Glucose Variance in ICU Patients Receiving Insulin Infusions

To the Editor:

Vanhorebeek and colleagues recently addressed the controversies surrounding insulin treatment of hyperglycemia in the ICU. The authors reviewed single-center studies that demonstrated benefits of tight glucose control, and a multicenter study that showed no improvement with insulin use. Failure to achieve glucose targets was proposed to explain the negative multicenter findings. This plausible hypothesis begs the question: how did the single-center and multicenter studies compare in achieving target glucose? Vanhorebeek and colleagues stated that 70% of treated patients in the Leuven studies had mean daily blood glucose levels <110 mg/dL, compared with a median glucose level of 118 mg/dL in the Glucontrol study. The Leuven studies reported 6:00 AM mean glucose levels, but if the mean daily blood glucose level was calculated from these values alone, meaningful comparison of glucose control in the different studies requires the assumptions that glucose does not vary with time of day and is distributed normally. We recently determined that these two assumptions are incorrect; in our ICU, glucose levels varied in an ultradian pattern, peaking twice every 24 h, and had a positively skewed distribution. These new findings complicate the comparison of the reported data undermining the conclusion that failure to achieve target glucose levels underlies the failure of the multicenter study.

For clinicians and investigators attempting to replicate the impressive results of the Leuven studies, it is essential to know what proportion of all glucose measurements were in range for patients receiving insulin in those studies because 6:00 AM values are not representative of mean daily glucose levels. We agree with Vanhorebeek et al that achieving the glucose target range is crucial when investigating the efficacy of insulin infusion protocols, but the objective comparison of these studies requires that the glucose values achieved be clearly reported and include multiple time points.

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Lung Function Testing Prediction Equations

Do They Fit All?

To the Editor:

The American Thoracic Society (ATS) recommends updating prediction equations of lung function testing preferably on a regular basis. A new set of prediction equations for spirometry derived from the general population of Hong Kong was published in 2006. As many lung diseases chiefly affect subjects beyond middle age, use of such equations may underpredict or overpredict the “normal” lung function values in these older patients.

From January 2001 to March 2003, among 230 Chinese female patients referred from the thoracic surgical unit of our hospital to the lung function laboratory, 33 women had small solitary lung nodules (≤3 cm) on CT scans. After excluding those with smoking history, obesity (body mass index >30 kg/m²), old age (>80 years), short stature (<145 cm), and unsatisfactory flow-volume loop maneuver, the remaining 28 women were included for data analysis. The women underwent lung function testing (SensorMedics 2200 System; SensorMedics; Yorba Linda, CA). ATS 1994 guidelines constituted the reference standard for the procedures and quality control. Percentages of predicted values of FEV₁ and FVC were calculated by the new set of prediction equations of Ip et al, and that of Knudson et al, as the latter is currently used in our laboratory. National Health and Nutrition Examination Survey (NHANES) III reference equations, as recommended by the ATS, were used largely as an overprediction control for the oriental population. The means of percentage of predicted FEV₁ and percentage of predicted FVC were compared with the target value (100) using one-sample t test. Data were analyzed using statistical software (SPSS version 11.5; SPSS; Chicago, IL).

The age of the 28 selected women was 57 ± 7.9 years (mean ± SD), and height was 156 ± 3.4 cm. The deviations of means of the percentage of predicted FEV₁ from the target value were 9 (95% confidence interval [CI], 4 to 14), −2 (95% CI, −7 to 2), and −8 (95% CI, −13 to −4) for the sets of equations of

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Ip et al., Knudson et al., and NHANES III, respectively. For percentage of predicted FVC, respective values were 10 (95% CI, 5 to 15), 2 (95% CI, −3 to 6), and −9 (95% CI, −13 to −4).

Despite the small sample of our study patients, a problem of significant underprediction using the prediction equations of Ip et al. appears to exist, leading to means of percentage of predicted FEV1 and percentage of predicted FVC both >100. Thus, application of this set of prediction equations may not be totally optimal in some clinical settings such as preoperative assessment for lung resections in female subjects in Hong Kong. We are planning a similar, larger scale study in patients with COPD currently to evaluate the issue further.

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Response

To the Editor:

Leung et al reported substantial differences in percentage of predicted FEV1 and percentage of predicted FVC when three prediction methods, namely Ip et al., Knudson et al., and the National Health and Nutrition Examination, were applied to a group of 28 Chinese women with solitary lung nodules. Leung et al expressed concerns about the utility of the prediction equations that were derived from the local population.

