Please find below the results of your literature search request.

If you would like the full text of any of the abstracts included, or would like a further search completed on this topic, please let us know.

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Thank you

**Literature search results**

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**Search details**

Are appropriate anaesthetic equipment safety checks being undertaken in clinical practice?

**Resources searched**

NHS Evidence; TRIP Database; Cochrane Library; BNI; CINAHL; EMBASE; HMIC; MEDLINE; Google Scholar

**Database search terms:** (anaesth* OR anesth*) adj2 (equipment OR machine* OR apparatus OR appliance* OR instrument* OR device*); safety adj2 (check* OR inspect* OR assess* OR test* OR examin*); exp ANESTHESIA EQUIPMENT AND SUPPLIES; exp EQUIPMENT SAFETY; exp ANESTHESIA CONDUCTION EQUIPMENT; exp ANESTHESIOLOGY THERAPEUTIC DEVICE; exp SAFETY; exp EQUIPMENT; exp ANESTHESIA; exp EQUIPMENT AND SUPPLIES

**Evidence search string(s):** (anaesthesia OR anaesthetic) (equipment OR instruments OR devices OR appliances OR apparatus OR machines) safety (checks OR examinations OR inspections OR assessments OR tested OR testing)

**Google search string(s):** (anaesthesia OR anaesthetic) (equipment OR instruments OR devices OR appliances OR apparatus OR machines) safety (checks OR examinations OR inspections OR assessments OR tested OR testing)

**Summary**

There is some research on safety checks and anaesthetic equipment; and a few more studies than first identified in our training session, which you may find useful.
Guidelines and Policy

Association of Anaesthetists of GB and Ireland
Changing Anaesthetic Equipment 2012

Australian and New Zealand College of Anaesthetists
Statement on the Minimum Safety Requirements for Anaesthetic Machines and Workstations for Clinical Practice 2013
Guidelines on Checking Anaesthesia Delivery Systems 2012
Guidelines on Equipment to Manage a Difficult Airway During Anaesthesia 2012

Royal College of Anaesthetists
Guidelines for the Provision of Anaesthetic Services (GPAS) 2014

Royal College of Nursing
Safety representative handbook 2011

Safe Anaesthesia Liaison Group
Patient safety update : July 2011 to September 2011

World Health Organization
WHO guidelines for safe surgery: safe surgery saves lives 2009

Evidence-based reviews
None found.

Published research – Databases

1. Patient injuries from anesthesia gas delivery equipment: A closed claims update

Author(s) Mehta S.P., Eisenkraft J.B., Posner K.L., Domino K.B.

Citation: Anesthesiology, October 2013, vol./is. 119/4(788-795), 0003-3022;1528-1175 (October 2013)

Publication Date: October 2013

Abstract: Background: Improvements in anesthesia gas delivery equipment and provider training may increase patient safety. The authors analyzed patient injuries related to gas delivery equipment claims from the American Society of Anesthesiologists Closed Claims Project database over the decades from 1970s to the 2000s. Methods: After the Institutional Review Board approval, the authors reviewed the Closed Claims Project database of 9,806 total claims. Inclusion criteria were general anesthesia for surgical or obstetric anesthesia care (n = 6,022). Anesthesia gas delivery equipment was defined as any device used to convey gas to or from (but not involving) the airway management device. Claims related to anesthesia gas delivery equipment were compared between time periods by chi-square test, Fisher exact test, and Mann-Whitney U test. Results: Anesthesia gas delivery claims decreased over the decades (P < 0.001) to 1% of claims in the 2000s. Outcomes in claims from 1990 to 2011 (n = 40) were less severe, with a greater proportion of awareness (n = 9, 23%, P = 0.003) and pneumothorax (n = 7, 18%; P = 0.047). Severe
injuries (death/permanent brain damage) occurred in supplemental oxygen supply events outside the operating room, breathing circuit events, or ventilator mishaps. The majority (85%) of claims involved provider error with \( n = 7 \) or without \( n = 27 \) equipment failure. Thirty-five percent of claims were judged as preventable by preanesthesia machine check.

Conclusions: Gas delivery equipment claims in the Closed Claims Project database decreased in 1990-2011 compared with earlier decades. Provider error contributed to severe injury, especially with inadequate alarms, improvised oxygen delivery systems, and misdiagnosis or treatment of breathing circuit events. Copyright 2013, the American Society of Anesthesiologists, Inc.

