Propofol and Cellular Calcium Homeostasis

To the Editor:—In an interesting paper, Jensen et al.1 described the effects of propofol on the cytosolic-free calcium concentration ([Ca"^2+"]) and on the cytoskeletal organization in neurons and astrocytes. The authors concluded that propofol induces an increase in [Ca"^2+"], and therefore a change in the organization of actin filaments. A large part of the discussion concerned the mechanisms of this [Ca"^2+"], increase. However, the authors did not provide a consistent explanation for their findings.

At least three processes are involved in [Ca"^2+"], regulation: (1) the transmembrane Ca"^2+" influx through voltage-activated Ca"^2+" channels, (2) the release of Ca"^2+" from intracellular stores (e.g., mitochondria or endoplasmic reticulum), and (3) the clearance of cytosolic Ca"^2+" by reuptake in the intracellular stores or extrusion in the extracellular medium. The authors found two components of the [Ca"^2+"], increase: an increased influx of extracellular Ca"^2+" and a release of Ca"^2+" from intracellular stores.

Propofol has been found to inhibit transmembrane Ca"^2+" current in myocytes and neurons.2,5 Nevertheless, a nonspecific membrane fluidizing effect could be involved in the extracellular Ca"^2+" influx. The most interesting point concerns the release of Ca"^2+" from intracellular stores. The authors cite the work of Eriksson on rat liver mitochondria.4 In this study, the author demonstrated that propofol could inhibit Ca"^2+" release from mitochondria.5 This finding appears for Jensen et al. to be contradictory with their own results. We studied the effects of propofol on Ca"^2+" transport in mitochondria. As previously reported by Eriksson in liver mitochondria, we have shown in heart mitochondria that propofol inhibits the permeability transition pore and the mitochondrial Ca"^2+" release.5 At higher concentrations (>100 μM), an uncoupling effect of propofol can decrease the mitochondrial Ca"^2+" uptake through the potential-dependent Ca"^2+" uniport.

We think that these data and those of Eriksson do not contradict the results of Jensen et al. In their study, the increase in [Ca"^2+"], after addition of propofol could be due to a release from another intracellular store like the endoplasmic reticulum. Recently, Hossain et al.6 reported that some anesthetics (halothane, isoflurane, octanol) increase [Ca"^2+"], by inducing a leak of Ca"^2+" from IP"_3" sensitive stores (e.g., endoplasmic reticulum). In the case of propofol, it seems important to test the same hypothesis to explain the results of Jensen et al.

References


(Accepted for publication September 19, 1995.)

François Sztark, M.D.
Assistant in Anesthesiology
François Ichas, M.D.
Research Fellow
Jean-Pierre Mazat, Ph.D.
Professor of Biochemistry
Philippe Dabadie, M.D.
Professor of Anesthesiology
Laboratoire d’Anesthésiologie (GRAF/DBM) 
Université Bordeaux II 
33076 Bordeaux Cedex, France

Anesthesiology, V 83, No 6, Dec 1995