

Calculation Of Lean Body Mass Using Bio-Impedance Analysis Could Be Used To Accurately Determine Heparin/Protamine Dosage For Obese Patients Undergoing Cardiac Surgery Using Cardiopulmonary Bypass

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The association between obesity and coronary disease has long been recognised by clinicians. According to Department of Health statistics, the prevalence of obesity doubled in Britain between 1980 and 1991 and is continuing to increase. At present 43% of men and 29% of women in the UK are 'overweight' with a body mass index (BMI) >27. The number of overweight patients presenting for cardiac surgery has increased significantly over the last decade.

A simple, but internationally accepted regime for heparin dosage for cardiopulmonary bypass (CPB) uses the patient's weight as a crude indicator of blood volume. A bolus of 300iu heparin / kg of body weight is administered pre CPB. During CPB the ACT is maintained at >480s. At the end of the procedure, protamine is administered to reverse the effect of heparin and achieve haemostasis.

Both of these drugs can have serious side effects, heparin can induce thrombocytopenia, and protamine, which is derived from fish sperm, has been known to cause reactions in patients allergic to fish, vasectomised men and some insulin dependent diabetics.

We hypothesise that calculation of lean body mass (LBM) might be an important factor when determining drug doses as opposed to total body weight. This may avoid giving overweight patients a relative overdose of heparin, which must subsequently be neutralised with protamine.

LBM is similar but not identical to fat free mass and can be determined by different methods. We employed Bio-electrical Impedance using the Bodystat 1500 body composition monitoring unit (Bodystat Ltd., Isle of Man) as the quickest and most accurate way to determine LBM.

A comparison was made between two groups of patients whose body mass index was $> 27\text{kg}/\text{m}^2$: Group 1, $n = 13$, mean BMI = 32, mean body fat = 36% received the conventional dose of $300\text{iu}/\text{kg}$ heparin for their TBW.

Group 2, $n = 14$, mean BMI = 31, mean body fat = 35% received a dose of $300\text{iu}/\text{kg}$ heparin for their calculated LBM. Activated clotting time (ACT) test was conducted before and after heparin administration and during bypass. Additional heparin was administered as required to maintain ACT $> 480\text{s}$. Mean ACT results and total heparin doses were analysed using unpaired two tailed t-tests. Our results indicate that, with care, a reduction of up to 25% in the doses of heparin ($p = 0.0032$) and protamine ($p = 0.0026$) can be achieved for a substantial number of patients classified as 'overweight' or obese.

However, simply using the BMI is not an accurate way to calculate the fat content of patients. The results obtained using a body composition monitor such as the Bodystat 1500 can assist in calculating more accurately doses of heparin and protamine for the growing number of overweight patients undergoing cardiac surgical procedures using cardiopulmonary bypass.