How Well Do You Know Your Anaesthetic Machine?

E H.A, A A.O, A V.O, U P.M, A J. O

Citation

E H.A, A A.O, A V.O, U P.M, A J. O. *How Well Do You Know Your Anaesthetic Machine?*. The Internet Journal of Anesthesiology. 2009 Volume 27 Number 2.

Abstract

BackgroundAlmost every piece of anaesthesia machine does carry some risk of failure predisposing to critical incidents and possible harm to the patient. Technicians who are experienced in checking machines are of tremendous help but each anaesthetist should be able to perform a pre-operative machine check. We assume that years of experience and higher cadre in practice will translate to a more meticulous pre-anaesethetic check to ensure patient safety. This assumption was tested by this study.AIM/OBJECTIVES1. To assess the ability of clinical anaesthetists to run a pre-anaesthetist machine check and detect any faults in the anaesthetic machine.2. To assess if cadre and years of experience affect the ability to detect faults in the anaesthetic machine3. To emphasize the need for continuous medical education including pre-anaesthetic machine check across all cadre of anaesthetists.METHODAll anaesthetists in the hospital were recruited for the study. They were asked to perform a pre anaesthetic check on two anaesthesia machines. The machines (Drager) had 6 pre-set faults set by the bio-ethical engineers as instructed by the authors. The six faults were chosen from common faults seen in our clinical practice.RESULTOf the thirteen participants, none fully identified all the 6 pre-set faults. The commonest detected fault was the disconnection of the scavenging system. Participants with experience of 0-2 years detected a mean of 2.1 faults, those with 3-7 years of experience detected a mean of 1.25 while those with >7years experience detected a mean of 3 faults. Of these 61.5% were registrars, 30.8% were senior registrars and one (7.7%) was a consultant. The maximum number of faults detected by any of the participants was 4 by one (7.7%) of the participants.CONCLUSIONOur study demonstrates that machine check in anaesthesia practice continues to be a problem.

INTRODUCTION

Over the years, the anesthesia machine has changed from being a rather simple composite system (Boyle's machine) to a highly integrated workstation that incorporates many devices. Thus, the anaesthetist needs to keep abreast with the trend and be familiar with his work station. Lack of familiarization with the machine and insufficient checking of the machine are common causes of critical incidents and morbidity in anaesthesia. In a study by Fasting and Gisvold, they noted that insufficient machine check before use was a main contributing factor in one quarter of critical incidents attributed to human error.[1] In our hospital, the Drager anaesthetic machines were supplied and all anaesthetists trained on use of the machines by the company that installed them. However, there had been a few critical incidents related to the anaesthesia machine. This study was thus undertaken to assess how well the anaesthetists can do the pre-induction machine checklist and detect any faults in the machines.

METHODS

After obtaining institutional ethical approval, all anaesthetists were asked to perform a pre anaesthetic check on two anaesthesia machines set up in the theatre. The anaesthetists involved in the study design were excluded. The machines (Drager) had 6 pre-set faults set by the bio-ethical engineers(determined by the authors). The six faults were chosen from faults seen in our clinical practice and comprised disconnection of scavenging system, disconnection of pressure sensor system, disconnection of expiratory flow sensor line, no disc in inspiratory one way valve, failed oxygen sensor and disconnected ventilator battery.

The anaesthetists were observed during the study and were not required to correct any detected fault. They were allowed a maximum of ten minutes to check out the machine. They were asked to list the faults on a sheet of paper. The potential participants were kept in rooms separate from those who had undergone the test so were not allowed to communicate their findings to the others.

The data gathered was subjected to analysis using the SPSS 17.0 software (Polar Engineering and Consulting 2008).

RESULTS

There were twelve participants, ten males, two females aged between 29 and 45. seven (58.3%) were registrars, 4 (33.3%) were senior registrars and one (8.4%) was a consultant. There were 6 participants who had 0-2 years experience, 5 had 3-7 years experience and 1 had more than 7 years experience in anaesthesia. All participants had used the machine in test for about a year. The average number of faults found by all participants was 2.08.

Practitioners with 0–2 years experience found a mean of 2.14 faults, participants with 3–7 years found a mean of 1.75 faults, and participants with more than 7 years experience detected a mean of 3.0 faults (Table 1). With respect to cadre, the consultant detected more faults followed by the registrar. The senior registrars detected the least faults(Table 2). No participant detected all the faults while one could not detect any fault. The commonest fault detected was disconnection of the scavenging system (83.3%), followed by oxygen sensor detection (50%), disconnection of the expiratory flow sensor tubing (41.7), disconnection of the pressor sensor tubing, absence of disc in inspiratory one way valve (25%) while faulty battery was the least 16.6%. hould be developed by each institution to suit local need.

