Deacon's Challenge No. 10 Answer

A patient receiving total parenteral nutrition is receiving 11.8g nitrogen/24h as amino acids. Urinary urea excretion is 580 mmol/24h. Indicating what assumptions you make, calculate whether she is in positive or negative nitrogen balance.

(MRCPath November 1999)

First calculate the urinary nitrogen excretion from the urea excretion:

Formula of urea: $CO(NH_2)_2$ Atomic weight of nitrogen = 14

Therefore each mmol of urea contains 2 x 14 = 28 mg of nitrogen
and the urinary nitrogen excretion is 580 x 28 = 16240 mg/24h

Divide by 1000 to convert to the same units as intake (g/24h):

$$\text{Urinary nitrogen excretion} = \frac{16240}{1000} = 16.2 \text{ g/24h (3 significant figures)}$$

Nitrogen balance = nitrogen intake - nitrogen excretion
= 11.8 - 16.2 = -4.4 g/24h

Therefore the patient is in negative nitrogen balance.

Assumptions made:
No other significant route for nitrogen excretion (i.e. urea loss via gut, sweat or fistulae).
No other significant nitrogen loss in the urine (i.e. amino acids, ammonia etc).
Urine flow adequate to minimise urea reabsorption.
That all amino acid nitrogen is converted to urea.

These assumptions are never true and it is quite common for urinary urea to account for between 60-90% of nitrogen loss. Adjustments have been proposed to attempt to correct for other nitrogen losses:

Addition of 20% to allow for other urinary nitrogen losses.

$$\text{Adjusted urinary nitrogen excretion} = \frac{16.2 \times 120}{100} = 19.4 \text{ g/24h}$$

Addition of 2g/day to account for other routes of loss (e.g. faeces).

Adjusted total nitrogen excretion = 19.4 + 2 = 21.4 g/24h
Adjusted nitrogen balance = 11.8 - 21.4 = -9.6 g/24h

So that the patient would be in an even greater negative nitrogen balance.

Correction to No. 9 Answer

For those of you who were perplexed, the NAD and NADH concentrations should have been in units of µmol/L and not mmol/L as printed.

Sorry!

Question No. 11

A male adult insulin-dependent diabetic forgot to take his insulin. His blood glucose concentration, which was 5 mmol/L, rose to 15 mmol/L in two hours.

Estimate the effect on his plasma sodium concentration, assuming that no other water intake nor loss of water from the body takes place during this time, indicating what assumptions you make.

(MRCPath November 1998)