Acid Base

AD01 [Mar96] [Apr01] [Mar05] [Jul05] ABGs: pH 7.35, pCO2 60 mmHg, pO2 40 mmHg.

These blood gas results are consistent with:

A. Atelectasis
B. Morphine induced respiratory depression (OR: Acute morphine overdose)
C. Diabetic ketoacidosis
D. Patient with COAD - although v hypoxic
E. Lobar pneumonia (OR: bronchopneumonia)
F. Metabolic acidosis
(Alt version of the gas results: pH 7.35; pO2 45mmHg; pCO2 60mmHg; HCO3- 34mmol/l)

AD02 [Mar97] [Mar98]

The ABGs of a 60yr old man who has overdosed on morphine would be:

A. paO2 60, paCO2 55, pH 7.29, HCO3 32, BE -1
B. paO2 40, paCO2 60, pH 7.37, HCO3 26, BE +5
C. ?

AD03 [Jul97] [Mar99] Buffering of a bicarbonate infusion:

A. 60 to 70% occurs intracellularly

- Metabolic acidosis: 57% of buffering occurs intracellularly and 43% occurs extracellularly (Of the 43% EC component, 80% is performed by the bicarbonate buffer system).
- Metabolic alkalosis: 30% IC, 70% EC
- Respiratory acidosis: 99% IC, 1% EC
- Respiratory alkalosis: 97% IC, 3% EC

B. Exchanged for Cl- across the red cell membrane
C. Compensated for by increased respiratory rate.
D. Intracellular proteins

AD04 [Jul97] [Mar98] [Mar99] [Feb00] Phosphate buffer system is an effective buffer intracellularly and in renal tubules because:

A. Its pKa is close to the operating pH
B. High concentration in distal tubule
C. High concentration intracellularly
D. All of the above

(Go to AD04 to see alt version as well)

For a buffer to be effective in a given location you need:

- A high enough concentration of it must be present
- the buffer's pKa to be within 1 pH unit of the local pH
- The acid to be buffered cannot be itself

AD05 [Jul97] [Apr01] Arterial gases including pH 7.46 bicarbonate 31mmol/l PCO2 46mmHg indicate:

A. Metabolic alkalosis with respiratory compensation
B. Respiratory alkalosis
C. Respiratory acidosis with compensation
D. Metabolic acidosis with respiratory compensation
E. Mixed metabolic and respiratory alkalosis
(Apr 01: AB05 changed so 2 top stems read partially compensated then bottom stem was "none of the above")

AD06 [Jul98] Metabolic acidosis is characterised by:

A. Increased H+] intracellularly
B. Decreased production of bicarbonate
C. ?
D. ?
E. ?

AD07 [Jul99] [Feb00] [Jul00] [Jul03] [Feb04] Bicarbonate system is the most important ECF buffer system because:

A. It has a pKa close to physiological pH
B. CO2 can be exchanged in lungs and HCO3 excreted in the kidneys
C: $HCO3^-$ occurs in such large amounts
D. ?
E: CO2 can be regulated by lung & HCO3 by the kidneys

AD08 [Jul00] [Jul10] During infusion of an acidic solution (hydrochloric acid solution), which contributes most to buffering?

A. Phosphate buffer
B. Bicarbonate buffer
C. Intracellular buffers
D. Proteins (?intracellular proteins)
E. None of the above
The processes involved in this buffering are:

ECF 43% (by bicarbonate & protein buffers)

ICF 57% (by protein phosphate and bicarbonate buffers) due to entry of H+ by: Na+-H+ exchange 36%, K+-H+ exchange 15%, Other 6%

AD10 [Apr01] [Jul04] [Jul10] A patient is draining 1 litre of fluid per day from a pancreatic fistula while maintaining normal volume status. The most likely acid-base disorder is:

A. Hyperchloraemic metabolic acidosis
B. Hypochloraemic metabolic acidosis
C. Metabolic acidosis with normal chloride
D. Hyperchloraemic metabolic alkalosis
E. Hypochloraemic metabolic alkalosis

AD11 [Apr01] ABG's in healthy young man with pneumothorax:

A. pO2=50, pCO2=25??
B. pO2=50, pCO2=46
C. pO2=90, pCO2=25
D. pO2=90, pCO2=46
Alt version: ABG of young male who develops total collapse of one lung postop:

A. pO2 95mmHg pCO2 50 mmHg
B. pO2 80mmHg pCO2 50mmHg
C. pO2 90mmHg pCO2 25mmHg??
D. pO2 60mmHg pCO2 50mmHg

AD12 [Mar03] [Jul03] [Jul10] For the following blood gas results, which clinical scenario fits best?

2003 version: ABGs pH 7.48, PCO2 24 (or 26), HCO3 19 BE 15
Jul10 version: ::ABGs: pH 7.53, PCO2 26, HCO3 22
A. Mixed metabolic and respiratory acidosis
B. Acute respiratory alkalosis

C. Metabolic acidosis with compensated respiratory alkalosis

D. Chronic respiratory disease

E. Mountain climber after several weeks at altitude

F. Hyperventilating consistent with acclimatisation to altitude

G. Hyperventilation for 5 mins

A CO_2 this low (24) would be expected to produce a pH of about 7.53. (0.1 change for every 12mmHg of CO_2 away from 40mmHg).

AD13 [Mar03] [Jul03] A 26 year old female with the following ABG's: pH 7.1, pCO_2 11, pO_2 110

A. ?

B. Metabolic acidosis with respiratory compensation

C. ?

AD13b [Feb04]

A 19 year old is admitted unconscious. She has the with the following arterial blood gases:

PaO_2 117 $PaCO_2$ 11 pH 7.1 Base excess -15

This is most consistent with:

A. Metabolic acidosis with respiratory compensation

B. Respiratory alkalosis with metabolic compensation

C. Mixed metabolic and respiratory acidosis

D. ?

AD15 [Mar05] A previously healthy man with this blood gas:

pH 7.40

pCO_2 50

pO_2 88

Must indicate

A. Breathing $FIO_2 > 0.21$

B. Acute respirator acidosis

C. Fully compensated metabolic acidosis

D. HCO_3 levels will be raised

E. ?Mixed respiratory & metabolic acidosis

AD16 [Mar05]

A man is air lifted up to 5000m and his arterial blood gas is taken after ½ hr. He lives there and his blood gas is repeated after 1 week. Compared to the first sample, the second blood gas shows:

A. No change in PaCO2 and PaO2

B. PaCO2 increase, PaO2 increase

C. PaCO2 increase, PaO2 decrease

D. PaCO2 decrease, PaO2 decrease

E. PaCO2 decrease, PaO2 increase

↑ in minute vol. in response to hypoxia at altitude is limited by the resulting respiratory alkalosis which tends to ↓ MV via central chemoreceptors. Then the renal compensation to respiratory alkalosis (HCO3 excretion - maximal at 3-4 days) results in HCO3 movement out of CSF and thus correcting CSF pH toward normal - 'releasing the brakes' on respiratory centre and allowing further increase in minute ventilation and further decrease in pCO2, and further improvement of pO2.

AD17 [Jul05] [Feb06]

ABG: pH 7.48, PaO2 70, HCO3 raised (~35mmHg), PaCO2 48 (OR 58).

This ABG could be explained by:

A. Acclimatisation to altitude

B. COAD

C. Metabolic acidosis

D. ?

E. Prolonged vomiting

Boston Rules Strategy:

pH 7.48 PO2 70 pCO2 48 HCO3 35

Step 1 pH>7.44 = alkalosis

Step 2 pCO2 and HCO3 raised = metabolic alkalosis OR respiratory acidosis

Step 3 No clues

Step 4 Assess respiratory compensation- One and a Half Plus Eight Rule Expected pCO2 = 1.5[HCO3] + 8 = 1.5[35]+8 = 60.5 >> 48 (but 58 about right)

Step 5 Metabolic alkalosis with appropriate respiratory compensation

AD18 [Feb06] [Feb08] Base excess calculation:

Base excess or deficit is the amount of acid or base required to titrate whole blood at 37 degrees celcius and PaCO2 of 40 mmHg to a pH of 7.4

A. When PaCO2 is 40 mm Hg

B. Difference of measured HCO_3 from standard HCO_3

C. Lower with higher HCO_3

D. Is an indicator of cellular buffers

E. Is negative when pH is greater than 7.40

AD19 Which of the following is a 'strong ion'?

A. PO4

B. SO4

C. Cl

D. ?

Common Strong Cations: Na,K,Mg,Ca

Common Strong Anions: Cl,Lactate,Ketone bodies

AD20 During infusion of hydrochloric acid (HCl), which contributes most to buffering? (repeated MCQ)

A. Phosphate buffer
B. Bicarbonate buffer
C. Intracellular buffers
D. Proteins (?intracellular proteins)
E. None of the above
ECF 43% (by bicarbonate & protein buffers)

ICF 57% (by protein phosphate and bicarbonate buffers) due to entry of H+ by: Na+-H+ exchange 36%, K+-H+ exchange 15%, Other 6%

AD21 Which of the following sets of values are measured directly by ABG machine

A. pCO2, paO2, pH
B. paCO2, HCO3, pH
C. paCO2, base excess, paO2
D. *Something with base excess*
E. Something with HCO3
Arterial blood gas machines measure PaO2, PaCO2 and pH. HCO3 is determined by substitution of the known values into the Henderson Hasselbach equation

AD22 [Feb08] Person with these blood gas results: pH 7.33 CO2 58 HCO3 33

A. Acclimitization after several weeks at altitude
B. Person with chronic pulmonary disease
C. Diabetic ketoacidosis
D. Hyperventilation
E. Prolonged vomiting

AD23 [Feb08] Person with these blood gas results: pH 7.53 pCO2 27 HCO3 22

A. Acclimitization after several weeks at altitude
B. Person with chronic pulmonary disease
C. Diabetic ketoacidosis
D. Hyperventilation
E. Prolonged vomiting

AD24 [Aug11] Buffering by Hb better than by plasma proteins because

A. Hb has 38 carboxyl residues histidine (imidazole)
B. great amount
C. plasma poreint pKa near pH of Blood
D.
E.

AD25 [Aug11] If pH is 7, then H+ concentration of pure water is:

A. O

B. 40 nmol/L
C. 70 nmol/L
D. 100nmol/L
E. 1000nmol/L
45 nmol/L for pH 7.35
40 nmol/L for pH 7.4,
35 nmol/L for pH 7.45

AD26 [Aug11] Fluid loss from pancreatic fistula with normovolaemia

A. Hypercholremic metabolic acidosis
B. ?
C. *all other combos*

AD27 [Mar10] [Aug11] [Feb12] With pCO2 200mmHg, what else would you find

A. Hyperkalemia
B. Bradycardia
C. Hypercalcaemia
D. Hypermagnesemia
E. Hypo ?K/?Ca

AD28 [Mar10] In plasma, a 'strong ion':

A. is usually a cation
B. is usually an anion
C. has its pKa close to 7.40
D. almost completely dissociates
E. ?
By definition, a strong ion is essentially completely dissociated at physiological pH.