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Simplified estimation of ideal and lean body weights in morbidly obese patients

Editor—Morbid obesity (MO) is associated with important physiological and anthropometric changes that alter the pharmacokinetic properties of most drugs.[1–3] Knowledge of these changes and careful consideration of the optimal dosing are necessary for safe and effective anaesthesia in MO patients.[1–3] Ideal body weight (IBW), lean body weight (LBW), and total body weight (TBW) are dosing scales for the commonly used anaesthetic agents.[1–3] The most common methods for the calculation of IBW and LBW are Devine's and Janmahasatian's formulas, respectively.[2 3] However, these are not intuitive, straightforward, or quick in emergency situations.[2–4] Therefore, we aimed to provide a simplified method for determining IBW and LBW using 200 consecutive male [mean (range) age (yr) 38.4 (18–65); mean (SD) BMI (kg m^{-2}) 47.7 (6.5)] and 200 consecutive female [age (yr) 41.1 (18–70); BMI (kg m^{-2}) 45.5 (4.8)] patients undergoing bariatric surgery at our University Hospital. A linear regression analysis was performed on the IBW and LBW as derived from Devine's and Janmahasatian's formulas, respectively.[2 3] It was based on the equation $y=\alpha x$, where y is the IBW or LBW, x the h^2, and α the best-fit values estimated by the model that should be inserted into the following simplified formula: IBW or LBW=BMI (best fit) h^2.

The linear regression analysis determined that the best-fit BMI of values derived from Devine's equation for IBW was 22.85 for men and 20.55 for women. Likewise,

