of a carbon dioxide sample and registration of a signal. This is not an easy task because one cannot be sure exactly when the carbon dioxide "front" reaches the sample window. A simple way to overcome this problem is to measure the time at which "carbon dioxide signal decay" occurs in relation to the time at which flow reversal occurs, when a subject suddenly and forcibly inspires at some point during expiration (i.e. zero expiratory pause). Figure 1 is an exaggerated illustration of this. Delaying the volume signal by six samples reduced the time lag to zero.

It is interesting to consider what would be the effects of failure to compensate for this time lag. First, one would expect the value by six samples reduced the time lag to zero.

Second, one might expect, prima facie, that the error in the value of $\frac{dP}{dV}$ is similarly affected. In fact, however, the value of $\frac{dP}{dV}$ is altered very little by an uncorrected time lag of this magnitude. In addition, the error in $\frac{dP}{dV}$ appears to be solely a function of $\Delta t$. It is independent of flow (unlike the deadspace error) and hence remains constant. Any changes in $\frac{dP}{dV}$ within or between individuals cannot therefore be a result of this measurement error as Dr Drummond suggests.

These assertions are based on empirical evidence (by observation of the effects of differing time lag values in the analysis of prerecorded breaths) and on a computerized mathematical lung model based on equations of alveolar carbon dioxide kinetics [1, 2] into which different values of $\Delta t$ are substituted. The constancy of the $\frac{dP}{dV}$ error (E) may be explained more simply as follows:

$$E = 1 - \frac{\text{measured } \frac{dP}{dV}}{\text{real-time } \frac{dP}{dV}} = 1 - \left( \frac{\frac{dP(t + \Delta t)}{dt}}{\frac{dP(t)}{dt}} \right)$$

The function $\frac{dP(t + \Delta t)}{dt}$ can be expanded by the expansion of Taylor [3] to give:

$$\frac{dP(t + \Delta t)}{dt} = \frac{dP(t)}{dt} + \Delta t \frac{d^2P}{dt^2} + \Delta t^2 \frac{d^3P}{dt^3} + \ldots$$

From equation (3) it can be seen that the measured value of $\frac{dP}{dt}$ is expressed in terms of derivatives (of successively increasing order) of the real-time values. For exponential functions, all such derivatives are equal and therefore cancel out when substituted in equation (2), the only remaining terms being $\Delta t$, $\frac{d^2P}{dt^2}$ etc, which converge. Hence, the measurement error, E, is seen to be constant for a given time lag. The plot of P against $V$ should therefore remain linear as it is virtually independent of flow.

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**Magnetic resonance imaging of extradural blood patches**

Sir,—It was interesting to see magnetic resonance imaging of extradural blood patches from Beards and colleagues [1]. However, I could not help thinking some opportunities were lost.

Only five cases were imaged, all with different histories and physically different. A time course of the natural history of a blood patch cannot be concluded from this study. The rapid reduction of post lumbar puncture headache still appears to be a conflicting argument. Initially it is suggested that displacement of CSF by the blood patch (18–20 ml) relieves the symptoms, but they also noted other occasions where much smaller volumes have been used successfully. There must be other mechanisms involved not described here.

Haematoma formation compressing the spinal was not correlated against reported symptoms from the patient, but this study has not examined this question.

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Displaying data

Sir,—Graphs and charts are useful tools. They allow rapid understanding of complex relationships. The personal computer is also a useful tool. Unfortunately, indiscriminate use of charting software can result in an increase in the amount of ink on the page without a corresponding increase in the amount of information conveyed (pace Edward R. Tufte).

Figure 2 in the paper by O’Meara and Gin [1] appears to be an example. This figure, representing the percentage of patients with at least 50% reduction in pain score plotted against time, puzzled me at first. It appears to show two series of data points, each connected by a line. The mystery is the presence of two data points for some, but not all, time values. I puzzled for some time before I realized that the lines actually represent the outlines of two bar (or column) plots. The circles, filled and hollow, do not represent data points as they do in the other figures in this paper. In fact, they have no place in the chart and serve merely to add confusion. I suspect that the authors did not intend to confuse their readers and we should all note the hazards of using computer charting programs whose features are seductive yet may thwart our purpose in using charts to convey information.

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1. O’Meara ME, Gin T. Comparison of 0.125% bupivacaine with 0.125% bupivacaine and clonidine as extradural analgesia in the first stage of labour. British Journal of Anaesthesia 1993; 71: 651-656.

Sir,—We apologize if the figure in question created confusion for Dr Mackie. This style of graph is typical of survival curves which are used commonly to display raw data and provide more information than the usual descriptive statistics, such as mean and SD. Survival curves are often drawn as lines without points and we have also used this format recently [1]. In the paper criticized by Dr Mackie, we added the circles to maintain consistency across figures and aid identification between the two groups of patients. This may confuse readers unfamiliar with the stepped lines used in survival curves. The figure may be improved by omitting the circles completely or by an alternative where circles represent true data points (fig. 1). Points should be joined by stepped lines rather than straight lines to reflect the discrete nature of the data [2]. In our study, pain scores were assessed at 15-min intervals and the percentage of patients “surviving” at any time would not be known to change before the next assessment time. When analysing data where the survival times for each patient are known exactly, consecutive data points may be spaced irregularly with respect to time, but they are still joined by stepped lines.

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