NAUSEA AND VOMITING DURING SPINAL ANESTHESIA ESPECIALLY AS INFLUENCED BY PRE-OPERATIVE NARCOTICS *

PRISCILLA SELLMAN, M.D.

Boston, Mass.

A FREQUENT and annoying complication during an otherwise satisfactory spinal anesthesia is the occurrence of nausea and vomiting. This distresses the patient, surgeon and anesthetist, nullifies the advantages of this type of anesthesia, and may be harmful to the patient through the accompanying fall in blood pressure.

Probably no one factor is responsible for this complication, though various ones have been suggested: the reduced blood pressure with tissue anoxia (1), especially of the central nervous system; "traction reflexes" from operative manipulation (2); central action of the anesthetic drugs (3) either direct or through the circulation; psychic stimuli due to fear and anxiety; or the preoperative narcotic drugs. Either one or all of these factors may produce a sufficient number of subminimal stimuli so that by a process of summation reflex nausea and vomiting may occur.

In an attempt to decrease the occurrence of nausea and vomiting in abdominal operations with spinal anesthesia, we substituted pantopon for the usual morphine in the preliminary medication. The remainder of the preliminary medication, scopolamine and pentobarbital sodium, was not changed. The amounts of these drugs were varied according to the age and type of patient. The narcotics were given subcutaneously and the barbiturate by mouth. Our aim was to produce a calm, drowsy, yet cooperative state of mind before and during operation.

Pharmacological studies on morphine (4) have shown that it will cause vomiting by direct central action, and may do so by reflex action through increased tone of the gastro-intestinal tract and spasm of the pylorus (5).

On pantopon, contrary reports have been issued. Pantopon (pantopium hydrochloricum) is a mixture of all the natural alkaloids of opium (6), freed from the nonalkaloidal materials and combined in the same proportion in which they are found in the crude drug. Few of these alkaloids have been adequately studied and very little is known of the properties of some of them (7). Approximately 50 per cent of pantopon is morphine so that its action might be expected to domi-

* From the Department of Anesthesia, The Lahey Clinic, Boston, Massachusetts. Read at a meeting of the American Society of Anesthetists, Oct. 10, 1940, in New York City.

nate the combined actions of the twenty opium alkaloids. The emetic action of pantopon is found to be greater than that of morphine on dogs in the laboratory (8), yet there are claims that clinically it causes less nausea and vomiting, less respiratory depression and has a more prolonged action than morphine (9). There is no large series of statistics comparing these drugs clinically but there seems to be little if any pharmacological evidence that pantopon has any advantage over morphine (7).

We reviewed 400 cases of abdominal operations under spinal anesthesia. In all of these, pontocaine-glucose was used according to the Sise (10) technic. The amount of pontocaine and the height of anesthesia varied according to the patient's condition and the operation planned. The height of anesthesia was determined before the start of the operation, and the occurrence and time of onset of nausea, retching or vomiting was recorded. These cases were divided into two groups. Two hundred patients received morphine, scopolamine and pentobarbital sodium as preoperative medication and 200 received pantopon, scopolamine and pentobarbital sodium. Of each 200 cases, 100 were upper abdominal operations (cholecystectomy), and 100 were lower abdominal operations (hysterectomy). Approximately 90 per cent of the patients in whom cholecystectomy was performed were women.

These two types of operations were selected in order that the effects of traction and operative manipulation and the height of the spinal anesthesia might be balanced in the morphine and pantopon groups. We also wished to find out if the effects of traction in the upper abdomen increased the percentage of nausea, retching and vomiting over that produced in lower abdominal operations. While differences between upper and lower abdominal operations could not be precisely checked because in almost all cases of hysterectomy brief exploration of the upper abdomen was carried out, the degree and duration of upper abdominal manipulation in the cholecystectomies were greater. In a few of the cases of cholecystectomy it was found that the anesthetist had written the word "traction" on the chart at the point where the nausea and vomiting had begun. However, this had not been recorded in a sufficient number of cases to be of any value. The occurrence of nausea, retching or vomiting was recorded at the time they appeared in the spaces denoting five minute intervals on the chart, but many spaces were left blank, without a mark to indicate the absence of the complication.

In the majority of the cases, nausea and vomiting, when present, appeared within the first fifteen minutes after operation had begun or within twenty-five to thirty minutes of the time the spinal anesthesia had been given. In a few cases they appeared even before the start of operation but after the spinal anesthetic had been given. In these last cases, naturally, operative manipulation could play no part. Occasionally nausea and vomiting occurred late in the operation, during a

shift in the operative field, as when the appendix was raised before removal, following hysterectomy.