Source: EMBASE

Available in fulltext from Anesthesiology at the ULHT Library and Knowledge Services’ eJournal collection

2. RP Summary: Recommended Practices for a Safe Environment of Care.

Author(s)

Citation: AORN Journal, 01 August 2013, vol./is. 98/2(167-171), 00012092

Publication Date: 01 August 2013

Source: CINAHL

Available in fulltext from AORN Journal at EBSCOhost

Available in fulltext at Association of Operating Room Nurses, AORN Journal;

Collection notes: On first login to a ProQuest journal you will need to select 'Athens (OpenAthens Federation)' from Select Region, and then 'NHS England' from Choose your Library.

3. Are the checkers bored? - The need to develop better routines for checking anaesthesia delivery systems

Author(s) Jorm C.M.

Citation: Anaesthesia and Intensive Care, November 2012, vol./is. 40/6(925-926), 0310-057X;1448-0271 (November 2012)

Publication Date: November 2012

Source: EMBASE

Available in fulltext from Anaesthesia & Intensive Care at EBSCOhost

Available in fulltext from Anaesthesia & Intensive Care at EBSCOhost

Available in fulltext at Anaesthesia and Intensive Care: Collection notes: On first login to a ProQuest journal you will need to select 'Athens (OpenAthens Federation)' from Select Region, and then 'NHS England' from Choose your Library.

4. Evaluation of new guidelines for checking the anaesthetic machine

Author(s) Reddy H., Bowen L., Bailey C., Clyburn P., Gemmell L.

Citation: Anaesthesia, November 2012, vol./is. 67/11(1300), 0003-2409 (November 2012)

Publication Date: November 2012

Abstract: This evaluation was undertaken to benchmark test the new Association of Anaesthetists of Great Britain and Ireland (AAGBI) guidelines for checking the anaesthetic machine against current practice [1]. We engaged a range of anaesthetists to test and obtain feedback on the proposed format. Methods Participants were randomised into two equal-sized groups via sealed envelopes. Each group was assigned two different pre-determined faults. Whilst carrying out their usual machine checks, participants were timed and scored on the completeness of their check compared to the new guidelines and on their identification of a fault. The process was then repeated whilst following a copy of the new guidelines, and a different fault used. Only one fault was placed in each check
depending on what envelope the participants had chosen. Participants were asked if they routinely carried out any functional checks between cases (which is a new six point additional check in the guidelines) and to comment on the guidelines’ format. Results We recruited 52 non-consultant anaesthetists: 16 CT1-2; 29 ST3-7; and seven non-consultant career-grade doctors. The usual machine check scored a median (IQR [range]) 14 (13-16 [4-20]) and took a 239 (180-351 [5-695]) seconds to complete. The time to finding a fault was 161 (123-257 [11-611]) seconds. Using the new guidelines, completion time was 290 (232-381 [92-714]) seconds, and time to finding a fault was 158 (100-281 [36-500]) seconds. Four anaesthetists failed to identify a fault during their routine check compared with two when using the guidelines. Participants commented on the format of the guideline using a visual analogue score of 0 (awful)-10 (fantastic). Layout was awarded 8 (8-9 [3-10]), legibility 9 (8-9 [5-10]), and safety implications 8 (8-9 [2-10]). Discussion Although the new guideline check took longer to perform, we anticipate that times will improve with repeated practice and exposure. The time to fault finding was recorded but is inevitably dependant on what the fault is and the order of the checking. The important safety point is whether the fault was identified, not how long it took. The functional check was identified as emphasising what should be checked between cases as this wasn’t addressed in the previous guidelines. Most anaesthetists were positive about the legibility, layout and safety implications. Qualitative comments included the ease and logical progression of the guidelines. Several people suggested the check should either be recorded in the notes or become part of the World Health Organisation safety checklist documentation.

Source: EMBASE
Available in fulltext from Anaesthesia at EBSCOhost
Available in fulltext from Anaesthesia at EBSCOhost


Author(s) Association of Anaesthetists of Great Britain and Ireland (AAGBI), Hartle A, Anderson E, Bythell V, Gemmell L, Jones H, McIvor D, Pattinson A, Sim P, Walker I

Citation: Anaesthesia, June 2012, vol./is. 67/6(660-8), 0003-2409:1365-2044 (2012 Jun)

Publication Date: June 2012

Abstract: A pre-use check to ensure the correct functioning of anaesthetic equipment is essential to patient safety. The anaesthetist has a primary responsibility to understand the function of the anaesthetic equipment and to check it before use. Anaesthetists must not use equipment unless they have been trained to use it and are competent to do so. A self-inflating bag must be immediately available in any location where anaesthesia may be given. A two-bag test should be performed after the breathing system, vaporisers and ventilator have been checked individually. A record should be kept with the anaesthetic machine that these checks have been done. The ‘first user’ check after servicing is especially important and must be recorded. Anaesthesia 2012 The Association of Anaesthetists of Great Britain and Ireland.

