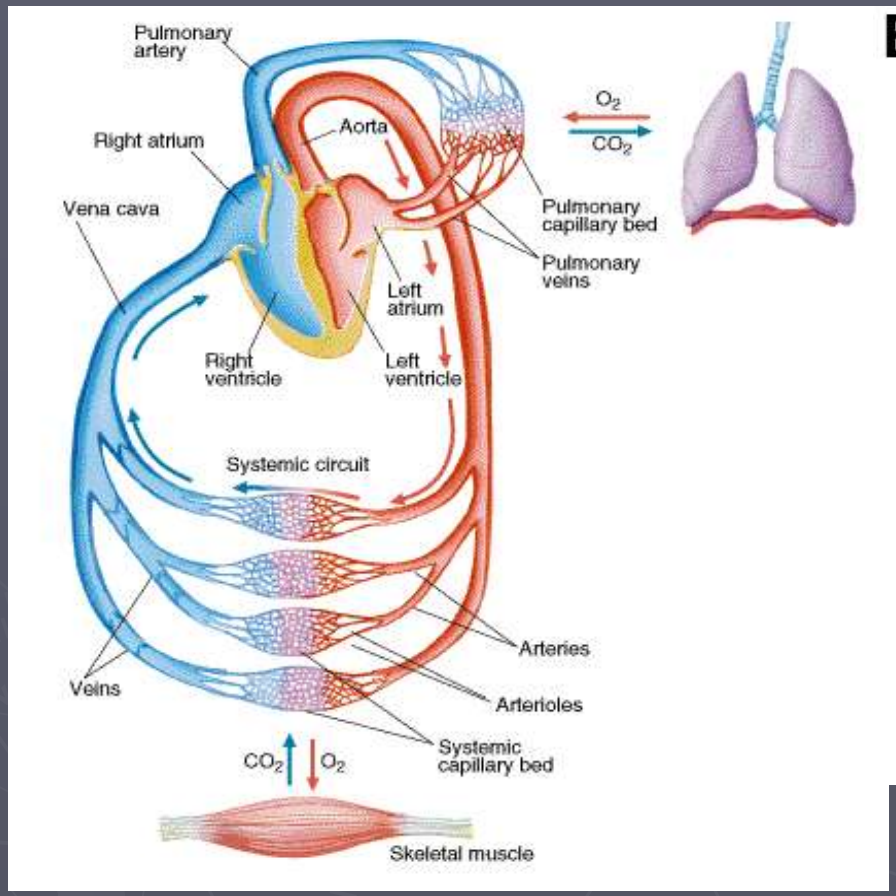
abdominal ultrasound

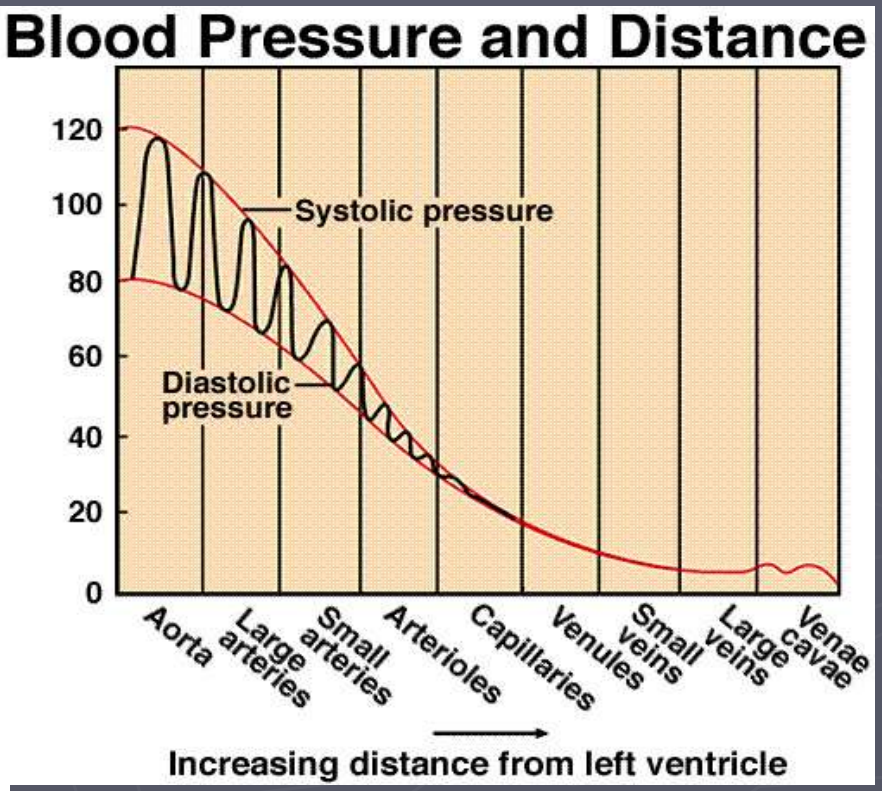
- FAST exam to evaluate for peritoneal hemorrhage. LUQ & RUQ views adequate to look for large volume hemorrhage.
- Aorta evaluation for dissection flap

skin perfusion

-warm extremities despite shock suggest vasodilatory shock
-mottling or cool extremities suggests inadequate cardiac output

Κυκλοφορικό σύστημα Ι





Πίεση=ροή Χ αντιστάσεις

Αρτηριακή πίεση=καρδιακή παροχή Χ αντιστάσεις

BP= Q X R

Παράμετροι καρδιακής λειτουργίας (Φυσιολογία)

Καρδιακή Παροχή

(CO) = Συχνότητα (HR) Χ Ογκος παλμού (SV)

- Βραδυκαρδία
- Ταχυκαρδία
- Αρρυθμίες

Παράμετροι καρδιακής λειτουργίας (Φυσιολογία)

Προφόρτιο (Preload)

- Ισοδυναμεί με τον τελοδιαστολικό όγκο - EDV (end diastolic volume)
- Χορήγηση υγρών αυξάνει τον EDV
- Η μέτρηση του EDV γίνεται με ECHO
- Στη πράξη χρησιμοποιείται συχνά η κεντρική φλεβική πίεση (CentralVenousPressure) και η πίεση ενσφήνωσης (PulmonaryCapillaryWedgePressure)
- Σε μειωμένη ενδοτικότητα οι τελοδιαστολικές πιέσεις υπερεκτιμούν τον EDV.

Παράμετροι καρδιακής λειτουργίας (Φυσιολογία)

Μεταφόρτιο

- Η δύναμη που αντιστέκεται στη συστολή
- Διαστολική πίεση αορτής
- Συστηματικές αντιστάσεις (SVR=MAP-CVP/CO)
- Η τάση στο τοίχωμα του μυοκαρδίου (T=Pr/t)
- Η γλοιότητα του αίματος

Παράμετροι καρδιακής λειτουργίας (Φυσιολογία)

Συσταλτικότητα

- Η δύναμη και ταχύτητα της συστολής
- Δεν υπολογίζεται άμεσα
- Τα ινότροπα την αυξάνουν η ισχαιμία την ελαττώνει

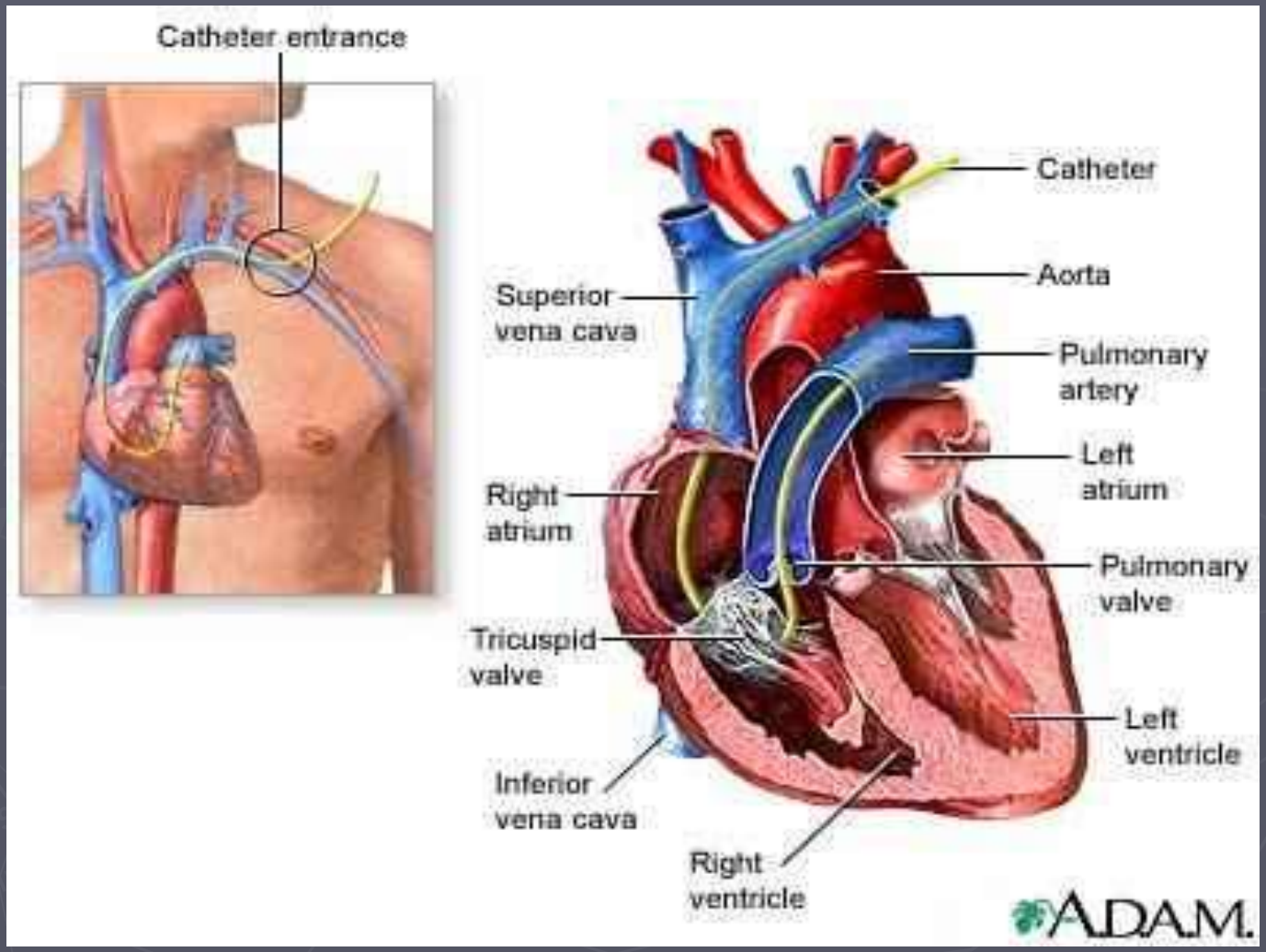
Μη αιματηρές μέθοδοι εκτίμησης του κυκλοφορικού συστήματος

- Αρτηριακή πίεση
- Θερμοκρασία
- Μέτρηση διούρησης
- Αιματοκρίτης
- Ισοζύγιο υγρών
- Ηλεκτροκαρδιογράφημα
- Οξυμετρία
- Υπερηχοκαρδιογραφημα

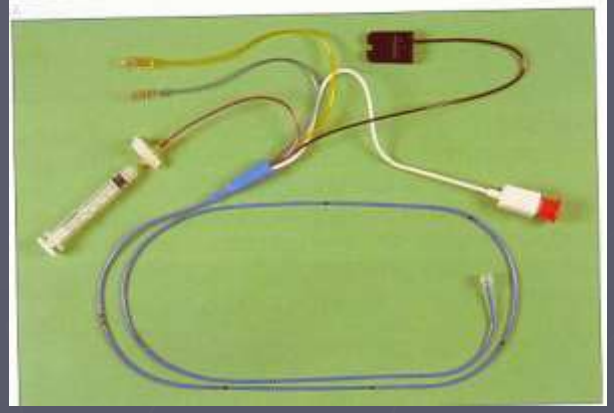
Υπερηχοκαρδιογραφημα

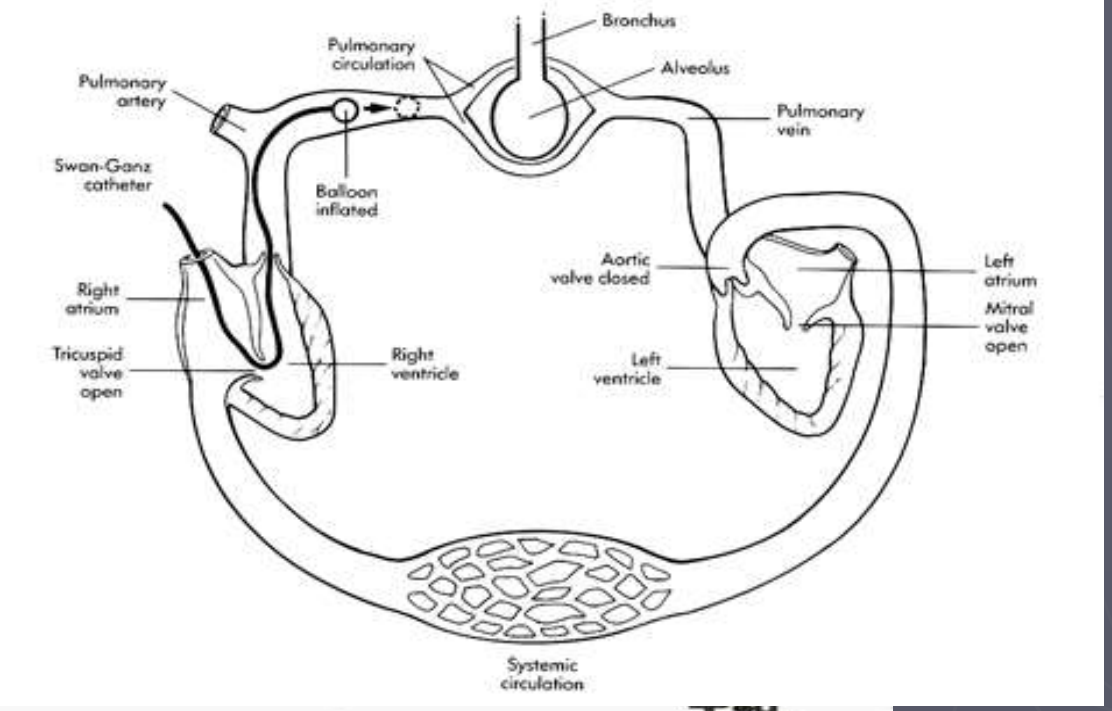
- Έλεγχος καρδιακών κοιλοτήτων (διαστάσεις, κινητικότητα)
- Εκτίμηση λειτουργίας βαλβίδων
- Διαπίστωση ύπαρξης περικαρδιακού υγρού
- Μέτρηση καρδιακής παροχής
- Υπολογισμός κλάσματος εξωθήσεως
- Δυναμική (έναντι στατικής) εκτίμηση

