



Clinical Chemistry

Kidney function tests

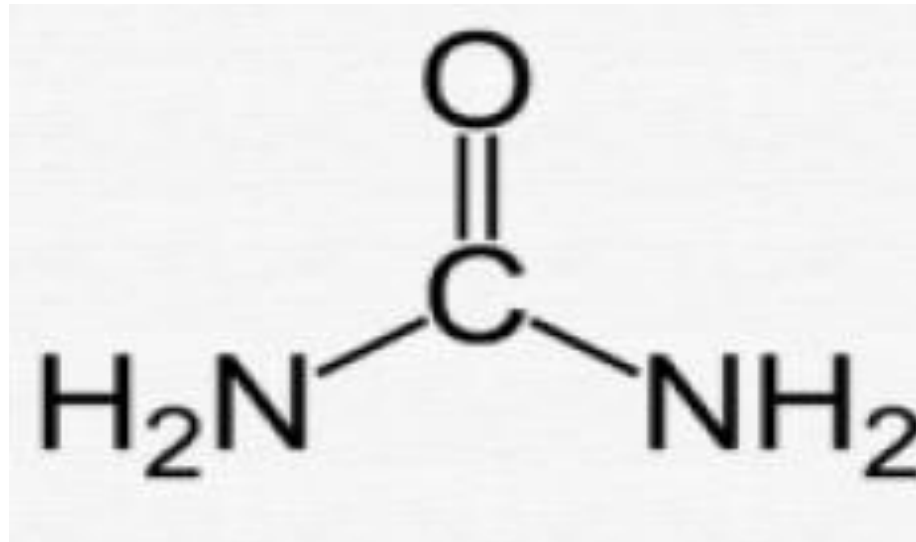
PART I



Why renal function tests are required?

- 1 Determine whether the kidneys are functioning normally.
- 2 Monitor the progress of kidney disease.
- 3 Monitor the kidney function of people who take medications that can cause kidney damage.
- 4 Monitor the effectiveness of dialysis and other treatments related to failure.
- 5 Ordered in cases of high blood pressure to assess kidney function.