Table 1 shows the part that upper abdominal manipulation may play in the stimulation of reflex nausea and vomiting. The difference between the results of the two types of operation is not striking. Regardless of the type of preoperative medication given, there is only 7.5 per cent more cases with nausea and vomiting during cholecystectomy than during hysterectomy.

There is, however, a more striking difference when pantopon is used than when morphine is employed. It must not be supposed that in all cases of cholecystectomy the same degree of traction was applied but by comparing 100 cases against another 100 cases with the same operation, the amount of operative manipulation must be fairly well balanced in the two groups. Table 1 shows the difference in the percentage of nausea and vomiting in the two groups of patients having cholecystectomy. Of the 100 patients who received morphine as part of their

TABLE 1

NAUSEA, RETCHING AND VOMITING WITH PANTOPON AND WITH MORPHINE OCCURRING IN UPPER AND LOWER ABDOMINAL SURGERY

	Hysterectomy			Cholecystectomy		
	Cases	With Nausea, etc.		Cases	With Nausea, etc.	
		No.	Per Cent		No.	Per Cent
Pantopon	100	24	24	100	33	33
Morphine	100	40	40	100	46	46
Total	200	64	32	200	79	39.5

preoperative medication, 46 (46 per cent) showed nausea and vomiting, while of the 100 who received pantopon in place of morphine, only 33 per cent showed nausea and vomiting. There is a difference of 13 per cent between the two groups of cases which are similar except for their preoperative narcotics. In these few cases there appeared to be some difference between the emetic action of morphine and that of pantopon.

A similar difference is seen in Table 1 in the frequency of nausea and vomiting during hysterectomy. In this operation 40 per cent of the patients who were given morphine had nausea or vomiting, and of the patients given pantopon, 24 per cent. showed this complication. Thus in the hysterectomy cases the difference between those of the morphine group and those of the pantopon group is 16 per cent.

Fear and anxiety may induce a sensation of nausea or actual vomiting in a nervous patient. When this occurs, stimuli have apparently come from the cerebral cortex to the vomiting center. One important function of preoperative medication is to decrease the activity of the

cerebral cortex, relieving anxiety and inducing a state of mental as well as physical quiescence. The efficiency of the preoperative narcosis should be considered in this group of 400 cases. The effect of the medication is estimated by the anesthetist and recorded on the patient's chart. It is judged by the patient's behavior and reactions to lumbar puncture and subsequent tests for height of anesthesia, and is classified as *good, fair, poor,* or *too heavy.* It is not a factor which can be accurately measured.

The presence and duration of nausea and vomiting are probably consciously or unconsciously included in the data from which the anesthetist forms his judgment of the efficiency of the preliminary medication. For the above reasons Tables 2 and 3 may have little statistical

TABLE 2

NAUSEA, RETCHING AND VOMITING ACCORDING TO EFFECTIVENESS OF PREOPERATIVE MEDICATION WITH PANTOPON AND MORPHINE

Pantopon *				Morphine *			
Effect	No. of Cases	Nausea, etc.		Effect	No. of Cases	Nausea, etc.	
		No.	Per Cent			No.	Per Cent
Good	125	27	21.6	Good	104	35	33.7
Fair	49	19	38.8	Fair	60	35	58.3
Poor	20	11	55.0	Poor	28	15	55.6
Too heavy	4	0	0	Too heavy	5	0	0
?	2	0	0	?	3	1	0

* 100 hysterectomies; 100 cholecystectomies.

TABLE 3

NAUSEA, RETCHING AND VOMITING IN ALL 400 CASES, ACCORDING TO EFFECTIVENESS OF PREOPERATIVE MEDICATION

Effect	No. of Cases	Nausea, etc.	
		No.	Per Cent
Good	229	62	27.1
Fair	109	54	49.6
Poor	48	26	54.2
Too heavy	9	0	0
?	5	1	

value but they do show that when the preliminary medication seems to exert a satisfactory effect the percentage of nausea and vomiting is less than when the medication is less satisfactory. It is also interesting that the 9 cases, 4 with pantopon and 5 with morphine, which showed a *too heavy effect* of their preoperative medication, had no nausea or vomiting.

