# Non Invasive Pulse Wave Analysis and Measurement of Cardiac Output During Hemodialysis
## - preliminary data -

C. L. Neumann[1], V. Claes [1], V. Schettler[1], E. G. Schulz[1]

[1]Center of Nephrology Goettingen GbR, An der Lutter 24, 37075 Goettingen, Germany

Nephrologisches Zentrum Göttingen

**Introduction:** The vascular structure of patients with end-stage renal failure undergoing chronic haemodialytic treatment differs from the structure of other hypertensive individuals due to hyperparathyroidism, calcium and volume overload, severe hypertension, uraemia and renal anaemia. The often required high ultrafiltration rate caused by the increased interdialytic weight gain is associated with haemodynamic events such as symptomatic hypotension, cramp and also higher mortality compared to patients with well controlled fluid intake. A more detailed monitoring of haemodynamic parameters during the haemodialysis session may provide an individual and more adequate hemodialysis regimen especially at respect to the ultrafiltration rate.

**Patients/ Methods:**

In 10 patients with end-stage renal failure peripheral blood pressure (pBP), augmentation index (AIx), central [aortic] blood pressure (cBP) and cardiac output (CO) was measured every 15 minutes during the haemodialysis session and additionally for the following 20 hours (4 times per hour during day / twice per hour during night time) by using the Mobil-O-Graph NG 24h PWA control from IEM, Germany. This new blood pressure monitor oscillometrically captures the pulse wave form from the brachialis artery by an upper-arm cuff. Within a single measurement cycle, the cuff pressure is hold for a time period of 10 seconds at diastolic value during cuff deflation. The recording time of the oscillometric signal at diastolic level allows the derivation of central heamodynamic parameters, such as cBP, AIx and CO from the pulse wave form by means of a transfer function. The pBP reading serves as the baseline for the embedded algorithm. In a non-invasive manner it is thereby possible to capture the parameters as described above over a day-/night cycle.

**Results:** Preliminary data showed a strong correlation between systolic (r=0.872) and diastolic (r=0.872) pBP and cBP before haemodialysis (AD), during (HD) and in the interdialytic interval (ED) in patients with a ultrafiltration rate > 600ml/h or < 600 ml/h (fig.2).

Systolic pBP (AD: 145.6 mmHg; HD: 122.8 mmHg; ED: 114.6 mmHg) was higher than systolic cBP (AD: 136.3 mmHg; HD: 111.5 mmHg; ED: 108.5 mmHg) at any period of the measurements (p= 0.007).

Mean cardiac output before HD was 4.2 l/min, during HD 3.8 l/min and in the period following HD 3.7 l/min (fig.3) and augmentation index (AIx) shows a significant (p=0.002) decrease under haemodialysis and a significant increase (p=0.02) after haemodialysis on average (AD: 20; HD: 8; ED: 16). There were no significant differences between patients with an ultrafiltration rate < 600 ml/h and those with > 600ml/h shown.

**Conclusions:**

The new possibility in the capture of central haemodynamic parameters promises to provide more relevant information about haemodynamics during haemodialysis and the individual vascular structure of patients with endstage renal failure. These data may help to prevent hypotensive episodes during haemodialysis which are associated with an increase in mortality. More patients have to be investigated and a correlation analysis of haemodialysis and clinical parameters such as interdialytic weight gain, stage of hyperparathyreoidism, blood pressure and medication should be performed to develop new and more appropriate individual adjustments during haemodialysis.