Figure 1

Figures 1: Faults detected versus Cadre

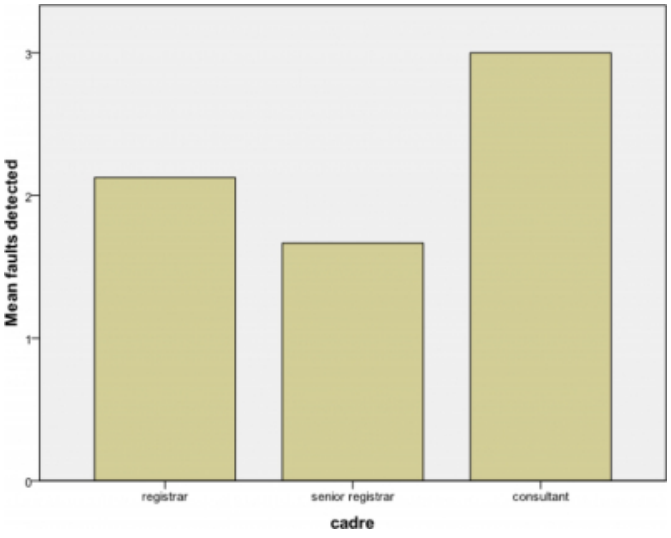

Figure 2

Fig. 2 : Faults detected, Age, Cadre

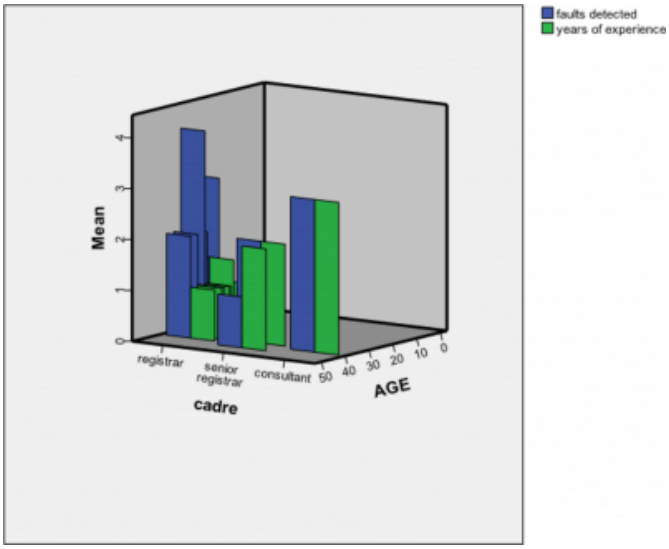

Figure 3

Table 1

years of experience	Mean	N	Std. Deviation	Variance
0-2	2.14	7	1.069	1.143
3-7	1.75	4	.500	.250
>7	3.00	1	.	.
Total	2.08	12	.900	.811

Figure 4

Table 2

Cadre	Mean	N	Std. Deviation	Variance
Registrar	2.13	8	.991	.982
senior registrar	1.67	3	.577	.333
Consultant	3.00	1	.	.
Total	2.08	12	.900	.811

DISCUSSION

Improper functioning or misuse of anesthesia gas delivery equipment can cause major morbidity and mortality.[2] Therefore, routine inspection of anesthesia equipment before each use confirms proper functioning and promotes patient safety. Overt equipment failure is rare in anesthesia practice[3], however, the conscientious use of a checkout list is mandatory before each anesthetic procedure.[3] Such a mandatory check-off procedure increases the likelihood of

detecting anesthesia machine faults.

Our study demonstrates that we continue to have problems detecting anesthesia machine faults despite having departmental pre anaesthetic machine check protocol. The role of equipment failures leading to malpractice litigation in the United States has been studied by the ASA Closed Claims Project (CCP). A 1997 analysis of 3791 claims, of which 76% occurred during the period 1980-1990, found that gas delivery equipment problems accounted for 72/3791 (2%) [4]

A study by Larson et al showed that ability to detect fault declined with increasing years of experience[5]. This is in contrast to our findings as those with greater years of experience detected more faults on the whole. An observational study by Armstrong-Brown et al found no correlation between participant age or years of experience with the number of items checked before induction of anesthesia.[6] In another by March M.G. et al, none of the participants in their study found all of the machine faults as was noticed in our study.[7]

Olympio et al.[8] hypothesized that the poor rate of fault detection was because of the lack of adequate training in checkout procedures. Therefore, we suggest that user education/in-servicing is essential when using sophisticated equipment. A pre-use checkout of the delivery systems

References

1. Fasting S, Gisvold SE. Equipment problems during anaesthesia–are they a quality problem? Br J Anaesth 2002;89:825–31.
2. Morgan G.E, Mikhail M.S, Murray M.J. The Anaesthetic Machine. Clinical Anesthesiology, 4th Edition. McGraw-Hill Companies, Inc.(Available on CDRom)
3. Eisenkraft J. Hazards of the Anesthesia Workstation. ASA 59th Annual Refresher Course Lectures 2008. Pg 212
4. Caplan RA, Vistica MF, Posner KL, Cheney FW: Adverse anesthetic outcomes arising from gas delivery equipment: a closed claims analysis. Anesthesiology 1997; 87: 741-8
5. Larson E.R., Nuttall G.A, Ogren B.D., Severson D.D,et al.A Prospective Study on Anesthesia Machine Fault Identification. Anesth Analg 2007;104:154 –6
6. Armstrong-Brown A, Devitt J, Kurrek M, Cohen M. Inadequate preanesthesia equipment checks in a simulator. Can J Anaesth 2000;47:974–9.
7. March MG, Crowley JJ. An evaluation of anesthesiologists' present checkout methods and the validity of the FDA checklist. Anesthesiology 1991;75:724–9.
8. Olympio MA, Goldstein MM, Mathes DD. Instructional review improves performance of anesthesia apparatus checkout procedures. Anesth Analg 1996;83:618–22.

Author Information

EZIKE H.A
Department of Anaesthesia, College of Medicine, University of Nigeria, Enugu Campus

AMUCHEAZI A.O
Department of Anaesthesia, College of Medicine, University of Nigeria, Enugu Campus

AJUZIEOGU V.O
Department of Anaesthesia, College of Medicine, University of Nigeria, Enugu Campus

UFUEGBUNAM P.M
Department of Anaesthesia, College of Medicine, University of Nigeria Teaching Hospital Ituku-Ozalla

Achi J. O
Department of Anaesthesia, College of Medicine, University of Nigeria Teaching Hospital Ituku-Ozalla