Our predicted equations were derived by aiming at minimizing the absolute difference between the observed and the predicted values for each spirometric parameter (FEV1 and FVC), rather than that of their predicted percentages (percentage of predicted FEV1 or percentage of predicted FVC = [observed FEV1 or FVC/predicted FEV1 or FVC] × 100%). With regard to the predicted percentages, we compare the use of the three prediction equations using our original set of 595 Hong Kong women with mean age of 46 years (SD, 17 years; range, 10 to 80 years) and mean height of 153 cm (SD, 6.3; range, 133 to 183). There is no evidence of outliers, and normality assumption is checked and fulfilled. The 95% confidence intervals for percentage of predicted FEV1 using the three sets of equations of Ip et al., Knudson et al., and National Health and Nutrition Examination Survey respectively, while the corresponding 95% confidence intervals for percentage of predicted FVC are 98.8 to 101.2, 104.9 to 107.5, and 83.3 to 85.2, respectively, while the corresponding 95% confidence intervals for percentage of predicted FVC both >100. Thus, application of this set of prediction equations may not be totally optimal in some clinical settings such as preoperative assessment for lung resections in female subjects in Hong Kong. We are planning a similar, larger scale study in patients with COPD currently to evaluate the issue further.

Estimation of the Radiation Dose From CT in Cystic Fibrosis

To the Editor:

Donadieu and colleagues (October 2007) reported the effective dose (ED) of radiation over the past 21 years from chest CT scans in their cystic fibrosis (CF) patients in France. Their findings stress the importance of implementing low-dose protocols in CF. Donadieu and colleagues found a relatively high mean ED of 6.5 millisieverts (mSv) [range, 1.5 to 29.3 mSv]. Previously, another center reported 1 mSv (range, 0.5 to 1.9 mSv) for routine biennial inspiratory sequential CT scans in CF children. Huda estimated ED for a “conventional” and a
“future” protocol of a 5-year-old CF patient as 2.1 mSv and 0.5 mSv, respectively. Long4 reported an ED of 0.22 mSv for CF infants, and Robinson reported an ED of 1.5 mSv (combined inspiratory and expiratory) for children.8

Several CT dose-reduction strategies are available. First, a reduction in the kilovoltage peak (kVp),4 and second a reduction in the milliamperes per second exposure (mA/s) provide important dose-reduction opportunities. Third, for a volumetric CT protocol, the pitch is an important parameter. Fourth, scanned body volume differs between an interval technique and a full-lung volumetric technique.

In the proposal of Huda,3 a volumetric inspiratory CT is performed with 20 mA/s, 100 kVp, and a pitch of 1.5. In the CF infants studied by Long,4 volumetric inspiratory 64-slice scans are obtained at 80 kVp, 40 mA, 0.5-s gantry rotation time, and a pitch of 1.35. In a current therapeutic development network study evaluating the natural history of progressive lung disease in CF children, 100 kVp, 40 to 50 mA, 0.5-s gantry rotation time, and a pitch of 1.0 (inspiratory) and 1.2 (expiratory) are used on a 64-slice scanner.

In conclusion, the data reported by Donadieu et al1 should not be regarded as representative of current chest CT radiation exposure in CF patients, but as the experience of one institution. Fortunately, with current CT technology, chest CT radiation dose in CF patients can be reduced approximately sixfold.

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Response

To the Editor:

The aim of our study in CHEST (October 2007)1 was to assess the actual CT scan dosimetry studies that are “routinely” performed in cystic fibrosis (CF) patients in a university hospital. Although not representative, because the assessment was based on data gathered in a single diagnostic radiology center, the study reported on both current medical practice and associated dosimetry, a subject that, to date, has rarely been discussed in the literature. The study is therefore not contradicted by the references7–9 quoted by de Jong et al in their letter, since none of the studies cited provided similar information. Indeed, these three studies7–9 can be considered as a technical discussion but not as an evaluation the effective dose (ED) received by a cohort of CF patients undergoing a routine CT scan. These studies7–9 suggested the parameters for a protocol for performing lung CT scans in CF patients, leading to a clear decrease in the ED provided by CT scan, but the investigators did not assess how such protocols are routinely applicable and, overall, how such protocols could provide the same diagnosis information comparatively in common practice. On this basis, we know from a pilot study by de Jong et al9 that an attempt to decrease the ED of CT scans was unsuccessful because the information on diagnosis derived from the CT scan had decreased. If, on one hand, one wants to open the debate about the risk-benefit relationship of performing repeated CT scans in CF patients, the assessment of the exposure to x-rays should take into account routine examination and not just specific experimental protocols; otherwise, the ED received by the patients will be systematically underestimated. On the other hand, the quality of the information on diagnosis provided by the CT scan has to be kept at the highest possible level to clearly contribute to the care of the patient, which has been questioned by some authors.6

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Erratum

In the January issue, in a review by Jeffrey Glassroth, “Pulmonary Disease Due to Nontuberculous Mycobacteria” (Chest 2008; 133:243–225), reference 42 incorrectly cites an article by Reich and Johnson. That reference should read: