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OBSERVATIONS IN THE IMMEDIATE POSTANAESTHESIA PERIOD
II. MODE OF RECOVERY

BY

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THE events taking place as a patient emerges from anaesthesia are not well understood and several theories have been advanced to explain the phenomena that occur during this period. However, their exact cause will probably not be found as long as the basic mechanisms of anaesthesia are not entirely clear.

A small number of clinical facts are, nevertheless, well established; an example is the well-known inordinate behaviour of alcoholics during emergence. But a number of very basic facts need clarification. Does the age, sex or constitution of a patient have any definite influence on emergence from anaesthesia? What are the effects of the anaesthetic agent, the duration of procedure and the site of operation on emergence? This report of our observations in the immediate postanaesthesia period is related to these questions. These observations will help us to gain more knowledge of the problem and may enable us to make progress toward more rational and effective methods of treating and preventing postanaesthetic delirium.

PROCEDURE

Special study sheets composed of two parts were filled out in conjunction with the anaesthetic record of each patient. The first section was completed by the person administering the anaesthetic. For classification of the structural type, the following criteria of body structure based on Kretchmer's (1926) work were used: narrow, slender (leptosome); rounded, chubby (pyknic); muscular, well developed (athletic); and with grossly abnormal proportions or deviations (dysplastic). These records then accompanied the patient to the recovery room where they were completed by the recovery room personnel under the supervision of an anaesthetist. The recovery room staff had no precise knowledge of the objects of this study so that observations may be presumed to be unbiased.

The completed data sheets were coded and the results reported on I.B.M. cards. These cards were used later for tabulation, correlation, and analysis. Complete observations and data were obtained on 1,450 patients of all ages of whom 651 were male and 799 were female. Four age groups were used in this study: group 1, ages 10–17, comprised 64 patients; group 2, ages 18–49 years, comprised 624 patients; group 3, ages 50–65 years, comprised 482 patients; and group 4, ages over 65 years, comprised 208 patients.

The expression "mode of recovery" will be used to define reactions and behaviour while consciousness is being regained during the period following cessation of anaesthesia and surgery. The patients were rated as to their mode of recovery in one of three groups. Mode 1 comprised those patients who made a tranquil and uneventful recovery; mode 2 comprised those patients who showed a moderate degree of restlessness, and mode 3 those who were markedly delirious and unco-operative, requiring special care and restraint. Ninety-seven per cent of the patients were given premedication with barbiturates and belladonna preparations using usually amylobarbitone (Amytal) sodium and atropine. Only 3 per cent received an opiate in lieu of, or in conjunction with, the barbiturate and belladonna. Four anaesthetic agents were used: a combination of thiopentone and nitrous oxide; ether; cyclopropane; and cyclopropane with ether.

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RESULTS

There was no significant relationship ($0.5 > P > .03$) between the mode of recovery and the sex of the patients (table I). There was no significant relationship ($P > 0.5$) between mode of recovery and age; there was, however, a tendency towards more agitated recovery in the teenage group (table II).

The body type (table III) did not influence the recovery (P is approximately 90 per cent).

There was a significant relationship ($P < .01$) between the mode of recovery and the anaesthetic agent (table IV).

The site of operation was of significant importance ($P < .01$) as to mode of recovery (table V).

The duration of the procedures (table VI) appeared to be of significant influence ($P < .01$).

The incidence of vomiting was 21 per cent among patients with mode of recovery 1; it was 30 per cent in mode of recovery 2; and 37.5 per cent in mode of recovery 3.

TABLE I

Mode of recovery—general results and distribution in relation to sex.

Mode of recovery	Total	Male	Female
1	1112 (76.6%)	483 (74.2%)	629 (78.7%)
2	298 (20.6%)	144 (22.1%)	154 (19.3%)
3	40 (2.8%)	24 (3.7%)	16 (2.0%)
Total	1450	651	799

TABLE II

Mode of recovery in relation to age groups.

Mode of recovery	Age group 2 11 to 17 yrs.	Age group 3 18 to 49 yrs.	Age group 4 50 to 65 yrs.	Age group 5 over 65 yrs.
1	45 (70%)	483 (77.5%)	370 (76.7%)	214 (76%)
2	14 (22%)	124 (19.8%)	101 (21%)	59 (21.4%)
3	5 (8%)	17 (2.7%)	11 (2.3%)	7 (2.6%)
Total	64	624	482	280

TABLE III

Mode of recovery in relation to structural type.

Mode of recovery	Leptosome	Athletic	Pyknic
1	392 (76.2%)	383 (77.7%)	307 (77.4%)
2	110 (21.3%)	95 (19.3%)	78 (19.6%)
3	13 (2.5%)	15 (3%)	11 (3%)

TABLE IV

Mode of recovery in relation to anaesthetic agents.

