

multi**Plus** – CRRT solution with phosphate

The plus point for your patients



During an effective CRRT treatment the removal of uraemic toxins from the patient's blood is desirable, but important nutrients such as glucose and phosphates are also lost. To limit the loss of glucose, modern CRRT solutions contain a near physiological glucose concentration. Following the same principle, the negative results of an excessive phosphate loss can be avoided. multi**Plus** is a unique advanced CRRT solution containing a physiological phosphate concentration with which the development of hypophosphatemia can be avoided.

Phosphate Loss during CRRT treatment

During a CRRT treatment using a phosphate-free dialysis solution and a dose of 2 L/h, the patient's blood loses approximately 1.7 mmol phosphate per hour. This equates to 40 mmol/day and this exceeds many times the amount of phosphate available in the blood plasma.^[1] The result is a significant removal of phosphate from the cellular lumen with unwanted effects on the intracellular buffer system. Without phosphate substitution, a renal replacement therapy over several days leading to the formation of hypophosphatemia can be expected. This can have negative consequences for a variety of body functions.

Possible Clinical Results of Hypophosphatemia^[2]

- Apnoea
- Limitation of cardiac capacity
- Leucocyte failure
- Rhabdomyolysis
- Haemolysis
- Diabetic ketoacidosis
- CNS dysfunction

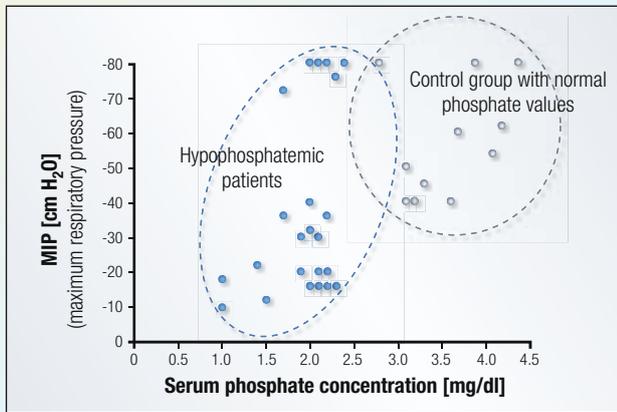


Figure 1: Correlation of the muscular breathing apparatus strength with the serum phosphate concentration. The majority of patients from the group of hypophosphatemic patients show a lower strength of the breathing apparatus muscles in comparison with the group having normal serum phosphate values.^[2]

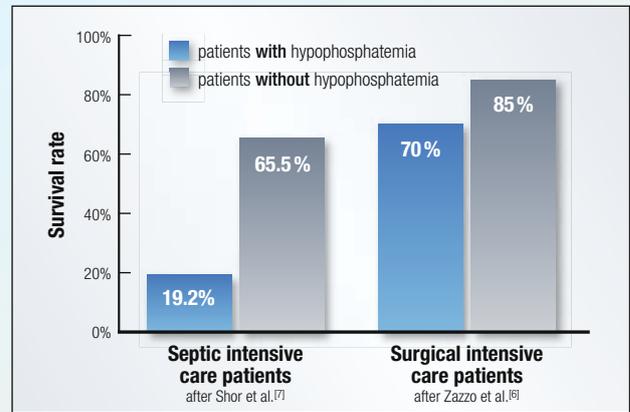


Figure 2: Mortality rate of septic and surgical intensive care patients in relation to hypophosphatemia

Clinical Relevance of Hypophosphatemia

Hypophosphatemia results in reduced availability of ATP in body cells.^[3-5] For example, this could result in the reduction of strength in the breathing muscle apparatus. The majority of patients with hypophosphatemia show a reduction of the pulmonary performance (Fig. 1). It is often difficult to terminate artificial respiration within this group of patients. Hypophosphatemia can result in a deficiency of 2,3-diphosphoglycerate in erythrocytes. Following the altered oxygen binding to the haemoglobin this can lead to tissue hypoxia.^[4]

Hypophosphatemia: Predictive for Mortality

Results of studies on septic and surgical intensive care patients proved that a severe hypophosphatemia is predictive for mortality. Both groups of patients demonstrated a considerably higher mortality in hypophosphatemic patients than in patients with normal serum phosphate values (Fig. 2).^[6,7] Studies showed that 28.8% of surgical intensive care patients developed hypophosphatemia after the surgical procedure.^[6] A higher risk of the development of cardiac arrhythmia could be demonstrated in patients in the early stages of a sepsis with lower serum phosphate values.^[8] The results as a whole impressively demonstrate the clinical relevance of the prevention of hypophosphatemia.