Source: Medline
Available in fulltext from Anaesthesia at EBSCOhost
Available in fulltext from Anaesthesia at EBSCOhost


Author(s) Eng TS, Durieux ME

Citation: Anesthesia & Analgesia, January 2012, vol./is. 114/1(144-6), 0003-2999;1526-7598 (2012 Jan)

Publication Date: January 2012

Abstract: We report a complete internal fresh gas flow disconnect within a Drager Fabius GS anesthesia machine without any alarms being triggered. This was undetected primarily because of an incomplete machine checkout in which the step of ensuring proper gas flows
by using a "test lung" was omitted. Machine-specific factors, however, also contributed to prevent diagnosis: (1) the machine passed its leak test because the flowmeter bobbin (i.e., floating ball) sealed the flowmeter when back pressure was applied; (2) the mechanical ventilator entrains room air, thus functioning in the absence of fresh gas flow; and (3) the electronic flow sensors functioned "appropriately" because the leak was downstream. Despite the advent of highly automated machines, manual checkout procedures remain crucial to minimizing undiagnosed failures.

Source: Medline
Available in fulltext from Anesthesia & Analgesia at the ULHT Library and Knowledge Services' eJournal collection

7. Adverse events with medical devices in anesthesia and intensive care unit patients recorded in the french safety database in 2005-2006

Author(s) Beydon L., Ledenmat P.Y., Soltner C., Lebreton F., Hardin V., Benhamou D., Clergue F., Laguenie G.

Citation: Anesthesiology, February 2010, vol./is. 112/2(364-372), 0003-3022;1528-1175 (February 2010)
Publication Date: February 2010

Abstract: Background: French regulations require that adverse events involving medical devices be reported to the national healthcare safety agency. The authors evaluated reports made in 2005-2006 for patients in anesthesia and critical care. Methods: For each type of device, the authors recorded the severity and cause of the event and the manufacturer's response where relevant. The authors compared the results with those obtained previously from the reports (n = 1,004) sent in 1998 to the same database. Results: The authors identified 4,188 events, of which 91% were minor, 7% severe, and 2% fatal. The cause was available for 1,935 events (46%). Faulty manufacturing was the main cause of minor events. Inappropriate use was the cause in a significantly larger proportion of severe events than minor events (P < 0.001) and was usually considered preventable via improved knowledge or device verification before use. Compared to with that in 1998, the annual number of reported events doubled and the rate of severe events decreased slightly (12-10%, P = 0.03). The rate of events related to manufacturing problems remained stable (59-60%, P = nonsignificant), and the rate of events caused by human errors was 32-42% (P = 0.01). There were no changes in the mortality rate (2% in both studies). Conclusions: The number of adverse events related to medical devices indicates a need for greater attention to these complex pieces of equipment that can suffer from faulty design and manufacturing and from inappropriate use. Improvements in clinician knowledge of medical devices, and to a lesser extent improvement in manufacturing practices, should improve safety. Copyright 2010, the American Society of Anesthesiologists, Inc. Lippincott Williams & Wilkins.

Source: EMBASE
Available in fulltext from Anesthesiology at the ULHT Library and Knowledge Services' eJournal collection

8. Yet another cause for blocked sidestream capnogram--beware of the non-threaded cap mount in heat and moisture exchangers.

Author(s) Umesh G, Jasvinder K, Shetty N

Citation: Journal of Clinical Monitoring & Computing, August 2009, vol./is. 23/4(207-8), 1387-1307;1573-2614 (2009 Aug)
Publication Date: August 2009

Abstract: Heat and moisture exchangers (HME) are commonly used during general anaesthesia and intensive care of patients on mechanical ventilators. Some of the HME manufacturers provide HMEs with a Luer lock fitting for connecting side stream CO(2) monitoring line, Luer lock cap, and a non-threaded cap mount. However, HMEs from different manufacturers and HMEs meant for use in children and for adults from the same manufacturer vary in the presence/absence of non-threaded cap mount. This can create
confusion to the clinicians and can result in inadvertent connection of the CO(2) monitoring line to the non-threaded cap mount resulting in blocked CO(2) monitoring line and leak in the circuit. We caution all the anaesthesiologists and intensivists regarding this possibility while using HMEs from different manufacturers.

Source: Medline

Available in fulltext at Journal of Clinical Monitoring and Computing; Collection notes: On first login to a ProQuest journal you will need to select 'Athens (OpenAthens Federation)' from Select Region, and then 'NHS England' from Choose your Library.

Available in fulltext from Journal of Clinical Monitoring & Computing at EBSCOhost

9. What is the Medicines and Healthcare products Regulatory Agency?

Author(s) Earl C

Citation: Journal of Advanced Perioperative Care, 01 July 2009, vol./is. 4/1(50-54), 14705664

Publication Date: 01 July 2009

Abstract: This article hopes to encourage adverse incident reporting of medical devices by perioperative practitioners who, by the nature of their work, come into daily contact with a diverse range of these devices. It will explain what the Medicines and Healthcare products Regulatory Agency is, what it does, how to report a faulty medical device and or poor instructions for use, the process involved during investigations, and what educational support for healthcare professionals is available.

Source: CINAHL

10. Safe learning and assessment for anaesthetic apparatus checks.

Author(s) Bowers M

Citation: Journal of Perioperative Practice, 01 April 2008, vol./is. 18/4(156-160), 17504589

Publication Date: 01 April 2008

Source: CINAHL

Available in fulltext at Journal of Perioperative Practice, The; Collection notes: On first login to a ProQuest journal you will need to select 'Athens (OpenAthens Federation)' from Select Region, and then 'NHS England' from Choose your Library.

Available in fulltext from Journal of Perioperative Practice at EBSCOhost

11. Anaesthetic machine checking guidelines: have we improved our practice?.

Author(s) Langford R, Gale TC, Mayor AH

Citation: European Journal of Anaesthesiology, December 2007, vol./is. 24/12(1050-6), 0265-0215;0265-0215 (2007 Dec)

Publication Date: December 2007

Abstract: BACKGROUND AND OBJECTIVES: This study follows up an initial audit in 1992 indicating that anaesthetic machine checking practices were often incomplete. The aims were to ascertain if there has been any improvement during this period with special reference to the latest guidelines.METHODS: Following the Association of Anaesthetists of Great Britain and Ireland machine checking guidelines, a structured questionnaire, was used to interview 41 anaesthetists in the South West region on one particular day.RESULTS: Despite 80% of subjects stating that they had read the latest guidelines recently, only one undertook a complete check and 39/41 (95%) performed partial checks (omitting one or more steps in the guidelines). Steps most commonly omitted were additional monitoring, ventilator function, availability of an alternative means of ventilation and function of ancillary equipment such as laryngoscopes. Only 5/41 subjects performed any check between cases. Several of these checks have been introduced in the 2004 guidelines.CONCLUSIONS: Although there has been a significant increase in the
proportion of anaesthetists undertaking machine checks since 1992 (P = 0.0007), we conclude that machine checking guidelines are still poorly followed, with checks specific to the latest guidelines most likely to be omitted.

**Source:** Medline

Available in fulltext from *European Journal of Anaesthesiology* (Cambridge University Press) at EBSCOhost

Available in fulltext from *European Journal of Anaesthesiology* (Cambridge University Press) at EBSCOhost


**Author(s)** Hignett R

**Citation:** European Journal of Anaesthesiology, November 2006, vol./is. 23/11(983), 0265-0215;0265-0215 (2006 Nov)

**Publication Date:** November 2006

**Source:** Medline

Available in fulltext from *European Journal of Anaesthesiology* (Cambridge University Press) at EBSCOhost

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**Published Research - Google Scholar**

*From 1st fifty results:*

**Guidelines for safety and quality in anaesthesia practice in the European Union**

JTA Knape, F PetriniJ, L Vimlati - European journal of ..., 2007 - Cambridge Univ Press

... Equipment should be tested according to a checklist at defined intervals. ... Anaesthetic records should be kept in all cases. All departments should have a systematic approach to anaesthesia-related problems and use these data for quality improvement strate- gies in the ...

Cited by 29 Related articles All 10 versions Cite Save

**[HTML] Theatre checklists and patient safety**

IH Wilson, IA Walker - Anaesthesia, 2008 - Wiley Online Library

... to all AAGBI members, on the topics of anaphylaxis, malignant hyperpyrexia and local anaesthetic toxicity ... as appropriate, whether blood is needed and available, if all equipment for the ... The 'sign-in' before induction checks that anaesthesia facilities have been prepared, a pulse ...

