A SHORT NOTE ON THE SURGICAL USE OF SUBCUTANEOUS INJECTIONS OF CARBO- HYDRATES IN EXHAUSTING DISEASES,

AND AS A PRELIMINARY TO SEVERE OPERATIONS.

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To all surgeons who have frequently to operate upon patients in a condition of great exhaustion, to whom subsequently it is necessary for a time to deny food in any considerable amount, some means of supplying their systems with materials which shall in some measure, at all events, make up to them for their hourly tissue waste must have often suggested itself as a serious desideratum. To some extent this waste may be replaced by rectal injections of fluid and peptonized foods. But this is a slow and imperfect method and only too frequently leads to irritability of the bowel, with rejection of the foods employed.

For many years some of us have sought help in these cases from copious subcutaneous injections of normal saline solutions, and have had the best results from the practice in most cases. But I now desire briefly to draw attention to a method of introducing compounds into the circulation which may be looked upon in the light of foods, and not merely an innocuous addition to the blood of the water which is so rapidly lost by the lungs, skin, and kidneys, and sometimes by the intestine or by vomiting.

This is the addition to our normal saline solutions of pure glucose. I learnt this from Professor K. Lennander, of Upsala, when he was my guest the year before last on the occasion of his receiving the Hon. F.R.C.S. of England. Since then I have constantly used it both at University College Hospital and in private with much satisfaction. I confess that when I began to do so I had certain misgivings on at least two points. In the first place I found that the introduction of so much glucose into the circulation and the tissues generally might possibly have the same injurious effects on the reparative processes in the latter which we see in diabetes. And though I was assured by my informant that in his large experience no ill-results had followed, it was not until I had employed it in several cases and seen my wounds heal in the most perfect manner, and until I had watched the urine of these patients and seen that no sugar was excreted in any, that I was reassured.

Another point seemed to me to demand careful consideration, namely, the osmotic effects of a saccharine solution on the parts into which it is injected. It is well known that even sterile and otherwise innocuous fluids, if injected subcutaneously above or below a certain concentration, produce in the first place intense pain through their effects on the sentient nerves; and, secondly, in concentration rapidly withdraw water from the living tissues by osmosis, and so lead to extensive necrosis, as in the case of a solution of 5 per cent. of sodium carbonate. Now if a solution of sugar had either of these effects it would be clearly inadmissible. The strength given to me by Professor Lennander was 5 per cent. of glucose added to normal saline solution = 0.6 per cent. It struck me in thinking over the matter that if 6 per 1,000 of NaCl. was "indifferent" to the tissues 5 per 100 of glucose might not be so. But on referring to tables giving the freezing-points of various solutions as determined by Beckmann's apparatus, I found that a 5 per cent. solution of sugar freezes at the same point as the serum of the blood and as normal saline solution, and, in the terms of the botanical physiologists who first investigated these phenomena, was "isotonic" or "isosmotic" with the latter. It ought therefore to be "indifferent" to the tissues, and this proved to be the case on employing it subcutaneously; no reaction or pain has followed.

This whole question of "isotonic" or "isosmotic" fluids in relation to human tissues is an interesting one, and should always be borne in mind in injecting subcutaneously. But it is only necessarily here to remember that fluids (exclusive of corrosives) of the same freezing point as serum are

"isotonic," and produce neither pain nor other change in the tissues into which they are injected.

Reassured on this point I have largely employed this saccharo-saline solution both in preparing exhausted patients for operation, and in supporting them during and after the latter. The only point remaining to be ascertained is the amount of glucose which may be introduced into the body at one time.

So far, I have limited myself to 25 grams in twenty-four hours as advised, equal to a litre of 5 per cent. solution, and have never seen any sugar in the urine. The mode of its employment has been simple. An ordinary aspirator needle of about 1 mm. in transverse section of its lumen attached to 3 ft. of rubber tubing, and with a glass funnel at the other end, is all that is necessary. This apparatus is, of course, carefully sterilized by boiling, and is filled with the sterilized and warmed saccharo-saline fluid; the needle is introduced under the sterilized skin of the arm near the axilla, and the funnel is raised 2 ft., when the transfusion is found to proceed easily as a rule, until the whole half litre is seen to distend the subcutaneous tissues of the arm and axilla. In preparing, say, for a gastro-enterostomy in an exhausted patient, I do this with 500 c.cm., morning and evening if possible, for some days before and up to the time of operation; and on the table again another 500 is injected. Possibly more might be used, but for the present I have been using only the half litre at a time. Again, for days after, while the stomach only receives a limited amount of food and fluid, the same course is pursued. The effect of this treatment has been uniformly good as regards pulse, general strength, and relief of thirst.

There is another effect which I think ought to be taken into account in septic cases; for example, appendicitis with septic peritonitis. This is the increased secretion of urine, which is rendered possible by the free use of saline injections. We believe that some, if not all, of the toxins in such cases, are eliminated from the system by the kidneys. If this is so the presence of abundance of water in the body ought to render the work of the kidneys easier. The toxins would be excreted in more abundance if there were plenty of water to be excreted and in greater dilution. The saving to the kidneys in eliminating dilute poisons rather than concentrated ought to be great, and we ought to see less of renal complications. In a case of very extensive peritonitis following on gangrenous epityphlitis I recently gave subcutaneously half a litre of the fluid mentioned above morning and evening for a fortnight, with, I believe, good results in many ways.

But in the preliminary treatment, the operation, and after-treatment of exhausted patients, the use of the saccharo-saline subcutaneous infusion is beyond doubt of great value, and ought to be more widely known and practised. A concentrated solution is now made for me sealed up in glass capsules, which can be diluted to the proper strength in a moment with the corresponding amount of boiled water. Such capsules can be carried about for every serious operation, and will, I believe, in the future be found of much use.

INTRAVENOUS INJECTION OF NORMAL SALINE SOLUTION IN A SEVERE CASE OF HAEMATEMESIS: RECOVERY.

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Mrs. A., aged 40, had for some two years devoted her life to the care of her husband, who was in a very precarious condition, being the subject of serious cardiac trouble. On December 15th, 1901, at about 10 p.m., I was called to her. I was shown the vomit which had been brought up at 6.30 p.m.; there was about a pint and a-half of bright-coloured blood, and I was informed by the patient that she had brought up a larger quantity the day before, but had said nothing, as she was afraid of frightening her husband. She was very weak and blanched to an alarming degree; there were the usual symptoms of gastric ulcer and a history of previous haemorrhages, though not severe. A teaspoonful dose of extract of hamamelis with a dessertspoonful of water every fourth hour was the only thing given by the mouth,