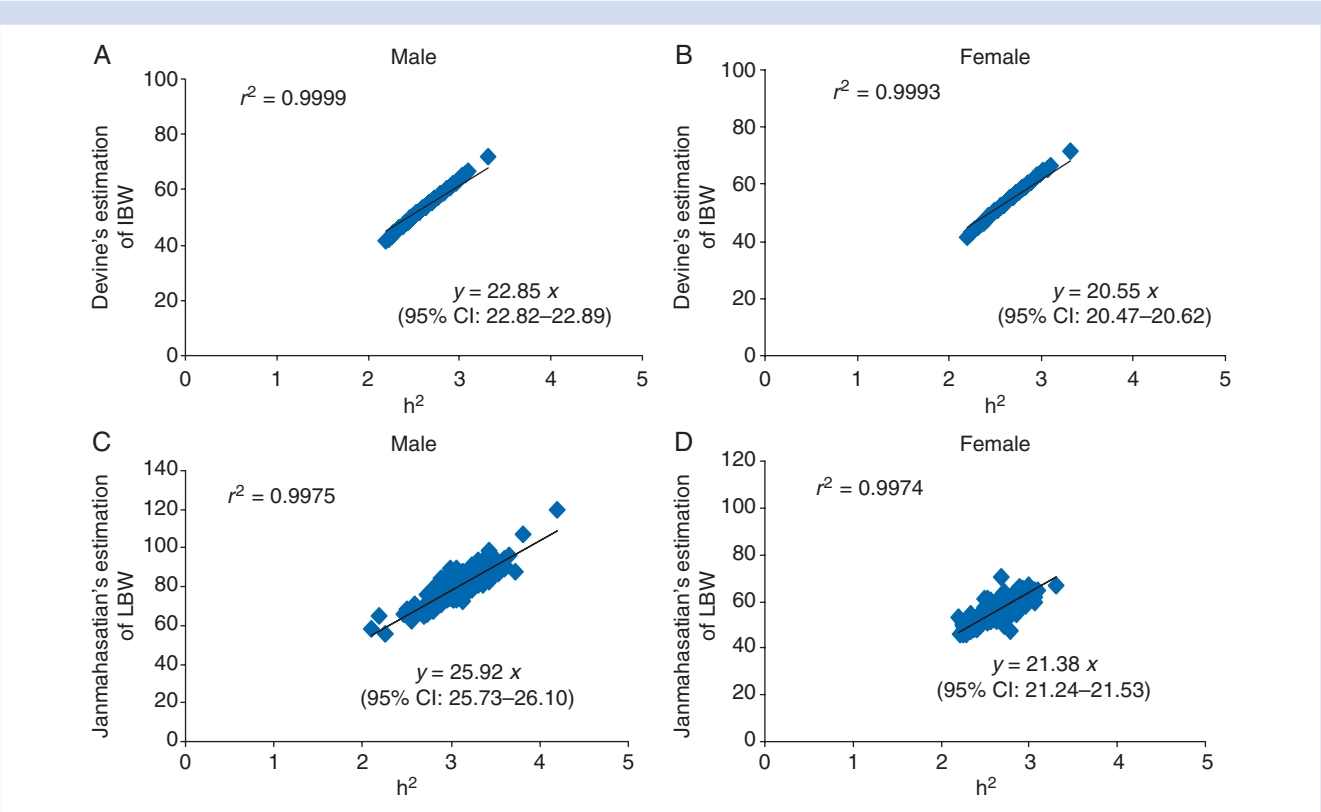

Fig 1 The relationship between Devine's estimation of IBW and Janmahasatian's estimation of LBW, and height square (h^2) determined by linear regression analysis. Devine's estimation of IBW (A and B) and Janmahasatian's estimation of LBW (C and D) are plotted against h^2. The equation is $y = \alpha x$, where y is IBW or LBW, x the h^2, and α the best-fit, gender-specific BMI (kg m^{-2}) for use in the simplified equation: IBW or LBW = BMI (best-fit) h^2. Data were obtained from 200 consecutive MO male patients and 200 consecutive MO female patients who underwent bariatric surgery in our University Hospital. Statistical analyses were performed with SAS for Windows, version 9.2 (SAS Institute Inc., Cary, NC, USA). 95% CI, 95% confidence intervals for the regression parameters.

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the best-fit BMI of values derived from Janmahasatian's equation for LBW was 25.92 for men and 21.38 for women (Fig. 1).

As there is a direct relationship between body weight and height for a given BMI,[4–7] a simplified formula has been proposed to estimate IBW, that is, IBW=BMI h^2.[5 6] Some authors have found that a BMI of 22 represents the best generic value for both men and women to replace BMI in this simplified formula.[5 6] Unfortunately, the BMI value of 22 identified by these earlier reports is not gender-specific, which is important given the differences in fat and lean mass between men and women.[8 9] Instead, we propose that a BMI value of 21 should be used for women and a BMI value of 23 should be used for men when estimating IBW.

Interestingly, there are no data available for a simplified means to estimate LBW in MO patients. From our results, we suggest using a BMI of 22 in the simplified formula for females and a BMI of 26 for males. The gender-specific values that should replace the BMI in the new simplified formula for estimating LBW are greater than those used for the estimation of IBW, which is appropriate. While in normal-weight patients, the IBW and LBW are similar,[1 2] this is not the case in MO patients, where LBW increases with increasing TBW.[1 2] In addition, for a given BMI, men have higher lean mass and more visceral and hepatic adipose tissue, whereas women in particular have elevated general adiposity and subcutaneous adipose tissue.[8 9] We suggest that our formulas provide an easy, quick, reproducible, and gender-specific estimation of IBW and LBW in MO patients.

Declaration of interest

None declared.

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Brain microdialysis distribution study of cefotaxime in a patient with traumatic brain injury

Editor—Following on from our recent review of microdialysis studies of antibacterial agents in the brain,[1] we report a case of a 56-yr-old woman (78 kg, normal renal function) admitted for severe traumatic brain injury (TBI), with a Glasgow coma scale score of 5, a contaminated temporal craniocerebral wound, and multiple haemorrhagic contusions. She was managed according to the TBI guidelines and received cefotaxime i.v. (4 g/8 h) to prevent central nervous system (CNS) infection. On admission, routine monitoring included intracranial pressure (Micro-sensor ICP; Codman & Shurtleff, Raynham, MA, USA), partial pressure brain tissue oxygen tension (Licox; Integra Neurosciences, Lyon, France), and cerebral microdialysis (CMA-70; CMA, Stockholm, Sweden). The probe was placed into healthy brain tissue, perfused at 0.3 ml min^{-1} with CNS perfusion fluid (CMA), and dialysates were analysed for metabolic parameters. This microdialysis monitoring allows us to determine unbound concentrations of therapeutic agents in brain extracellular fluid (ECF) and only few microdialysis studies have characterized antibiotics' brain distribution in humans.[2–5] After informed consent from relatives, cefotaxime brain ECF distribution was explored after the 12th dose, on Day 4. After baseline samples, cefotaxime (4 g) was infused over 30 min and nine brain dialysates were collected every 30 min during 3 h, then hourly to the 7th hour. One blood sample was collected at 30 min and ultrafiltered to determine unbound plasma cefotaxime peak concentration ($Cu_{max,p}$). Cefotaxime assays used high-performance liquid chromatography with UV detection. *In vivo* probe recovery was determined using the retrodialysis-by-drug method as previously described.[6] A non-compartmental analysis of brain ECF concentrations was performed (Phoenix WinNonlin 6.2, Pharsight, USA). Time over minimal inhibitory concentrations ($t>$MIC) was estimated at two MIC values (2 and 4 μg ml^{-1}), corresponding to intermediate and resistant strains of *Streptococcus pneumoniae*.[6 7]

The mean probe recovery was estimated at 67 (0.25)% and even if *in vivo* recovery was not always determined in the past,[2 4 5] this observation attests to the absolute necessity of careful assessment of *in vivo* probe recovery in each individual patient.

The $Cu_{max,p}$ was equal to 118.8 μg ml^{-1} and the maximal brain ECF concentration was clearly lower ($C_{max,b}$=11.4 μg ml^{-1}). $C_{max,b}$ was achieved at t_{max}=85 min, 55 min after

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