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CJ Cassidy, A Smith, J Arnot-Smith - Anaesthesia, 2011 - Wiley Online Library

... Theatres/departments of anaesthesia should have ... Anaesthetic machines should be plugged into an uninterruptible power supply (UPS) and batteries, where present, should be kept ... Equipment problems may arise not only from power failure during the test if backup power is ...

Cited by 23 Related articles All 4 versions Cite SaveSaved More

**Towards better patient safety: WHO Surgical Safety Checklist in otorhinolaryngology**

P Helmiö, K Blomgren, A Takala… - Clinical …, 2011 - Wiley Online Library
Test questions. In replies to the questions that were testing the internal validity of the questionnaire, there were no differences between the study groups. Safety checks. Pre-check of anaesthesia equipment increased from 70.5% to 84.0% of the operations, P < 0.001.

Patient safety during anaesthesia: incorporation of the WHO safe surgery guidelines into clinical practice
WS Schlack, MA Boermeester - Current opinion in Anesthesiology, 2010 - journals.lww.com
... of anaesthesia has been able to decrease the complication rate resulting from anaesthetic interventions – at ... 7. The team will prevent inadvertent retention of instruments and sponges in surgical ... and focus on the safety check – and before induction of anaesthesia, the patient ...

Narratives of professional regulation and patient safety: the case of medical devices in anaesthesics
G Currie, M Humphreys, J Waring, E Rowley - Health, risk & society, 2009 - Taylor & Francis
... Extent and practicalities of filter use in anaesthetic breathing circuits and attitudes towards ... Infection control in anaesthesia, London: Association of Anaesthetists of Great Britain and Ireland. ... the Medicines Devices Agency (MDA) has stated that: clinical instruments labelled as ...

Checking in healthcare safety: theoretical basis and practical application
J Shillito, K Arfanis, A Smith - International journal of health ..., 2010 - emeraldinsight.com
... They seem to have an effect on medical equipment problems and drug errors ... There has been guidance on checking anaesthetic machines before use since the early ... Risk perception and communication: recent developments and implications for anaesthesia", Anaesthesia, Vol. ...

Surgical safety checklists: do they improve outcomes?
IA Walker, S Reshamwalla... - ... journal of anaesthesia, 2012 - British Jnl Anaesthesia
... operating theatre, this leads to mistakes, inefficient use of resources, wasted equipment, frustration, poor ... 75 and a requirement of international standards for a safe practice of anaesthesia. ... are used to checklists in theatre, the best known being the anaesthetic machine checklist. ...

[HTML] Checking anaesthetic equipment: AAGBI 2012 guidelines
P Magee - Anaesthesia, 2012 - Wiley Online Library
... Sections M and N on single-use devices and machine failure remain unchanged from 2004, and a new section, O, on responsibility for 'shared ... Checking Anaesthetic Equipment 2012. Anaesthesia; 67: 660–8. PubMed. 15 Association of Anaesthetists of Great Britain and Ireland ...

Development and validation of the SURgical PATient Safety System (SURPASS) checklist
EN de Vries, MW Hollmann... - Quality and Safety ..., 2009 - qualitysafety.bmj.com
... problems, for example with sterile equipment, this could lead to structural measures such as more stringent checks of instruments or equipment before sterilisation. ... use of checklists in medicine.16173637 An aviation-style checklist has been evaluated in
anaesthesia and was ...

[HTML] The history of anaesthetic equipment evaluation in the United Kingdom: lessons for developing future strategy
AR Wilkes, J Pandit, E O'Sullivan - Anaesthesia, 2011 - Wiley Online Library
... Introducing new anaesthetic equipment into clinical practice. Anaesthesia ... Safe Management of Anaesthetic Related Equipment. London: AAGBI, 2009. 3 Medicines and Healthcare products Regulatory Agency (MHRA). Managing Medical Devices (DB2006(05)). ...

Equipment-related incidents in the operating room: an analysis of occurrence, underlying causes and consequences for the clinical process
I Wubben, JG Van Manen… - Quality and Safety ..., 2010 - qualitysafety.bmj.com
... However, patients were affected indirectly by longer anaesthesia as a result of 29 incidents ... under review is advised to re-evaluate its inventory capacity of equipment (especially instruments). ... this study provide insight into the occurrence and effect of equipment-related incidents. ...

Published Research – Database Search Strategy

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<td>26</td>
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