Changes in Intrapulmonary Shunting

To the Editor:

We would like to offer the following comments concerning the interesting paper by Shapiro et al (Chest 1980; 77:138). Even though we agree, in general terms, with their statement that venous admixture (Qva/Qt) should increase when a patient breathes 100 percent O2, measured either by Berggren's classic method1 or with the inert gases technique,2 we have observed that it does not always do so because the increase depends upon multiple factors. When Qva/Qt is measured breathing room air, the final value will reflect gas exchange abnormalities caused either by Vv/Q inequalities, diffusion impairment or shunt (Qs/Qt); and if FIO2 is gradually increased reaching 100 percent, final findings will depend upon the interrelationship between the correction of the first two factors and the eventual occurrence of true shunt that ventilation with 100 percent O2 usually provokes. That explains the significant correction of Qva/Qt in conditions with only moderate inequalities of Vv/Q when FIO2 is increased slightly. Besides, alterations of gas exchange produced by Vv/Q inequalities at FIO2 greater than 50 percent do not play an important role.3 At this FIO2 level, Qva/Qt modifications are possibly due to very important Vv/Q mismatching (log normal distribution of Vv/Q log SD(σ) > 1.5)4 and/or eventual diffusion impairment with concomitantly increasing shunt. It seems clear to us that in patients with slight Vv/Q inequalities and no diffusion impairment FIO2 increments will enhance true shunt caused by the absorption atelectasis that high O2 administration would produce.5 On the other hand, in cases with severe Vv/Q inequalities and eventual diffusion impairment the correction of these defects can counterbalance the shunt increment caused by a high FIO2 and Qva/Qt decrease accordingly.

In this context it is interesting to report our results in 16 patients with bacterial bronchopneumonia who were mechanically ventilated with different FIO2 (Fig 1). When Qva/Qt with maintenance FIO2 was compared with the Qva/Qt on pure oxygen, no significant differences were found. If the patients were divided in two groups (those with Qva/Qt less than 0.20, and those with Qva/Qt >0.20), we observed that in the former group Qva/Qt did not change significantly when on 100 percent oxygen (0.16 vs 0.17, n = 7), while it decreased significantly in the other group (0.57 vs 0.41, P < 0.05, n = 9). These findings demonstrate the existence of two different populations with dissimilar Qva/Qt response to FIO2 increments. These Qva/Qt reductions on FIO2 increments have been reported earlier by other authors.5-7

The above mentioned data do not agree with the conclusion of Shapiro et al that "the original intent of administration of 100 percent oxygen . . . is not valid since . . . results in an increase in the calculated shunt." This assertion is possible true in their particular group of patients with moderate alterations in gas exchange (Qva/Qt =0.17), but it is not applicable to all at more severely affected patients, eg, Qva/Qt > 0.40 in which the relationship of altered mechanisms of gas exchange are probably different. We also disagree with their statement, "We feel confident that there is no clinical advantage to making this measurement at an FIO2 of 1.0." In this context we find it very interesting that King4 when referring to patients with catastrophic pulmonary failure, points to the usefulness of measuring shunt modifications with different FIO2. In the case of no change of shunt when FIO2 is modified, this could be reduced without a significant decrease of PaO2. On the contrary, if Qs/Qt decreases significantly on FIO2 increments, a reduction of the latter could enhance hypoxemia. It seems evident that Qva/Qt assessment on different FIO2 in patients with severe acute respiratory failure adds useful information for its management and that it cannot be assumed a priori that Qs/Qt with 100 percent O2 will be always equal or greater than that measured with FIO2 0.4-0.6.

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REFERENCES

To the Editor:

Drs. Raimondi present shunt study data from two small groups of patients with "bacterial bronchopneumonia." Group A consists of seven patients with Qsp/Qt of less than 20 percent on a maintenance FIO2 of 0.4 who demonstrate no significant change in Qsp/Qt after administration of 100 percent oxygen. These data are dramatically opposite not only to our findings,1 but to other comparable published data.2-4 Without additional information concerning patient profile, treatment protocols and methodology associated with collecting these data, we can make no further comment.

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Group B contains five patients with intrapulmonary shunts between 40 and 65 percent on maintenance FIO2, who demonstrated no significant changes in shunt measurement following 100 percent oxygen administration. Since we were concerned with evaluating the effects of 100 percent oxygen in clinical situations where an FIO2 of 0.5 or less would produce adequate arterial oxygenation, by design our study excluded patients with large Qsp/Qt. The observation that some patients with intrapulmonary shunts greater than 40 percent do not increase the shunt calculation with 100 percent oxygen is consistent with previously published data; however, it must be reemphasized that Quan et al3, Mcaaslan et al2, Douglas et al1, Carlson at al,4 and our study do not support the data of the Drs. Raimondi or assertions concerning their Group A.

Of particular interest are the remaining four patients in Group B with intrapulmonary shunts ranging from 55 to 80 percent. These shunt measurements dramatically decreased with 100 percent oxygen administration. In our experience, the cardiovascular system of patients with this magnitude of intrapulmonary shunting are so unstable that comparative shunt studies at varying FIO2 meeting the criteria of our research protocol are not possible. Without further information concerning the methodology utilized, we must question the reliability of their reported measurements.

In light of the above analysis, we believe that the statements and conclusions contained in the last paragraph of the letter from Drs. Raimondi are invalid. We reaffirm our statement that "clinical measurements of shunting for purposes of following intrapulmonary pathologic abnormalities should be accomplished at maintenance values of FIO2, or at some reference point well below 100 percent oxygen." This conclusion is based primarily on the fact that our data1 and other published data2-5 establish that intrapulmonary shunt calculations are usually increased with 100 percent oxygen and, secondly, that the hypoxemia with most V/Q inequalities is corrected with oxygen concentrations well below 100 percent.

We believe the most appropriate clinical approach for evaluating intrapulmonary shunting is to measure Qsp/Qt at a maintenance FIO2 that provides adequate arterial oxygenation, and then repeat the measurement at a higher FIO2 - a form of "oxygen challenge." In our experience, an increase in FIO2 of more than 0.2 is seldom necessary to differentiate V/Q mismatching from true shunt (V/Q = 0). By avoiding 100 percent oxygen, iatrogenic contributions to the true shunt can be minimized without affecting the value of the information obtained.

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REFERENCES

5 Quan SF, Kronberg GM, Schlobohm RM, et al. The change in venous admixture with varying inspired oxygen concentrations. Anesthesiology 1980; 52:477-82

Is it CPR or PCR?

To the Editor:

As any educational psychologist well knows, the terms or choice of words we frequently use in any specific training discipline can paint a picture that influences the behavior of students. This explains why outstanding textbooks and training manuals are carefully written, using terms that define, clarify, and support the meaning we wish a student to understand. Since medical education, in itself, is a method of modifying behavior, a well-chosen term must impart knowledge as well as guide a physician in making decisions that are appropriate and follow a logical order during any sequence of care.

The term, cardiopulmonary resuscitation (CPR), is certainly an example of a very popular term which has received widely circulated usage in the medical, paramedical, and nonprofessional communities. CPR is considered to be a standard term in all emergency medical technique courses, in all advanced life support seminars, and in all standard texts dealing with first aid, emergency medicine, and critical care.

The thing that is very interesting about the term cardiopulmonary resuscitation is that the compound word, cardiopulmonary, indirectly places the emphasis on the cardiac aspect of basic life support ahead of the pulmonary aspects by the very order of the construction of this compound word. Thus, any reader of a text or listener at a lecture (particularly beginners) where the essentials of CPR are being disseminated becomes subtly influenced or educationally conditioned to accept that the cardiac aspect of a cardiac arrest is more important than the airway interventions which are classically taught to be the first considerations in the management of the sequence of events during a successful code.

It is also very interesting to observe students of CPR who have been presented a very accurate lecture involving the sequence to be followed in cardiac arrest. The so-called "A, B, Cs" of cardiopulmonary resuscitation, in order, are always airway, breathing and circulation or compression. When the students are asked to demonstrate this order during a practical exam, one of the most common errors is to start compressions initially before any airway considerations are made. This sequence error is also observed commonly in the "real world" of cardiac arrest when laypersons, emergency medical technicians, paramedics, nurses, and physicians under pressure attempt to save a victim.

Is it possible that the repeated usage of the term cardiopulmonary resuscitation covertly motivates inappropriate behavior in a rescuer who has been taught the appropriate, ordered sequence in CPR? From an educational and psychologic standpoint, would it not be more appropriate to call CPR pulmonocardiac resuscitation or PCR to emphasize that early airway interventions are sequentially more important in basic life support?

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