Mode of recovery		Thiopentone nitrous oxide	Ether	Cyclopropane	Cyclopropane —ether
1	Total	235 (87%)	236 (80%)	427 (73.6%)	206 (70%)
	Male	140 (84.3%)	114 (76%)	144 (71%)	83 (62%)
	Female	95 (90%)	122 (83%)	283 (74%)	123 (76%)
2	Total	34 (12%)	54 (18%)	129 (22.3%)	81 (27.5%)
	Male	23 (13.7%)	34 (22.6%)	41 (22%)	46 (34%)
	Female	11 (10%)	20 (13.6%)	88 (24%)	35 (22%)
3	Total	3 (1%)	5 (2%)	24 (4.1%)	8 (2.5%)
	Male	3 (2%)	2 (1.4%)	14 (7%)	5 (4%)
	Female	0	3 (3.4%)	10 (2%)	3 (2%)

TABLE V

Mode of recovery in relation to operative site.

Site of operation	Mode of recovery 1	2	3
Head and neck	106 (78%)	28 (20%)	3 (2%)
Thoracic	29 (67%)	9 (21%)	5 (12%)
Intra-abdom (gyn. except)	241 (68.8%)	99 (28.2%)	11 (3%)
Gynaecol.	152 (80.5%)	30 (16%)	7 (3.5%)
Urine tract	206 (80%)	48 (18%)	5 (2%)
Extremities, periphery	164 (82%)	36 (17%)	2 (1%)

TABLE VI

Mode of recovery in relation to duration of procedure.

Duration of procedure	Mode of recovery 1	2	3
To 1 hour	383 (86.5%)	52 (12.6%)	3 (0.5%)
To 2 hours	351 (73.2%)	114 (23.8%)	14 (3%)
To 3 hours	212 (73.8%)	64 (22.2%)	11 (4%)
To 4 hours	124 (72.1%)	42 (24.4%)	6 (3.5%)
Over 4 hours	72 (69.3%)	26 (25%)	6 (5.7%)

DISCUSSION

The many causative factors of postanaesthetic delirium may be divided into two main groups. The first contains those related to the anaesthetic and surgical procedures. The second is composed of those inherent in the individuality of the patient, such as sex, age, body constitution, and mental attitude. There is little doubt that the anaesthetic agent is of major importance in the mode of recovery, as the results indicated that cyclopropane caused the most violent reactions, followed in decreasing order by ether and by barbiturates.

Guedel in 1940 observed that "emergence delirium is greater and more active with cyclopropane than with any other anaesthetic agent". He postulated that this agent in sub-anaesthetic concentration stimulates the central nervous system and that, inasmuch as cyclopropane does not depress muscular activity as does ether, a more active delirium is to be expected upon emergence from anaesthesia.

We cannot accept Guedel's central nervous system stimulation theory but rather believe that the difference between the agents is caused mainly by a slower elimination of barbiturates and ether as compared with cyclopropane. Barbiturates and ether in subanaesthetic concentrations appear to have the ability to modify the patient's reaction to emergence. The Guedel theory concerning muscular depression is not borne out by the fact that thiopentone has minimal muscular relaxant effect and yet is followed by the quietest mode of recovery.

Observations related to the duration of the procedure seem to indicate that this is an important factor in postanaesthetic recovery. Indeed, while over 86 per cent of the group of patients lasting 1 hour or less were followed by uneventful recoveries, only 69 per cent of the group of cases lasting over 4 hours had equally favourable results. This difference can be partly explained by the fact that thiopentone-nitrous oxide anaesthesia was used in 33 per cent of the cases in the first group, but only in 1 per cent of those in the second group. Furthermore, surgery in the first group was mostly limited to peripheral operations whereas the longer cases were mostly intra-abdominal and intrathoracic procedures which are types of surgery followed by the highest incidence of violent reactions. In view of these considerations it appears justified to conclude that the duration of a procedure is by itself of no appreciable influence on the mode of recovery.

The operative site appears to have a significant influence on the mode of recovery. Peripheral surgery was followed by a relatively low incidence of delirium, whilst the highest incidence occurred after intrathoracic and intra-abdominal surgery. There can be little doubt that painful afferent stimuli are far more pronounced in the latter types of operations, as the abdominal and thoracic walls are continuously in motion and may cause the operative wound to be quite painful.

The second group of factors conditioning the mode of recovery contains those related to the individuality of the patient. The influence of sex appears to be minimal, although females predominate slightly in mode of recovery 1 and males in modes of recovery 2 and 3.

Age seems to have no significant influence in the mode of recovery. Distribution was quite even among adults but there was a definite tendency towards more agitated recovery in the teenage group.

There appears to be no relation between structural type and postanaesthetic mode of recovery. There was no difference in this respect between leptosome, athletic, and pyknic individuals. Of course delirium can be more impressive and more difficult to manage in athletic patients than in asthenic ones, but there is no relation as to the frequency of occurrence.

