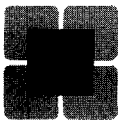

Postoperative nausea and vomiting

A comparison of sufentanil, nitrous oxide, and isoflurane

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■ Postoperative nausea and vomiting have been associated with the use of nitrous oxide and, in some studies, with isoflurane. Sufentanil, a new synthetic narcotic with a duration as long as fentanyl, was studied with regard to postoperative nausea and vomiting. A total of 63 patients undergoing extra-abdominal procedures (excluding thoracotomies and intracranial, ophthalmologic, and middle-ear surgery) was studied and randomly divided into four groups: Group A, sufentanil/N_2O/O_2 with 0.25% isoflurane; Group B, O_2/N_2O/isoflurane; Group C, O_2/isoflurane/sufentanil; Group D, O_2/isoflurane. Patients with a history of postoperative nausea and vomiting were excluded. The incidence of postoperative nausea and vomiting was observed in the recovery room. The overall incidence of nausea was 25% and of vomiting 9.5%; differences between techniques were not statistically significant.

□ INDEX TERMS: ANESTHETICS; NAUSEA; VOMITING □ CLEVE CLIN J MED 1988; 55:549–552

NAUSEA AND VOMITING postoperatively can be a distressing sequel to anesthesia and surgery, especially when early recovery is prejudiced in outpatients. Many factors have been implicated, including anesthetic agents, narcotics, age, gender, weight, type of surgical procedures, and pain.[1] Recently, Alexander et al[2] have suggested that N_2O can significantly increase the incidence of postoperative nausea and vomiting. We undertook a pilot study to compare the incidence of postoperative nausea and vomiting when using sufentanil, nitrous oxide, and isoflurane.

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MATERIALS AND METHODS

Sixty-three patients were studied, all of whom had signed consent forms as required by the Human Subjects Committee of the University of Colorado Health Science Center. Their age range was 18–60 years and their ASA Classification I–III. They were allocated to one of four groups, using random number tables, and received one of the following anesthetics: Group A (n=16), sufentanil with nitrous oxide/oxygen and 0.25% isoflurane; Group B (n=16), isoflurane with nitrous oxide/oxygen; Group C (n=15), sufentanil with oxygen and 0.5% isoflurane; Group D (n=16), isoflurane and oxygen. Because of the decreased potency of nitrous oxide in Denver, isoflurane 0.25% was added in Group A to assure amnesia. No premedication was used because of possible gastrointestinal effects. Patients taking antacids or histamine-type 2 beta blockers were excluded from the study, as were morbidly obese patients and those with a history of postoperative nausea and vomiting.

TABLE 1
TYPES OF CASES

1. Acrominoplasty
2. Parathyroid removal
3. Marshall-Matchetti-Krantz (cystourethroplexy), anteriorculporrhapy
4. Cone biopsy
5. Laparoscopic tubal ligation
6. Cone biopsy
7. Open reduction internal fixation, left ulna
8. Inguinal hernia repair
9. Parotidectomy
10. Open reduction internal fixation, left hand
11. Laser excision of anal warts
12. Hemorrhoidectomy
13. Inguinal hernia repair
14. Laparotomy
15. Breast removal
16. Fusion of talus
17. Vein ligation, left leg
18. Breast reduction
19. Left subclavian vein bypass
20. Right hip pinning
21. Laparoscopy
22. Inguinal hernia repair
23. Revision of medi-port catheter
24. Right inguinal hernia repair
25. Benegraft, right mandible
26. Right temporomandibular joint replacement
27. Tonsillectomy
28. Resection (submandibular) of hand
29. Septoplasty
30. Radical hysterectomy
31. Tonsillectomy
32. Laminectomy
33. Open reduction internal fixation, right ankle
34. Vaginal hysterectomy
35. Open reduction internal fixation, left ankle
36. Laser excision of anal warts
37. Drainage, sphenoid sinus
38. Excisional breast biopsy
39. Septoplasty
40. Open urethral lithotomy
41. Right mastectomy
42. Tonsillectomy
43. Right inguinal hernia repair
44. Hemorrhoidectomy
45. Chest wall reconstruction
46. Vaginal hysterectomy
47. Insertion of penile prosthesis
48. Cone biopsy
49. Lumbar sympathectomy
50. Split-thickness skin graft, forearm
51. Nerve repair, right ulna
52. Removal of hardware, left elbow
53. Incision and drainage, right leg
54. Incision and drainage, right leg
55. Release contracture, right finger
56. Split thickness skin graft, left thigh
57. Right mastectomy
58. Ventral hernia repair
59. Removal of Harrington rod
60. Laser excision of condylomata
61. Transphenoidal tumor excision
62. Rectovaginal fistula repair
63. Cone biopsy

