

RC-178 a/A ratio

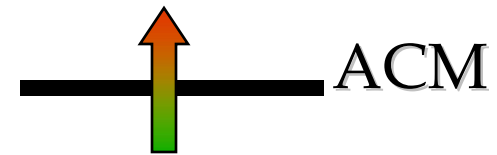
- Better than guessing!!



RC-178 a/A ratio

- A relative way to judge the lungs ability to transport O₂.
- Determine new FIO₂ to achieve specific PaO₂.

PaO₂ amount that got through the:

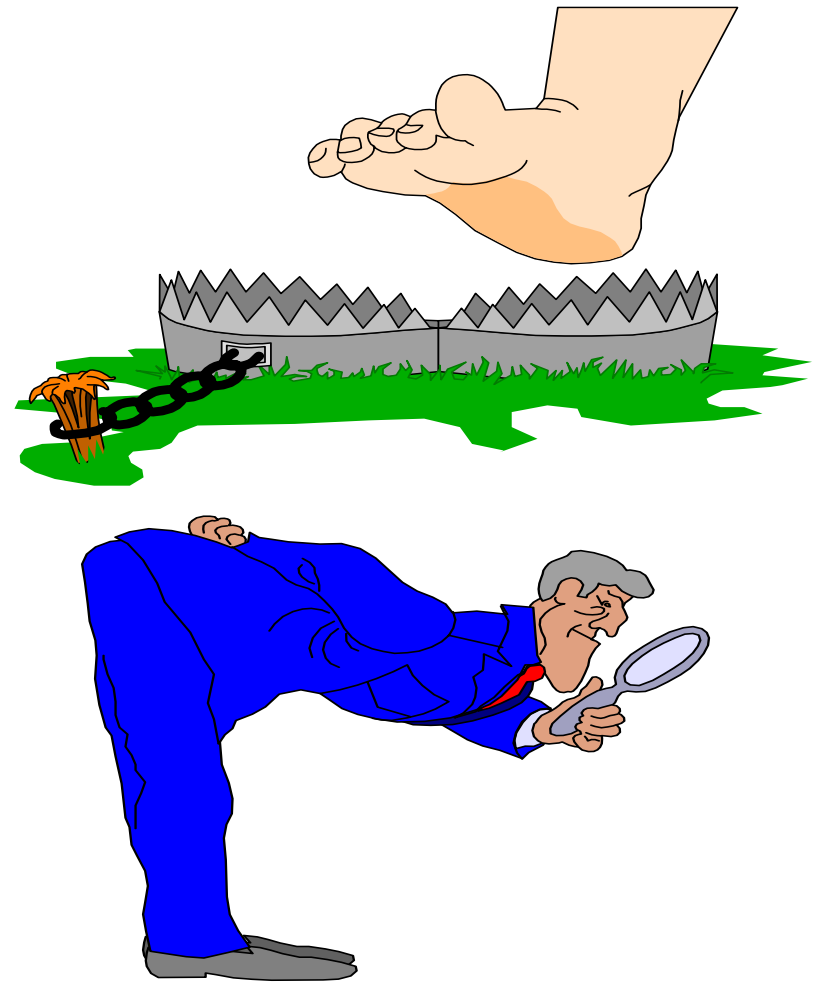


PAO₂ amount you put into the lung.

M.D.: I would like this patient's PaO₂ to be 75 mmhg.
RCP: No problem.

RC-178 a/A ratio

- Reduce the number of ABGs needed to regulate PaO₂.
- Monitor the effects of various therapeutic interventions.



A-aDO₂

- The alveolar-arterial Oxygen difference.
 - The difference between the pressure of oxygen in the alveoli (what you put in) and the pressure of Oxygen in the arterial blood (what got into the blood through the ACM).

$$\frac{a}{A} = \frac{\text{PaO}_2}{\text{PAO}_2}$$

↑
ACM

95/109
= .87

$$\frac{\text{Alveolar Pressure (PA)O}_2 - \text{arterial Pressure (Pa)O}_2}{\text{A-aDO}_2 (109-95) = 14 \text{ on RA}}$$

BETTER THAN A-aDO₂

- TELLS HOW MUCH OF A DIFFERENCE BETWEEN WHAT WENT IN AND WHAT GOT INTO THE BLOOD.
- AT R.A. OR 100% TELLS HOW WELL LUNG IS WORKING COMPARED TO NORMAL.
- DOES NOT HELP YOU PREDICT ACCURATE EFFECT OF CHANGES IN FIO₂.