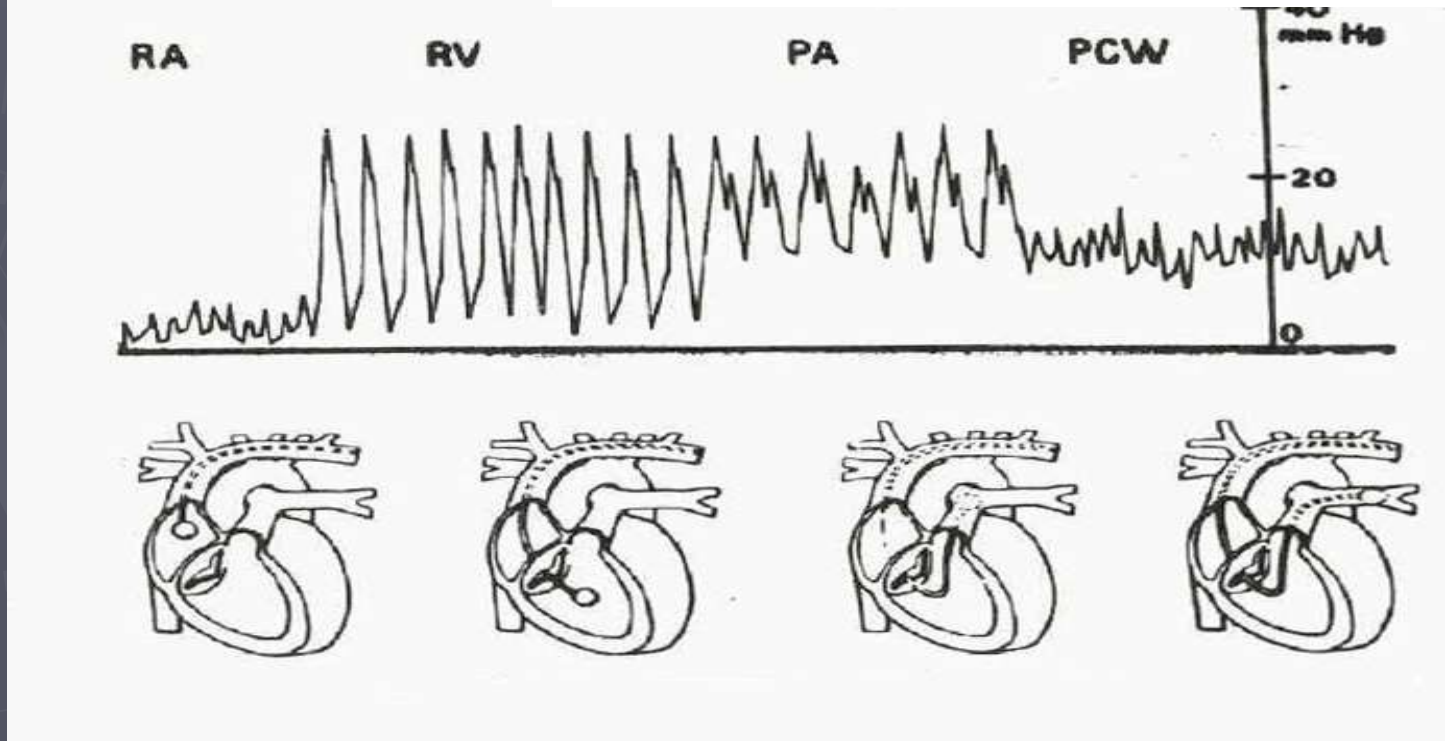
Καθετήρας Swan-Ganz



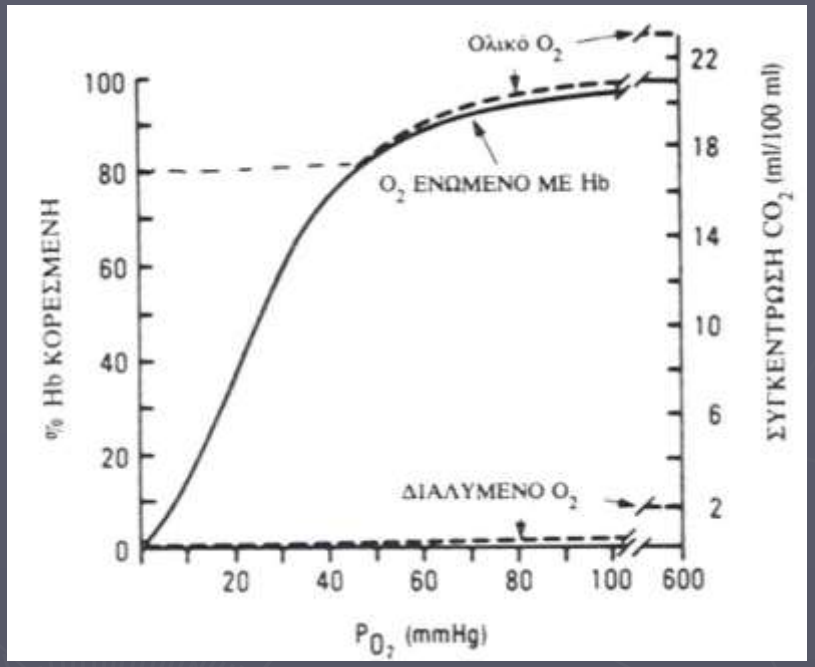
PULMONARY ARTERY CATHETER (PAC)

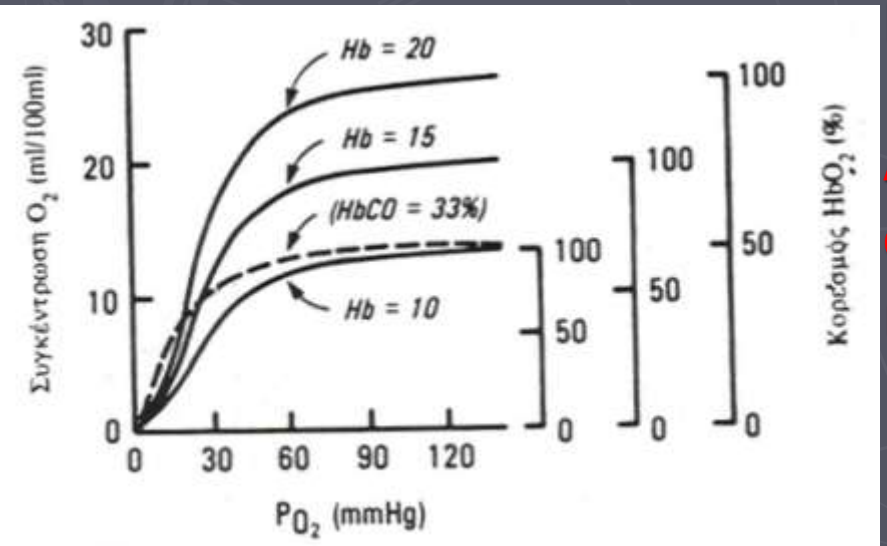






ΜΕΤΑΦΟΡΑ Ο2 ΣΤΟΥΣ ΙΣΤΟΥΣ





Το Ο2 μεταφέρεται στους ιστούς

- **διαλυμένο** (0,003ml/100ml αίματος)
- **συνδεδεμένο με την αιμοσφαιρίνη** (1,34ml/gr Hb)

Η συνολική ποσότητα Ο2 που μεταφέρουν 100ml αίματος (CaO2) είναι:

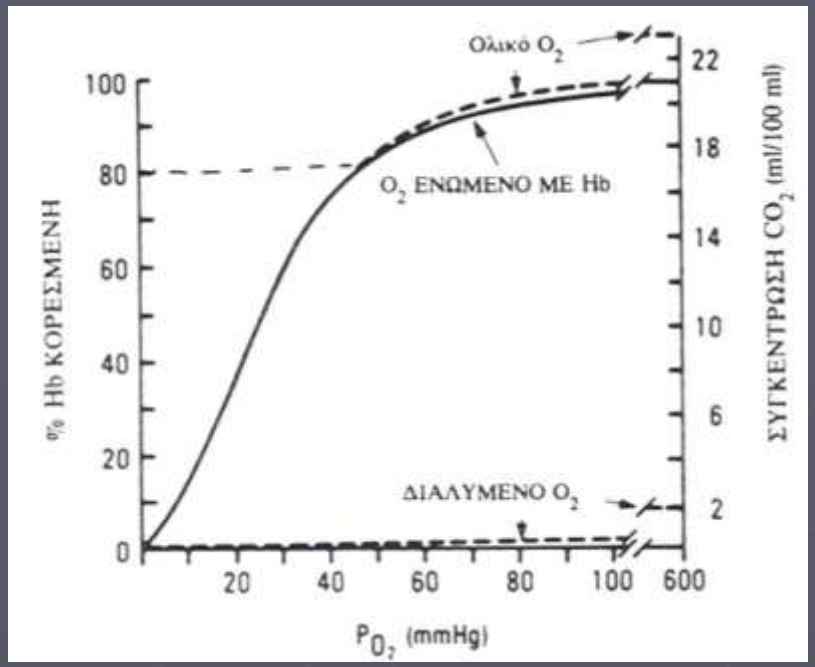
(1,34 x Hbgr/100ml x SAT)+(0,003x PaO2)

SAT= κορεσμός της αιμοσφαιρίνης σε Ο2

PaO2=μερική πίεση Ο2 στο αίμα

Hbgr/100ml= gr αιμοσφαιρίνης/100ml αίματος

Αυτό σημαίνει ότι όσο περισσότερη αιμοσφαιρίνη έχουμε, ή ότι όσο περισσότερο είναι αυτή κορεσμένη σε O_2, τόσο περισσότερο Ο2, μεταφέρεται στους ιστούς



- Η **σιγμοειδής μορφή** της καμπύλης επιτρέπει στους ιστούς, **με πολύ μικρή μεταβολή του PaO2, να παίρνουν πολύ O2** (μεγάλη μεταβολή στο SAT)
- **Σημαντικό σημείο στην καμπύλη είναι ο κορεσμός (SAT) 90%,** γιατί από εκεί και κάτω η μερική πίεση του O2 στο αρτηριακό αίμα μειώνεται δραματικά και επομένως το O_2 το οποίο παραμένει έτσι ώστε να μπορέσουν να το χρησιμοποι-ήσουν οι ιστοί είναι πολύ λίγο.

♦ **Μετατόπιση της καμπύλης πρός τα δεξιά**: δηλαδή ευκολότερη απόδοση του O2 στούς ιστούς, έχουμε στην **↑ του PaCO2 και την ↓ του pH και της θερμοκρασίας**

♦ **Μετατόπιση της καμπύλης πρός τα αριστερά**: δηλαδή δυσκολότερη απόδοση του O2 στούς ιστούς, έχουμε στην **↓ του PaCO2 και την ↑ του pH και της θερμοκρασίας**

Oxygen content, CaO_2

Η περιεκτικότητα του αρτηριακού αίματος σε οξυγόνο (CaO_2) υπολογίζεται με την εξίσωση :

$$CaO_2 = SaO_2 \cdot Hb \cdot 1,34 + PaO_2 \cdot 0,003$$

όπου SaO_2 ο οξυαιμοσφαιρινικός κορεσμός του αρτηριακού αίματος και Hb η αιμοσφαιρίνη σε gr/dL.

Oxygen delivery, DO_2

Η μεταφορά του οξυγόνου στη περιφέρεια (oxygen delivery, DO_2) δίνεται από το τύπο :

$$DO_2 = CO \ .CaO_2$$

Όπου : CO (Cardiac Output) η καρδιακή παροχή και CaO_2 (arterial Oxygen Content) η περιεκτικότητα του αρτηριακού αίματος σε οξυγόνο.

$DO_2 = CO \ . CaO_2$

- $CO = HR \ . \ SV$
- $CaO_2 = SaO_2 \ . \ Hb \ . \ 1{,}34 + PaO_2 \ . \ 0{,}003$

Συνήθως ποσοτικά ελάχιστο

$DO_2 = CO \ . \ SaO_2 \ . \ Hb$

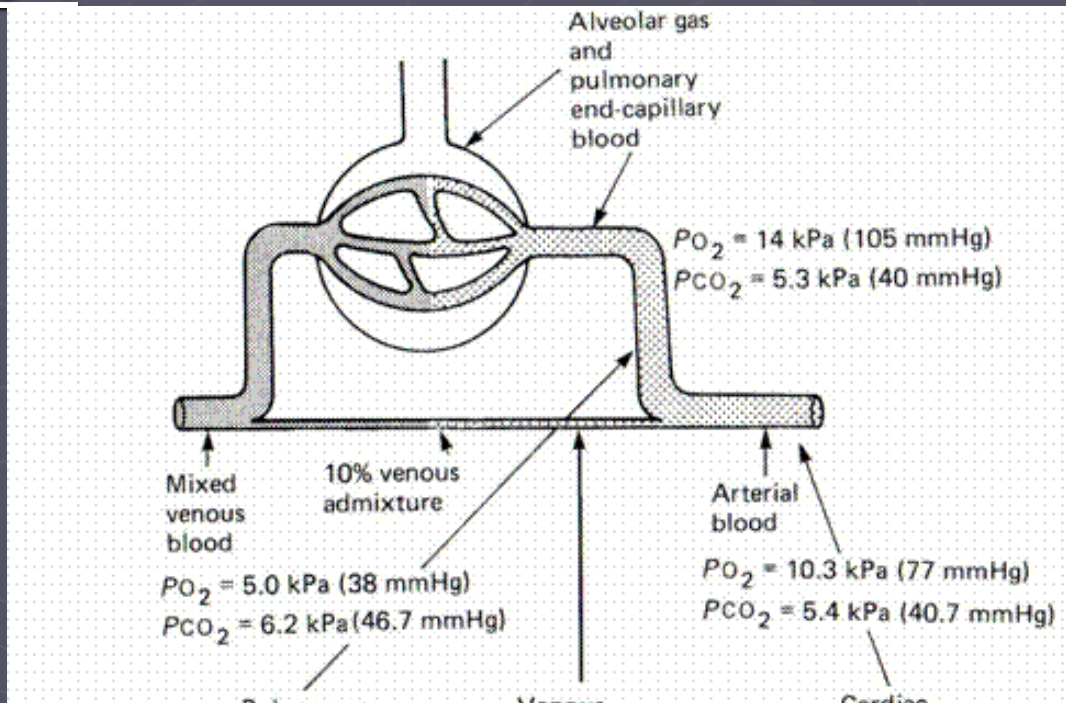
$DO_2 = CO \cdot SaO_2 \cdot Hb$

Κατά συνέπεια η ιστική υποξία ή ανοξία μπορεί να οφείλεται σε διαταραχές της καρδιακής παροχής (HR, SV), της οξυγόνωσης (SaO2) ή της τιμής της αιμοσφαιρίνης(Hb), όπως πρώτος περιέγραψε ο Barcroft το 1920.

