



A Questionnaire Survey on use of Low Flow Anesthesia by Anesthesiologists

Authors

Vivek Mahajan¹, Shailja Gupta²

¹Professor, Department of Anaesthesia, Pacific Medical College and Hospital, Udaipur, Rajasthan

²Professor and Head, Dept of Biochemistry, Pacific Medical College and Hospital, Udaipur, Rajasthan

Corresponding Author

Dr Shailja Gupta

Professor and Head, Department of Biochemistry, Pacific Medical College and Hospital, Udaipur, Rajasthan

Abstract

Background: The routine use of low flows can cut down anesthesia costs up to 75%. The amount of volatile anesthetic agents extracted is directly proportional to the fresh gas flow (FGF) into the breathing circuit and system. The present study was conducted to determine the pattern of LFA among anesthetists.

Materials & Methods: It included 250 anesthetists. A questionnaire was prepared and was distributed among them. The questionnaire contained two parts, the first part intended to collect general information such as years of experience in anesthesia, region of practice, subspecialty of the participant if any and the practice setting of the participant. The second part dealt with questions specific to the practice of LFA, use of oxygen analysers and agent analysers, routine use of ETCO₂ monitors and bispectral index (BIS) monitors, type of anesthesia machine being used routinely, preferred carrier gas and volatile agent as well as the volatile agent in routine use.

Results: Out of 250 subjects, males were 120 and females were 130. The difference was non-significant (P-0.5). The years of experience of anesthesiologists were 0-5 years (85), 6-11 years (65), 11-15 years (40), 16-20 years (20), 21-25 years (25) and >25 years (15). The difference was significant (P-0.01). Region of practice was north India (150) and south India (100). The difference was significant (P-0.05). The specialty of use was general (85), Cardiac & Vascular (60), pediatric (76), critical care (20) and other (9). Practice setting was private (160) and government (90). The difference was significant (P-0.02). The availability of workstations, scavenging systems and minimum monitoring equipment were oxygen analyzers (100), agent analyzers (30), ETCO₂ monitors (45), BIS monitors (8), work stations (55) and work stations with MAC (12). The difference was significant (P-0.02). The fresh flow rate was <0.5 L (12%), 0.5 L (15%), 0.5-1 L (32%), 1-1.5 L (13%), 1.5- 2 L (18%) and >2 L (10%). The difference was significant (P-0.05). The volatile agents used was halothane (40%), desflurane (17%), isoflurane (65%) and sevoflurane (70%). The difference was significant (P-0.01).

Conclusion: Low flow anesthesia is practiced by many anesthesiologists. There is a lack of adequate monitoring facilities and scavenging systems.

Keywords: Desflurane, Low flow anesthesia, Isoflurane.

Introduction

The inhalational anesthetic agents presently available are metabolised only to a small extent

and are largely exhaled unchanged. This property can be taken advantage of, to perform successful, economic and safe "low flow anesthesia" (LFA).

The economical, ecological and pulmonary benefits of LFA warrant its routine practice.¹

The term low flow anesthesia was introduced by F. Foldes, inaugurating an anesthetic technique performed with a fresh gas flow of 1.0 l/min. R. Virtue introduced the term minimal flow anesthesia by recommending the use of an even lower flow of 0.5 l/min. As emphasized beforehand, the lower the fresh gas flow the lower is the amount of gas vented out of the breathing system as waste and the higher is the proportion of rebreathing. The general term - low flow anesthesia - should be restricted to defining an anesthetic technique in which a semiclosed rebreathing system is used recirculating at least 50% of the exhaled air back to the patient after CO₂ absorption. Using modern rebreathing systems this will be achieved only if the fresh gas flow is reduced to at least 2 l/min.²

The routine use of low flows can cut down anesthesia costs up to 75%. The amount of volatile anesthetic agents extracted is directly proportional to the fresh gas flow (FGF) into the breathing circuit and system. When high FGF are used, 90% of the volatile agents are unused and are emitted as waste anesthetic gases (WAG) into the operation theatre (OT) environment or to the atmosphere, exposing those in the OT to health hazards and adding on to the greenhouse effect as well as ozone depletion.³

A survey on LFA found that the routine use of LFA would circumvent the initial expenditure in months by saving on expenses on volatile agents and carrier gases. Another study found that educating the anesthesiologists was very effective in reducing the FGF rates used thereby contributing to overall cost reduction of anesthesia.⁴ The present study was conducted to determine the pattern of LFA among anesthetists.

