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INTRODUCTION

THE MODERN VIEW OF ANAESTHESIA

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The aim of the pioneers of anaesthesia was to make surgical operations tolerable by the patient, and their chief object was the establishment of unconsciousness. With the development of surgery, particularly of abdominal surgery, muscle relaxation was required, which could be attained only with profound anaesthesia. As deep anaesthesia was usually necessary to allow major operations to be performed, the view became accepted that it was necessary, also, to protect the patient from the harmful effects of painful stimuli. With deep anaesthesia, cardiovascular reactions to such stimuli as traction on the mesentery, presumably mediated through the autonomic nervous system, could be modified. This view gained support from the success of Crile's combination of local analgesia with light nitrous oxide anaesthesia and from the evident indifference of patients under the complete block, visceral and somatic, of spinal analgesia.

The various general anaesthetic agents were held

to possess in common the property of producing anaesthesia, while their undesirable side-effects differed. They were, accordingly, used in number of different combinations designed to limit the severity of any individual side-effect. Burgi postulated that the whole anaesthetic effect, particularly of pharmacologically different groups of substances, was greater than the sum of the individual effects, and Gwathmey, in the application of this hypothesis, advocated the use of combinations of considerable complexity.

Our approach to the problem has been revolutionized by our present ability to exercise separately, and in varying degree, many of the functions that were formerly required of a single agent. The true anaesthetics, such as ether, do not produce a significant degree of analgesia before consciousness is lost; this can be presumed to increase in degree as anaesthesia is deepened, when there is also some modification of response mediated through the autonomic nervous system.

The short-acting barbiturates, we believe, produce unconsciousness without analgesia. The analgesics, such as pethidine, produce analgesia with little effect on consciousness; in combination with the hypnotics they can give a fair imitation of anaesthesia. The muscle relaxants produce neither unconsciousness nor analgesia, but they allow surgical operations to be performed at any arbitrary level of anaesthesia.

Unconsciousness is not essential; Artusius has conducted thoracotomies with ether analgesia. Nor, apparently, is analgesia, for many surgical operations have been carried out successfully under light barbiturate sleep combined with paralysis by muscle relaxants. Certainly hypnosis can act only by inhibition, through the cerebral cortex, of the normal reactions. One is forced to the astonishing conclusion that it is from his reactions to injury rather than from the injury itself that the patient most needs protection.

This much we have in common with the upholders of the views of Selye and of Reilly on the nature and the meaning of the body's responses to injury. Here there is much confusion. Those who accept these views in their entirety feel impelled to block the autonomic nervous system at all levels and to interfere with the functions of endocrine glands by employing a number of agents in combination. Good results are claimed but, if these are accepted, it is impossible to know to what they are to be attributed. We can use drugs which are cholinergic or anticholinergic, adrenergic or antiadrenergic, hypnotic or analeptic, histaminic or antihistaminic, which block autonomic ganglia or which interfere with autonomic function at some higher level. Mixed up with this is the application of cold, from a fancied resemblance of the state of the patient to that of hibernating animals. In this state surgical operations can be performed, but we have no clear evidence that the whole or any part of these actions is either necessary or desirable.

Evaluation is made difficult by the lack of any clear-cut criteria of success or failure, other than the somewhat crude death or survival, and by the great variability in the pre-operative condition of

the patient and in the performance of the operation and the handling of the anaesthetic. Few of our agents are truly specific; d'tubocurarine produces a significant degree of autonomic ganglion block and some histamine release; thiopentone produces marked peripheral vasodilatation and a relative increase in vagal tone; pethidine is antihistaminic and atropine-like, as well as analgesic; promethazine is hypnotic as well as antihistaminic—it prevents some of the vascular responses to histamine but it neither destroys it nor prevents its formation, and its effectiveness in anaesthesia may have nothing to do with any action against histamine as such. Animal experiments can guide us but their results cannot be applied directly to human beings. Much carefully controlled work must be done, subject to the limitations imposed by ethical considerations, before we can be sure that we are achieving the effects at which we aim. Only then can we begin to find out whether these effects play any useful part.

Our physiological trespass has extended to the deliberate induction of apnoea, of hypotension and of hypothermia as aids to surgery; these are discussed in detail in subsequent articles. Our experience of the handling of apnoeic patients has proved of value in the treatment of bulbar poliomyelitis, of barbiturate intoxication and of tetanus by the paralytic method and we, in turn, have learned much from these that does not become apparent within the short duration of a surgical operation. Induced hypotension and even the temporary arrest of the circulation have such obvious advantages that our researches may be confined to finding ways of making them sufficiently safe. Here, induced hypothermia, by reducing cellular metabolism and so prolonging survival without oxygen, will probably play its most important part. The artificial heart-lung can take over a part of the normal functions of respiration and of circulation and a combination of this with the extracorporeal method of cooling is attractive in theory. For the present, induced hypothermia has limited indications and cannot be considered well enough established for general use.