Αντίστοιχα, η περιεκτικότητα του μικτού φλεβικού αίματος σε οξυγόνο CvO_2 (mixed venous Oxygen Content) υπολογίζεται από την εξίσωση :

$CvO_2 = SvO_2 \cdot Hb \cdot 1,34 + PvO_2 \cdot 0,003$

$\underline{CvO_2 = SvO_2 \cdot Hb \cdot 1,34}$



Oxygen consumption, VO_2

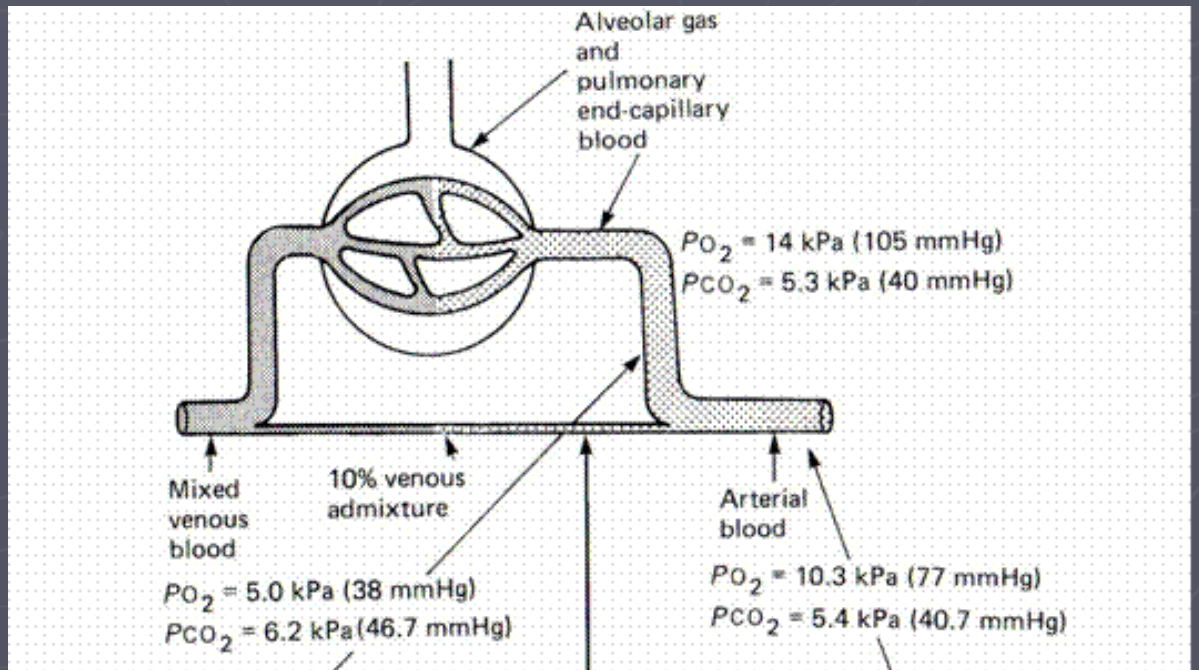
Η κατανάλωση του οξυγόνου VO_2 υπολογίζεται στην εξίσωση :

$$VO_2 = CO \, . \, (CaO_2 - CvO_2)$$

$$VO_2 = CO \,.\, (CaO_2 - CvO_2)$$

$$CaO_2 = SaO_2 \,.\, Hb \,.\, 1{,}34$$

$$VO_2 = CO \,.\, Hb \,.\, (SaO_2 - SvO_2)$$

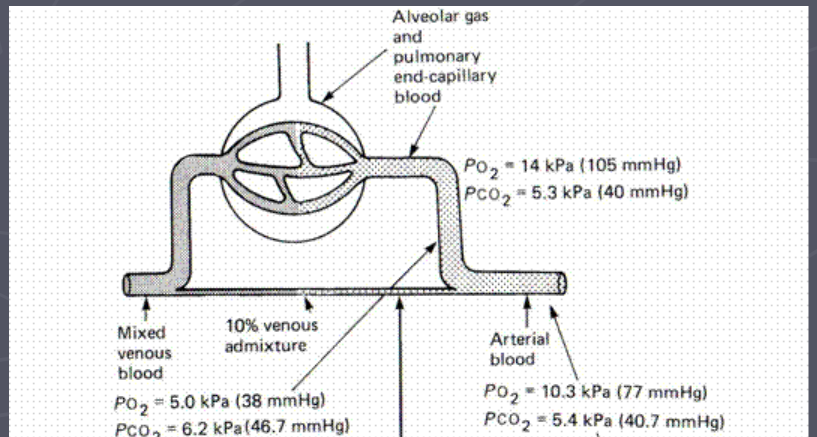


$$VO_2 = CO \cdot Hb \cdot (SaO_2 - SvO_2)$$

$$SvO_2 = SaO_2 - VO_2 / CO \cdot Hb$$

Πίνακας 2. Παράγοντες που επηρεάζουν τον $S\nabla O_2$.

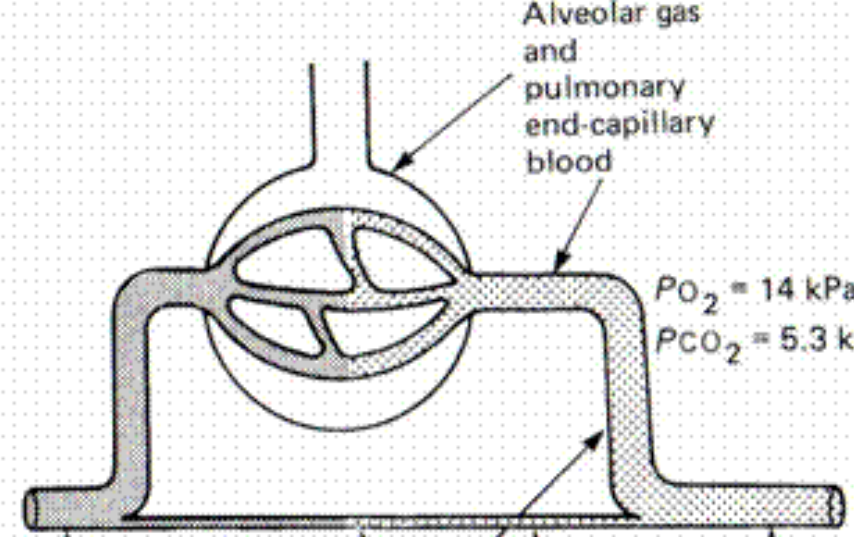
Μείωση του $S\nabla O_2$	**Αύξηση του $S\nabla O_2$**
Ελάττωση καρδιακής παροχής	Αυξημένη παροχή O_2 στους ιστούς
Ελάττωση SaO_2	Ελαττωμένη κατανάλωση O_2
Ελαττωμένη συγκέντρωση Hb	Ελαττωμένη απόσπαση O_2 από τους ιστούς
Αύξηση της κατανάλωσης O_2	Ενδοκαρδιακό shunt με ροή από αριστερά προς τα
	Σοβαρή ανεπάρκεια της μιτροειδούς
	Ενσφήνωση του καθετήρα στη πνευμονική αρτηρία



Oxygen extraction, OER

$$OER = VO_2/DO_2 = SaO_2 - SvO_2/SaO_2$$

Το OER αντιστοιχεί στη διαφορά του κορεσμού στο αρτηριακό και στο μικτό φλεβικό αίμα. Η κουκίδα αντιστοιχεί σε μια τυπική κατάσταση με DO2 1000ml/min, VO2 250ml/min και OER 25%. Αν ο ασθενής αυτός έχει κορεσμό 95% στο αρτηριακό αίμα, ο κορεσμός στο μικτό φλεβικό του αναμένεται να είναι 70%.



Pulmonary capillary blood flow + Venous admixture = Cardiac output

$$\dot{Q}c + \dot{Q}s = \dot{Q}t$$

$$Cc'_{O_2} \times \dot{Q}c + C\bar{v}_{O_2} \times \dot{Q}s = Ca_{O_2} \times \dot{Q}t$$

$$\therefore \frac{\dot{Q}s}{\dot{Q}t} = \frac{Cc'_{O_2} - Ca_{O_2}}{Cc'_{O_2} - C\bar{v}_{O_2}}$$


Shock
Hypovolemic
Atila

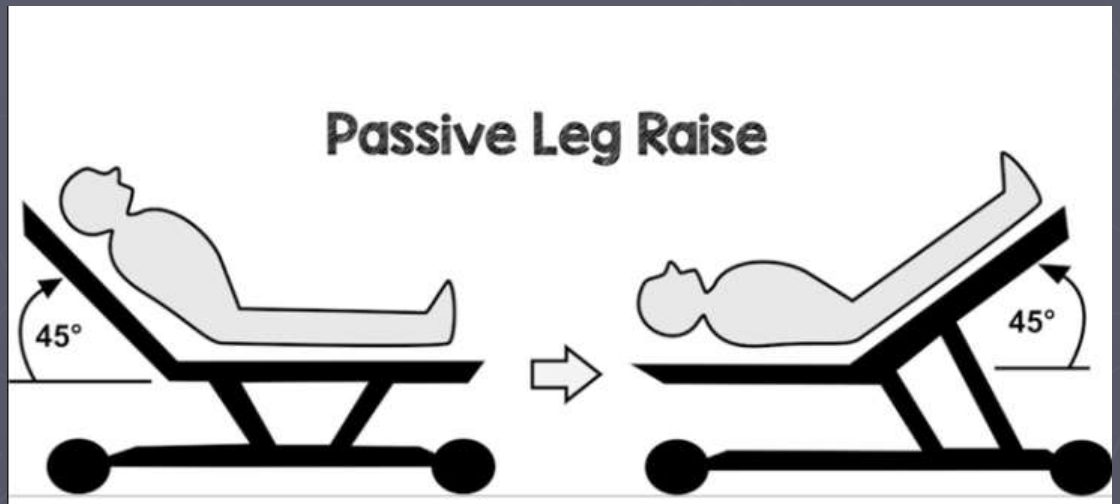
HYPOVOLEMIC

low circulating volume

- Intravascular vol loss
- hemorrhagic
- fluid loss

EM in 5

- Εξατομίκευση
- Δυναμικοί δείκτες απαντητικότητας (SVV, PPV)
- Passive leg rising
- POCUS (IVC)
- Χειρουργικός έλεγχος αιμορραγίας



TiP

Εάν η αναπλήρωση του ενδαγγειακού όγκου με iv κρυσταλλοειδή δεν οδηγήσει σε αποκατάσταση της αρτηριακής πίεσης αναζητήστε άλλη αιτία καταπληξίας.

Shock……Βήμα 1

Υποψία - Αναγνώριση

Shock……Βήμα 2

Το δεύτερο βήμα στην αρχική αντιμετώπιση του shock είναι **η αναγνώριση της πιθανής αιτίας του shock.** Στον πολυτραυματία η διασαφήνιση αυτή είναι ανάλογη με το μηχανισμό της κάκωσης. Όλοι οι τύποι του shock μπορεί να εμφανισθούν στον πολυτραυματία. Στους περισσότερους, όμως, τραυματίες το shock είναι ολιγαιμικό, χωρίς να αποκλείεται η πιθανότητα να είναι και καρδιογενές, νευρογενές ή και σηπτικό σε σπάνιες περιπτώσεις. Επίσης μπορεί να οφείλεται σε πνευμοθώρακα υπό τάση και η πιθανότητα αυτή θα πρέπει να λαμβάνεται υπόψη σε πάσχοντες με κακώσεις πάνω από το διάφραγμα. Το νευρογενές shock προέρχεται από εκτεταμένες κακώσεις του εγκεφάλου ή του νωτιαίου μυελού. Από πρακτική άποψη πρέπει να θεωρείται ότι **μια μεμονωμένη κάκωση της κεφαλής δεν προκαλεί shock.** Οι τραυματίες με κάκωση του νωτιαίου μυελού μπορεί να εμφανίζουν αρχικά shock και λόγω αγγειοδιαστολής και λόγω ολιγαιμίας. Το σηπτικό shock είναι ασύνηθες, αλλά θα πρέπει να λαμβάνεται υπόψη σε πάσχοντες που η αρχική τους αντιμετώπιση έχει καθυστερήσει πάρα πολύ.

Shock……Βήμα 2

- **ΑΙΜΟΡΡΑΓΙΚΟ SHOCK???**

- Μη αιμορραγικό shock

Καρδιογενές

Πνευμοθώρακας υπό τάση

Νευρογενές

Σηπτικό

Αιμορραγία

- Κατηγορία Ι……15%
- Κατηγορία ΙΙ……..15-30%
- Κατηγορία ΙΙΙ…….30-40%
- Κατηγορία ΙV……>40%

ΥΠΟΛΟΓΙΖΟΜΕΝΗ ΑΠΩΛΕΙΑ ΥΓΡΩΝ ΚΑΙ ΑΙΜΑΤΟΣ[1]
Βασιζόμενη στην Αρχική Εμφάνιση του Πάσχοντος

	Κατηγορία I	Κατηγορία II	Κατηγορία III	Κατηγορία VI
Απώλεια Αίματος (mL)	Ως 750	750-1500	1500-2000	>2000
Απώλεια Αίματος (%B.V.)	Ως 15%	15%-30%	30%-40%	>40%
Συχνότητα Σφυγμού	<100	>100	>120	>140
Αρτηριακή Πίεση	Φυσιολογική ή αυξημένη	Φυσιολογική	Ελαττωμένη	Ελαττωμένη
Πίεση Σφυγμού (mmHg)	Φυσιολογική ή αυξημένη	Ελαττωμένη	Ελαττωμένη	Ελαττωμένη
Συχνότητα Αναπνοών	14-20	20-30	30-40	>35
Αποβολή Ούρων (ml/ωρα)	>30	20-30	5-15	Αμελητέα
Διανοητική Κατάσταση (ΚΝΣ)	Ελαφρά Αγχώδης	Μέτρια Αγχώδης	Αγχώδης Συγχυτική	Συγχυτική Ληθαργική
Αποκατάσταση Υγρών (Κανόνας 3:1)	Κρυσταλλοειδή	Κρυσταλλοειδή	Κρυσταλλοειδή και αίμα	Κρυσταλλοειδή και αίμα

Δευτεροβάθμια εκτίμηση -Ιστορικό

- Περιβάλλον/συνθήκες τραυματισμού
- Αλλεργίες
- Φάρμακα
- Αρρώστιες στο παρελθόν/Εγκυμοσύνη
- Γεύμα τελευταίο

Κακώσεις θώρακα (SOS)