Materials & Methods

The present study was conducted by the department of anesthesia. It included 250 anesthetists who were involved in the study. A questionnaire was prepared and distributed among

them. The questionnaire contained sixteen questions related to demography, practice of LFA, routine use of workstations, scavenging systems, gas analysers and choice of volatile agents as well as carrier gas preference. The questionnaire contained two parts, the first part intended to collect general information such as years of experience in anesthesia, region of practice, subspecialty of the participant if any and the practice setting of the participant. The second part dealt with questions specific to the practice of LFA, use of oxygen analysers and agent analysers, routine use of ETCO₂ monitors and bispectral index (BIS) monitors, type of anesthesia machine being used routinely, preferred carrier gas and volatile agent as well as the volatile agent in routine use. Results thus obtained were subjected to statistical analysis using chi-square test. P value < 0.05 was considered significant.

Results

Table I Distribution of subjects

	Total- 250	
Male	Female	P value
120	130	0.5

Table I shows that out of 250 subjects, males were 120 and females were 130. The difference was non-significant (P=0.5).

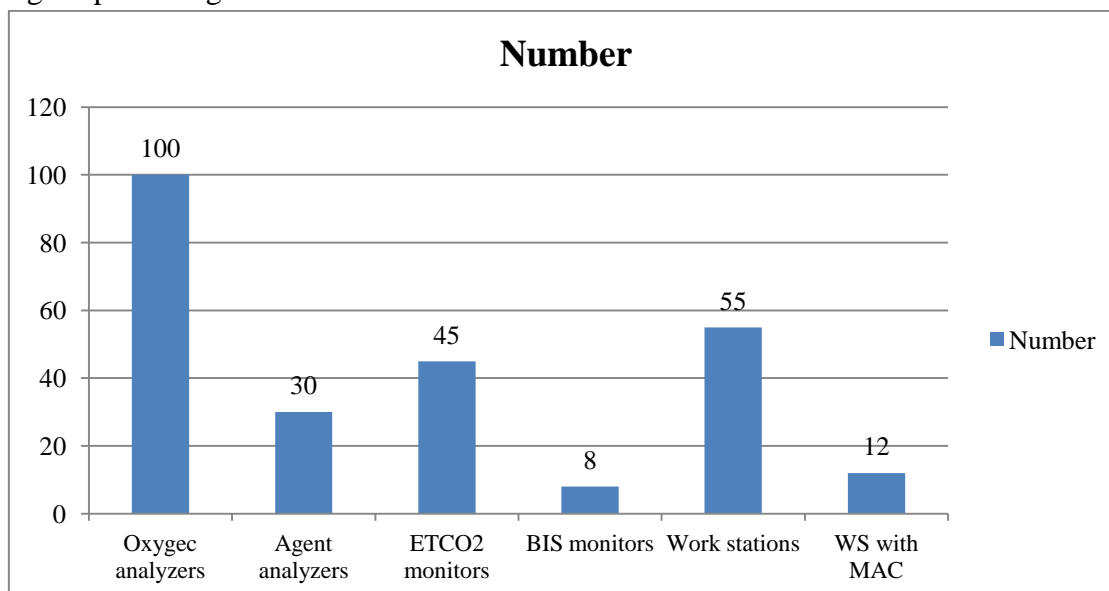
Table II Demographic data

Variable	Number	P value
Years of experience in anesthesia		
0-5	85	0.01
6-10	65	
11-15	40	
16-20	20	
21-25	25	
>25	15	
Region of practice		
North India	150	0.05
South India	100	
Subspeciality		
General	85	0.01
Cardiac & Vascular	60	
Pediatric	76	
Critical care	20	
Other	9	
Practice setting		
Private	160	0.02
Government	90	

Table II shows that years of experience of anesthesiologists were 0-5 years (85), 6-11 years (65), 11-15 years (40), 16-20 years (20), 21-25 years (25) and >25 years (15). The difference was significant (P-0.01). Region of practice was north India (150) and south India (100). The difference

was significant (P-0.05). Specility of use was general (85), Cardiac & Vascular (60), pediatric (76), critical care (20) and other (9). Practice setting was private (160) and government (90). The difference was significant (P-0.02).

