
Survey Report

Results of the Canadian Anaesthetists' Society Opinion Survey on Anaesthetic Equipment

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Design shortcomings in carbon dioxide absorber bypasses and conical connectors in breathing circuits have been implicated in a number of fatal anaesthesia mishaps. In order to obtain users' views on the risks and benefits of these devices, a questionnaire was sent to 1,950 members of the Canadian Anaesthetists' Society. This paper presents a summary of the 313 responses received. Respondents were equally divided on whether the advantages of a CO₂ absorber bypass outweigh the risks of accidental misuse. However, 53 per cent felt the bypass should not be removed from the absorber and 79 per cent favoured clearer labelling of the bypass setting. Accidental disconnections of conical fittings are daily occurrences. The most frequent site is the tracheal tube connector. Sixty-eight per cent of respondents use some method of securing the connectors, in most cases by taping them. The commonest reason given for not using commercial locking devices was that they are not available. Eighty-seven per cent of respondents use disconnect alarms when ventilating a patient.

Key words

EQUIPMENT: carbon dioxide absorber; connectors.

In June 1982 the Canadian Anaesthetists' Society (CAS) mailed out to its members a questionnaire prepared jointly by the Canadian Standards Association Task Force on Anaesthesia Breathing Circuits, the CAS and the Bureau of Medical Devices of Health and Welfare Canada.

The aim of the questionnaire was to gather user experience and opinions concerning two types of anaesthesia equipment: CO₂ absorber bypass mechanisms, and conical connectors for anaesthetic breathing circuits.

The CO₂ absorber used in circle systems is usually equipped with a bypass controlled by a manually operated valve. When the valve is "on," gas flows through the absorber. With the valve "off," the flow is diverted around the absorber with the result that no CO₂ is removed from the recirculating gas. The "absorber off" setting can be used to allow CO₂ build-up in the respiratory gas in order to stimulate spontaneous breathing by the patient at the end of an anaesthetic procedure. It is also useful to divert gas flow temporarily to allow the absorbent canister to be changed in the course of an anaesthetic.

Accidental mis-settings of the CO₂ absorber bypass have led to several potentially hazardous incidents of hypercarbia.* Some anaesthetists have suggested that the inclusion of a bypass on the absorber should be prohibited. In order to address this issue, the Task Force solicited CAS members' opinions on the benefits and risks of the bypass.

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Conical connections are another critical factor in breathing circuits. Since most of these friction-fit components have no locking mechanism, accidental disconnections are common and, unless detected in time, can cause death or severe injury by anoxia. The survey sought to gain information on users' experience with disconnections and their views on the need for alarms or anti-disconnect mechanisms.

The questionnaire was mailed to 1,950 physicians on the CAS mailing list. At the time of mailing, the Society's 1,970 members included: 1,327 active anaesthetists in Canada (defined as those with Royal College certificates in anaesthesia); 160 associates (without certificates but not in training); 228 students; 51 honorary, life and senior members; 173 active members outside Canada; and 31 retired anaesthetists.

Three hundred and thirteen replies were received. This is a response rate of 16 per cent, which is considered very high for a survey of this type. The questionnaire did not require respondents to indicate their name, address, or membership status. However, ten gave addresses in the United States, five stated that they had been practising for four years or less, one was "almost retired," and one still in training. Many respondents made helpful comments on the survey form and several wrote letters as well. The interest in this subject was obviously high.

Respondents were asked to estimate the number of anaesthetics they had given in the past year and in the past ten years. The results showed an average of about 1,100 per anaesthetist per year (range 90 to 3,000; standard deviation 412) and about 10,000 in the past ten years (range 750 to 25,000; standard deviation 4,351). Thus, the 313 respondents in this survey were reporting on the collective experience of more than 3,000,000 procedures over the past decade.

Views on the CO₂ absorber bypass mechanism

The results of Part I of the questionnaire, dealing with the CO₂ absorber bypass are summarized in Table I. Users were almost equally divided as to the merits of the bypass. Forty-five per cent believed the benefits outweighed the risks while 43 per cent did not. Fifty per cent reported that they seldom or never use the bypass and only 36 per cent use it often or very often.

About half (47 per cent) of respondents said they would request a bypass when ordering a new CO₂ absorber and an equal number would not. Five reported that their hospital had no CO₂ absorbers and 14 said that they had not used one for several years. Most of these indicated that they used the Bain circuit instead. Only nine per cent said they would refuse to use a CO₂ absorber that had no bypass. One anaesthetist probably expressed the attitude of most when he asked, "What choice would I have?"

