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 method or with the inert gas technique, 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 V̇a/Q̇ 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 V̇a/Q̇ when FIO₂ is increased slightly. Besides, alterations of gas exchange produced by V̇a/Q̇ inequalities at FIO₂ greater than 50 percent do not play an important role.

At this FIO₂ level, Qva/Qt modifications are possibly due to very important V̇a/Q̇ mismatching (log normal distribution of V̇a/Q̇, log SD(σ) > 1.5) and/or eventual diffusion impairment with concomitantly increasing shunt. It seems clear to us that in patients with slight V̇a/Q̇ inequalities and no diffusion impairment FIO₂ increments will enhance true shunt caused by the absorption atelectasis that high O₂ administration would produce.

On the other hand, in cases with severe V̇a/Q̇ 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.

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 possibly true in their particular group of patients with moderate alterations in gas exchange (Qva/Qt =0.17), but it is not applicable at all to 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 King 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.

Guillermo A. Raimondi, M.D., F.C.C.P.
and Alejandro C. Raimondi, M.D., F.C.C.P.
Centro Nacional de Rehabilitacion Respiratoria “Maria Ferrer,” Buenos Aires, Argentina

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, but to other comparable published data. Without additional information concerning patient profile, treatment protocols and methodology associated with collecting these data, we can make no further comment.