TABLE 2
SEX

Group	Male	Female
A	9	7
B	8	8
C	7	8
D	8	8

TABLE 3
AGE (YEARS)

Group	*n*	Mean	S.D
A	16	32	11
B	16	37	13
C	15	39	11
D	16	37	12

The operations all lasted more than 30 minutes and were extra-abdominal in all but two patients (two laparoscopies). Patients undergoing intracranial, ophthalmic, middle-ear, and intrathoracic procedures were excluded. The duration of anesthesia extended over similar ranges for all four groups, and the median durations did not differ significantly: Group A, 30–250 minutes, median 78 minutes; Group B, 25–230 minutes, median 72 minutes; Group C, 50–445 minutes, median 115 minutes; Group D, 35–295 minutes, median 118 minutes. Patients were monitored by arterial pressure cuff, ECG, neuromuscular blockade monitor, and end-tidal CO_2. After placement of intravenous and monitoring devices, the patients were given oxygen, and anesthesia was induced as follows: vecuronium (0.015 mg/kg, administered intravenously) as a priming dose and sufentanil (0.6–1.2 μg/kg) with Surital (thiamylal sodium)(2–3 mg/kg in the groups that received narcotics [A and C] and 3–5 mg/kg in the others). Vecuronium 0.06 mg/kg was given to all patients for full muscular relaxation.

Following tracheal intubation, an orogastric tube was placed and suctioned for stomach decompression. Anesthesia was then continued according to group protocol. Patients in Groups A and C received sufentanil (0.1 to 0.3 μg/kg/hr); those in Groups B and D were given isoflurane to maintain vital signs within 20% of baseline values. Patients in Groups A and C received 0.25% and 0.5% isoflurane, respectively, whereas those in Groups B and D received generally 1.5% or more.

TABLE 4
INCIDENCE OF NAUSEA

Group	Yes	No	P
A	5	11	0.39
C	2	13	
A	5	11	1.00
B	6	10	
B	6	10	0.43
D	3	13	
C	2	13	1.00
D	3	13	

TABLE 5
INCIDENCE OF VOMITING

Group	Yes	No	P
A	1	15	0.60
C	2	13	
A	1	15	1.00
B	2	14	
B	2	14	1.00
D	1	15	
C	2	13	0.60
D	1	15	

TABLE 6
95% CONFIDENCE INTERVALS FOR DIFFERENCES IN INCIDENCES BETWEEN GROUPS

	Groups	Lower	Upper
Vomiting	A–C	-28	14
	B–D	-18	30
	A–B	-30	18
	C–D	-14	28
Nausea	A–C	-10	46
	B–D	-12	50
	A–B	-38	28
	C–D	-39	27

TABLE 7
TIME FROM EXTUBATION TO RECOVERY ROOM DISCHARGE (MINUTES)

Group	n	Mean	S.D.
A	16	88	33
B	16	96	31
C	15	92	37
D	16	100	24

At the end of surgery, the orogastric tubes were aspirated and removed; neuromuscular blockade was reversed with glycopyrrolate (0.02 mg/kg) and edrophonium (0.7 mg/kg). Extubation was performed before transfer to the recovery room. No sufentanil was given during the last 30 minutes of anesthesia.

In the recovery room, nausea and vomiting were recorded by an observer unaware of the anesthetic technique used. Chi-square tests or Fisher's exact tests, as appropriate, were used to compare the frequency of nausea and vomiting between different pairs of groups. Nausea and vomiting were measured on a two-point scale. The distribution of operative time was compared among treatment groups by means of a Kruskal-Wallis test. Analysis of variance was used to compare patient age and time from extubation to discharge from the recovery room among the groups.

There were 15 or 16 patients in each set of two groups. With a two-tailed significance level of 0.05 (and no adjustment for multiple comparisons), differences in incidence rates of approximately 45% (e.g., 10% *v* 55%) could be detected with a statistical power of 80%. Hence, the trial was not designed to detect differences of less than 45% in incidence rates between groups. To aid in the interpretation of differences in incidence rates, 95% confidence intervals are also provided.

