ADRENAL STRESS DURING HAEMODIALYSIS

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Cortisol is the main biologically active steroid secreted by the adrenal that can be estimated in the plasma by fluorescent techniques (Mattingly, 1962). Variations in the level of the plasma cortisol in the main reflect alterations of cortisol secretion rate. In the normal person there is a diurnal pattern of plasma cortisol in which the levels are highest at 10.00 am, and fall progressively during the day to the lowest level at midnight (see Fig. 1). Following acute stress there is a sharp rise and fall of the plasma cortisol (Klein and Palmer, 1963) but in chronically maintained stress the levels may be normal but there is a loss of diurnal rhythm (Penkoff et al., 1959).

DIURNAL PATTERN OF PLASMA CORTISOL
IN MEDICAL STRESS

Fig. 1. Plasma cortisol levels during the 24 hours in patients stressed by acute pyrexial illness. Shaded area shows the normal range.

The present study was part of an investigation of the effects of a variety of acute and chronic stressful illnesses on adrenal function. Fig. 1 illustrates the plasma cortisol levels from patients with acute pyrexial illnesses mainly exacerbation of chronic bronchitis. The levels during the day were all within the normal range but over half the patients showed elevated midnight levels.

Fig. 2 shows the mean plasma cortisol levels taken during 13 haemodialyses with a Koff kidney on 9 patients in the renal unit at Hammersmith Hospital. Eight patients were in chronic renal failure but 1 was a salicylate overdose. The separate plot shown in grey (power-line) is of a patient who was on Prednisone 20 mg/day.
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![Graph showing plasma cortisol levels during haemodialysis analysis of 13 dialyses in 9 patients.](image)

**Fig. 2.** Plasma cortisol levels (below) and plasma urea levels (above) during 13 dialyses on 9 patients. Solid lines indicate mean results and broken vertical lines show the range. The lowest (grey) line indicates one patient on prednisone.

The resting levels before dialysis are high and there is no alteration after connecting the patients to the kidney. During the dialysis the mean plasma cortisol level rose to 32.0 μg% at 240 min. and then fell slightly to 29.9 μg% at 360 min. These figures are considerably higher than the normal range. The rise probably reflects increasing adrenal secretion either due to continued stress or the effects of removal from the plasma of a small amount of unbound free cortisol. Very slight changes in the 'free' cortisol can alter the rate of release of ACTH from the pituitary. This may be shown in the case graphed separately. This patient on 20 mg/day of Prednisone started the dialysis with a very low plasma cortisol level which is normally found with steroid-induced pituitary adrenal suppression. During the dialysis the plasma cortisol rose indicating secretion of endogenous cortisol. This must indicate that the Prednisone had been removed by dialysis thus releasing pituitary inhibition. The danger in patients on chronic steroid therapy is that the adrenals may be too atrophic to respond. There would then be the danger of an adrenal crisis.

**Summary**

The plasma cortisol of 9 patients during 13 haemodialyses showed a steady rise throughout the procedure indicating increasing adrenal secretion. The case of a Prednisone suppressed patient is shown, demonstrating the possible dangers of adrenal unresponsiveness.

**REFERENCES**