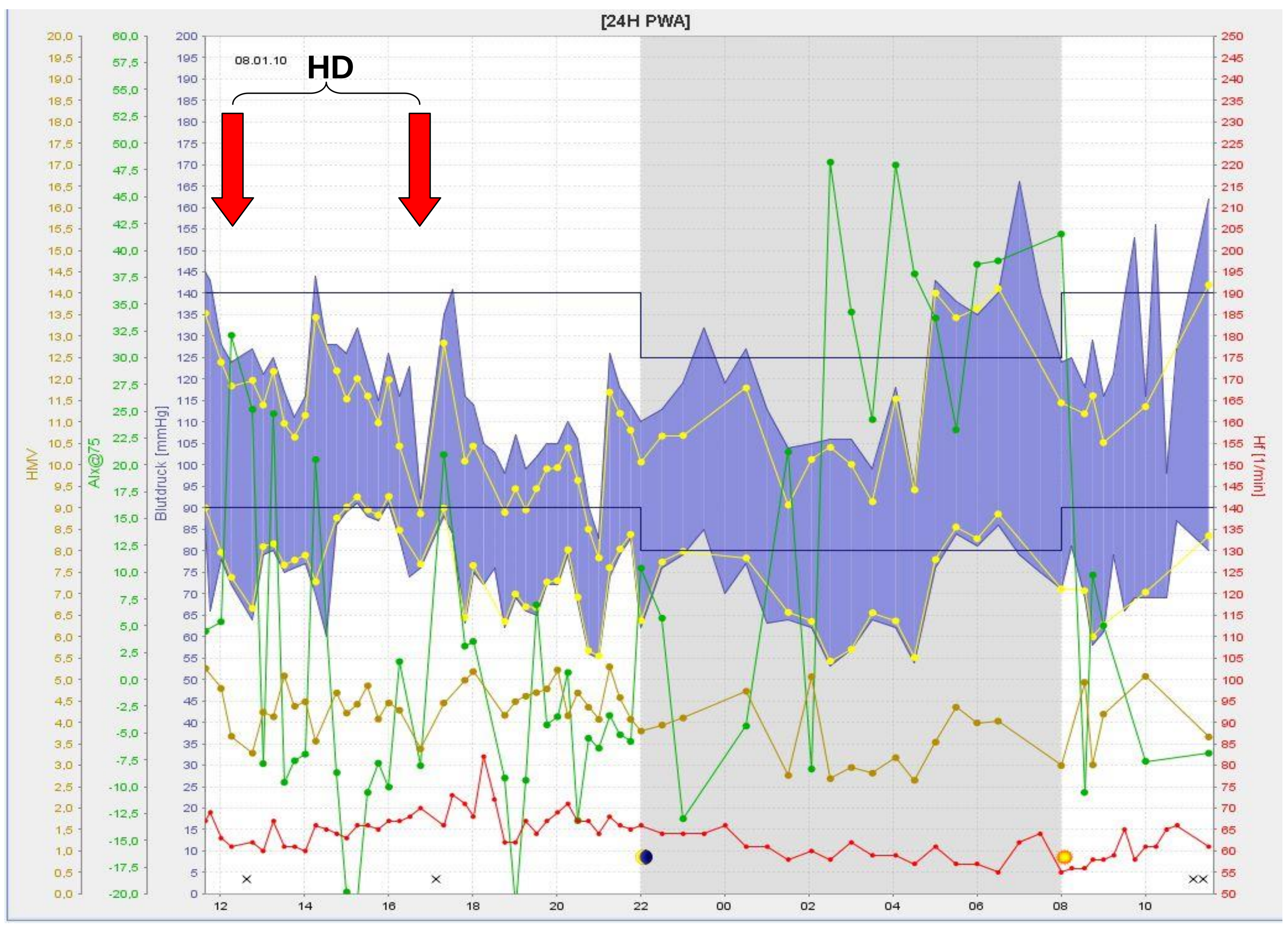


fig. 1

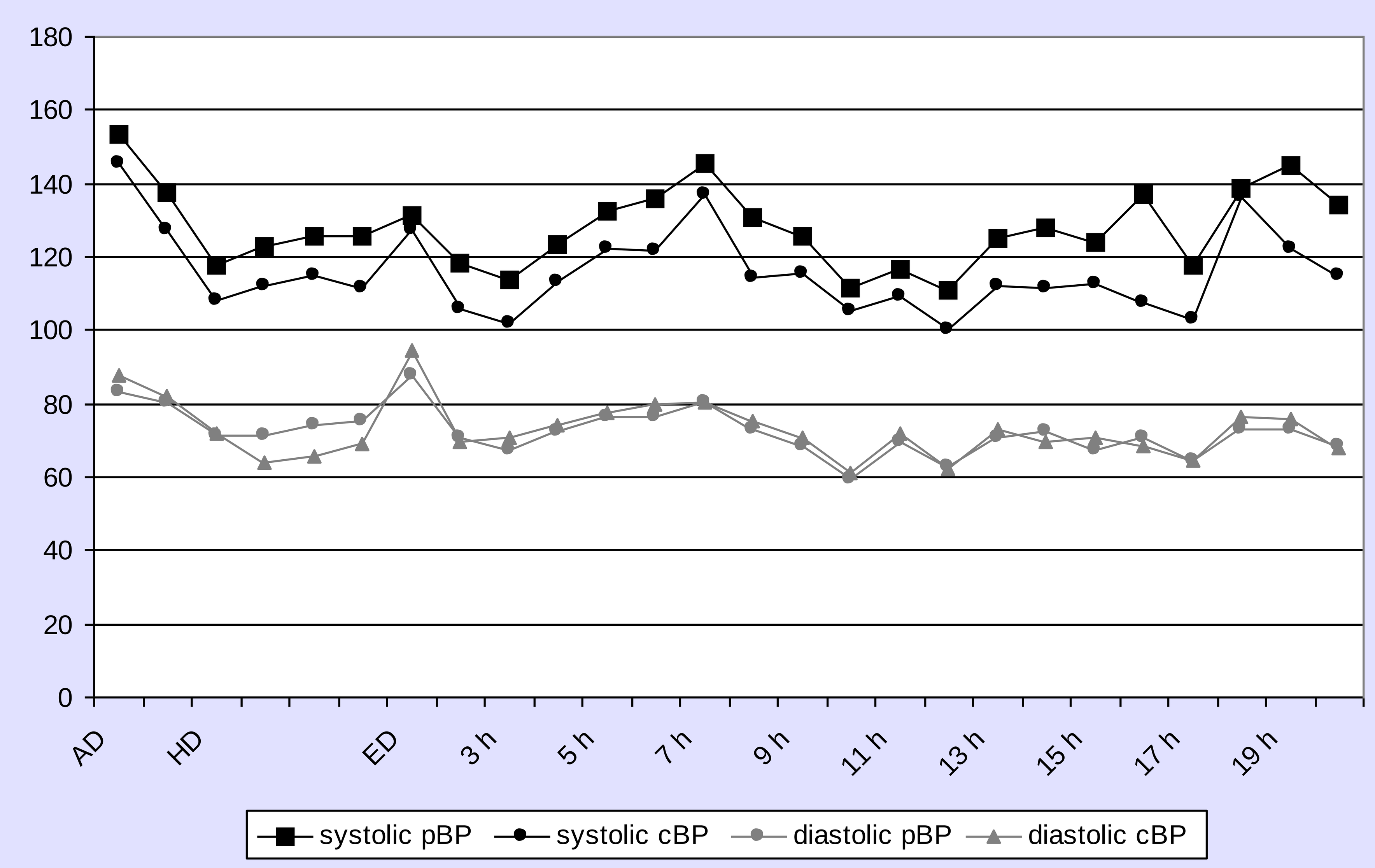