The height of anesthesia was also considered in reviewing these 400 cases as to its effect on the occurrence of nausea and vomiting. If the anesthesia were too low it might be presumed that reflexes would be easily set up from above the anesthetized area during exploration of the upper abdomen (Table 4, thoracic 7–8). If the level of anesthesia were very high, diffusion might well carry a dilute solution of the drug to the medulla and stimulate the vomiting center directly, if Co Tui's experiments on dogs hold true clinically. It is interesting in Table 4 that the one case with intercostal paralysis showed no record of nausea. Table 3 shows a steady increase in the incidence of nausea and vomiting

TABLE 4

NAUSEA, RETCHING AND VOMITING IN UPPER AND LOWER ABDOMINAL OPERATIONS ACCORDING TO HEIGHT OF SPINAL ANESTHESIA

	Height of Spinal Thoracic Segment						Intercostal Paralysis	?
	T 7–8	T 6	T 5	T 4	T 3	T 2		
Cholecystectomy								
No nausea, etc.	3	13	46	43	12	0	1	3
Nausea, etc.	4	7	25	31	9	0	0	3
Total cases	7	20	71	74	21	0	1	6
Nausea, etc., per cent	57	35	35	42	43			
Hysterectomy								
No nausea, etc.	38	31	45	17	4	1	0	0
Nausea, etc.	16	12	17	12	4	1	0	2
Total cases	54	43	62	29	8	2		2
Nausea, etc.	30	28	27	41	50	50		
Total cases	61	63	133	103	29	2	1	8
Nausea, etc., number	20	19	42	43	13	1		
Nausea, etc., per cent	33	30	32	42	45	50		

with increasing heights of spinal anesthesia. Table 4 also demonstrates that the higher spinal anesthesias are more frequent when the operations are in the upper abdomen. Higher spinal anesthesia is usually planned for upper abdominal operations, and in these operations, traction reflexes are thought to be greater, so that no definite conclusions can be drawn from the more frequent occurrence of nausea and vomiting in these cases.

In conclusion, it may be said that while no single factor is known to cause nausea and vomiting during abdominal operations under spinal anesthesia and probably no such single cause exists, it would seem that several factors may create stimuli which act on the vomiting center and

cause this complication. Mild anoxemia (1) and the presence of spinal anesthetic drugs in the cerebrospinal fluid about the medulla have not been discussed in this paper and have not been proved clinically to be a cause. Reflexes from the operative site and stimuli from the cerebral cortex appear probable. The percentage of cases of nausea and vomiting was only slightly higher in operations in the upper abdomen than in operations in the lower abdomen. From this series of 400 cases it may be concluded that the occurrence of nausea and vomiting will be decreased by the use of pantopon instead of morphine. Adequate preoperative medication appears to reduce further the frequency of this complication. There appears to be an interesting correlation between the levels of spinal anesthesia from the sixth to the third thoracic segment and an increasing percentage of nausea and vomiting, but this series is too small to do more than indicate this trend.

REFERENCES

1. Evans, C. H.: Spinal Anesthesia, New York, Hoeber, 1929, pp. 103–110.
2. Beecher, H. K.: The Physiology of Anesthesia, New York, Oxford, 1938, p. 271.
3. Co Tui, F. W.: Further Studies in Subarachnoid Anesthesia, Anesth. & Analg. 13: 143–151 (July–Aug.); 183–192 (Sept.–Oct.) 1934.
4. Sollman, T.: A Manual of Pharmacology, Philadelphia, 1939, pp. 273–302.
5. Weisel, W.; Youmans, W. B., and Cassels, W. H.: Effect on Intestinal Motility of Cyclopropane Anesthesia Alone and After Morphine-scopolamine Premedication, J. Pharmacol. & Exper. Therap. 63: 391–399 (Aug.) 1938.
6. New and Nonofficial Remedies, Chicago, 1930.
7. Leake, C. D.: Chemical Adjuncts to General Anesthesia, California & West. Med. 33: 714–717 (Oct.) 1930.
8. Hayman, J. M., Jr., and Fox, H.: Comparison of Analgesic Action of Pantopon and Morphine Sulfate, J. A. M. A. 109: 1813–1814 (Nov. 27) 1937.
9. Axelrod, M. L.: Combining Opiates and Barbiturates for Preoperative Medication, Anesth. & Analg. 13: 164–168 (July–Aug.) 1934.
10. Sise, L. F.: Pontocain-glucose Solutions for Spinal Anesthesia, S. Clin. North America 15: 1501–1511 (Dec.) 1935; 16: 1707–1711 (Dec.) 1936.
11. Pouchet: Étude Pharmacodynamique sur le Pantopon, Bull. gen. de thérap. 163: 768–796, 1912.
12. Thienes, C. H.: Preanesthetic Drugs, Anesth. & Analg. 13: 80–85 (Mar.–Apr.) 1934.