Several respondents pointed out that many anaesthetists use such high gas flow rates that the CO₂ is being flushed from the system, making the absorber unnecessary. Others reported that they use the bypass only when changing the soda lime in the absorber. Two users recommended that the bypass should be equipped with an automatic self-cancelling feature, perhaps with a half-hour timer. It would then reset itself to the "absorber on" mode if the anaesthetist should forget.

Although no clear consensus emerged on the usefulness of the bypass, 53 per cent of respondents did not think the bypass should be removed from the absorber. Seventy-nine per cent were in favour of a clearer indication of the bypass setting.

Views on connections in anaesthesia breathing circuits

Responses to the second part of the questionnaire are summarized in Table II. Anaesthetists were asked to estimate the number of accidental disconnections and extubations they had experienced or heard of in their hospitals in the past year and in the past ten years. The estimated number of disconnections varied over an extremely wide range – from none to a thousand per year. The reason for this variation was due to a difference in interpretation of the question. Some respondents counted only disconnections which went undetected until some adverse condition was observed in the patient, while others counted every unwanted separation, even if it was directly observed and immediately corrected. The latter type of occurrence is very common. As several respondents pointed out, "Something falls apart at least once a day."

One might expect the reported figures for extubations to be more accurate, since an accidental extubation is a well-defined, serious and noteworthy incident. Here the median values were quite

TABLE I Survey results on CO₂ absorber bypass mechanism

1 Do you believe that providing a bypass mechanism on the CO ₂ absorber allows for greater net benefit in the flexibility that it offers than the potential danger arising through its accidental misuse?						
	<i>Yes</i>	<i>No</i>	<i>Uncertain</i>	<i>Other reply or no reply</i>		
Number	140	136	21	16		
Per cent	45	43	7	5		
2 Approximately how often in a year would you use the bypass mechanism?						
	<i>Very often</i>	<i>Often</i>	<i>Occasionally</i>	<i>Seldom</i>	<i>Never</i>	<i>No reply</i>
Number	70	40	32	40	117	14
Per cent	22	13	10	13	37	5
3 When purchasing a new CO ₂ absorber, would you request that a bypass be installed on it?						
	<i>Yes</i>	<i>No</i>	<i>Other reply or no reply</i>			
Number	145	148	20			
Per cent	46	47	6			
If yes, would you use an absorber that did not have a bypass?						
	<i>Yes</i>	<i>No</i>	<i>Other reply or no reply</i>			
Number	143	29	141			
Per cent	46	9	45			
4 Should the bypass be removed from the absorber?						
	<i>Yes</i>	<i>No</i>	<i>Other reply or no reply</i>			
Number	123	165	25			
Per cent	39	53	8			
5 If the bypass mechanism is retained on new absorbers, would you be in favour of a more positively defined bypass switch having a more noticeable indication of its setting? (Such indications could be provided by flags and/or alarms.)						
	<i>Yes</i>	<i>No</i>	<i>Other reply or no reply</i>			
Number	247	46	20			
Per cent	79	15	6			

low (one in the past year and 2.5 in the past ten years). One hundred and thirty-two respondents reported no extubations in the past year, and twenty-seven reported none in the past ten.

Respondents were asked to indicate the relative frequency of disconnections at various sites in the breathing circuit. The commonest site was the tracheal tube connector; 22 per cent of respondents experienced disconnections here "often" or "very often." Only seven per cent had never had one at this connection. At the other end of the scale, only four per cent reported disconnections at the ventilator "often" or "very often" and 40 per cent had never had one there. Fifteen respondents specifically mentioned the Bain circuit as the component most often involved in disconnections.

The responses on the use of anti-disconnect devices revealed interesting features. Sixty-eight per cent of respondents used some kind of anti-

disconnect device but with one exception, the only reported method was adhesive tape. By far the commonest location secured was the tracheal tube connector. Several users pointed out that taping is not a very satisfactory solution; sometimes the joint separates under the tape, resulting in large leaks. Such a separation is hard to see and can be difficult to rejoin without removing the tape – a time-consuming process.

The commonest reason given for not using commercial anti-disconnect devices was that they are unavailable. However, 20 per cent of respondents believed such devices are unnecessary. Eighty-seven per cent of respondents use a disconnect alarm in the anaesthesia circuit.

The last question on the survey asked anaesthetists whether they would be willing to participate in an interview to discuss disconnect problems. One hundred and forty respondents indicated an interest.

