SOMETHING WORHT-REMEMBERING

Solutions for Intravenous Infusion

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There are three main reasons for choosing the intravenous route of administration-the need for a speedy action; the need to give a volume of solution greater than can be accommodated subcutaneously, or intramuscularly; and the special cases of blood, and of plasma and plasma expanders, in which an intravascular action is specifically required. This article deals with intravenous infusions (drips) for the repair of electrolyte disturbances and the maintenance of nutrition in acute illness. The intravenous use of blood and fat emulsions, protein hydrolysates and amino acids will be discussed separately in Prescribers' Journal shortly.

Water and Electoriytes

Water can be supplied intravenously in the form of 5 per cent dextrose, the amount given depending of the observed urine-volume, and on the balance between water derived from food or tissue breakdown and water lost insensibly by skin and lungs. The second of these two quantities is, in a temperate climate nearer 500 ml. than a litre, especially if body-fat (which supplies at least its own weight of water) is being broken down. The total daily volume needed for the maintenance of water requirement will be of the order of 2 litres, except in anuria, when it is 0.5 liters. Larger amounts would of course be needed to correct existing deficits, or to keep pace with

continuing abnormal losses; circumestances which may increase the daily fluid requirement to six liters or more.

Thirst and increased sodium- concentration in the plasma or serum are the two main indications that insufficient water is being given; these are of course also produced by hypertonic saline infusion under which circumstances they are clearly invalid as indices of water- depletion. Hyponatremia is suggestive but not at all conclusive, of overloading with water, being found also in sodium-depletion and in a number of situations, including the post-operative state, in which anti-diuretic hormone is secreted, as we call it, inappropriately'.

Sodium-depletion

Alimentary lesses of saline fluid are usually obvious, renal losses of salt water have to be looked for. The evidence that such losses have occurred is to be found in the state known as clinical dehydration, which often concludes notable oliguria and partntially reversible azotaemia. Hyponatremia is common, but not universal. When saline fluids are being lost or have been lost, replacement must include saline, and I use isotonic (0.9 per cent) sodium chloride solution for most cases, reserving hypertonic (5 per cent) saline for the treatment of gross sodium-depletion, or for the cautious treatment of the extrarenal azotaemia which sometimes complicates renal failure. Overloading with saline fluid is indicated by overfilling of the neck veins, and can lead to pulmonary oedema; in an emergency, it can be corrected by frusemide or ethacrynic acid, if there is a residue of renal function.

Potassium-depletion likewise arises most commonly by either the alimentary route or the urine, the latter including the loss of potassium under the stimulus of excess adrenal ateroids. Whenever possible, potassium losses should be replaced by mouth, and this is generally possible in chronic condition. The situation is more difficult in acute gastrointestinal upsets, because then potassium cannot well be given by mouth; there is generally also sodium-depletion which increases the risks of giving potassium; and the serum-potassium level is quite unreliable as an index of potassium-depletion. In these circumstances, massive amounts

of potassium have been successfully given intravenously, but as a safe general rule, I would still recommend that 40 Meq per liter is a limiting safe concentration, and that ordinary drip-rates should not be exceeded. This concentration can be achieved by adding, to the saline or glucose drip, 20 ml. of potassium chloride injection B. P. per litre of infusion fluid. When potassium is being given intravenously; the serum-potassium level should be checked, and also the electro-cardiogram. Alkalosis can generally be treated by saline; infusion, and rarely needs either ammonium chloride or hydrochloric acid though each of these can be given intravenously in dilute form. On the other hand, acidosis in such contexts as recent myocardial infarction is a sign of danger, and is worth correcting by the infusion of 1.85 per cent sodium lactate or 1 per cent sodium bicarbonate. In anoxic tissue, the conversion of lactate to bicarbonate cannot be relied upon, and lactic acidosis is an established entity; in the critically ill patient, bicarbonate infusion is therefore perferable.

Maintenance of nutrition

The alimentary route is always preferable, even if as in the comatose patient it demands the use of an intragastric tube; but intractable vomiting, alimentary obstruction, or the need of for intestinal aspiriation may make so-called intravenous feeding unvoidable. With modern techniques the vein is no longer a citadel which has to be assaulted by cut-down and glass cannula; and there seems little excuse for imposing total starvation on any patient for longer than say 24 hours. The caloric and other nutritional needs of the patient in acute illness are no less than those of some patient in normal health; the catabolic respones to infection or trauma is likely to equal, if not exceed, the sparing of calories by bed rest. This does not mean that a few days of intravenous feeding must necessary include fat emulsions and protein hydrolysates; but that sufficient carbohydrate calories should be given to prevent the breakdown of bodyprotein merely to satisfy energy requirements. This condition of minimum protein catabolism was shown by Gamble to be attained by as little as 100 of carbohydrate daily (equiva-

lent to 400 calories) when there is no renal damage, this amount can be given as 2 litres of 5 percent dextrose. In the patient with acute renal failure the fluid intake should not exceed 500 ml. if this has to be given intravenously, 20 percent dextrose can be given by catheter passed up into the vena cave. (it is however, greatly preferable to control the ureamia by peritoneal dialysis to prevent vomiting, and so allow oral feeding)

When catabolism is greatly increased (e. g. multiple injury) or when intravenous nutrition is needed for a prolonged period, the above regime is inadequate to supply calories and to maintain nitrogen balance. Intravenous fat emulsion, protein hydrolysates, and mixtures of pure amino-acids are then required.

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