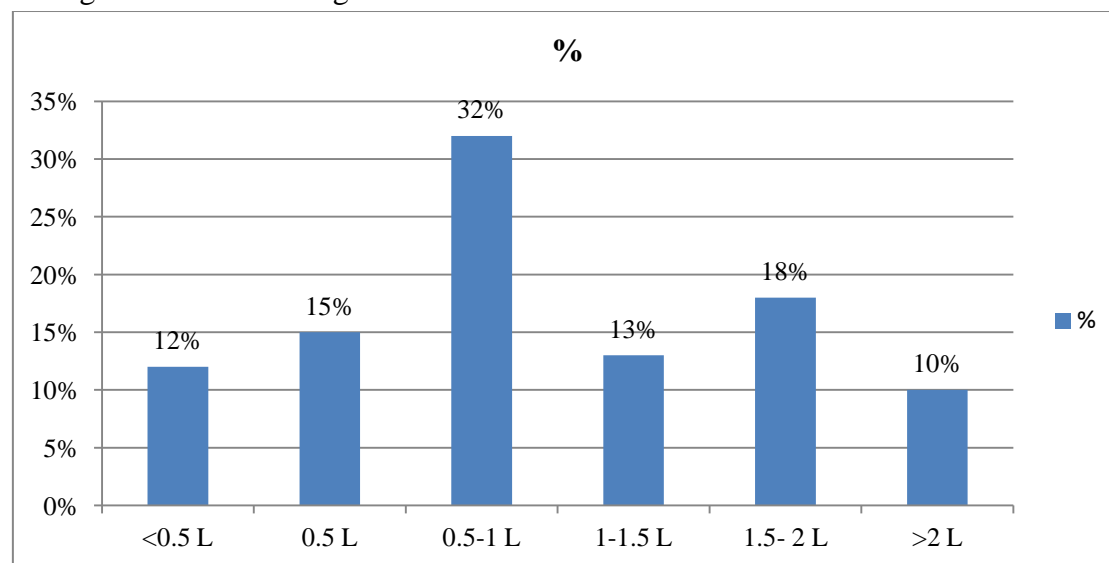
Graph I Availability of workstations, scavenging systems and minimum monitoring equipment for anesthesiologists practicing low flow anesthesia



Graph I shows that availability of workstations, scavenging systems and minimum monitoring equipment were oxygen analyzers (100), agent analyzers (30), ETCO₂ monitors (45), BIS

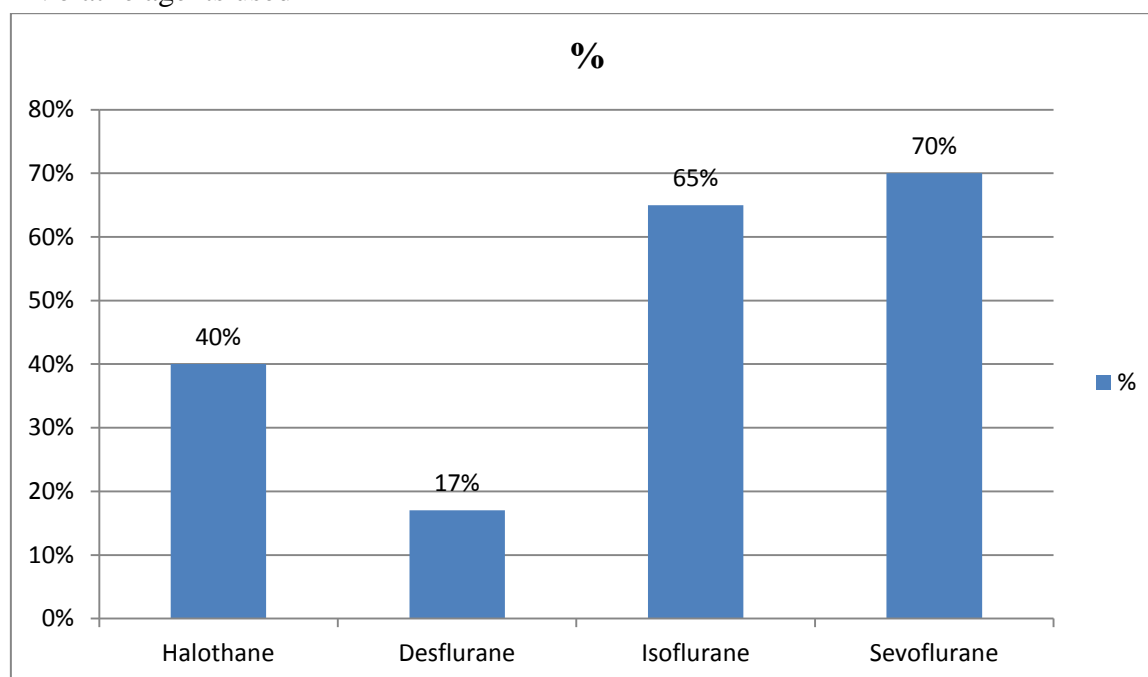
monitors (8), work stations (55) and work stations with MAC (12). The difference was significant (P-0.02).

Graph II Fresh gas flow rates during routine use of low flow anesthesia



Graph II shows that fresh flow rate was <0.5 L (12%), 0.5 L (15%), 0.5-1 L (32%), 1-1.5 L

(13%), 1.5- 2 L (18%) and >2 L (10%). The difference was significant (P-0.05).

