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ST VINCENT'S PATHOLOGY

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CREATININE INFORMATION SHEET

PHYSIOLOGY

Creatinine is spontaneously formed from creatine in muscle and released into the bloodstream at a fairly constant rate. It is removed from the body by largely by glomerular filtration although additionally there is a small amount of creatinine removed by renal tubular secretion and gastro-intestinal losses. By far the major determinants of serum creatinine concentration are muscle mass and glomerular filtration rate (GFR). As muscle mass is generally constant within an individual over short time periods, changes in serum creatinine are useful markers of changes in GFR.

In any individual with stable renal function the scatter of serum creatinine concentrations is very small and can be described with a Coefficient of Variation (CV) of about 4%. By contrast there is a wide variation in creatinine concentrations between individuals. This means that population-based reference intervals are often a poor tool to identify early renal impairment. Comparison of a result with a patient's own previous serum creatinine measurement provides a much more sensitive tool for detection of changes in renal function. In general changes in an individual's serum creatinine of 20% or more are highly likely to indicate a significant change in renal function.

PATHOLOGY

Decreases in GFR are marked by a rise in serum creatinine. The relationship is described mathematically as a rectangular hyperbola, meaning that as the GFR falls by half, there is approximately a doubling in the serum creatinine. This means that by the time a rise in serum creatinine is detected, there may be 30 - 50% fall in GFR. Thus, serum creatinine is a very specific marker of falling GFR (ie there are no other causes of a significant rise in serum creatinine) but it is not very sensitive for small decreases in GFR.

With increasing adult age there is generally a significant fall in GFR which is nearly matched by a concomitant fall in muscle mass. The combined effect of these changes is that serum creatinine changes very little with advancing age into the geriatric range, despite decreasing GFR. Estimation of the GFR with a formula such as the CKD-EPI formula or the Cockcroft and Gault equation allows better quantitation of decreased GFR than interpretation of serum creatinine alone.

URINE CREATININE

Creatinine in urine may be measured for a number of purposes. In a 24 hour urine sample urine creatinine can be used as a rough marker of completeness of the sample. Samples with a low 24 hour urine creatinine (and/or low urine volume) may be due to incomplete collection and samples with high 24 hour urine creatinine may be due to collection for longer than a single day. Note that these findings may be due to low or high muscle mass for the patient respectively. Urine creatinine may also be measured in a 24 hour urine sample

to calculate the creatinine clearance, although this method of estimating creatinine clearance is considered less accurate than calculations such as CKD-EPI or the Cockcroft and Gault equation in most circumstances.

Creatinine is often measured in spot urine samples as a marker of the effect of hydration on other analytes, for example measurement of the albumin:creatinine ratio. A low spot urine creatinine generally indicates high urine output, for example after high fluid intake and high urine creatinine may be caused by the body's response to dehydration. In the setting of urine drug testing a very low urine creatinine may be due to dilution of the sample with water or other fluids.