fig. 2

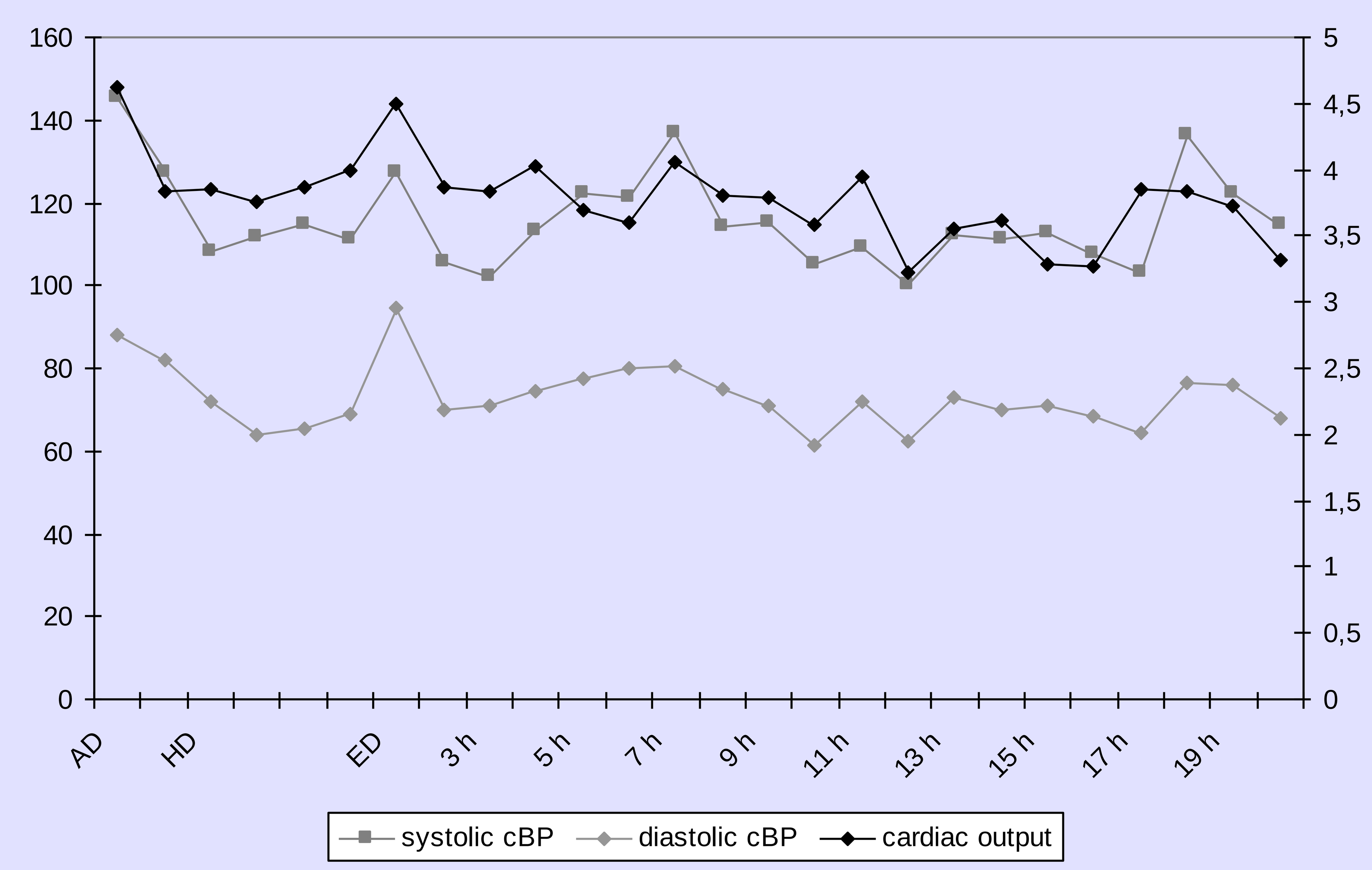


fig. 3