Letter to the Editor

An Easier Way to Regulate Continuous Intravenous Heparin Infusion

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Kuwait Medical Journal 2001, 33 (2): 197-198

Sir,

Continuous intravenous (IV) heparin infusion sometimes becomes an essential part of the surgical patient management. The two available ways to deliver heparin often require unnecessary repeated preparations of the medicine resulting in a large waste and sometimes in a wrong calculation of the dose. A new way is suggested here to avoid these disadvantages.

In practice, continuous IV heparin infusion becomes necessary mainly in two situations. Firstly, when a patient on an oral anticoagulant, like warfarin, is scheduled for an elective operation, it is a standard practice to replace warfarin with IV heparin infusion for approximately 3 – 5 days until the warfarin effect wears off. The use of heparin continues postoperatively until the patient starts oral feeding and the oral anticoagulant becomes effective. This also usually takes another 3 – 5 days. Secondly, if a patient develops deep venous thrombosis (DVT), continuous IV heparin infusion is administered until the simultaneously-started oral anticoagulant is effective and five days have elapsed. Pelvic surgery for malignant pelvic tumours increases the chances of developing DVT. It is thus evident that continuous IV heparin infusion is commonly needed in those situations.

The difficulty in administering IV heparin comes from the fact that the dose is calculated in international units (IU) of heparin per 24 hours (hr), (IU / 24 hr), while the available IV infusion pumps deliver medicine in millilitres (ml) per hr (ml / hr). Furthermore, when therapeutic heparin treatment is administered, the activated partial thromboplastin time (APTT) is measured 6 hourly for the patient and a control. The ratio of APTT of the patient to the control needs to be kept between 2.5 and 3.5. In practice, it is difficult to reach this ratio and keep it stable without changing the heparin dose repeatedly throughout the day. The heparin dose often needs to be changed 3 – 4 times a day, especially in the beginning of the treatment.

There are two methods to establish and regulate continuous IV heparin infusion. Each, however, has its own major disadvantage(s). In the first one, the required IU / 24 hr are added to 500 ml of normal saline. The mixture is then run at a rate of 21 ml / hr, to allow the 500 ml to be administered in 24 hours, approximately. If the dose is changed six hours later, the old pint of heparin / normal saline mixture is replaced with a new one containing the new heparin dose. This means preparation of a new mixture and a waste of about 75% of the old mixture, sometimes every six hours for five days. In other words, 20 new preparations may have to be made and 15 pints of heparin / saline mixture may be wasted in the five days.

The other method tries to circumvent the repeated preparation and waste by calculating a new rate of infusion depending on the new dose. The following equation is used for that purpose: new rate = new dose x old rate ÷ old dose. The disadvantage is the necessity to perform a new calculation every time the dose is changed. I have seen wrong calculations made and wrong doses given as a result. This has sometimes led to an increase in the dose of the administered heparin when it was actually meant to be reduced.

An easier way to regulate continuous IV heparin infusion: The method introduced here avoids the above three disadvantages: (1) the need for repeated mixture preparations, (2) waste of medicine and (3) errors in calculations and administered doses. If 21000 IU of heparin, i.e. 4.2 ml of the heparin solution of the concentration 5000 IU / ml, are added to 500 ml of normal saline, the resulting mixture delivers heparin such that 1 ml / hr = 1000 IU / 24 hours, approximately. This means that the nurse runs the pump at a rate equal to the ordered dose (after removing the three zeros), without having to make any calculation. For

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example, if the dose to be given is 12000 IU/24 hr, then the rate is 12 ml/hr. Similarly, 20000 IU/24 hr = 20 ml/hr, 24000 IU/24 hr = 24 ml/hr, 30000 IU/24 hr = 30 ml/hr and so forth.

In fact, after developing this formula, my order has become "give x ml/hr (after preparing the mixture as above)", instead of "give x thousand IU 24 hourly". The nurses find this way easier and clearer. They do not have to make any calculation and they prepare the heparin in the same standard way for all adult patients regardless of the dose to be given. No new preparation is necessary if the dose is changed. No mixture is wasted.

DISCUSSION

In the proposal presented here, instead of having different concentrations run at a fixed rate of 21 ml/hr, as in the above first popular way of administering heparin, I made a fixed concentration of 21000 IU/500 ml run at different rates depending on the chosen dose. Number 21 is a key number, because a 24-hr dose is given in 500 ml of saline and about 4 ml of heparin and 504/24 = 21. This is interesting, although it was not in my mind when I started developing the formula.

If one wishes to be accurate, 0.2 ml can be discarded from the normal saline pint before adding the heparin. This makes the volume of the resulting mixture 504 ml (499.8 ml + 4.2 ml). I do not feel that the difference is important enough to make that additional step necessary.

If the heparin concentration is 25000 IU/ml, practical preparation is slightly more difficult. This is because one needs to add 0.83 ml of concentrated heparin solution. Approximating the amount to 0.8 ml reduces the amount of heparin that should be in the mixture by 750 IU, because the solution is very concentrated. The result is a decline in accuracy. Therefore, I do not recommend using such concentrated heparin solutions for preparation of the desired mixtures. The same principle can be applied in other situations with other medicines to develop similar formulas for easy drug administration and regulation.

CONCLUSION

A mixture of heparin and normal saline was presented here for easy regulation of repeatedly changing doses of continuous heparin IV infusion. The mixture is standard for all adult patients and for all doses. It is prepared by adding 4.2 ml of heparin (of the concentration 5000 IU/ml) to 1 pint of normal saline. The rate of administration changes depending on the dose to be administered, such that 1 ml/hr of the mixture = 1000 IU/24 hr of heparin. This method (1) avoids the need for repeated preparations of heparin/normal saline mixtures whenever the heparin dose is changed, (2) helps cut down the waste of medicine and (3) guards against making mistakes in the doses of the administered heparin.