Graph III Volatile agents used

Graph III shows that volatile agents used was halothane (40%), desflurane (17%), isoflurane (65%) and sevoflurane (70%). The difference was significant ($P=0.01$).

Discussion

If commercially available anesthetic machines are used, with low and minimal flow anesthesia the maximum of flow reduction is reached which can be gained in routine clinical practice. Both techniques are extreme variants of semiclosed use of rebreathing systems, as still a small amount of excess gas is used. The performance of low and minimal flow anesthesia becomes very simple if standardized schemes are used to control the fresh gas flow and its composition. This scheme requires only rare adjustments at the gas flow controls and vaporizers. The anesthetist, however, must accept that the gas concentrations within the breathing system not will remain constant at the aspired values, but rather will change slowly but continuously during the course of anesthesia. The present study was conducted to determine the pattern of LFA among anesthetists.⁵

In this study, out of 250 subjects, males were 120 and females were 130. The maximum anesthetists had experience of 0-5 years, followed by 6-11 years, 11-15 years, 16-20 years, 21-25 years and >25 years. This is similar to Mitra et al.⁶ Most of them were from north India. The specialty of use

was general, cardiac & vascular, pediatric and critical care. Practice setting was private and government.

The availability of workstations, scavenging systems and minimum monitoring equipment were oxygen analyzers, agent analyzers, ETCO_2 monitors, BIS monitors, work stations and work stations with MAC. This is in accordance to Ravishankara et al.⁷ The advantages of low flow anesthesia are the reduction of anesthetic gas and vapour consumption, the decrease of atmospheric pollution with inhalation anesthetics, the improvement of anesthetic gas climate, and the significant reduction of costs.⁸

Anesthetists also have to deal with increasingly stringent official regulations on the maximum acceptable workplace concentrations of anesthetic gases. Careful maintenance of the anesthetic apparatus and scrupulous attention on leaks from breathing systems provided, even the extremely low anesthetic gas concentrations stipulated by the US National Institute of Occupational Safety and Health can be achieved easily only by the use of low flow techniques. Most operating theatres, however, are equipped with central gas-

scavenging systems, and it is possible to stay within the defined limits even if high fresh gas flows are used. Nevertheless, high flow anesthesia will inevitably result in pollution of the atmosphere beyond the operating theatre. Both, nitrous oxide and the volatile anesthetics contribute to the destruction of the ozone layer and to the greenhouse effect.⁹

12% used fresh flow rate of <0.5 L, 15% used 0.5 L, 32% used 0.5-1 L, 13% used 1-1.5 L, 18% used 1.5- 2 L and 10% used >2 L. The volatile agents used were halothane, desflurane, isoflurane and sevoflurane. This is in agreement with Goyal R.¹⁰

Conclusion

Author concluded that low flow anesthesia is practiced by many anesthesiologists. There is a lack of adequate monitoring facilities and scavenging systems.

References

1. Cotter SM, Petros AJ, Doré CJ, Barber ND, White DC. Low-flow anaesthesia. Practice, cost implications and acceptability. *Anesthesia* 1991; 46:1009-12.
2. Body SC, Fanikos J, DePeiro D, Philip JH, Segal BS. Individualized feedback of volatile agent use reduces fresh gas flow rate, but fails to favorably affect agent choice. *Anesthesiology* 1999; 90:1171-5.
3. Yasny JS, White J. Environmental implications of anesthetic gases. *Anesth Prog.* 2012; 59:154-8.
4. Occupational disease among operating room personnel: A national study. Report of an Ad Hoc Committee on the Effect of Trace Anesthetics on the Health of Operating Room Personnel, American Society of Anesthesiologists. *Anesthesiology*. 1974; 41:321-40.
5. Baum J. Low Flow Anaesthesia: The Theory and Practice of Low Flow, Minimal Flow and Closed System Anaesthesia. 2nd ed. Boston: Butterworth-Heinemann; 2001.
6. Mitra JK, Jain V, Sharma D, Prabhakar H, Dash HH. A Survey on use of nitrous oxide in current anaesthetic practice in India. *Indian J Anaesth.* 2007; 51:405-8.
7. Ravishankara AR, Daniel JS, Portmann RW. Nitrous oxide (N₂O): The dominant ozone-depleting substance emitted in the 21st century. *Science.* 2009; 326:123-5.
8. Hönemann C, Hagemann O, Doll D. Inhalational anaesthesia with low fresh gas flow. *Indian J Anaesth.* 2013; 57:345-50.
9. Baum JA, Aitkenhead AR. Low-flow anaesthesia. *Anaesthesia.* 1995; 50: 37-44.
10. Goyal R, Kapoor MC. Anesthesia: Contributing to pollution? *J Anaesthesiol Clin Pharmacol* 2011; 27:435-7.