- Απόφραξη αεραγωγού
- Πνευμοθώρακας υπό τάση
- Ανοικτός πνευμοθώρακας
- Μαζικός αιμοθώρακας
- Ασταθής θώρακας
- Καρδιακός επιπωματισμός

Κακώσεις θώρακα

- Απλός πνευμοθώρακας
- Αιμοθώρακας
- Θλάση πνεύμονα
- Ρήξη τραχειοβρογχικού δένδρου
- Θλάση καρδιάς
- Τραυματική ρήξη αορτής
- Τραυματική κάκωση διαφράγματος
- Κακώσεις μεσοθωρακίου

Ακτινογραφικά Ευρήματα	Διαφοροδιαγνωστικές Σκέψεις
Αναπνευστική δυσχέρεια χωρίς τραυματική ασφυξία	Κάκωση ΚΝΣ, εισρόφηση,
Κάταγμα οποιασδήποτε πλευράς	Πνευμοθώρακας, πνευμονική θλάση
Κατάγματα, πρώτων 3 πλευρών ή κάταγμα-εξάρθρημα στερνοκλειδικής	Κάκωση αεραγωγού ή μεγάλων αγγείων
Κατάγματα πλευρών 9 ως 12	Κοιλιακή κάκωση
Δυο ή περισσότερες πλευρές με κατάγματα σε δυο ή περισσότερα σημεία	Ασταθής θώρακας, θλάση πνεύμονα
Κάταγμα ωμοπλάτης	Κάκωση μεγάλων αγγείων, θλάση πνεύμονα, κάκωση βραχιονίου πλέγματος
Κατάγματα στέρνου	Κλειστή κάκωση μυοκαρδίου
Διεύρυνση μεσοθωρακίου	Κάκωση μεγάλων αγγείων, κάταγμα στέρνου, κάκωση θωρακικής σ.σ.
Επιμένων μεγάλος πνευμοθώρακας ή μεγάλη διαφυγή αέρα μετά από παροχέτευση θώρακα	Ρήξη βρόγχων
Αέρας στο μεσοθωράκιο	Ρήξη οισοφάγου, κάκωση τραχείας, πνευμοπεριτόναιο
Γαστρεντερικός αέρας στο θώρακα (περιχαρακωμένος αέρας)	Διαφραγματική ρήξη
Ρινογαστρικός σωλήνας στο θώρακα	Ρήξη διαφράγματος ή ρήξη οισοφάγου
Υδραερικό επίπεδο στο θώρακα	Αιμοπνευμοθώρακας ή ρήξη διαφράγματος
Ρήξη διαφράγματος	Κάκωση κοιλιακών σπλάγχνων
Ελεύθερος αέρας κάτω από το διάφραγμα	Ρήξη κοιλακών σπλάχνων

Ρήξη μεγάλων αγγείων

1. **Διεύρυνση Μεσοθωρακίου**
2. Εξάλειψη του κομβίου του αορτικού τόξου (aortic knob)
3. Απόκλιση της τραχείας προς τα δεξιά
4. Εξάλειψη του διαστήματος μεταξύ της πνευμονικής αρτηρίας και της αορτής (ασαφοποίηση του αορτοπνευμονικού παραθύρου).
5. Κατάσπαση του αριστερού κύριου βρόγχου
6. Απόκλιση του οισοφάγου (ρινογαστρικού σωλήνα) προς τα δεξιά
7. Διεύρυνση της παρατραχειακής ταινίας
8. Διεύρυνση του παρασπονδυλικού χώρου
9. Παρουσία υπεζωκοτικού "σκούφου"
10. Αριστερός αιμοθώρακας
11. Κατάγματα της 1ης ή 2ης πλευράς ή της ωμοπλάτης

Κοιλιά / (+) lavage

- Κλινικά: >10cc σχέτο αίμα, έξοδος του lavage από θωρακο- ή ουροκαθετήρα, χολή ή φυτικές ίνες
- Εργαστηριακά: 100000RBC/mm^3

PRIORITIES

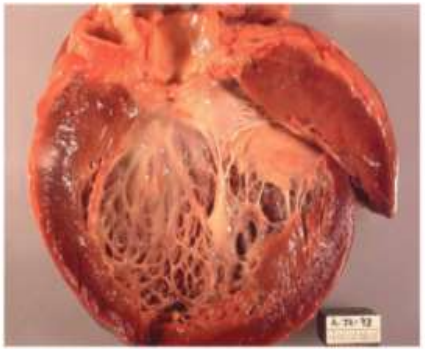
A trauma patient often has multiple problems requiring attention. Determining priorities is not always easy. In general, the priorities are to:

- *Support life*: the patient is kept alive with resuscitative techniques, while the various injuries and complications are attended to
- *Locate and control bleeding*, which may be varied (see below)
- *Prevent brainstem compression* and spinal cord damage
- Diagnose and treat all other injuries and complications.


Shock
Cardiogenic
Alila

CARDIOGENIC

poor pump function



- Arrhythmia
- AMI, valve failure
- cardiomyopathy
- pericarditis/PE

EM in 5


Κυκλοφορική κατάρριψη
Καρδιακή ανακοπή
Αδρεναλίνη + Μηχανική υποστήριξη της κυκλοφορίας
Ανθεκτική ΚΚ
Αποτυχία σταθεροποίησης – Μη ανταπόκριση στη θεραπεία
Νορεππινεφρίνη + Δοβουταμίνη +/- Βαζορεσίνη + Μηχανική υποστήριξη της κυκλοφορίας
Εμφανής ΚΚ
Υπόταση - Ιστική Υποάρδευση
Νορεπινεφρίνη + Δοβουταμίνη (Εναλλακτικά: λεβοσιμεντάνη + νορεπινεφρίνη)
Αντιρροπούμενη ΚΚ
σημεία shock: αγγειοσύσπαση – ταχυκαρδία
Όχι πάντα υπόταση
Δοβουταμίνη ή Λεβοσιμεντάνη
(Ιδίως σε ανεπάρκεια ΔΕ κοιλίας με ↑ πνευμονικές πιέσεις)
Χωρίς συμπτώματα & σημεία shock – ασθενής σε κίνδυνο εμφάνισης shock
Λελογισμένη αναζωογόνηση με iv υγρά
Επαπειλούμενη ΚΚ
ΘΕΡΑΠΕΙΑ ΑΙΤΙΟΛΟΓΙΚΟΥ ΠΑΡΑΓΟΝΤΑ


Shock
Obstructive
Afifa

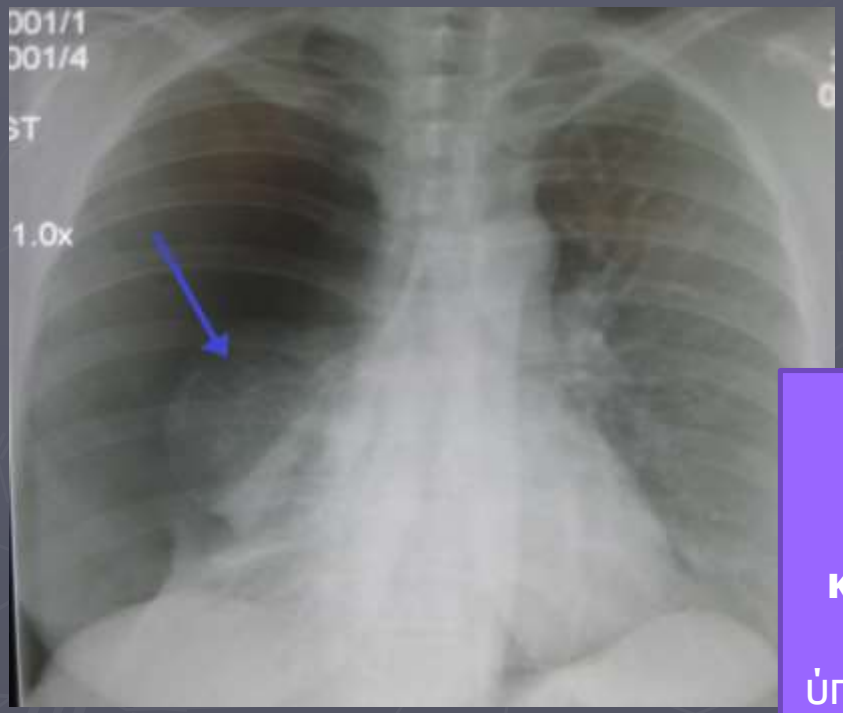
OBSTRUCTIVE

extracardiac obstruction to blood flow

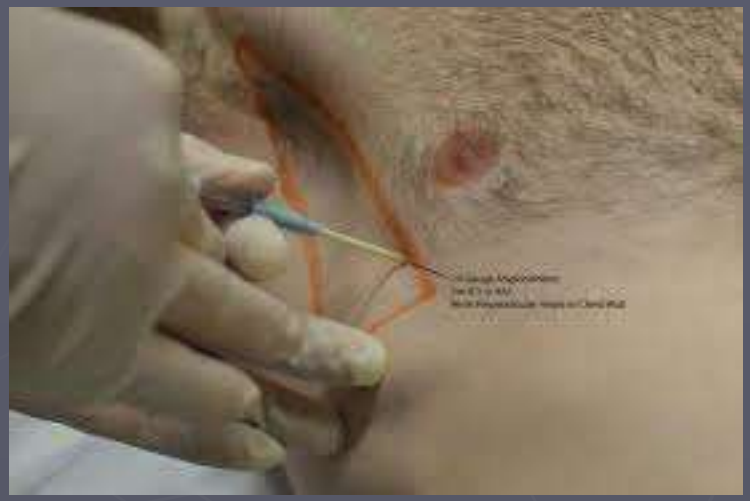
- Tension PTX
- Tamponade
- PE

EM in 5

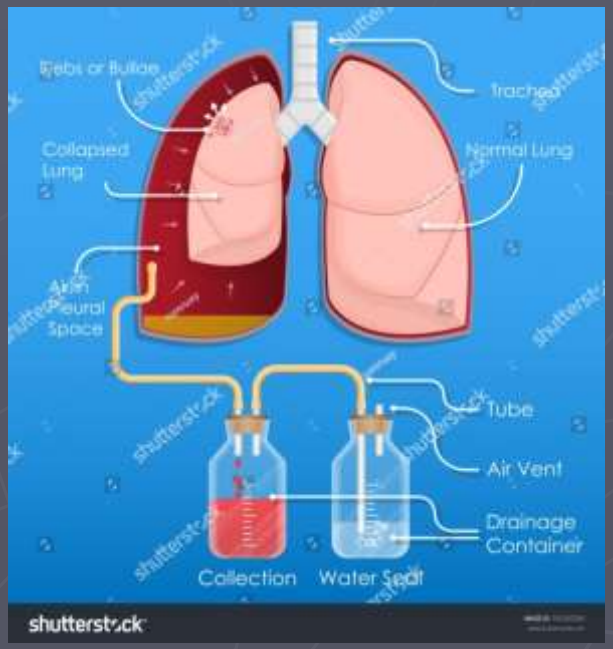
Πνευμοθώρακας Υπό Τάση



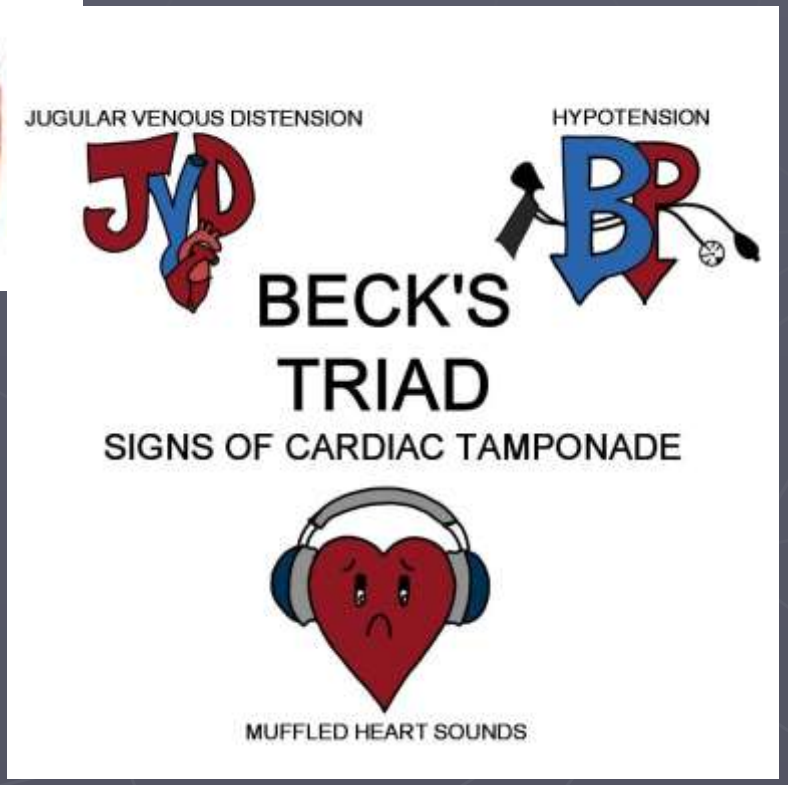
Ετερόπλευρη μείωση του αναπνευστικού ψιθυρίσματος + καταπληξία θα πρέπει να θέτει την πιθανότητα ύπαρξης πνευμοθώρακα υπό τάση




The
TREATMENT


Webs or Bullae
Trachea
Collapsed Lung
Normal Lung
Pleural Space
Tube
Air Vent
Drainage Container
Collection
Water Seal
shutterstock

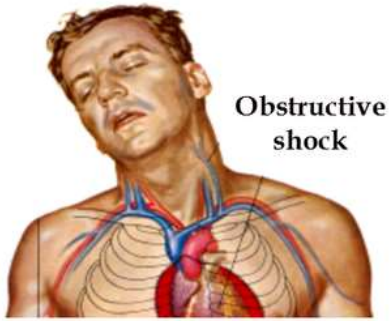
Καρδιακός Επιπωματισμός



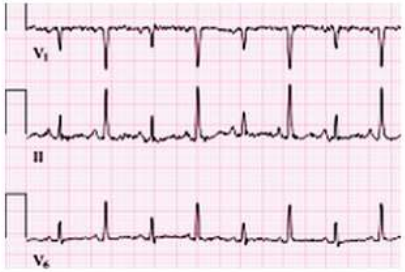
EMNote.org

Cardiac Tamponade & Pericardiocentesis

Clinical: Beck's Triad
1. Hypotension
2. Jugular vein distension
3. Muffled heart sounds