Patient Assessment a/A ratio

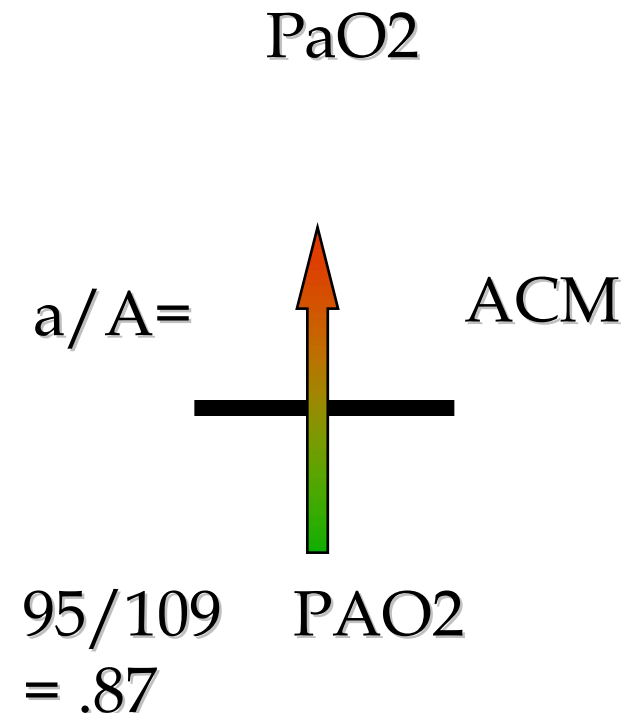
- A relative way to judge the lungs ability to transport O₂.
 - Ratio vs a Difference
- Determine new FIO₂ to achieve specific PaO₂.
- Reduce the number of ABGs needed to regulate PaO₂.
- Monitor the effects of various therapuetic interventions.
- *Better than guessing!!!!*

Caveats...

- Best if used close to time of ABG used to calculate it:
 - If a/A ratio was .6 yesterday at 3pm, not as good for predicting as a a/A ratio you just got 20 minutes ago.
- Best if patient has not had any significant changes in cardiopulmonary indices or settings:
 - HR, RR, Vt, Bp, CO, PAP, PvO₂, O₂ Sat. %
 - No major events, i.e. Code, extubation, Changes in ventilator settings effecting V_e, V_A, distribution of ventilation(mode changes), etc.

How does it work?

- Calculate the Alveolar PO₂:
 - $PAO_2 = (P_b - P_{H_2O}) \times FIO_2 - PaCO_2$
- Divide PAO₂ into PaO₂:
 - $a/A \text{ ratio} = PaO_2 / PAO_2$
- Normal a/A ratio:
 - .80 or above is normal for any FIO₂.
 - .60 or below may be incompatible with spontaneous breathing.



PAO₂ CALCULATED USING ALL FORMULAS

FIO ₂	Alveolar Air Equation	MODIFIED RQ	CLINICAL
.21	101.8	99.7 (-2)	109.7 (+8)
.40	239.2	235.2 (-4)	245.2 (+6)
.60	383.8	377.8 (-6)	387.8 (+4)
.80	528.4	520.4 (-8)	530.4 (+2)
1.00	673.0	663.0 (-10)	673.0 (+0)

PAO2 IS CALCULATED USING CLINICAL FORMULA

REAL PAO2	MODIFIED RQ	CLINICAL
<p>ACCURATE AT ALL FIO2s BUT FORMULA IS NOT PRACTICAL FOR CLINICAL USE, RESEARCH</p>	<p>CLOSE TO REAL AT FIO2s AT OR BELOW .40-.60</p> <p>$PAO_2 = 713 \times FIO_2 - PaCO_2 / RQ (.8)$</p>	<p>CLOSE TO REAL AT FIO2s AT OR ABOVE .60</p> <p>$PAO_2 = 713 \times FIO_2 - PaCO_2$</p>

Find a/A ratio:

- $713 \times .21$
- minus the PaCO₂
 - use normal if not given.
- Divide PAO₂ by PaO₂ of 50.
- Interpret with respect to normal.
- PaO₂ is 50.
- FIO₂ is .21
- Calculate PAO₂
- Divide into PaO₂
- Compare to normal

Exercise 1

- Patient's ABG is the following:
 - pH 7.25 PaCO₂ 60 HCO₃ 25
 - PaO₂ = 50 Sat. 82% FIO₂ .30
 - Calculate this patient's a/A ratio
 - Interpret this patient's a/A ratio
 - Good?
 - Bad?
 - Express in common terms what is happening...

