

Editorial Views

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Deliberate Hypotension

TO MOST ANESTHESIOLOGISTS, "deliberate hypotension" is an all-inclusive term that means blood pressure is decreased in an anesthetized patient in order to lessen bleeding at operation. The anesthetic agents used, the ancillary drugs injected, or the special techniques employed are seldom considered. Yet it is the agents, the ancillary drugs and the special techniques that determine whether deliberate hypotension can be done safely and with advantage. We have left the era when "an anesthesia" meant ether or chloroform, probably by open drop; today qualifying terms needed to clarify "an anesthesia" are too numerous to recount. Not so with deliberate hypotension; it remains for most a "basket" term.

Deliberately lowering blood pressure to facilitate a surgical procedure is relatively new—within 30 years. This is not to say that hypotension did not accompany anesthesia before that; in fact, many of the deaths recorded from the early administration of chloroform with the patient in the sitting position occurred because chloroform is a myocardial depressant and the patient was placed in a sitting position. The probable sequence was venous pooling, decreased cardiac output, cerebral anemia, and death. Surgeons recognized early that spinal anesthesia decreased blood pressure and provided better operating conditions than did general anesthesia, although they didn't write of this being deliberate hypotension. A few were even known to use spinal anesthesia for thyroidectomy because of the perfect surgical conditions they thought it produced.

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Since the terms "controlled" and "deliberate" hypotension were coined, a variety of agents and techniques have been recommended. The manner in which the hypotension is produced and maintained determines the safety and effectiveness of the technique and, therefore, must have impact upon the significance of the scientific data being accumulated during use of the technique. The short-comings of the technique in the early years of its use and the lack of understanding of its application led to the report of Hampton and Little in 1953, which almost caused the abolition of deliberate hypotension in this country.¹ Methods of producing hypotension differ, and authors as well as readers must understand what is being said. We have seen deliberate hypotension produced by arteriotomy, high spinal anesthesia, nitrous oxide-narcotic-muscle relaxant and hexamethonium or trimethaphan, ether, halothane, nitrous oxide-halothane-pentolinium, nitrous oxide-nitroprusside, Éthrane, with patients positioned horizontally, head-up tilt, or head-down tilt (to "protect" the brain). Some believe in adjunctive use of beta-adrenergic blocking drugs to help diminish cardiac output. There are those who advocate use of controlled ventilation, some with increased end-expiratory pressure (when needed to decrease venous return), presenting data to support their positions, while on the opposite side some espouse spontaneous ventilation, pointing to failure of arterial carbon dioxide partial pressure increase as a reason to doubt the need for controlled ventilation. Nonetheless, the need for clarity and specificity in writing is obvious.

There are four essential components of deliberate hypotension: anesthetic agents and adjuvants, ventilation, drugs acting upon the cardiovascular system, and body position. The details of each of these components, especially body position, must be spelled out by

writers and understood by readers. When blood loss at the operative site is being measured, what is the relationship of that site to the remainder of the body and to the point of measurement of blood pressure? Bleeding is least when the wound is uppermost because the blood pressure in the wound is hydrostatically lower and blood is pooled in capacitance vessels in dependent portions of the body, thereby decreasing cardiac output. When pressure is measured intra-arterially in the supine patient, the pressure is usually referenced to the heart level, but not always when there is head-up or head-down tilt or when the patient is positioned laterally. When the patient is in the lateral position and blood pressure is being measured in the radial artery in the dependent arm, and the manometer referenced to that artery, then the blood pressure at heart level will be less than the reading obtained, and it will be further diminished at the level of the non-dependent hip. These variations may be exaggerated or lessened by tilt of the table. Similarly with studies of organ function: what is the level of the organ in relation to blood pressure reference? While Thompson and associates mention a mean blood pressure of 50 torr, we have no idea of the relationship of this measurement to wound or brain, or whether the relationship was always constant among the patients studied. In the reference to our 1964 work, the mean systolic blood pressure was 63 torr, but we pointed out that the patients were in a 25-degree head-up tilt; it was estimated that the average cerebral systolic blood pressure at the base of the brain was 16 torr less, or 47 torr.

Body position is likewise important in the management of ventilation during deliberate hypotension. In the supine patient with modest hypotension, spontaneous respiration may suffice. However, with body tilt or with the lateral position, both augmenting venous pooling leading to decreased cardiac output, physiologic deadspace increases and spontaneous ventilation becomes insufficient for adequate respiratory

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Anesthesia and Surgical Care—Manpower Needs and Utilization

IT IS OPPORTUNE to have Francis Moore, M.D., Elliott Carr Cutler Professor of Surgery, Harvard Medical School, who has studied surgical manpower for many years, apply his experience, from the surgeon's perspective, to the field of anesthesiology. His article in this issue of ANESTHESIOLOGY is based on his presentation as the 1976 Rovenstine Lecturer. His correlation

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exchange. The authors' data for the deep halothane-spontaneous ventilation group demonstrate this point. Why did it not occur with the nitroprusside-spontaneous ventilation group? This question is not answerable without a better definition of body position and comparison of referenced levels of blood pressure among the groups. I can't agree that hypotension from deep halothane anesthesia results principally from cardiac depression. This minimizes other pharmacologic actions of halothane. There probably was more blood pooled in dilated capacitance vessels with deep halothane anesthesia, worsening physiologic deadspace, than was true with light halothane anesthesia and a modest dose of nitroprusside. If all other conditions of the two groups could be proven equal, then a case is made for light halothane anesthesia and nitroprusside rather than deep halothane anesthesia as the better technique for deliberate hypotension.

The principal advantage of deliberate hypotension is often thought to be the decreased need for blood replacement. This is untrue. Bleeding is lessened but this allows the surgeon to see better and to do a more definitive operation. It also allows better wound healing and less wound infection, since there is less blood, ligatures or cauterized tissue in the wound. These were the reasons Sir Archibald MacIndoe, the eminent British plastic surgeon, so encouraged the anesthetists to pursue the technique. Oddly enough, considering the advantages are mostly surgical, the reports have appeared chiefly from anesthesiologists. It is good to see that a surgeon was involved here.

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Reference

1. Hampton LJ, Little DM Jr: Complications associated with the use of "controlled hypotension" in anesthesia. *Arch Surg* 67: 549-556, 1953

of the surgical data base greatly broadened by the Study of Surgical Services for the United States¹ (SOSSUS) with anesthesiology data expands our understanding of manpower issues. Dr. Moore was able to draw upon considerable demographic data about anesthesia personnel. These included the 1970 American Society of Anesthesiologists Manpower Study,² the 1972 ASA Study of Nurse Anesthetists,³ the 1974 ASA Manpower Survey of Practice and Attitudes,⁴ the ASA manpower material prepared for the Govern-