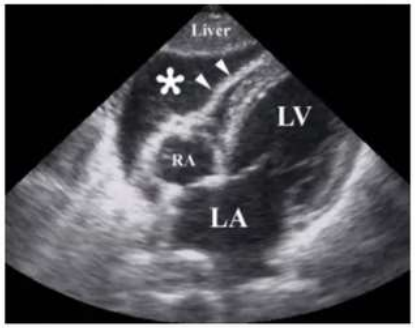


ECG Triad *
1. Sinus tachycardia
2. Low voltage
3. Electrical alternans



* Indicative of massive pericardial effusion but not always tamponde

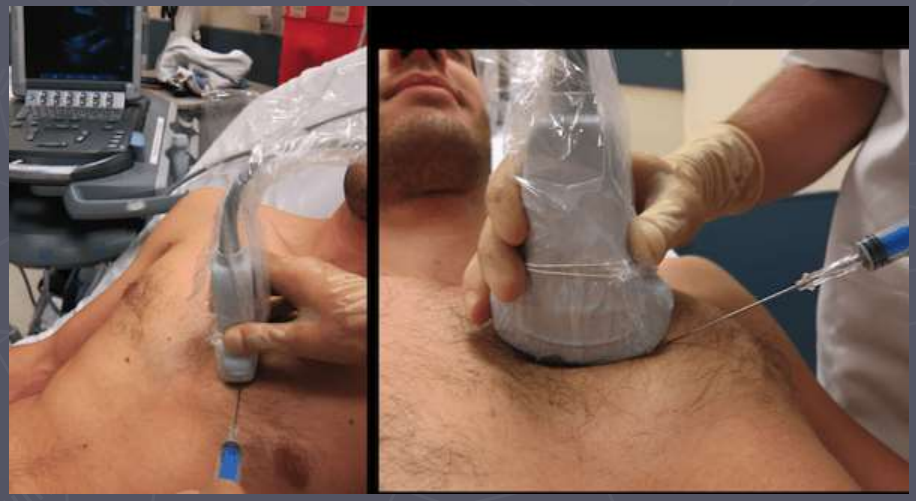
POCUS Triad
1. Pericardial fluid
2. RV diastolic collapse
3. Dilated IVC

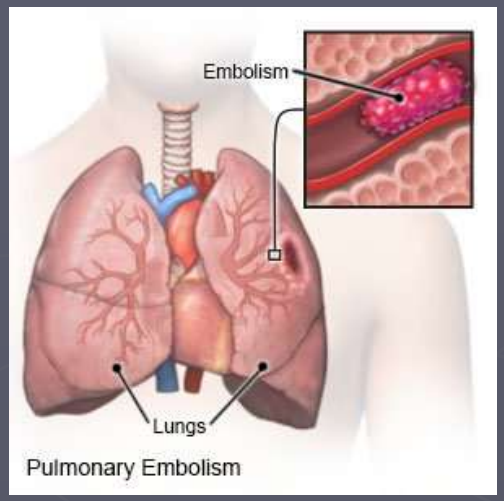


@ jackcfchong

EM CASES PRESENTS

POCUS CASES

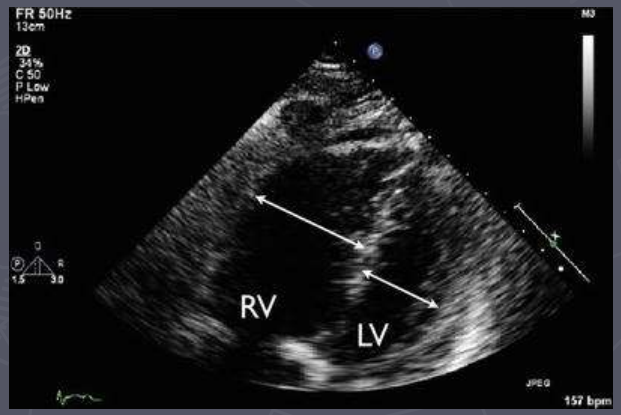




Πνευμονική Εμβολή

Ειδικά σημεία στον POCUS
+
SHOCK

CT - PA



TREATMENT

Θρομβόλυση (επί ενδείξεων)
+
Αντιπηκτικά

Χειρουργική Θρομβεκτομή
Φίλτρο Κάτω Κοίλης


Shock
Distributive
Afifa

DISTRIBUTIVE

Vasodilatory-↓↓ SVR

-septic shock/SIRS/TSS
- Anaphylaxis
- neurogenic shock
- Drug/toxin
- Addisonian crisis

EM in 5

Αρχική Αναζωογόνηση με υγρά

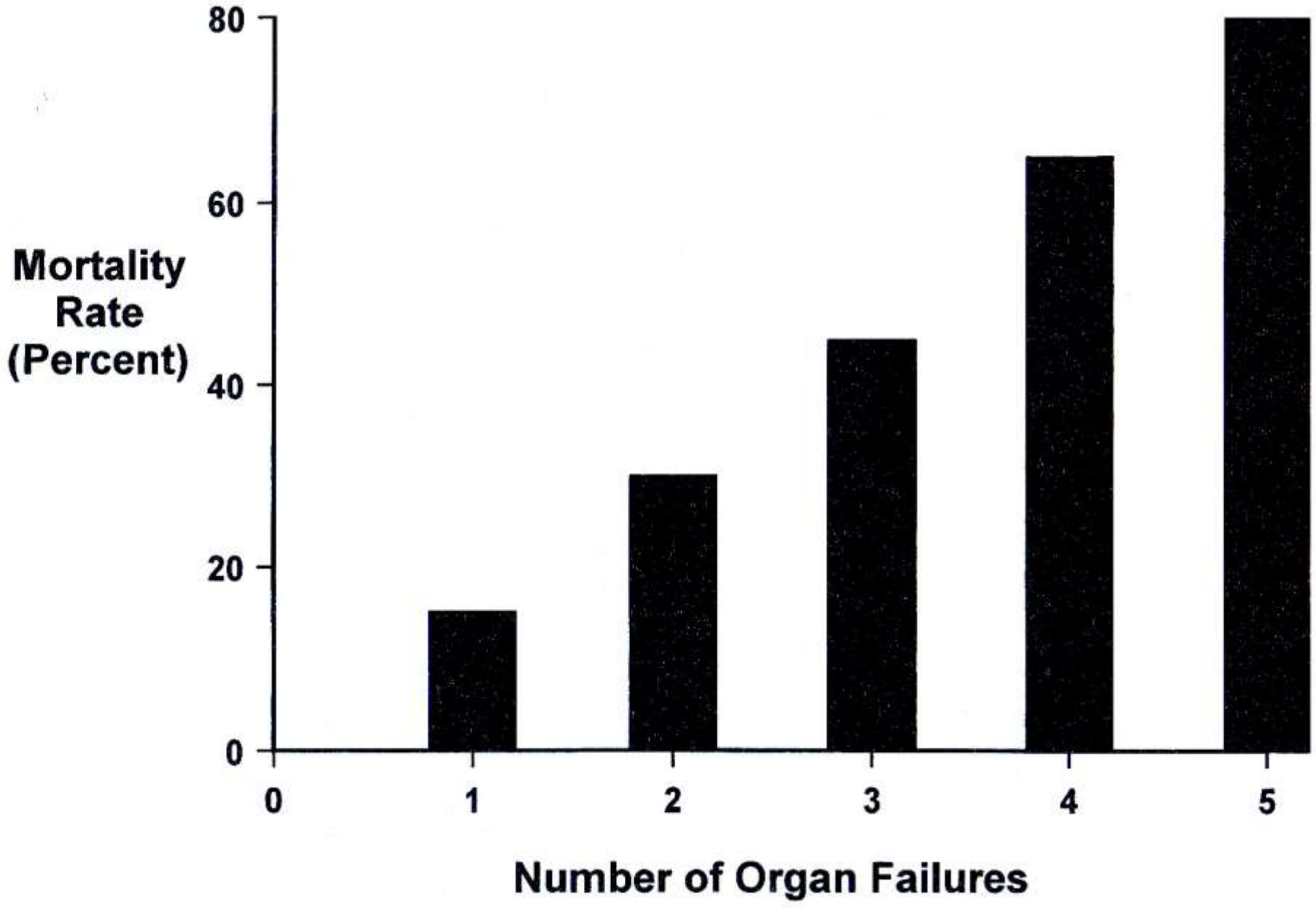
<u>Καλλιέργειες πριν την έναρξη αντιμικροβιακής αγωγή</u>

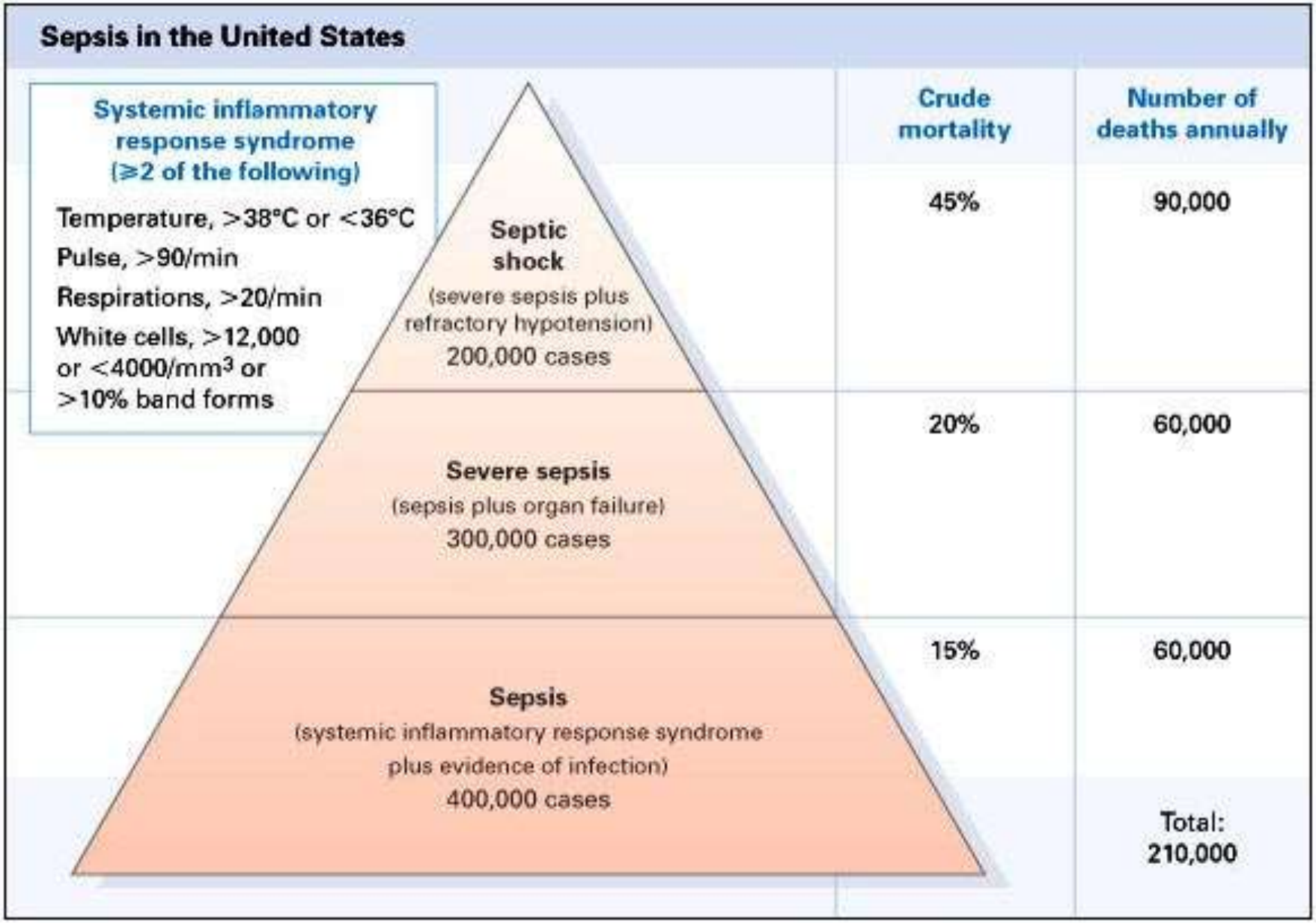
Σηπτικό shock

ΣΗΨΗ

- 1/3 - 1/2 ΜΕ ΣΗΨΗ ⇒ ΣΗΠΤΙΚΟ ΣΟΚ
- ΣΗΠΤΙΚΟ ΣΟΚ: 50% ΘΝΗΤΟΤΗΤΑ
- ΣΗΨΗ: 13η ΟΔΗΓΟΣ ΑΙΤΙΑ ΘΑΝΑΤΟΥ (ΗΠΑ)

Groeneveld ABJ, Thijs LG. Septic Shock 2000:355-81
Rodrigues JC, Fein AM. Septic Shock, 1997 :269


Mortality Rate (Percent)
80
60
40
20
0
0
1
2
3
4
5
Number of Organ Failures



RICHARD P. WENJEL, M.D. NEJM 2002; 347:966-967.

LIPPINCOTT WILLIAMS & WILKINS

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Surviving Sepsis Campaign guidelines for management of severe sepsis and septic shock

[SPECIAL ARTICLES]

Dellinger, R. Phillip MD; Carlet, Jean M. MD; Masur, Henry MD; Gerlach, Herwig MD, PhD; Calandra, Thierry MD; Cohen, Jonathan MD; Gea-Banacloche, Juan MD, PhD; Keh, Didier MD; Marshall, John C. MD; Parker, Margaret M. MD; Ramsay, Graham MD; Zimmerman, Janice L. MD; Vincent, Jean-Louis MD, PhD; Levy, Mitchell M. MD; for the Surviving Sepsis Campaign Management Guidelines Committee

Surviving Sepsis Campaign guidelines for management of severe sepsis and septic shock

R. Phillip Dellinger, MD; Jean M. Carlet, MD; Henry Masur, MD; Herwig Gerlach, MD, PhD; Thierry Calandra, MD; Jonathan Cohen, MD; Juan Gea-Banacloche, MD, PhD; Didier Keh, MD; John C. Marshall, MD; Margaret M. Parker, MD; Graham Ramsay, MD; Janice L. Zimmerman, MD; Jean-Louis Vincent, MD, PhD; Mitchell M. Levy, MD; for the Surviving Sepsis Campaign Management Guidelines Committee

Sponsoring Organizations: American Association of Critical-Care Nurses, American College of Chest Physicians, American College of Emergency Physicians, American Thoracic Society, Australian and New Zealand Intensive Care Society, European Society of Clinical Microbiology and Infectious Diseases, European Society of Intensive Care Medicine, European Respiratory Society, International Sepsis Forum, Society of Critical Care Medicine, Surgical Infection Society.

Objective: In 2003, critical care and infectious disease experts representing 11 international organizations developed management guidelines for severe sepsis and septic shock that would be of practical use for the bedside clinician, under the auspices of the Surviving Sepsis Campaign, an international effort to increase awareness and improve outcome in severe sepsis.

Design: The process included a modified Delphi method, a consensus conference, several subsequent smaller meetings of subgroups and key individuals, teleconferences, and electronic-based discussion among subgroups and among the entire committee.

