

Anesthesiology  
54:524, 1981

### The Need for a Clearer Distinction between Anesthesia and Analgesia in Relation to the Opiate System

*To the Editor:*—The article published in your journal related to halothane and cerebral metabolic effects is of great interest.<sup>1</sup> However, the statement, "Naloxone has been reported to reverse the analgesic effects of a variety of drugs and therapies other than narcotic including nitrous oxide, halothane, enflurane, cyclopropane, pentobarbital. . . ."<sup>1</sup> raises a number of issues which we would like to mention.

There is some work which suggests that nitrous oxide, particularly in analgesic doses, does in fact have narcotic properties, closely resembling morphine.<sup>2-5</sup> This interaction could be mediated either by nitrous oxide causing the release of endogenous opiates or by direct receptor activation as suggested by Gillman and Lichtigfeld.<sup>4</sup> It is unlikely that nitrous oxide causes the release of endogenous opiate substances, since nitrous oxide does not seem to alter titers of these substances in human CSF (Y. Hosobuchi: personal communication). Agents with marked analgesic properties at subanesthetic concentrations may in fact be opiate receptor agonists. This analgesic property is most clearly seen with substances with high blood/gas solubilities such as methoxyflurane and trichloroethylene; nitrous oxide, however, is an exception to this rule as it acts rapidly and has a low solubility. The work of Artru *et al.*<sup>1</sup> highlights the considerable experimental evidence against naloxone acting as an antianesthetic agent. However, we know that naloxone reverses the analgesic effects of "non-opiate" agents, particularly nitrous oxide, as previously mentioned.

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We, therefore, would like to suggest that more information might be derived from the study of agents in which the distinction between anesthetic and analgesic effects is more obvious, particularly as the latter effects may be opiate receptor mediated.

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(Accepted for publication December 15, 1980.)

### The Dorsal Root Ganglion as a Site of Blockade during Epidural Anesthesia

*To the Editor:*—It is unfortunate that Cusick *et al.*<sup>1</sup> failed to examine the dorsal root ganglion as a site of blockade during epidural anesthesia, or even to cite our work on this subject.<sup>2,3</sup> Ironically, at the same 1979 ASA meeting where these authors presented their work, Galindo and Witcher<sup>4</sup> presented their findings on this subject. Galindo tested our results using complex neurophysiological techniques and confirmed our conclusion that the dorsal root ganglion is the most sensitive intradural structure to anesthetic block.

These findings could account for threshold sensory anesthesia during both spinal and epidural block.

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(Accepted for publication December 15, 1980.)

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*In reply:*—Our article was not intended to be a review of the various proposed mechanisms of action of epidural analgesia, but Frumin's comments do serve to emphasize the value and need for our model in such investigations. Its capability to give objective, direct and reproducible evidence regarding the varying sites of altered neural conduction during epidural analgesia must be considered preferable to many of the previous studies including that of Frumin and associates<sup>1</sup> which developed a hypothesis of the mechanism of action from secondary and remote observations. Although we purposely reserved many interpretations regarding the participation of peripheral nerve, dorsal roots and dorsal root entry zone from our study until completion of additional investigations with varying drug doses and concentrations are completed, certain information regarding the dorsal root ganglia can be obtained from that study. The positioning of the cauda equina electrode in many of our preparations usually was located distal to dorsal root ganglia relative to the stimulated nerve, and, therefore, comments regarding the peripheral nerve component may be considered pertinent to the possible participation of the dorsal root ganglia relative to the local anesthetic agents used in our study. In fairness, it must be noted that the previous studies concerned with the participation of the dorsal root ganglia present an oversimplification of the neurophysiologic function of this structure, as well as indicating a seemingly mistaken concept of its anatomic configuration and localization (an extra arachnoidal structure, an area of tissue transition with thickened tissue barriers, an outpouching of the conducting afferent fibers, *etc.*<sup>2</sup>). Frumin's implication that studies done by Galindo and Witcher<sup>3</sup> using the frog sciatic nerve-spinal cord preparation either verified his hypothesis or suggested that our evaluation using the present model was erroneous do not appear warranted. In that study, the sensitivity of various

levels along the peripheral nerve and dorsal nerve roots to local application of varying concentrations of procaine was evaluated by applying a shock stimulus at the sciatic nerve level and recording the response from the dorsal roots. Therefore, this preparation examined the anesthetic susceptibility only of the peripheral nerve and dorsal roots (apparently proximal to their glial-Schwann transition zone just prior to their entrance into the dorsal horn gray matter), used a local anesthetic agent not studied in our investigation, and in no fashion mimicked a model of epidural infusion. Therefore, we are unable to offer any support to Frumin's contention that the dorsal root ganglion is an important site of altered neural conduction during epidural analgesia. Our studies using epidurally administered bupivacaine, chloroprocaine, and etidocaine, all indicated that the major site of action of these anesthetic agents was at the spinal cord level. The various regions of the spinal cord, especially that area of transition zone in the dorsal root fibers, requires further differential studies.

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(Accepted for publication December 15, 1980.)