Fick equation:

$VO2 = Q(CaO2-CvO2)$

Where $CaO2 = (Hg \times 1.34 \times SaO2) + (PaO2 \times 0.003)$
$CvO2 = (Hg \times 1.34 \times SvO2) + (PaO2 \times 0.003)$
So:
$VO2 = Q[((Hg \times 1.34 \times SaO2) + (PaO2 \times 0.003)] - [((Hg \times 1.34 \times SvO2) + (PaO2 \times 0.003)]$

Let's solve for the highlighted area first:

$[(Hg \times 1.34 \times SaO2) + (PaO2 \times 0.003)] - [((Hg \times 1.34 \times SvO2) + (PaO2 \times 0.003)]$

I will call $Hg \times 1.34 \times SaO2 = x$
$Hg \times 1.34 \times SvO2 = y$
$PaO2 \times 0.003 = L$
The above will equal the difference of $O2 = O2diff$

Simplifying
$(x + L) + -1(y + L) = O2diff$

Reorder the terms:
$(L + x) + -1(y + L) = O2diff$

Remove parenthesis around $(L + x)$
$L + x + -1(y + L) = O2diff$

Reorder the terms:
$L + x + -1(L + y) = O2diff$
$L + x + (L * -1 + y * -1) = O2diff$
$L + x + (-1L + -1y) = O2diff$

Reorder the terms:
$L + -1L + x + -1y = O2diff$

Combine like terms: $L + -1L = 0$
$0 + x + -1y = O2diff$
$x + -1y = O2diff$

Solving
$x - y = O2diff$

That being said, will go back to the original equation:

$VO2 = Q[((Hg \times 1.34 \times SaO2) + (PaO2 \times 0.003)] - [((Hg \times 1.34 \times SvO2) + (PaO2 \times 0.003)]$

This now can be simplified as:

$VO2 = Q[(Hg \times 1.34 \times SaO2) - (Hg \times 1.34 \times SvO2)]$

Simplifying:

$VO2 = Q[Hg \times 1.34 (SaO2 - SvO2)$

VO2/QxHgx1.34 = SaO2 – SvO2

In other words:

SvO2 = SaO2 – VO2/Q x Hg x 1.34

In summary:
Determinants of SVO2 are: SpaO2, hemoglobin, cardiac output and O2 consumption at the tissue level

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Questions:

A 65 year-old male is admitted to the ICU with a diagnosis of severe sepsis. He is started on broad spectrum antibiotics. Vital signs are: BP 115/60, HR 110, SpaO2 95 on 4L NC. A right jugular centlar line capable of measuring CVO2 is placed. What is the expected reading of his CVO2 on admission?

a. Elevated (higher than normal)
b. Reduced (lower than normal)
c. As expected from a normal patient
d. As expected from a patient intoxicated with cyanide
e. As expecetd from a patient on high dose sodium nitroprusside for 8 days

Answer: B. CVO2 can be use as a surrogate of SVO2 and should be low in the setting of early sepsis

Determinants of SVO2 include all except:

a. SpaO2
b. Oxygen consumption
c. Cardiac output
d. Hemoglobin
e. The amount of O2 a gram of hemoglobin can carry

Answer: E. hemoglobin, cardiac output, SpaO2 and oxygen consumption at the tissue level are the determinants of SVO2. Each gram of hemoglobin can carry 1.34 mL of O2 and this is the constant (not a determinant) of SVO2.