Methods: We used a modified Delphi methodology for grading recommendations, built on a 2001 publication sponsored by the International Sepsis Forum. We undertook a systematic review of the literature graded along five levels to create recommendation grades from A to E, with A being the highest grade. Pediatric considerations were provided to contrast adult and pediatric management.

Results: Key recommendations, listed by category and not by hierarchy, include early goal-directed resuscitation of the septic patient during the first 6 hrs after recognition; appropriate diagnostic studies to ascertain causative organisms before starting antibiotics; early administration of broad-spectrum antibiotic therapy; reassessment of antibiotic therapy with microbiology and clinical data to narrow coverage, when appropriate; a usual 7–10 days of antibiotic therapy guided by clinical response; source control with attention to the method that balances risks and benefits; equivalence of crystalloid and colloid resuscitation; aggressive fluid challenge to restore mean circulating filling pressure; vasopressor preference for norepinephrine and dopamine; cautious use of vasopressin pending further studies; avoiding low-dose dopamine administration for renal protection; consideration of dobutamine inotropic therapy in some clinical situations; avoidance of supranormal oxygen delivery as a goal of therapy; stress-dose steroid therapy for septic shock; use of recombinant activated protein C in patients with severe sepsis and high risk for death; with resolution of tissue hypoperfusion and in the absence of coronary artery disease or acute hemorrhage, targeting a hemoglobin of 7–9 g/dL; appropriate use of fresh frozen plasma and platelets; a low tidal volume and limitation of inspiratory plateau pressure strategy for acute lung injury and acute respiratory distress syndrome; application of a minimal amount of positive end-expiratory pressure in acute lung injury/acute respiratory distress syndrome; a semirecumbent bed position unless contraindicated; protocols for weaning and sedation/analgesia, using either intermittent bolus sedation or continuous infusion sedation with daily interruptions/lightening; avoidance of neuromuscular blockers, if at all possible; maintenance of blood glucose <150 mg/dL after initial stabilization; equivalence of continuous veno-veno hemofiltration and intermittent hemodialysis; lack of utility of bicarbonate use for pH ≥7.15; use of deep vein thrombosis/stress ulcer prophylaxis; and consideration of limitation of support where appropriate. Pediatric considerations included a more likely need for intubation due to low functional residual capacity; more difficult intravenous access; fluid resuscitation based on weight with 40–60 mL/kg or higher needed; decreased cardiac output and increased systemic vascular resistance as the most common hemodynamic profile; greater use of physical examination therapeutic end points; unsettled issue of high-dose steroids for therapy of septic shock; and greater risk of hypoglycemia with aggressive glucose control.

Conclusion: Evidence-based recommendations can be made regarding many aspects of the acute management of sepsis and septic shock that are hoped to translate into improved outcomes for the critically ill patient. The impact of these guidelines will be formally tested and guidelines updated annually and even more rapidly as some important new knowledge becomes available. (Crit Care Med 2004; 32:858–873)

Key Words: sepsis; severe sepsis; septic shock; sepsis syndrome; infection; guidelines; evidence-based medicine; Surviving Sepsis Campaign

DOI: 10.1097/01.CCM.0000117317.18092.E4

Sepsis-3 Definitions

- ***Sepsis***: Life-threatening organ dysfunction caused by dysregulated host response to infection
- ***Septic Shock***: Subset of sepsis with circulatory and cellular/metabolic dysfunction associated with higher risk of mortality

JAMA. 2016;315(8):801-810.
doi:10.1001/jama.2016.0287

SSC Guidelines and Sepsis-3 Definitions

- ***"Sepsis"*** in place of ***"Severe Sepsis"***
- Sepsis-3 clinical criteria (i.e. qSOFA) were not used in studies that informed the recommendations in this revision
  - Could not comment on use of Sepsis-3 clinical criteria

JAMA. 2016;315(8):801-810.
doi:10.1001/jama.2016.0287

High versus Low Blood-Pressure Target in Patients with Septic Shock

We recommend an initial target mean arterial pressure of 65 mmHg in patients with septic shock requiring vasopressors.
(Strong recommendation; moderate quality of evidence)

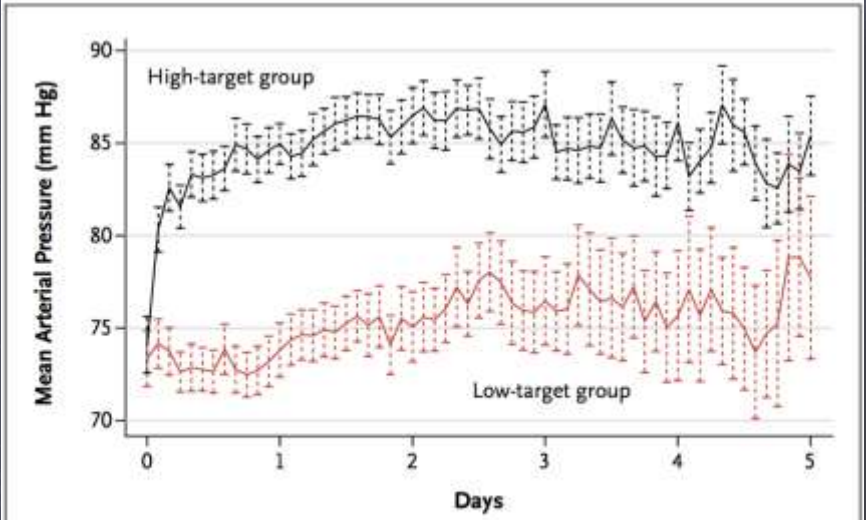


Figure 2. Mean Arterial Pressure during the 5-Day Study Period.

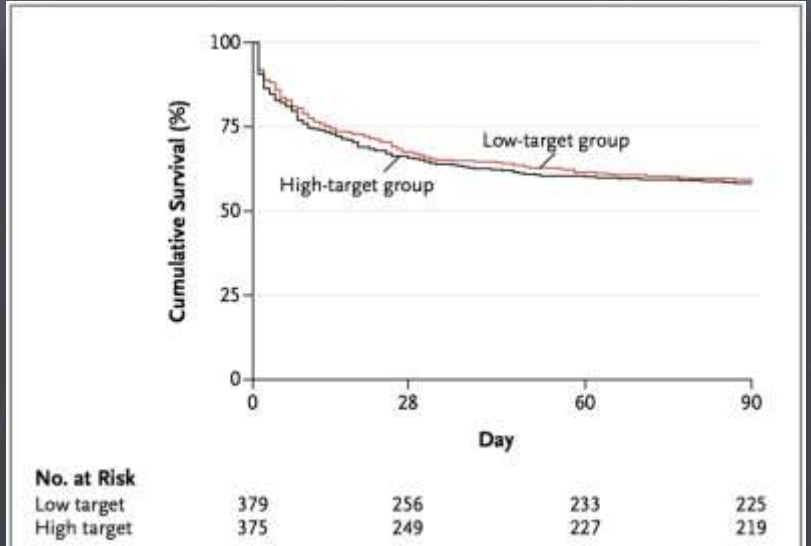


Figure 3. Kaplan–Meier Curves for Cumulative Survival.

DOI: 10.1056/NEJMoa1312173

Lactate can help guide resuscitation

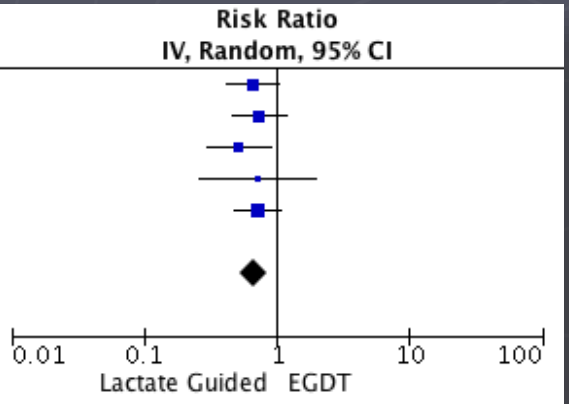
- We suggest guiding resuscitation to normalize lactate in patients with elevated lactate levels as a marker of tissue hypoperfusion.

(Weak recommendation; low quality of evidence)

Study or Subgroup	Lactate Guided Events	Total	Standard Events	Total	Weight	Risk Ratio IV, Random, 95% CI	Year
Jansen, 2010	20	68	30	67	24.9%	0.66 [0.42, 1.03]	2010
Jones, 2010	25	150	34	150	23.8%	0.74 [0.46, 1.17]	2010
Tian, 2012	14	43	12	19	16.9%	0.52 [0.30, 0.89]	2012
Yu, 2013	5	25	7	25	5.1%	0.71 [0.26, 1.95]	2013
Lyu 2015	20	50	28	50	29.2%	0.71 [0.47, 1.09]	2015
Total (95% CI)		**336**		**311**	**100.0%**	**0.67 [0.53, 0.84]**	
Total events	84		111				

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 1.14$, df = 4 (P = 0.89); $I^2 = 0\%$

Test for overall effect: Z = 3.51 (P = 0.0004)



Intensive Care Med (2018) 44:925–928
https://doi.org/10.1007/s00134-018-5085-0

SPECIAL EDITORIAL

The Surviving Sepsis Campaign Bundle: 2018 update

Mitchell M. Levy[1*], Laura E. Evans[2] and Andrew Rhodes[3]

- Measure lactate level. Remeasure if initial lactate is >2 mmol/L.
- Obtain blood cultures prior to administration of antibiotics.
- Administer broad-spectrum antibiotics.
- Begin rapid administration of 30ml/kg crystalloid for hypotension or lactate ≥4 mmol/L.
- Apply vasopressors if patient is hypotensive during or after fluid resuscitation to maintain MAP ≥65 mm Hg.

**"Time zero" or "time of presentation" is defined as the time of triage in the Emergency Department or, if presenting from another care venue, from the earliest chart annotation consistent with all elements of sepsis (formerly severe sepsis) or septic shock ascertained through chart review.*

Fig. 1 Hour-1 Surviving Sepsis Campaign Bundle of Care

Intensive Care Med
https://doi.org/10.1007/s00134-021-06506-y

GUIDELINES

Surviving sepsis campaign: international guidelines for management of sepsis and septic shock 2021

Laura Evans[1*], Andrew Rhodes[2], Waleed Alhazzani[3], Massimo Antonelli[4], Craig M. Coopersmith[5], Craig French[6], Flávia R. Machado[7], Lauralyn Mcintyre[8], Marlies Ostermann[9], Hallie C. Prescott[10], Christa Schorr[11], Steven Simpson[12], W. Joost Wiersinga[13], Fayez Alshamsi[14], Derek C. Angus[15], Yaseen Arabi[16], Luciano Azevedo[17], Richard Beale[9], Gregory Beilman[18], Emilie Belley-Cote[19], Lisa Burry[20], Maurizio Cecconi[21,22], John Centofanti[23], Angel Coz Yataco[24], Jan De Waele[25], R. Phillip Dellinger[11], Kent Doi[26], Bin Du[27], Elisa Estenssoro[28], Ricard Ferrer[29], Charles Gomersall[30], Carol Hodgson[31], Morten Hylander Møller[32], Theodore Iwashyna[33], Shevin Jacob[34], Ruth Kleinpell[35], Michael Klompas[36,37], Younsuck Koh[38], Anand Kumar[39], Arthur Kwizera[40], Suzana Lobo[41], Henry Masur[42], Steven McGloughlin[43], Sangeeta Mehta[44], Yatin Mehta[45], Mervyn Mer[46], Mark Nunnally[47], Simon Oczkowski[3], Tiffany Osborn[48], Elizabeth Papathanassoglou[49], Anders Perner[50], Michael Puskarich[51], Jason Roberts[52,53,54,55], William Schweickert[56], Maureen Seckel[57], Jonathan Sevransky[5], Charles L. Sprung[58,59], Tobias Welte[60], Janice Zimmerman[61] and Mitchell Levy[62]

ADMISSION TO INTENSIVE CARE

LOW

10 For adults with sepsis or septic shock who require ICU admission, we **suggest** admitting the patients to the ICU within 6 hours.

INFECTION

BEST PRACTICE

11 For adults with suspected sepsis or septic shock but unconfirmed infection, we **recommend** continuously re-evaluating and searching for alternative diagnoses and discontinuing empiric antimicrobials if an alternative cause of illness is demonstrated or strongly suspected.

12 For adults with possible septic shock or a high likelihood for sepsis, we **recommend** administering antimicrobials immediately, ideally within one hour of recognition.

LOW — Septic shock

VERY LOW — Sepsis without shock

2016 STATEMENT

*"We **recommend** that administration of intravenous antimicrobials should be initiated as soon as possible after recognition and within one hour for both a) septic shock and b) sepsis without shock."*

BEST PRACTICE

13 For adults with possible sepsis without shock, we **recommend** rapid assessment of the likelihood of infectious versus non-infectious causes of acute illness.

VERY LOW

14 For adults with possible sepsis without shock, we **suggest** a time-limited course of rapid investigation and if concern for infection persists, the administration of antimicrobials within 3 hours from the time when sepsis was first recognized.

2016 STATEMENT

*"We **recommend** that administration of intravenous antimicrobials should be initiated as soon as possible after recognition and within one hour for both a) septic shock and b) sepsis without shock."*

VERY LOW

15 For adults with a low likelihood of infection and without shock, we **suggest** deferring antimicrobials while continuing to closely monitor the patient.

2016 STATEMENT

*"We **recommend** that administration of intravenous antimicrobials should be initiated as soon as possible after recognition and within one hour for both a) septic shock and b) sepsis without shock."*

VERY LOW

16 For adults with suspected sepsis or septic shock, we **suggest against** using procalcitonin plus clinical evaluation to decide when to start antimicrobials, as compared to clinical evaluation alone.

BEST PRACTICE STATEMENT

NO RECOMMENDATION

WEAK RECOMMENDATION

STRONG RECOMMENDATION

WEAK RECOMMENDATION AGAINST

STRONG RECOMMENDATION AGAINST

HIGH QUALITY EVIDENCE

MODERATE QUALITY EVIDENCE

LOW QUALITY EVIDENCE

VERY LOW QUALITY EVIDENCE

UPGRADE

DOWNGRADE

NO CHANGE FROM PREVIOUS GUIDELINES

NEW / CHANGED RECOMMENDATION

SCREENING FOR PATIENTS WITH SEPSIS AND SEPTIC SHOCK

1 For hospitals and health systems, we **recommend** using a performance improvement programme for sepsis, including sepsis screening for acutely ill, high-risk patients and standard operating procedures for treatment.

MODERATE — Screening

VERY LOW — Standard operating procedures

2016 STATEMENT

*"We **recommend** that hospitals and hospital systems have a performance improvement programme for sepsis including sepsis screening for acutely ill, high risk patients."*

MODERATE — **2** We **recommend against** using qSOFA compared to SIRS, NEWS, or MEWS as a single screening tool for sepsis or septic shock.

