

Thesis Title	Factors Affecting Incompatibility of Parenteral Nutrition Solution
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### ABSTRACT

Parenteral nutrition solution (PN) containing high concentrations of calcium (Ca) and phosphorus (P) are not always available since precipitation will occur. Accordingly, the present study was performed in order to determine factors affecting incompatibility occurred in PN solution and to look for a solution of the incompatibility problem.

The study composed of 2 parts. Part 1 was a study concerning the influence of ingredient concentrations of PN solutions, i.e., dextrose, amino acids, Ca, P, and magnesium. Influence of standing time and storage temperature was included, as well. PN solutions, each 100 ml composed of 0.5 and 1.0 mmol of Ca in the form of calcium gluconate, 0.5 and 1.0 mmol of P in the form of dipotassium phosphate (DPP), 10 and 20 g of dextrose, 1, 2, and 3 g of amino acids, 0.84, 1.68, 2.52, and 3.36 mEq of magnesium in the form of magnesium sulfate and water, were aseptically prepared under clean environment of laminar air flow hood. PN solutions were visually observed and measured for pH immediately after preparation and at 24 and 48 hours after standing in room (27-

35°C) and refrigerated (10-12°C) temperature. Only clear PN solutions were further measured for number of particles of which size over 3, 5, 8, and 16 micrometer, using Coulter Technique. Part 2 study was a trial to solve the incompatibility problem by replacing DPP in PN with either monopotassium phosphate (MPP) or phosphate buffer. PN solutions were then visually observed, measured for pH, and analyzed for particle size.

The Part 1 study showed that 35 of total 120 formulas contained precipitation. The incompatibilities were found to associate with the concentrations of dextrose, amino acids, Ca, P and magnesium, and storage time and temperature. Precipitation was most likely to occur in PN solutions containing 10% dextrose rather than those with 20% dextrose, 1% amino acid rather than 2% and 3%, Ca and P each at 1 mmol/100ml rather than 0.5 mmol/100 ml, and magnesium at 0.84 mEq/100 ml rather than 1.68, 2.52, and 3.36 mEq/100 ml. Storage of PN solutions in room temperature for 48 hours had also tendency to develop incompatibility, compared to those kept in refrigerator or stood for 24 hours. In addition, clear PN solutions had lower pH than turbid PN solutions ( $6.57 \pm 0.11$  vs  $6.73 \pm 0.09$ ) and contained many particles, mostly less than 8 micrometer. When MPP or phosphate buffer was used in the place of DPP, all PN solutions previously turbid were visually clear and had relatively acidic stable pH ( $5.83 \pm 0.10$  and  $6.15 \pm 0.06$  for MPP and phosphate buffer, respectively). PN solutions containing MPP remained clear for at least 48 hours after preparation but those with phosphate buffer developed flakes after standing in room temperature for 24 hours. Although the use of MPP and phosphate buffer could prevent the incompatibility problem, the PN solutions had a relatively acidic pH and would lead to metabolic acidosis when administration. Patients on these PN solutions thus should be monitored of acid-base balance.

Conclusions of the study were that pH and the compositions of PN solutions both determined the incompatibility problem in which potentiated by standing time and storage temperature. One solution for the problem would be the use of MPP or phosphate buffer as a P source in PN solutions.