Determination of blood or serum urea

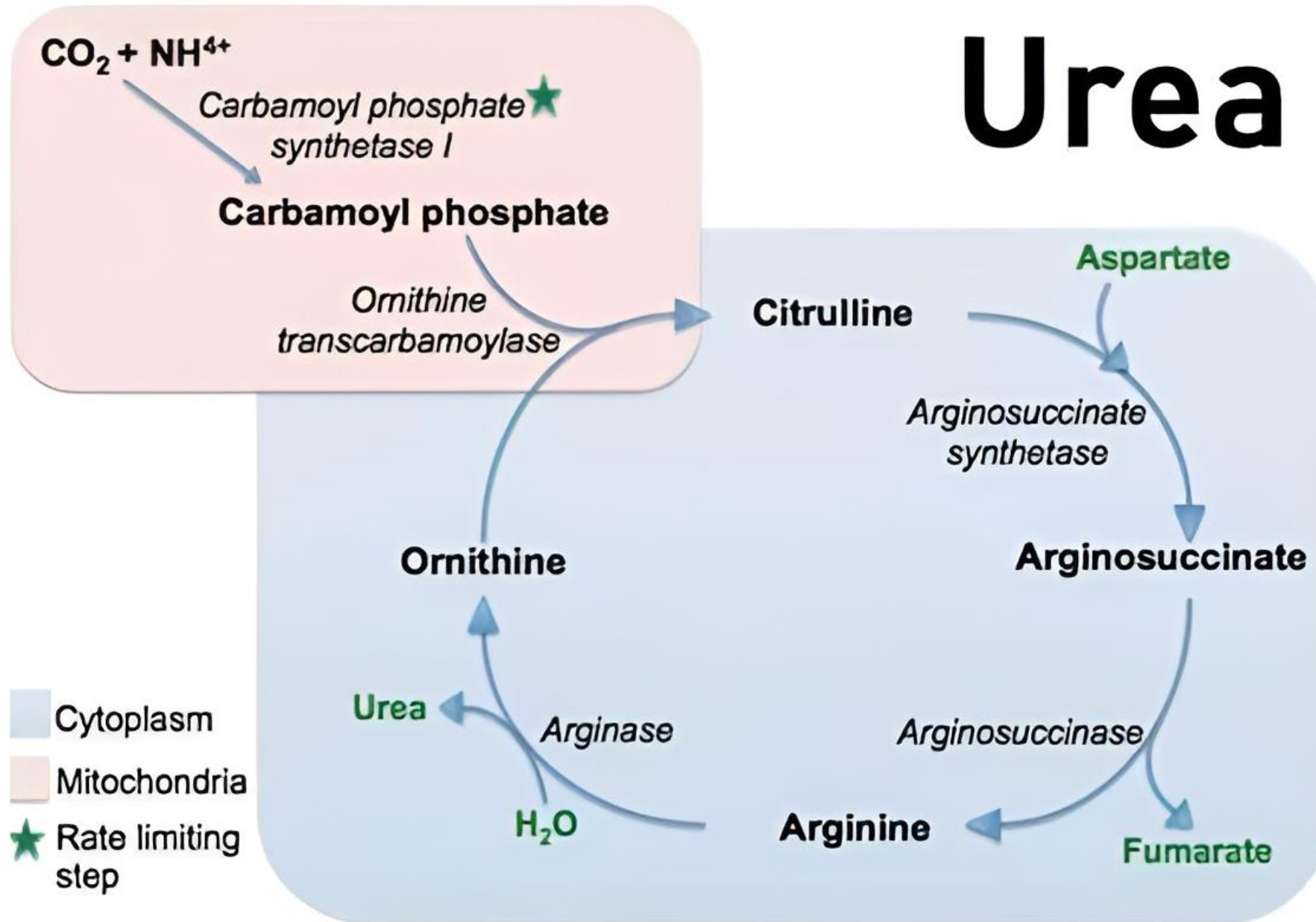


Background:

Urea is the major end product of protein nitrogen metabolism. It is synthesized by the urea cycle in the liver and excreted through the kidneys. The circulating levels of urea depend upon protein intake, protein catabolism and kidney function. Elevated urea levels can occur due to renal impairment or in some diseases such as diabetes, infections, congestive heart failure and during different liver diseases. Determination of blood urea nitrogen is the most widely used screening test for renal function together with serum creatinine.

Urea Cycle

Enzymes & Steps



Clinical significance :

Normal renal function depends on a normal filtration rate , normal tubular function and normal blood supply. A low GFR (glomerular filtration rate) lead to uremia.

➤ Causes lead to increased serum urea concentration :

1- Increase production (High protein diet , increase catabolism of cellular protein of the body as in fever and infection) .

2- Decrease GFR may be due to :

- Reduction of blood volume , which could be associated with gastrointestinal loss, reduced intake and dehydration
- Reduced pressure due to shock as a result for example MI or intravascular hemolysis.

3- Post-renal uremia as a result for example renal calculi or kidney diseases

➤ Causes lead to decreased serum urea concentration:

- 1 Malnutrition
- 2 Very severe liver disease
- 3 Inborn error of urea cycle
- 4 Inappropriate ADH secretion

Principle :

Urea is hydrolyzed by urease forming ammonia and carbamic acid. Carbamic acid spontaneously decomposes into ammonia and carbon dioxide.

The released ammonium, in the presence of salicylate and nitroferricyanide reacts in alkaline solution of sodium hypochlorite, to form a green dye compound.

The intensity of the green color produced is directly proportional to the urea concentration.

Procedure:

Pipetting in tubes:

	BLANK	STANDARD	SAMPLE
Reagent (R3)	1000 µL	1000 µL	1000 µL
R2	50 µL	50 µL	50 µL
Standard		10 µL	
Sample			10 µL

Mix and incubate for 3 min at 37 C or 5 min at 20-25C

Reagent (R4)	200 µL	200 µL	200 µL
--------------	--------	--------	--------

Incubate for 5 min at 37C or 10 min at 25C and read sample and standard extinction against blank.

Notes:

Wave length: 578nm (578-630)

Optical Path: 1 cm light path

Temperature: 20-25 / 37 C

Reading: Against reagent blank

Calculation:

$$\text{UREA mg/dl} = \frac{\text{A Sample}}{\text{A Standard}} \times 50$$

Unit conversion

$$\text{mg/dl} \times 0.166 = \text{mmol/l}$$

Expected value:

Serum/Plasma: 45-15mg/dl - 7.5-2.5mmol/l

Urine: 35-20g/24h - 580-330mmol/24h

Thank you