VERY LOW — **3** For adults suspected of having sepsis, we **suggest** measuring blood lactate.

INITIAL RESUSCITATION

BEST PRACTICE — **4** Sepsis and septic shock are medical emergencies, and we **recommend** that treatment and resuscitation begin immediately.

LOW — **5** For patients with sepsis induced hypoperfusion or septic shock we **suggest** that at least 30 mL/kg of intravenous (IV) crystalloid fluid should be given within the first 3 hours of resuscitation.

2016 STATEMENT

*"We **recommend** that in the initial resuscitation from sepsis-induced hypoperfusion, at least 30ml/kg of intravenous crystalloid fluid be given within the first 3 hours."*

VERY LOW — **6** For adults with sepsis or septic shock, we **suggest** using dynamic measures to guide fluid resuscitation, over physical examination, or static parameters alone.

LOW — **7** For adults with sepsis or septic shock, we **suggest** guiding resuscitation to decrease serum lactate in patients with elevated lactate level, over not using serum lactate.

LOW — **8** For adults with septic shock, we **suggest** using capillary refill time to guide resuscitation as an adjunct to other measures of perfusion.

MEAN ARTERIAL PRESSURE

MODERATE — **9** For adults with septic shock on vasopressors, we **recommend** an initial target mean arterial pressure (MAP) of 65 mm Hg over higher MAP targets.

BEST PRACTICE STATEMENT

NO RECOMMENDATION

WEAK RECOMMENDATION

STRONG RECOMMENDATION

WEAK RECOMMENDATION AGAINST

STRONG RECOMMENDATION AGAINST

HIGH QUALITY EVIDENCE

MODERATE QUALITY EVIDENCE

LOW QUALITY EVIDENCE

VERY LOW QUALITY EVIDENCE

UPGRADE

DOWNGRADE

NO CHANGE FROM PREVIOUS GUIDELINES

NEW / CHANGED RECOMMENDATION

BEST PRACTICE

17 For adults with sepsis or septic shock at high risk of MRSA, we **recommend** using empiric antimicrobials with MRSA coverage over using antimicrobials without MRSA coverage.

2016 STATEMENT

*"We **recommend** empiric broad-spectrum therapy with one or more antimicrobials for patients presenting with sepsis or septic shock to cover all likely pathogens (including bacterial and potentially fungal or viral coverage."*

LOW

18 For adults with sepsis or septic shock at low risk of MRSA, we **suggest against** using empiric antimicrobials with MRSA coverage, as compared with using antimicrobials without MRSA coverage.

2016 STATEMENT

*"We **recommend** empiric broad-spectrum therapy with one or more antimicrobials for patients presenting with sepsis or septic shock to cover all likely pathogens (including bacterial and potentially fungal or viral coverage."*

VERY LOW

19 For adults with sepsis or septic shock and high risk for multidrug resistant (MDR) organisms, we **suggest** using two antimicrobials with gram-negative coverage for empiric treatment over one gram-negative agent.

VERY LOW

20 For adults with sepsis or septic shock and low risk for multidrug resistant (MDR) organisms, we **suggest against** using two gram-negative agents for empiric treatment, as compared to one gram-negative agent.

VERY LOW

21 For adults with sepsis or septic shock, we **suggest against** using double gram-negative coverage once the causative pathogen and the susceptibilities are known.

LOW

22 For adults with sepsis or septic shock at high risk of fungal infection, we **suggest** using empiric antifungal therapy over no antifungal therapy.

2016 STATEMENT

*"We **recommend** empiric broad-spectrum therapy with one or more antimicrobials for patients presenting with sepsis or septic shock to cover all likely pathogens (including bacterial and potentially fungal or viral coverage."*

LOW

23 For adults with sepsis or septic shock at low risk of fungal infection, we **suggest against** empiric use of antifungal therapy.

2016 STATEMENT

*"We **recommend** empiric broad-spectrum therapy with one or more antimicrobials for patients presenting with sepsis or septic shock to cover all likely pathogens (including bacterial and potentially fungal or viral coverage."*

24 We make no recommendation on the use of antiviral agents.

MODERATE

25 For adults with sepsis or septic shock, we **suggest** using prolonged infusion of beta-lactams for maintenance (after an initial bolus) over conventional bolus infusion.

BEST PRACTICE

26 For adults with sepsis or septic shock, we **recommend** optimising dosing strategies of antimicrobials based on accepted pharmacokinetic/pharmacodynamic (PK/PD) principles and specific drug properties.

BEST PRACTICE STATEMENT

NO RECOMMENDATION

WEAK RECOMMENDATION

STRONG RECOMMENDATION

WEAK RECOMMENDATION AGAINST

STRONG RECOMMENDATION AGAINST

HIGH QUALITY EVIDENCE

MODERATE QUALITY EVIDENCE

LOW QUALITY EVIDENCE

VERY LOW QUALITY EVIDENCE

UPGRADE

DOWNGRADE

NO CHANGE FROM PREVIOUS GUIDELINES

NEW / CHANGED RECOMMENDATION

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NO RECOMMENDATION

WEAK RECOMMENDATION

STRONG RECOMMENDATION

WEAK RECOMMENDATION AGAINST

STRONG RECOMMENDATION AGAINST

HIGH QUALITY EVIDENCE

MODERATE QUALITY EVIDENCE

LOW QUALITY EVIDENCE

VERY LOW QUALITY EVIDENCE

UPGRADE

DOWNGRADE

NO CHANGE FROM PREVIOUS GUIDELINES

NEW / CHANGED RECOMMENDATION

BEST PRACTICE

27 For adults with sepsis or septic shock, we **recommend** rapidly identifying or excluding a specific anatomical diagnosis of infection that requires emergent source control and implementing any required source control intervention as soon as medically and logistically practical.

BEST PRACTICE

28 For adults with sepsis or septic shock, we **recommend** prompt removal of intravascular access devices that are a possible source of sepsis or septic shock after other vascular access has been established.

VERY LOW

29 For adults with sepsis or septic shock, we **suggest** daily assessment for de-escalation of antimicrobials over using fixed durations of therapy without daily reassessment for de-escalation.

VERY LOW

30 For adults with an initial diagnosis of sepsis or septic shock and adequate source control, we **suggest** using shorter over longer duration of antimicrobial therapy.

LOW

31 For adults with an initial diagnosis of sepsis or septic shock and adequate source control where optimal duration of therapy is unclear, we **suggest** using procalcitonin AND clinical evaluation to decide when to discontinue antimicrobials over clinical evaluation alone.

HEMODYNAMIC MANAGEMENT

MODERATE

32 For adults with sepsis or septic shock, we **recommend** using crystalloids as first-line fluid for resuscitation.

LOW

33 For adults with sepsis or septic shock, we **suggest** using balanced crystalloids instead of normal saline for resuscitation.

2016 STATEMENT

*"We **suggest** using either balanced crystalloids or saline for fluid resuscitation of patients with sepsis or septic shock"*

MODERATE

34 For adults with sepsis or septic shock, we **suggest** using albumin in patients who received large volumes of crystalloids.

HIGH

35 For adults with sepsis or septic shock, we **recommend against** using starches for resuscitation.

MODERATE

36 For adults with sepsis and septic shock, we **suggest against** using gelatin for resuscitation.

2016 STATEMENT

*"We **suggest** using crystalloids over gelatins when resuscitating patients with sepsis or septic shock."*

BEST PRACTICE STATEMENT

NO RECOMMENDATION

WEAK RECOMMENDATION

STRONG RECOMMENDATION

WEAK RECOMMENDATION AGAINST

STRONG RECOMMENDATION AGAINST

HIGH QUALITY EVIDENCE

MODERATE QUALITY EVIDENCE

LOW QUALITY EVIDENCE

VERY LOW QUALITY EVIDENCE

UPGRADE

DOWNGRADE

NO CHANGE FROM PREVIOUS GUIDELINES

NEW / CHANGED RECOMMENDATION

37 For adults with septic shock, we **recommend** using norepinephrine as the first-line agent over other vasopressors.

- HIGH — Dopamine
- MODERATE — Vasopressin
- LOW — Epinephrine
- LOW — Selepressin
- VERY LOW — Angiotensin 2

MODERATE — 38 For adults with septic shock on norepinephrine with inadequate mean arterial pressure levels, we **suggest** adding vasopressin instead of escalating the dose of norepinephrine.

LOW — 39 For adults with septic shock and inadequate mean arterial pressure levels despite norepinephrine and vasopressin, we **suggest** adding epinephrine.

LOW — 40 For adults with septic shock, we **suggest against** using terlipressin.

LOW — 41 For adults with septic shock and cardiac dysfunction with persistent hypoperfusion despite adequate volume status and arterial blood pressure, we **suggest** either adding dobutamine to norepinephrine or using epinephrine alone.

LOW — 42 For adults with septic shock and cardiac dysfunction with persistent hypoperfusion despite adequate volume status and arterial blood pressure, we **suggest against** using levosimendan.

VERY LOW — 43 For adults with septic shock, we **suggest** invasive monitoring of arterial blood pressure over non-invasive monitoring, as soon as practical and if resources are available.

VERY LOW — 44 For adults with septic shock, we **suggest** starting vasopressors peripherally to restore mean arterial pressure rather than delaying initiation until a central venous access is secured.

45 There is insufficient evidence to make a recommendation on the use of restrictive versus liberal fluid strategies in the first 24 hours of resuscitation in patients with sepsis and septic shock who still have signs of hypoperfusion and volume depletion after the initial resuscitation.

2016 STATEMENT

*"We **suggest** using either balanced crystalloids or saline for fluid resuscitation of patients with sepsis or septic shock."*

*"We **suggest** using crystalloids over gelatins when resuscitating patients with sepsis or septic shock."*

BEST PRACTICE STATEMENT

NO RECOMMENDATION

WEAK RECOMMENDATION

STRONG RECOMMENDATION

WEAK RECOMMENDATION AGAINST

STRONG RECOMMENDATION AGAINST

HIGH QUALITY EVIDENCE

MODERATE QUALITY EVIDENCE

LOW QUALITY EVIDENCE

VERY LOW QUALITY EVIDENCE

UPGRADE

DOWNGRADE

NO CHANGE FROM PREVIOUS GUIDELINES

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- HIGH — Dopamine
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LOW — 41 For adults with septic shock and cardiac dysfunction with persistent hypoperfusion despite adequate volume status and arterial blood pressure, we **suggest** either adding dobutamine to norepinephrine or using epinephrine alone.

LOW — 42 For adults with septic shock and cardiac dysfunction with persistent hypoperfusion despite adequate volume status and arterial blood pressure, we **suggest against** using levosimendan.

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2016 STATEMENT

*"We **suggest** using either balanced crystalloids or saline for fluid resuscitation of patients with sepsis or septic shock."*

*"We **suggest** using crystalloids over gelatins when resuscitating patients with sepsis or septic shock."*

BEST PRACTICE STATEMENT

NO RECOMMENDATION

WEAK RECOMMENDATION

STRONG RECOMMENDATION

WEAK RECOMMENDATION AGAINST

STRONG RECOMMENDATION AGAINST

HIGH QUALITY EVIDENCE

MODERATE QUALITY EVIDENCE

LOW QUALITY EVIDENCE

VERY LOW QUALITY EVIDENCE

UPGRADE

DOWNGRADE

NO CHANGE FROM PREVIOUS GUIDELINES

NEW / CHANGED RECOMMENDATION

VENTILATION

? — 46 There is insufficient evidence to make a recommendation on the use of conservative oxygen targets in adults with sepsis-induced hypoxemic respiratory failure.

! — LOW — 47 For adults with sepsis-induced hypoxemic respiratory failure, we **suggest** the use of high flow nasal oxygen over non-invasive ventilation.

? — 48 There is insufficient evidence to make a recommendation on the use of non-invasive ventilation in comparison to invasive ventilation for adults with sepsis-induced hypoxemic respiratory failure.

!! — HIGH — 49 For adults with sepsis-induced ARDS, we **recommend** using a low tidal volume ventilation strategy (6 mL/kg), over a high tidal volume strategy (>10 mL/kg).

!! — MODERATE — 50 For adults with sepsis-induced severe ARDS, we **recommend** using an upper limit goal for plateau pressures of 30 cm H2O, over higher plateau pressures.

! — MODERATE — 51 For adults with moderate to severe sepsis-induced ARDS, we **suggest** using higher PEEP over lower PEEP.

! — LOW — 52 For adults with sepsis-induced respiratory failure (without ARDS), we **suggest** using low tidal volume as compared to high tidal volume ventilation.

! — MODERATE — 53 For adults with sepsis-induced moderate-severe ARDS, we **suggest** using traditional recruitment maneuvers.

!! — MODERATE — 54 When using recruitment maneuvers, we **recommend against** using incremental PEEP titration/strategy.

!! — MODERATE — 55 For adults with sepsis-induced moderate-severe ARDS, we **recommend** using prone ventilation for greater than 12 hours daily.

! — MODERATE — 56 For adults with sepsis induced moderate-severe ARDS, we **suggest** using intermittent NMBA boluses, over NMBA continuous infusion.

! — LOW — 57 For adults with sepsis-induced severe ARDS, we **suggest** using Veno-venous (VV) ECMO when conventional mechanical ventilation fails in experienced centres with the infrastructure in place to support its use.

ADDITIONAL THERAPIES

! — MODERATE — 58 For adults with septic shock and an ongoing requirement for vasopressor therapy we **suggest** using IV corticosteroids.

2016 STATEMENT

↑ 1 LOW

*"We **suggest against** using intravenous hydrocortisone to treat septic shock patients if adequate fluid resuscitation and vasopressor therapy are able to restore hemodynamic stability (see goals for Initial Resuscitation). If this is not achievable, we **suggest** intravenous hydrocortisone at a dose of 200 mg per day."*

BEST PRACTICE STATEMENT

NO RECOMMENDATION

WEAK RECOMMENDATION

STRONG RECOMMENDATION

WEAK RECOMMENDATION AGAINST

STRONG RECOMMENDATION AGAINST

HIGH QUALITY EVIDENCE

MODERATE QUALITY EVIDENCE

LOW QUALITY EVIDENCE

VERY LOW QUALITY EVIDENCE

↑ UPGRADE

↓ DOWNGRADE

NO CHANGE FROM PREVIOUS GUIDELINES

NEW / CHANGED RECOMMENDATION

LOW

59 For adults with sepsis or septic shock we **suggest against** using polymyxin B hemoperfusion.

2016 STATEMENT
"We make no recommendation regarding the use of blood purification techniques."

60 There is insufficient evidence to make a recommendation on the use of other blood purification techniques.

MODERATE

61 For adults with sepsis or septic shock we **recommend** using a restrictive (over liberal) transfusion strategy.

LOW

62 For adults with sepsis or septic shock we **suggest against** using intravenous immunoglobulins

MODERATE

63 For adults with sepsis or septic shock, and who have risk factors for gastrointestinal (GI) bleeding, we **suggest** using stress ulcer prophylaxis.