RESULTS

A listing of the types of cases evaluated for this study is shown in *Table 1*. There was an equal sex distribution of patients in the four groups (*Table 2*). Mean ages, ranging from 32 to 39 years, were not significantly different (*Table 3*).

Table 4 shows the incidence of nausea in all four groups. Group A had an incidence of 31.25%; Group B, 37.5%; Group C, 13.3%; and Group D, 18.75%. The incidence of nausea varied insignificantly among all groups.

Table 5 shows the incidence of vomiting in all four groups. Group A had an incidence of 6.25%; Group B, 12.5%; Group C, 13.3%; and Group D, 6.6%. All incidences of vomiting varied insignificantly among all groups.

Table 6 shows the 95% confidence limits for all groups.

Table 7 shows the time from extubation in the operating room until discharge from the recovery room. The mean times varied from 88 to 100 minutes.

DISCUSSION

These results confirm that nausea and vomiting remain common sequels to modern anesthetic techniques. An overall incidence of 25% for nausea and 10% for vomiting represents obvious room for improvement. No difference could be shown, moreover, between methods based mainly on inhalation anesthesia with isoflurane, and intravenously administered analgesia with sufentanil. To our knowledge, no one has studied this problem in regards to sufentanil.

Alexander et al[2] found a significant difference in postoperative nausea and vomiting when comparing oxygen-fentanyl-nitrous oxide with oxygen-fentanyl-isoflurane. White et al[3] found a surprisingly high incidence of nausea and vomiting when nitrous oxide was used with alfentanil or fentanyl for outpatients, raising a question whether nitrous oxide significantly increased the incidence of postoperative nausea and vomiting when associated with narcotics. The data of Alexander et al[2] would indicate that this is true with fentanyl. Others have attributed emetic properties to nitrous oxide, and our study tends to support this, although the differences were not statistically significant.[2,4] However, in a large series of 780 patients, Muir et al[1] found no association between postoperative nausea and vomiting and the use of nitrous oxide in combination with enflurane or isoflurane, which would tend to argue against the emetic properties of nitrous oxide.

The emetic properties of sufentanil have not, to our knowledge, been examined in any great detail. Sufentanil, a narcotic five to 10 times more potent than fentanyl, has just as rapid an awakening time when used in equipotent dosages. When used for cardiac surgery with 100% oxygen, both fentanyl and sufentanil tend to have very low incidences of nausea and vomiting. We wondered whether the addition of nitrous oxide would make a significant difference.

Our study shows the inherent difficulty of comparing different anesthetic techniques. Supplementation of sufentanil with inhalational anesthetics was necessary in this study since suppression of awareness is not intrinsic to this drug. Also, the reduced potency of nitrous oxide at the high altitude of Denver deserves emphasis. The treatment received by Group A was planned as a strict nitrous oxide/narcotic technique. However, we have found a higher incidence of intraoperative recall with this technique because of the decreased partial pressure of nitrous oxide in Denver. Therefore, we added 0.25% isoflurane in Group A to insure total amnesia.

There are several design limitations in this study. The first is the possible cross-contamination of inhalational agents with narcotics. The combination becomes necessary to avoid postoperative respiratory depression and to insure intraoperative amnesia. The second is the small number of cases. A much larger series will be required to gain accurate data in regard to "potency equivalents" for inhalation and intravenous agents. A third factor involves postoperative evaluation. Muir et al[1] evaluated their patients in the recovery room and at a 24-hour follow-up visit. It is hard to know how long postoperatively the emetic effects of intravenous and inhalational agents last. Finally, other miscellaneous factors, such as age, gender, length of the surgery, weight, pain, medical history, and the type of surgical procedures influence postoperative nausea and vomiting.[5,6] Very old and very young patients were excluded from our study. No statistical differences were found in any of the groups regarding sex or length of surgery. Morbidly obese patients and patients with a history of nausea and vomiting were also excluded. All surgical procedures were extra-abdominal, except for two laparoscopies.

CONCLUSION

In this pilot study, we were unable to demonstrate significant differences in postoperative nausea and vomiting with sufentanil in combinations with and without nitrous oxide and isoflurane. A larger series to enhance the lack of statistical power caused by this small sample will be needed.

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