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Accuracy of insulin injection in elderly patients

Good control of diabetes depends on the patient being capable of consistently injecting accurate amounts of insulin. Problems with self administration of insulin might be expected in patients suffering from confusion or impaired vision or coordination. Thus older diabetic patients might be at particular risk from errors in the amounts of insulin injected. We investigated this hypothesis and the possible merits of different insulin syringes.

Patients, methods, and results

We studied nine diabetic patients with an age range of 56-81 (mean 66) years who had been treated with self administered insulin for at least one year. Patients with impaired vision, cognition, or coordination were excluded from the study. Nine doctors and nurses with normal vision who were trained in administering insulin served as controls.

We used ¹²⁵I (as sodium iodide) as a label. A reference solution was established, and 500 µl of it was drawn up with a semiautomatic Oxford pipette as a standard for volume measurements. By measuring the gamma particles emitted from the test samples and comparing this with the standard solution we obtained an accurate measurement of the volume of the test fluid.

Estimation of dead space—Altogether 0.5 ml of labelled solution was withdrawn with one of four insulin syringes (Chance glass, Plastipak SFP, Sabre disposable, Plastipak polypropylene). The solution was then expelled to the zero marker and discarded. The aliquot remaining in the syringe was termed the dead space. This was extracted by four washings of the syringe with 0.5 ml saline. The counts of ¹²⁵I from the collected washings were then measured to calculate the dead space. Ten measurements were made for each type of syringe. The Plastipak SFP syringe had a dead space of 0.01 ml whereas the Chance glass, Sabre disposable, and Plastipak polypropylene syringes had dead spaces of 0.12 ml, 0.13 ml, and 0.12 ml, respectively.

Accuracy of insulin dose—The patients and controls withdrew and expelled 20 units (0.5 ml) of labelled solution with their usual syringes (Sabre disposable or Chance glass). The controls used a Sabre disposable with a 23 gauge needle. This was repeated three times. The three expelled samples were counted for ¹²⁵I activity and the actual volumes expelled were calculated. The table shows the individual results in patients and controls. The mean variation in dose was 4.4% in the controls compared with 12.2% in the patients.

Comment

Our results show a considerable dead space in three commonly used types of insulin syringes. This means a wastage of 12% if 1.0 ml insulin is required and 24% if only 0.5 ml insulin is required. If a patient is taking a mixture of insulins in one syringe the dead space may alter the relative proportions of insulins actually being injected. This would be particularly important in patients with altering insulin requirements or when different types of syringe are used. Unless care is taken unplanned proportions of the insulins will

Accuracy of amount of insulin administered on three occasions by each patient and control

| Age (years) | Insulin syringe used | Individual % error | | | Mean % error |
|-----------------|----------------------|--------------------|--------|-------|--------------|
| | | First | Second | Third | |
| <i>Controls</i> | | | | | |
| 28 | Sabre disposable | +3.0 | +3.9 | +3.4 | 3.5 |
| 27 | Sabre disposable | +2.4 | +5.4 | +4.8 | 4.2 |
| 23 | Sabre disposable | -1.8 | +4.5 | +5.1 | 3.8 |
| 25 | Sabre disposable | +5.6 | +2.4 | +6.4 | 4.8 |
| 32 | Sabre disposable | -3.6 | +6.9 | +5.1 | 5.2 |
| 26 | Sabre disposable | +6.8 | -1.6 | +3.3 | 3.9 |
| 25 | Sabre disposable | -5.2 | -3.2 | +6.8 | 5.1 |
| 24 | Sabre disposable | +8.2 | -2.4 | -2.3 | 4.3 |
| 37 | Sabre disposable | +3.4 | -4.1 | +7.5 | 5.0 |
| <i>Patients</i> | | | | | |
| 56 | Sabre disposable | +5.9 | +6.0 | -7.4 | 6.4 |
| 59 | Sabre disposable | +9.2 | -7.8 | -8.6 | 8.5 |
| 62 | Chance glass | +12.1 | +8.0 | -11.1 | 10.4 |
| 61 | Sabre disposable | +19.2 | +17.0 | +24.8 | 20.3 |
| 68 | Chance glass | +11.1 | +8.4 | +13.2 | 10.9 |
| 70 | Sabre disposable | +19.1 | -11.1 | -17.9 | 16.1 |
| 81 | Sabre disposable | -7.2 | -4.9 | +9.1 | 7.1 |
| 72 | Sabre disposable | +16.3 | +9.7 | +12.1 | 12.7 |
| 70 | Sabre disposable | +13.5 | +18.2 | +19.1 | 16.9 |

be given, resulting in disturbed control of diabetes and particularly the risk of hypoglycaemia. It may be desirable in these circumstances to use a "premixed" insulin such as Initar (Nordisk) or Mixtard (Nordisk) or a similar mixture prepared in the hospital pharmacy.

Kesson and Bailie showed a 19% error in insulin dose in older diabetic patients.¹ Our study showed a smaller inaccuracy (mean of 12.2%) possibly because visual and neurological disorders were specifically used as exclusion criteria. All our patients had been self administering their insulin for at least one year. This inaccuracy in the insulin dose administered may contribute to management problems in elderly diabetics. In such patients more use should be made of preset insulin syringes of the type used for the partially sighted.

¹ Kesson CM, Bailie GR. Do diabetic patients inject accurate doses of insulin. *Diabetes Care*. 1981;4:333.

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Treatment of hypercalcaemia in sarcoidosis with flurbiprofen

A previously fit man presented with sarcoidosis complicated by hypercalcaemia. He was treated with flurbiprofen, a potent prostaglandin synthetase inhibitor, and his serum calcium concentration rapidly fell within the normal range. Further investigations suggested that this fall was due to inhibition of bone resorption induced by prostaglandin.

Case report

A previously fit 29 year old solicitor, who was also a first class rugby player, presented with a history of epigastric discomfort, thirst and polyuria, slight weight loss, and general malaise. There were no abnormal physical findings, and a chest x ray film showed bilateral hilar lymphadenopathy with enlarged paratracheal lymph nodes. Sarcoidosis was provisionally diagnosed, and he was admitted to hospital. Investigations supporting this diagnosis included a positive reaction to a Kveim test, serum angiotensin converting enzyme activity of 63 IU/l (normal range 20-55 IU/l), β_2 microglobulin concentration of 3.55 mg/l (normal range 1.2-2.4 mg/l), and a negative reaction to a Mantoux test at a 1:100 dilution.

Serum calcium concentration (normal range 2.25-2.60 mmol/l (9.0-10.4 mg/100 ml)) was 2.89, 3.09, and 2.93 mmol/l (11.6, 12.4, and 11.7 mg/100 ml) on three consecutive days, and serum albumin concentration was 40, 45, and 43 g/l respectively (normal range 35-48 g/l). Parathyroid hormone