MODERATE

64 For adults with sepsis or septic shock, we **recommend** using pharmacologic venous thromboembolism (VTE) prophylaxis unless a contraindication to such therapy exists.

MODERATE

65 For adults with sepsis or septic shock, we **recommend** using low molecular weight heparin over unfractionated heparin for VTE prophylaxis

LOW

66 For adults with sepsis or septic shock, we **suggest against** using mechanical VTE prophylaxis, in addition to pharmacological prophylaxis, over pharmacologic prophylaxis alone.

LOW

67 In adults with sepsis or septic shock and AKI, we **suggest** using either continuous or intermittent renal replacement therapy.

MODERATE

68 In adults with sepsis or septic shock and AKI, with no definitive indications for renal replacement therapy, we **suggest against** using renal replacement therapy.

MODERATE

69 For adults with sepsis or septic shock, we **recommend** initiating insulin therapy at a glucose level of ≥ 180mg/dL (10mmol/L).

LOW

70 For adults with sepsis or septic shock we **suggest against** using IV vitamin C.

LOW

71 For adults with septic shock and hypoperfusion-induced lactic acidemia, we **suggest against** using sodium bicarbonate therapy to improve hemodynamics or to reduce vasopressor requirements.

LOW

72 For adults with septic shock and severe metabolic acidemia (pH ≤ 7.2) and acute kidney injury (AKIN score 2 or 3), we **suggest** using sodium bicarbonate therapy.

VERY LOW

73 For adult patients with sepsis or septic shock who can be fed enterally, we **suggest** early (within 72 hours) initiation of enteral nutrition.

BEST PRACTICE STATEMENT

NO RECOMMENDATION

WEAK RECOMMENDATION

STRONG RECOMMENDATION

WEAK RECOMMENDATION AGAINST

STRONG RECOMMENDATION AGAINST

HIGH QUALITY EVIDENCE

MODERATE QUALITY EVIDENCE

LOW QUALITY EVIDENCE

VERY LOW QUALITY EVIDENCE

UPGRADE

DOWNGRADE

NO CHANGE FROM PREVIOUS GUIDELINES

NEW / CHANGED RECOMMENDATION

LONG-TERM OUTCOMES AND GOALS OF CARE

BEST PRACTICE — 74 For adults with sepsis or septic shock, we **recommend** discussing goals of care and prognosis with patients and families over no such discussion.

LOW — 75 For adults with sepsis or septic shock, we **suggest** addressing goals of care early (within 72 hours) over late (72 hours or later).

76 For adults with sepsis or septic shock, there is insufficient evidence to make a recommendation on any specific standardized criterion to trigger goals of care discussion.

BEST PRACTICE — 77 For adults with sepsis or septic shock, we **recommend** that the principles of palliative care (which may include palliative care consultation based on clinician judgement) be integrated into the treatment plan, when appropriate, to address patient and family symptoms and suffering.

LOW — 78 For adults with sepsis or septic shock, we **suggest against** routine formal palliative care consultation for all patients over palliative care consultation based on clinician judgement.

VERY LOW — 79 For adult survivors of sepsis or septic shock and their families, we **suggest** referral to peer support groups over no such referral.

VERY LOW — 80 For adults with sepsis or septic shock, we **suggest** using a handoff process of critically important information at transitions of care over no such handoff process.

81 For adults with sepsis or septic shock, there is insufficient evidence to make a recommendation on the use of any specific structured handoff tool over usual handoff processes.

BEST PRACTICE — 82 For adults with sepsis or septic shock and their families, we **recommend** screening for economic and social support (including housing, nutritional, financial, and spiritual support), and make referrals where available to meet these needs.

VERY LOW — 83 For adults with sepsis or septic shock and their families, we **suggest** offering written and verbal sepsis education (diagnosis, treatment, and post-ICU/post-sepsis syndrome) prior to hospital discharge and in the follow-up setting.

BEST PRACTICE — 84 For adults with sepsis or septic shock and their families, we **recommend** the clinical team provide the opportunity to participate in shared decision making in post-ICU and hospital discharge planning to ensure discharge plans are acceptable and feasible.

VERY LOW — 85 For adults with sepsis and septic shock and their families, we **suggest** using a critical care transition programme, compared to usual care, upon transfer to the floor.

BEST PRACTICE — 86 For adults with sepsis and septic shock, we **recommend** reconciling medications at both ICU and hospital discharge.

BEST PRACTICE — 87 For adult survivors of sepsis and septic shock and their families, we **recommend** including information about the ICU stay, sepsis and related diagnoses, treatments, and common impairments after sepsis in the written and verbal hospital discharge summary.

BEST PRACTICE STATEMENT

NO RECOMMENDATION

WEAK RECOMMENDATION

STRONG RECOMMENDATION

WEAK RECOMMENDATION AGAINST

STRONG RECOMMENDATION AGAINST

HIGH QUALITY EVIDENCE

MODERATE QUALITY EVIDENCE

LOW QUALITY EVIDENCE

VERY LOW QUALITY EVIDENCE

UPGRADE

DOWNGRADE

NO CHANGE FROM PREVIOUS GUIDELINES

NEW / CHANGED RECOMMENDATION

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BEST PRACTICE — 86 For adults with sepsis and septic shock, we **recommend** reconciling medications at both ICU and hospital discharge.

BEST PRACTICE — 87 For adult survivors of sepsis and septic shock and their families, we **recommend** including information about the ICU stay, sepsis and related diagnoses, treatments, and common impairments after sepsis in the written and verbal hospital discharge summary.

BEST PRACTICE STATEMENT

NO RECOMMENDATION

WEAK RECOMMENDATION

STRONG RECOMMENDATION

WEAK RECOMMENDATION AGAINST

STRONG RECOMMENDATION AGAINST

HIGH QUALITY EVIDENCE

MODERATE QUALITY EVIDENCE

LOW QUALITY EVIDENCE

VERY LOW QUALITY EVIDENCE

UPGRADE

DOWNGRADE

NO CHANGE FROM PREVIOUS GUIDELINES

NEW / CHANGED RECOMMENDATION

BEST PRACTICE

88 For adults with sepsis or septic shock who developed new impairments, we **recommend** hospital discharge plans include follow-up with clinicians able to support and manage new and long-term sequelae.

89 For adults with sepsis or septic shock and their families, there is insufficient evidence to make a recommendation on early post-hospital discharge follow-up compared to routine post-hospital discharge follow-up.

90 For adults with sepsis or septic shock, there is insufficient evidence to make a recommendation for or against early cognitive therapy.

BEST PRACTICE

91 For adult survivors of sepsis or septic shock, we **recommend** assessment and follow-up for physical, cognitive, and emotional problems after hospital discharge.

VERY LOW

92 For adult survivors of sepsis or septic shock, we **suggest** referral to a post-critical illness follow-up programme if available.

VERY LOW

93 For adult survivors of sepsis or septic shock receiving mechanical ventilation for >48hours or an ICU stay of >72 hours, we **suggest** referral to a post-hospital rehabilitation programme.

BEST PRACTICE STATEMENT

NO RECOMMENDATION

WEAK RECOMMENDATION

STRONG RECOMMENDATION

WEAK RECOMMENDATION AGAINST

STRONG RECOMMENDATION AGAINST

HIGH QUALITY EVIDENCE

MODERATE QUALITY EVIDENCE

LOW QUALITY EVIDENCE

VERY LOW QUALITY EVIDENCE

UPGRADE

DOWNGRADE

NO CHANGE FROM PREVIOUS GUIDELINES

NEW / CHANGED RECOMMENDATION

Anaphylactic Shock

Anaphylactic reaction?

Airway, Breathing, Circulation, Disability, Exposure

Diagnosis - look for:
- Acute onset of illness
- Life-threatening Airway and/or Breathing and/or Circulation problems [1]
- And usually skin changes

- **Call for help**
- Lie patient flat
- Raise patient's legs

Adrenaline [2]

When skills and equipment available:
- Establish airway
- High flow oxygen
- IV fluid challenge [3]
- Chlorphenamine [4]
- Hydrocortisone [5]

Monitor:
- Pulse oximetry
- ECG
- Blood pressure

1 Life-threatening problems:

Airway:	swelling, hoarseness, stridor
Breathing:	rapid breathing, wheeze, fatigue, cyanosis, SpO_2 < 92%, confusion
Circulation:	pale, clammy, low blood pressure, faintness, drowsy/coma

2 Adrenaline *(give IM unless experienced with IV adrenaline)*
IM doses of 1:1000 adrenaline (repeat after 5 min if no better)

• Adult	500 micrograms IM (0.5 mL)
• Child more than 12 years:	500 micrograms IM (0.5 mL)
• Child 6 -12 years:	300 micrograms IM (0.3 mL)
• Child less than 6 years:	150 micrograms IM (0.15 mL)

Adrenaline IV to be given **only by experienced specialists**
Titrate: Adults 50 micrograms; Children 1 microgram/kg

3 IV fluid challenge:
Adult - 500 – 1000 mL
Child - crystalloid 20 mL/kg

Stop IV colloid
if this might be the cause
of anaphylaxis

	4 Chlorphenamine (IM or slow IV)	5 Hydrocortisone (IM or slow IV)
Adult or child more than 12 years	10 mg	200 mg
Child 6 - 12 years	5 mg	100 mg
Child 6 months to 6 years	2.5 mg	50 mg
Child less than 6 months	250 micrograms/kg	25 mg


Neurogenic
Shock
Credit: Lightspring/Shutterstock.com

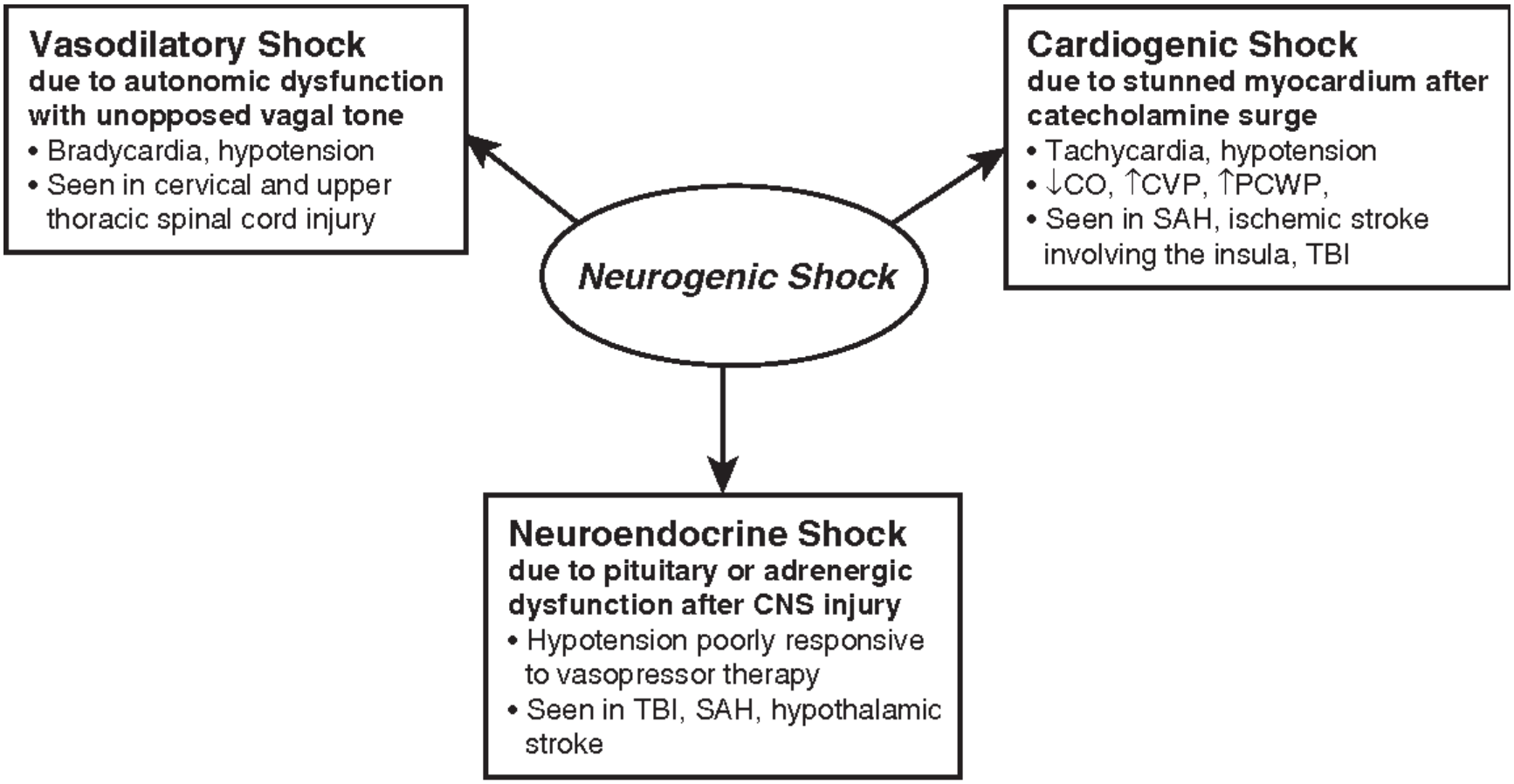

FIGURE 59.1. Neurogenic shock consists of three pathomechanisms. CNS, central nervous system; CO, cardiac output; CVP, central venous pressure; PCWP, pulmonary capillary wedge pressure; SAH, subarachnoid hemorrhage; TBI, traumatic brain injury.

Neurogenic Shock- Treatment

- A,B,Cs
  - Remember c-spine precautions
- Fluid resuscitation
  - Keep MAP at 85-90 mm Hg for first 7 days
  - Thought to minimize secondary cord injury
  - If crystalloid is insufficient use vasopressors
- Search for other causes of hypotension
- For bradycardia
  - Atropine
  - Pacemaker
- Methylprednisolone
  - Used only for blunt spinal cord injury
  - High dose therapy
  - Must be started within 8 hours
  - Controversial- Risk for infection, GI bleed

Συμπερασματικά

- Shock= Υπόταση + Ιστική υποάρδευση
- Υπογκαιμικό, Καρδιογενές, Ανακατανομής, Αποφρακτικό
- Υπογκαιμία: **Υγρά + μεταγγίσεις**
- Καρδιογενές: Ισορροπία υγρών, αγγειοσυσπαστικών και **ινότροπων**
- Ανακατανομής: δτρχ τόνου οπότε **αγγειοσυσπαστικά**
- Tamponade & Πνευμοθώρακας: Υγρά & **Βελόνα**
- Πνευμονική Εμβολή: **Αντιπηκτικά & Θρομβόλυση**

Thank you