Predicting the PaO₂ as a result of a FIO₂ change:

- Calculate the a/A ratio on most recent ABG.
- Most recent ABG:
 - PaO₂ 95 FIO₂ .40
- a/A ratio =
 - 95 / PAO₂ on .40 FIO₂
 - 713 x .40 - 40
 - 285 - 40
 - 245 is new PAO₂
 - 95/245 = .39 is a/A ratio of this patient

Predicting the PaO₂ as a result of a FIO₂ change:

- Calculate the a/A ratio on most recent ABG.
- Calculate the PAO₂ at new FIO₂, let's say new FIO₂ is .21:

$$\text{PAO}_2 = (\text{Pb}-\text{PH}_2\text{O}) \times \text{FIO}_2(.21) - \text{PaCO}_2$$

Solve for FIO₂(X)

$$\text{PAO}_2 + \text{PaCO}_2 = (\text{Pb}-\text{PH}_2\text{O}) \times \text{FIO}_2 - \text{PaCO}_2 + \text{PaCO}_2$$

$$\text{PAO}_2 = (760-47) \times .21 - 40$$

$$\text{PAO}_2 = 713 \times .21 - 40$$

$$\text{PAO}_2 = 149 - 40$$

$$\text{New PAO}_2 \text{ will} = 109$$

Predicting the PaO₂ as a result of a FIO₂ change:

- Calculate the a/A ratio on most recent ABG.
- Calculate the PAO₂ at new FIO₂.
- **Multiply a/A ratio times the new PAO₂.**

$109 \times .40(a/A) = \text{new PaO}_2$ if we
make FIO₂ Change

Predicting the PaO₂ as a result of a FIO₂ change:

- Calculate the a/A ratio on most recent ABG.
 - Calculate the PAO₂ at new FIO₂.
 - Multiply a/A ratio times the new PaO₂.
- Answer is the new PaO₂ when FIO₂ is lowered or raised.

$$109 \times .40 = \sim 44 \text{mmHg new PaO}_2 \text{ if we make FIO}_2 .21$$

Predicting the PaO₂ as a result of a FIO₂ change:

- Calculate the a/A ratio on most recent ABG.
- Calculate the PAO₂ at new FIO₂.
- Multiply a/A ratio times the new PAO₂.
- Answer is the new PaO₂ when FIO₂ is lowered or raised.
- **Determine a good PaO₂ for patient based on age, etc.**

$$\frac{\text{Desired PaO}_2}{\text{Current a/A ratio}} = \text{New PAO}_2$$

Exercise 2:

- Patient is breathing on a FIO₂ of 1.00.
- ABG comes back and PaO₂ is 150.
- M.D. orders FIO₂ lowered to .30.
 - What would PaO₂ be if you follow order?
 - What would be a good PaO₂ for a 21 year old otherwise normal lungs, etc.?
 - What FIO₂ would you suggest?

How to Achieve a Desired PaO₂:

- ↘ Calculate a/A ratio of the blood gas on most recent ABG.
- ✦ Divide it into the desired PaO₂.
- ✦ **Answer is the new PAO₂ needed to achieve the desired PaO₂.**

Predicting the PaO₂ as a result of a FIO₂ change:

- Calculate the a/A ratio on most recent ABG.
- Calculate the PAO₂ at new FIO₂.
- Multiply a/A ratio times the new PAO₂.
- Answer is the new PaO₂ when FIO₂ is lowered or raised.
- Determine a good PaO₂ for patient.
- **Find new FIO₂ to achieve the PAO₂.**

How to Achieve a Desired PaO₂:

↘ Calculate a/A ratio of the blood gas on most recent ABG.

✦ Divide it into the desired PaO₂.

✦ Answer is the new PAO₂ needed to achieve the desired PaO₂.