Treatment of Hypophosphatemia

The treatment of renal failure with a phosphate-free dialysis solution results in a considerable reduction of the serum phosphate concentration and necessitates the substitution of phosphate (Fig. 3A). The development of hypophosphatemia can be prevented by the use of a dialysis solution containing phosphate (Fig. 3B). A separate adjustment of the phosphate substitution for the efficacy of the renal replacement therapy is unnecessary. Thereby complications connected to over- or under-dosing of the substituted amount of phosphate are avoided.^[9] Thus, a dialysis solution containing phosphate should be used preferentially to a separate phosphate substitution.^[10]

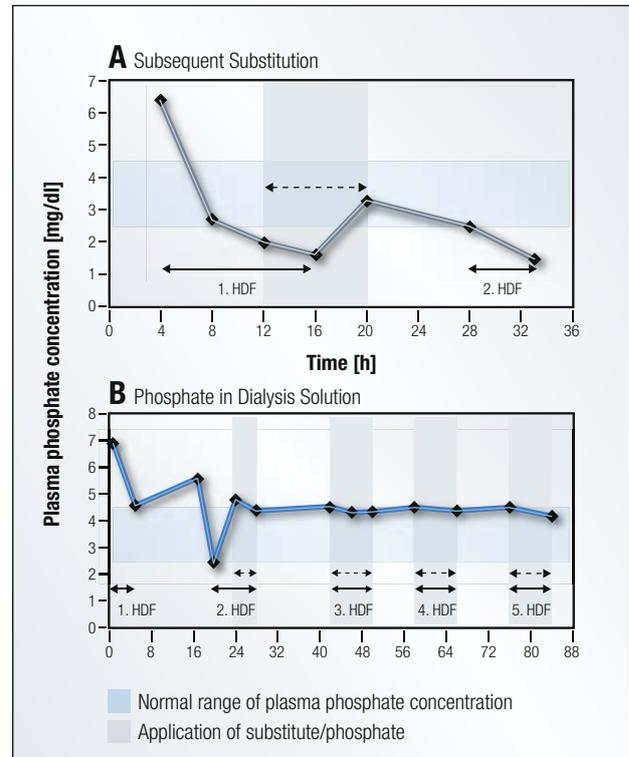


Figure 3: Development of the serum phosphate concentration during intermittent dialysis (after Gatchalian et al. 2004):

A: Dialysis solution without phosphate. During the first renal replacement therapy the serum phosphate concentration is reduced and necessitates a phosphate substitution of 40 mmol during 8 hours (highlighted in grey). The normalised serum phosphate concentration is again reduced considerably during a subsequent renal replacement therapy.

B: Usage of a dialysis solution with phosphate during the second and all subsequent treatments prevents the necessity for a further phosphate substitution and stabilises the serum phosphate concentration within the normal range. (Treatment intervals with dialysis solution containing phosphate are highlighted in grey).

multiPlus

A unique improved therapeutic concept



Figure 4: multiPlus, a novel bicarbonate-buffered CRRT solution containing phosphate in a PVC-free 5 litre dual chamber bag, preventing the formation of hypophosphatemia. After mixing both compartments the ready-to-use solution must be used within 48 hours.

multiPlus possesses the known advantages of bicarbonate buffered CRRT solutions,^[11,12] combined with a physiological concentration of 1 mmol/l phosphate. Herewith, multiPlus prevents the excessive reduction of phosphate during the CRRT treatment and thus prevents the formation of hypophosphatemia with all its negative implications for the patient.

multiPlus means that there is no need for separate phosphate substitution to compensate for losses during CRRT and its subsequent adjustment for the efficacy of the CRRT treatment.

Description/Art. No.		Solution composition:							
Name	2 × 5.0 L	Na ⁺ mmol/l	K ⁺ mmol/l	Ca ⁺⁺ mmol/l	Mg ⁺⁺ mmol/l	Cl ⁻ mmol/l	HCO ₃ ⁻ mmol/l	Inorganic Phosphate mmol/l	Glucose g/l
multiPlus	968 820 1	140	2	1.5	0.75	109.7	35	1	1
5 litre bag Packaging: 2 bags/carton, 104 cartons/pallet		Other contents: Aqua ad injectionem, hydrochloric acid 25%, CO ₂							

The advantages at a glance

- Prevents the formation of hypophosphatemia and results in normalisation of the serum phosphate concentration
- Phosphate and glucose ensure the adequate provision of energy rich components for metabolic processes
- Safety and cost efficiency – separate phosphate substitution is unnecessary
- Simple handling due to the 5 litre dual chamber bag

Literature

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