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Flammable Anesthetics Are Nearing Extinction

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In 1976, a survey of the use of flammable anesthetics in U. S. institutions having anesthesiology training programs revealed a declining employment of these agents.[1] A continued decline in the utilization of flammable agents obviously would have significant implications, in regard to the design of anesthetizing locations, code requirements, risk-benefit issues, and cost effectiveness. Thus, the American Society of Anesthesiologists Committee on Flammable Hazards and Electrical Equipment believed this survey should be repeated to determine our current status with respect to the use of flammable anesthetic agents.

METHODS

A questionnaire was mailed to 163 directors of U. S. anesthesiology residency training programs (Group 1) to determine present usage of flammable anesthetics, costs involved in such practice, and to explore attitudes of the respondents to these agents.

In contrast to our original survey, questionnaires were also mailed to the 154 directors of nurse anesthesia programs (Group 2) in the U. S. and the 16 directors of Canadian anesthesia residency programs (Group 3).

The questionnaires were mailed during the first week of January 1981. As in the previous survey, no attempt was made to obtain replies from program directors who did not respond.

RESULTS

Table 1 shows the number of questionnaires mailed, and responding programs not using, and using flammable agents in 1980. Table 2 shows the years in which flammable anesthetics were discontinued by non-user respondents. The Groups 1, 2, and 3 respondents using only nonflammable agents in 1980 averaged 12,815, 12,650, and 22,771 anesthetics per institution, respectively. Table 3 summarizes the numbers of anesthetics administered in institutions using flammable agents in 1980.

TABLE 1. Programs Not Using and Using Flammable Anesthetic Agents in 1980

Group	Questionnaires Mailed	Non-Users	Users
1	163	121	5 (3)*
2	154	88	6 (4)
3	16	14	1 (0)
TOTALS	323	223	12 (7)

* Numbers in parenthesis are programs which still continue to use flammable anesthetic agents.

Of the five respondents of Group 1 who used flammable anesthetic agents in 1980, two of their programs have now discontinued the use of flammable anesthetic agents. The remaining three programs average 7,833 anesthetics/institution, of which 16 or 0.2 per cent anesthetics/institution were with flammable agents. Of the four Group 2 programs which still use flammable anesthetic agents, these agents represent 0.27 per cent of their anesthetics. Group 3 programs no longer use flammable anesthetic agents.

The reasons for discontinuing the use of flammable anesthetic agents were similar in all three groups. In descending order of frequency the reasons cited included: the risk of fire and explosion; pharmacologically ac-

TABLE 2. Year in Which Flammable Anesthetic Agents Were Discontinued

Year Discontinued	Number of Programs Discontinuing Use of Flammable Anesthetic Agents in That Year		
	Group 1	Group 2	Group 3
1979	7	2	1
1978	18	7	—
1977	13	7	—
1976	7	15	1
1975	20	12	—
1974	13	7	—
1973	11	4	3
1972	8	8	—
1971	2	5	—
1970	7	7	2
1959-1969	8	11	5
Never used	1	—	—
Not stated	6	3	4

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TABLE 3. Institutions Using Flammable Agents in 1980

Institutions by Group	Total Anesthetics	Number of Flammable Anesthetics	Number of Ether Anesthetics	Number of Cyclopropane Anesthetics
Group 1				
(a)*	15,000	30	20	10
(b)	5,500	2	2	—
(c)	3,000	15	7	8
(d)†	18,000	100	—	100
(e)†	7,600	62	62	—
Group 2				
(a)	37,500	100	100	—
(b)	20,000	50	50	
(c)	9,000	25	23	2
(d)	2,000	10	2	8
(e)†	8,500	6	5	1
(f)†	6,000	5	—	5
Group 3				
(a)†	38,000	3	—	3

* Letters in parenthesis designate component institutions in each group.

† Have now discontinued the use of flammable agents.

ceptable or better alternative agents; increased use of electrical equipment such as the electrosurgical unit; difficulty and cost involved in complying with safety codes; hospital construction; medicolegal; prohibited by law; insurance rates; low frequency of use leading to low proficiency; no longer a training requirement; difficulty in obtaining conductive ancillary equipment; and they "perforate the ear drums."

DISCUSSION

Discounting the two Group 1 institutions where flammable anesthetic agents, although used in 1980, are now no longer employed, only 47 flammable anesthetics were given in that year by the three remaining programs (see Table 3). Proportionately, and in absolute terms, more flammable agents were given in the institutions reported on by Group 2 respondents, though again their numbers were small. Group 3 respondents no longer use flammable agents.

In the previous 1976 survey 37 of 117 (32 per cent) anesthesiology training programs used flammable anesthetic agents.[1] In that year 27 per cent of the Pennsylvania hospitals (both teaching and nonteaching) reported the use of such anesthetics,[2] whereas in 1972 56 per cent of these hospitals used flammable anesthetics.[3] Thus, in 1976, although the use of flammable anesthetic agents was declining, almost one-third of hospitals responding to the surveys still employed these agents. In the present survey only five of 126 (4 per cent) anesthesiology training programs used flammable anesthetic agents in 1980. Only three of these programs continue to use them.

This study and our previous survey[1] differ from the others[2,3] in that we determined the frequency with which flammable anesthetic agents were used by those responding institutions where such agents are still employed. The present survey was limited to teaching institutions in order to make it comparable with our previous one. Nurse anesthesia programs in the U. S. and Canadian anesthesia residency programs were surveyed also.

The use of flammable anesthetic agents in U. S. teaching institutions obviously has declined almost to a vanishing point. The disadvantages of continuing to use flammable agents were enumerated by almost all respondents, were similar to those described in the previous survey,[1] and have been reiterated by others.[4-6]

It was not possible to estimate the costs involved when flammable anesthetics are used; very few respondents provided cost data, and these data varied widely. On the basis of recommendations and standards developed by the National Fire Protection Association, Underwriter's Laboratories, and the Joint Commission on Accreditation of Hospitals, the use of flammable anesthetics probably adds approximately $9.4 million to the annual cost of surgical care.[6]

REFERENCES

1. Duncalf D: Survey of the use of flammable anesthetics. ANESTHESIOLOGY 48:298–299, 1978
2. Babinski M, Brian Smith R: Use of explosive anesthetic agents in hospitals. P Med 81:35–36, 1978
3. Brian Smith R: The use of explosive anesthetic agents. Pa Med 75:55–56, 1972
4. Ngai SH: Explosive agents—are they needed? Surg Clin North Am 55:975–985, 1975
5. Prevoznik SJ: Flammable anesthetics are outmoded, Controversy in Anesthesiology. Edited by Eckenhoff JE. Philadelphia, WB Saunders Co, 1979, pp 19–25
6. Fineberg HV, Pearlman LA, Gabel RA: The case for abandonment of explosive anesthetic agents. N Engl J Med 303:613–617, 1980