✦ Solve for new PAO₂.

✦ **Alveolar equation:**

- new PAO₂

- Make FIO₂ the "X"

- Solve for "X"

How to Achieve a Desired PaO₂:

- ↘ Calculate a/A ratio of the blood gas on most recent ABG.
- ✿ Divide it into the desired PaO₂.
- ✿ Answer is the new PAO₂ needed to achieve the desired PaO₂.
- ✂ Solve for new PAO₂
- ↻ Alveolar equation:
 - new PAO₂
 - Make FIO₂ the "X"
 - Solve for "X"
- ✂ **Adjust FIO₂ (error on the side of too high not too low).**

Predicting the PaO₂ as a result of a FIO₂ change:

- Calculate the a/A ratio on most recent ABG.
- Calculate the PAO₂ at new FIO₂.
- Multiply a/A ratio times the new PAO₂.
- Answer is the new PaO₂ when FIO₂ is lowered or raised.
- Determine a good PaO₂ for patient.
- Find new FIO₂ to achieve the PaO₂.
- **Call MD make recommendation.**

Exercise 3:

- Patient is breathing room air in the E.D.
- ABG is :
 - pH 7.30, PaCO₂ 50, HCO₃ 24, base 24
 - PaO₂ 65, Sat.% 84
- MD wants PaO₂ at 80 or higher.
- What FIO₂ will you recommend and how will you deliver it?

Practice...Name & answer...

- PaO₂ is 90 FIO₂ is .40 a/A = ???
- PaO₂ is 60 FIO₂ is .40 a/A = ???
- PaO₂ is 40 FIO₂ is .40 a/A = ???
- PaO₂ is 90 FIO₂ is .21 a/A = ???
- PaO₂ is 90 FIO₂ is .60 a/A = ???
- PaO₂ is 90 FIO₂ is 1.00 a/A = ???

Practice...Name & answer...

- PaO₂ is 90 FIO₂ is .40 a/A = .36
- PaO₂ is 60 FIO₂ is .40 a/A = .24
- PaO₂ is 40 FIO₂ is .40 a/A = .16
- PaO₂ is 90 FIO₂ is .21 a/A = .82
- PaO₂ is 90 FIO₂ is .60 a/A = .23
- PaO₂ is 90 FIO₂ is 1.00 a/A = .12

More Practice...

- PaO₂ is 90, FIO₂ is .40, What will PaO₂ on .21 O₂ would be = ???
- PaO₂ is 40, FIO₂ is .40, What will PaO₂ on .21 O₂ would be = ???
- PaO₂ is 150, FIO₂ is .40, What will PaO₂ on .21 O₂ would be = ???
- PaO₂ is 90, FIO₂ is 1.00, What will PaO₂ on .21 O₂ would be = ???

More Practice...

- PaO₂ is 90, FIO₂ is .40, What will PaO₂ on .21 O₂ would be = ~40
- PaO₂ is 40, FIO₂ is .40, What will PaO₂ on .21 O₂ would be = ~18
- PaO₂ is 150, FIO₂ is .40, What will PaO₂ on .21 O₂ would be = ~68
- PaO₂ is 90, FIO₂ is 1.00, What will PaO₂ on .21 O₂ would be = ~15

And yet more...

- PaO₂ is 90, FIO₂ is .40, desired PaO₂ is 75, to achieve this the FIO₂ = ???
- PaO₂ is 50, FIO₂ is .40, desired PaO₂ is 75, to achieve this the FIO₂ = ???
- PaO₂ is 350, FIO₂ is .40, desired PaO₂ is 95, to achieve this the FIO₂ = ???
- PaO₂ is 90, FIO₂ is .21, desired PaO₂ is 75, to achieve this the FIO₂ = ???

And yet more...

- PaO₂ is 90, FIO₂ is .40, desired PaO₂ is 75, to achieve this the FIO₂ =
- PaO₂ is 50, FIO₂ is .40, desired PaO₂ is 75, to achieve this the FIO₂ =
- PaO₂ is 350, FIO₂ is .40, desired PaO₂ is 95, to achieve this the FIO₂ =
- PaO₂ is 90, FIO₂ is .21, desired PaO₂ is 75, to achieve this the FIO₂ =

TAKE A BREAK !