On the contrary, psychological characteristics appear to be of much importance. Most individuals are able to function within the limits of their capabilities and personality liabilities by developing satisfactory automatic psychological defences which allow them to perform in an integrated manner and to lead well-adjusted lives. However, there are situations which may result in aberrant behaviour and thinking. These circumstances can be placed into two categories. There can be a weakening of the controls by the action of some agent or by hypoxia resulting in subdued personality defence mechanisms. There can be an unusual and overwhelming stress, as all individuals, to a greater or lesser degree, may develop disabling emotional disturbances given appropriate stress. Such situations could be present on emergence from surgical anaesthesia. The cerebral cortex may still be depressed to a degree where perception of painful stimuli is regained but where self control is not yet re-established. It is our belief that other factors being equal, emergence from surgical anaesthesia is primarily conditioned by the patient's personality structure. Pain by itself does not appear to be the essential factor causing any specific degree of delirium. It seems, rather, to be the reaction to pain and to stress in a type of submerged personality characteristic kept in check under normal circumstances.

The preceding considerations should be taken into account in the treatment of postanaesthetic emergence delirium. Much can be achieved prior to anaesthesia if the anaesthetist reassures apprehensive patients during the pre-operative interview. Cautious discussion and explanation of the procedure will do much to dispel doubts, fears, and anxieties, and will give the patient some measure of confidence and courage. This state of mind will be helpful during the postanaesthetic phase.

In spite of this reassurance, apprehensive subjects may show anxiety while in the process of regaining consciousness. The person in charge of the emergent patient should talk to him, orientate him as to time and place, and reassure him until he has regained full control of his faculties. In situations where a known disturbance exists, such as alcoholism or established neurotic behaviour, drugs in the general class of tranquillizers may be indicated. The usual precautions should be exercised to avoid or minimize possible side effects of these particular compounds. Apomorphine in appropriate doses is still very useful when there is a contra-indication to medication of the phenothiazine type. Of course, whenever pain is present in any appreciable degree, it should be tempered by opiates or equivalent drugs. When the usual medications are of no avail against postanaesthetic delirium of alcoholics, intravenous administration of 500 ml 5 per cent dextrose in water containing 5 per cent ethyl alcohol may be of benefit.

The welfare of the patient during the immediate postanaesthetic phase is the responsibility of the anaesthetist. Appreciable harm can be done at this particular time by the use of inappropriate medications. On the other hand, very much good can be achieved by judicious and specific therapy.

SUMMARY

(1) A series of 1,450 patients above the age of 10 years was observed while recovering from surgical anaesthesia. Of these 76 per cent had a quiet recovery, 20 per cent had a moderately agitated recovery, and 3 per cent had marked delirium.

(2) The anaesthetic agent appears to be a significant factor; thiopentone-nitrous oxide being associated with the quietest recovery phase among the anaesthetic techniques studied.

(3) The operative site appears to be important; intrathoracic and intra-abdominal surgery is followed by the highest incidence of postanaesthetic delirium.

(4) The structural type and sex of the patient had little influence on the mode of recovery. Teenagers acted more violently than patients of older age groups.

(5) The psychological characteristics of the individual are the most important single factor in postanaesthetic mode of recovery.

REFERENCES

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BOOK REVIEW *continued from page* 180

to be mentioned in this connection is the excellent account of the role of the anaesthetist in cases of Respiratory Insufficiency, and the chapter on Methods of Measurement in Anaesthesia is a stimulation to all enquiring minds. As in the other volume, it is inevitable that even among so much excellence, some chapters are less outstanding than others. The value of the contribution on Types of Congenital Heart Disease and their investigations would be enhanced if the Notes on Anaesthesia were enlarged for the information and interest of those less frequently in contact with this work.

The editors have wisely allowed their contributors to speak for themselves while preserving an all-over standard of accepted practice, and no legitimate issue can be taken with the views expressed. In so large a contribution to the literature of anaesthesia as this, a few small errors must creep in (even in spelling) and doubtless they will be frequently brought to the notice of the editors. It is unlikely that the remark on page 401 suggesting that 2.5 mg of atropine is a small dose could meet with much approval.

These volumes constitute an outstanding contribution to anaesthetic literature and no anaesthetist aspiring to a knowledge of the subject in its widest aspects dare refrain from studying them. That the editors and authors realize that all has not been said even in this monumental text is clearly expressed in the many valuable and pertinent references included at the end of each chapter. The book provides a wealth of information for those reading for higher qualifications, first on its own account and second for its guidance to invaluable references.

The book is produced in the handsome manner which has been previously associated with editions of *Modern Practice in Anaesthesia* (for the production of which one of the editors has long been responsible). The illustrations and diagrams are well reproduced and a reasonable index concludes each volume. The binding and appearance are both impressive and attractive, in happy contrast to the dust-covers which amply confirm the view expressed in one chapter (and already commented upon) that anaesthesia is a movement towards the grave. The editors can be congratulated and warmly thanked for their industry and foresight in producing this book which will be a testimony to the eminence of British Anaesthesia.

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