Blood Sampling through a Peripheral Venous Infusion Line

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The usefulness of a blood sampling technique for the measurement of blood glucose concentration through a peripheral venous infusion line was investigated with patients under general anesthesia. An infusion line was connected through a T-connecter to a venous catheter indwelled in a forearm vein, and lactated Ringer's solution was infused at a flow rate of 100 ml/hour. At an arbitrary time, 0.5 ml of blood sample was obtained through the T-connecter after discarding 1.5 ml of blood, while a vein in another arm was punctured to obtain 0.5 ml of blood. As a result, the glucose concentration in the sample from the venous infusion line was strongly correlated with that obtained by direct puncture, and the regression line passed through the origin. This suggests that blood samples from a peripheral venous line can be used in place of samples obtained by direct puncture. (Key words: blood sampling, glucose, peripheral infusion line)

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Measurements of blood glucose concentration are indispensable during the perioperative period in patients with diabetes mellitus[1]. However, except for major surgery, during which an arterial line is available, frequent punctures of peripheral vessels are necessary to obtain blood samples. This not only puts patients at risk of local bacterial infection but causes them discomfort during surgery under regional anesthesia and during the post-operative period. We therefore sampled blood through a peripheral venous line, as described below.

In 15 patients, including four diabetic patients undergoing surgery under general anesthesia, a forearm vein was cannulated with a 20-gauge venous catheter, and lactated Ringer's solution was infused through a T-connecter (Dainabot Co. Ltd., Japan). The infusion speed was 100 ml/hour. At an arbitrary time during the operation, 1.5 ml of blood (discard volume) was aspirated retrogradely into the infusion line by pulling a syringe which was connected to a three-way stopcock near the bottle, then 0.5 ml of blood was drawn into another syringe through a 22-gauge needle punctured at the rubber portion of the T-connecter. At the same time, a vein in another arm was punctured and 0.5 ml of blood was obtained. The blood glucose concentrations in these two samples were quickly measured with a reflectometer (TOECHO III, Kyoto Daiichi Kagaku Co. Ltd). Least squares regression analysis was per-

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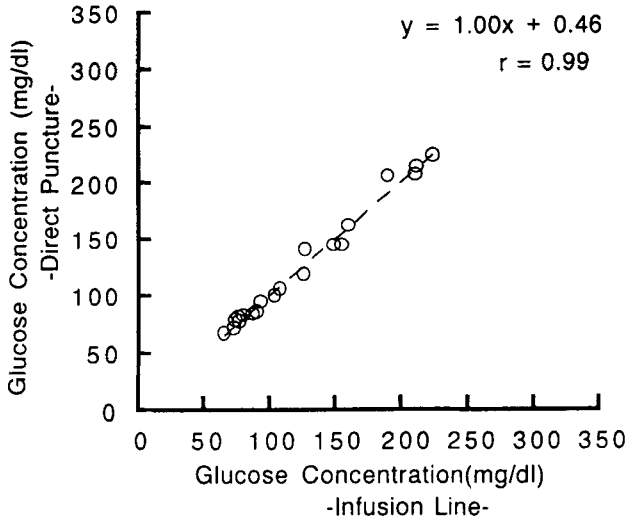

Fig. 1. Glucose concentrations in 40 blood samples, half of which were obtained from a lactated Ringer's solution infusion line (horizontal axis) and the other half of which were obtained by venipuncture (vertical axis). The equation of the regression line is also shown.

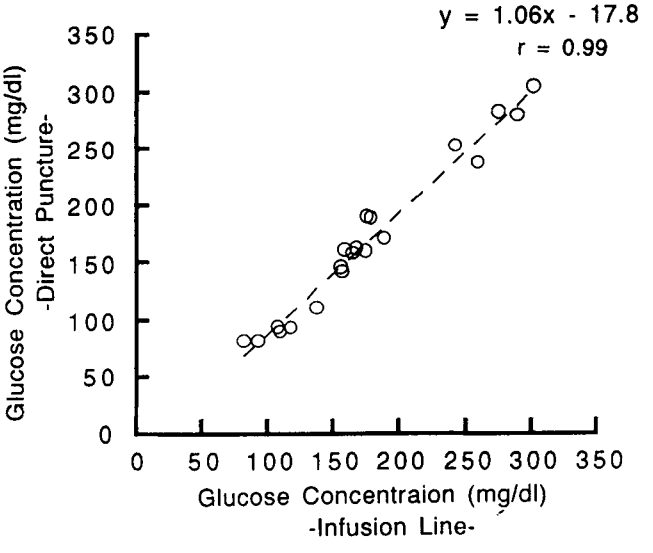

Fig. 2. Glucose concentrations in 42 blood samples, half of which were obtained from a 5% glucose solution infusion line (horizontal axis) and the other half of which were obtained by venipuncture (vertical axis). The equation of the regression line is also shown.

formed on the glucose concentrations in the two samples. Then, statistical analysis to determine whether the regression intercept passed through the origin was performed with a significance level of 0.05. As shown in figure 1, the glucose concentration in the sample from the venous infusion line was strongly correlated (r=0.99) with the glucose concentration in the sample obtained by direct puncture, and the regression line passed through the origin. This suggests that blood samples from a peripheral venous line can be used in place of samples obtained by direct puncture. This sampling technique may be applicable when measuring substances other than glucose.

Factors affecting the accuracy of the results of this technique are the discard volume, the contents of the infused solution, and the infusion flow rate. Regarding the discard volume, we tested a glucose solution in a beaker and found that a discard volume of 1.5

ml was sufficient to obtain a correct value for glucose in the sample[2]. We also found that the use of a three-way stop-cock decreased accuracy of the result, probably because of the dead space in the area, where the syringe is connected[2]. Regarding the contents of the infused solution, we examined the effect of a 5% glucose solution as the infused fluid on the glucose concentration in samples obtained from a venous infusion line, by the method described above. The results are shown in figure 2. The glucose concentration in the sample from the venous infusion line was strongly correlated with the glucose concentration in the sample obtained by direct puncture ($r=0.99$), but the regression line did not pass through the origin. Therefore, the use of a solution with a high concentration of glucose can influence the value obtained by this technique. Infusion flow rate may also affect the result, but rates greater than 100 ml·hour^{-1} may not be necessary during a minor operation or postoperative period. Obviously, lower rates would not compromise the usefulness of this technique.

In conclusion, when blood must be sampled frequently, it can be drawn through a peripheral infusion line, and this should be especially useful in conscious patients.

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