TABLE II Survey results on connections in anaesthesia breathing circuits

1 Approximately how many times have you administered a general anaesthetic in the past year? In the past ten years?						
In past year:	average = 1,124	(304 respondents)				
In past ten years:	average = 10,267	(288 respondents)				
2 Approximately how many accidental disconnections have you seen or heard of in your hospital in the past year? In the past ten years?						
In past year:	median = 3.5	(230 respondents)				
In past ten years:	median = 15	(165 respondents)				
3 Approximately how many accidental extubations have you seen or heard of in your hospital in the past year? In the past ten years?						
In past year:	median = 1	(264 respondents)				
In past ten years:	median = 2.5	(193 respondents)				
4 Approximately how often do you experience accidental disconnections at the following locations?						
	<i>Very often</i>	<i>Often</i>	<i>Occasionally</i>	<i>Seldom</i>	<i>Never</i>	<i>Other</i>
(a) at the connection to the ventilator?	2 (1%)	8 (3%)	49 (16%)	116 (37%)	126 (40%)	12 (3%)
(b) at the connection between the ventilator delivery hose and the anaesthetic circuit?	4 (1%)	21 (7%)	68 (22%)	126 (40%)	83 (26%)	11 (4%)
(c) at the common gas outlet on the anaesthesia machine?	8 (3%)	15 (5%)	91 (29%)	118 (38%)	71 (22%)	10 (3%)
(d) at the fresh gas breathing circuit?	4 (1%)	11 (4%)	68 (22%)	111 (35%)	108 (35%)	11 (3%)
(e) at any other location within the circuit except for (f)?	6 (2%)	31 (10%)	56 (18%)	98 (31%)	60 (19%)	62 (20%)
(f) at the tracheal tube connector?	17 (5%)	52 (17%)	128 (41%)	91 (29%)	21 (7%)	4 (1%)
5 Do you regularly use anti-disconnect devices (either commercially available or home-made varieties such as tape) at the above locations?						
(a) at the connection to the ventilator				46	(15%)	
(b) at the connection between the ventilator delivery hose and the anaesthetic circuit				42	(14%)	
(c) at the common gas outlet on the anaesthesia machine				55	(18%)	
(d) at the fresh gas inlet to the breathing circuit				50	(16%)	
(e) at any other locations within the circuit except for (f)				68	(22%)	
(f) at the tracheal tube connector				171	(54%)	
If you do not use commercially available anti-disconnect devices, specify why.						
Not necessary				63	(20%)	
Not effective				25	(8%)	
Not available				99	(32%)	
Too expensive				25	(8%)	
Too inconvenient				40	(13%)	
Other				76	(24%)	
Comments rather than categorized response				60	(19%)	
6 Do you use a "disconnect alarm" when ventilating a patient in the operating room?						
	<i>Yes</i>	<i>No</i>	<i>Other reply or no reply</i>			
Number	272	30	11			
Per cent	87	10	3			
7 Would you be interested in participating in a detailed interview to discuss disconnect problems?						
	<i>Yes</i>	<i>No</i>	<i>Other reply or no reply</i>			
Number	140	141	32			
Per cent	45	45	10			

Twenty to thirty persons will be selected from this list and will be contacted by researchers conducting a study of anaesthesia disconnections under contract to the Bureau of Medical Devices, Health and Welfare Canada.

Conclusions

The Task Force was pleased with the high response rate to the questionnaire, the interest of the respondents, and the many helpful comments received. This method of obtaining professional views on complex issues affecting standards development appears to be very useful and cost-effective. The Task Force will consider using this method again when other suitable topics arise.

Résumé

Des défauts de conception au niveau des soupapes de dérivation pour l'absorption du gaz carbonique et des raccords de forme conique de circuits respiratoires ont été mis en cause dans un certain nombre d'incidents anesthésiques mortels. À la suite de cette constatation, on a fait parvenir un questionnaire à 1 950 membres de la Société canadienne des anesthésistes afin d'obtenir l'opinion des utilisateurs de ces appareils sur les avantages et les risques qu'ils présentent. Le présent article résume les 313 réponses recueillies. Les répondants ont exprimé des opinions également partagées sur la question de savoir si les avantages de l'utilisation de soupapes de dérivation pour l'absorption du gaz carbonique surpassaient les risques qu'en comporte une mauvaise utilisation accidentelle. Cependant, 53 pour cent des répondants sont d'avis qu'il ne faut pas retirer le système de dérivation de l'absorbeur et 79 pour cent se sont prononcés en faveur d'un étiquetage plus précis des modalités d'installation de cette dérivation. Il arrive tous les jours que des raccords coniques se détachent accidentellement de l'appareil, le plus souvent au niveau de la canule trachéale. Soixante-huit pour cent des répondants signalent qu'ils consolident la fixation des raccords d'une façon ou d'une autre, le plus souvent au moyen d'une bande adhésive. Le motif le plus souvent évoqué pour expliquer la non-utilisation des dispositifs de sûreté commerciaux est qu'ils ne sont pas disponibles. Enfin, 87 pour cent des répondants déclarent faire usage d'un système d'alarme destiné à signaler toute anomalie, lorsqu'ils procèdent à la ventilation d'un malade.