AVOIDABLE ANAESTHETIC DEATHS IN LOW INCOME SETTINGS: A NARRATIVE REVIEW

[1]Job G. Otokwala, [2]Juliet O. Amadi

*[1]Department of Anaesthesiology, Faculty of Clinical Sciences, University of Port Harcourt, Nigeria

[2]Department of Internal Medicine, Rivers State University Teaching Hospital.

***Corresponding author:** Job G. Otokwala **Email:** job.otokwala@uniport.edu.ng

ABSTRACT

Background: *One of the most devastating events in the perioperative period is the loss of an apparently healthy patient from a purely avoidable cause. Anaesthesia is a known risk factor for critical incidents that could result in mortality. The complex mix of both human and other associated factors which have seen improvements in developed climes but remain a cause for concern in resource-limited environments is the basis for this review. The authors feel concerned about the sustained loss of precious lives to avoidable causes. This paper reviews the available literature for the history, causative factors and summarizes the evidence to prevent such an anaesthetic disaster.*

Method: *A systematic literature search was conducted on the incidences of avoidable anaesthetic deaths in the developing countries. The review used the electronic database; Cochrane library, Medline, PubMed, EMBASE and African journal online (AJOL), screening of the titles and abstracts of papers to define relevant studies for inclusion. Searches were limited mainly to studies relating to the developing countries. The search period was up to 2021.*

Results: *We reviewed studies which were carried out in developing countries and in some developed countries and discovered that most intraoperative deaths from anaesthesia were avoidable and affected patients in the younger age group. Conversely however, one study showed only one anaesthesia-related death (0.05%) in a middle-aged man. Furthermore, avoidable anaesthetic mortality rates were found to be 1:504 in Malawi and 1:133 in Togo.*

Conclusion*: Anaesthetic deaths in the peri-operative period are largely preventable and have far-reaching consequences on the patient's relatives, anaesthetists, surgeons, and other hospital personnel involved in the management of the patient. Although the incidence is on a downward trend in developed*

Print ISSN: 0189-9287 | Online ISSN: 2992-345X

The Nigerian Health Journal, Volume 22 No 1, January to March 2022

www.tnhjph.com

A Publication of Nigerian Medical Association, Rivers State, Nigeria

countries, it is still a major problem in developing countries and human factors account for majority of the cases. The correct use of checklists, paying attention to even the smallest detail, training and re-training of personnel and provision of appropriate equipment in developing countries will go a long way to curb this menace.

***Key Words**: Avoidable, Anaesthetic, Deaths, Low Income Settings*

INTRODUCTION

Wilson et al.[1] observed that investment in anaesthesia services is a vital pathway to ensuring sustained progress towards a safer surgery and obstetric care. This report underscores the important role that anaesthesia plays in perioperative medicine with the singular aim of reducing perioperative morbidity and mortality. The focus of anaesthetic practice revolves around the maintenance of patient safety and health during surgery. This was the vantage of the revered Professor Aitkenhead who had noted that the avoidance of intraoperative disaster should be the focus of anaesthetic training rather than the management of the aftermath[2].

Avoidable anaesthetic death is a feared outcome in perioperative practice and depicts inherent inadequacies which are either ignored or taken for granted[3]. It is implied in avoidable anaesthetic death that there is evidence of mismanagement that is sufficient to result in death and it is defined as the loss of a patient which is attributed wholly or partly to anaesthesia in the perioperative period. The scope of this definition is poorly defined in terms of the timing and limit of the period in question. Is it death on the table within the surgical period, twenty-four hours, or 72 hours of surgery? This lack of consensus creates ambiguity in defining what constitutes anaesthetic death in defiance to what surgical death is. The authors limited the search for the ideal definition of anaesthetic death to include only; '' death of a patient that is purely from anaesthesia and that occurs within 24 hours following the administration of anaesthesia''[4].

Avoidable anaesthetic death therefore defines a scenario where the patient would most likely have survived if improved care by the anaesthetic team suffices[5].

There is a significant difference in outcomes in patients receiving anaesthesia across developed and developing countries[6]. Anaesthetic -related mortality is rare in the developed world[6]. For instance, in the U.S.A., it is about 1.1 per million persons per year[7]. In the developing world, data are lacking, but anaesthetic mortality is 2-3 times higher in middle-income countries and may be up to 100-fold greater in low-income countries[6].

Lessons from the aviation industry where safety is optimally guaranteed have highlighted the contributions of the following factors for man made errors which could lead to fatalities. Pilots have been found in confidential reports to have demonstrated over confidence in reacting to critical incidents on board. Others have been found to be confused when scenarios become ill- defined and occasionally, the cockpit becomes hostile as well as when standard flight operating guidelines are ignored. These observations reflect scenes that are prevalent in the operating suites.

It is obvious that with the increasing volume and complexity of the surgical patient comes the increasing risk of intraoperative mishap. Patients are either too young or old, and with associated comorbidities which could be obvious or unrecognized[5]. The consequence of any anaesthetic mishap is immediate, evident and of negative impact.

METHODOLOGY

We searched Medline, PubMed, google scholars, Scopus for papers on preventable, avoidable deaths, death on the table, or death primarily attributed to anaesthesia. The review focused on articles up to 2022. We searched for historical perspectives from articles from peer reviewed papers, published locally in Nigeria and internationally and in English. In addition, we searched anaesthesia specific journals using the google scholar search boxes. Inclusion criteria were all human related studies and communication from anaesthetists. Excluded were animal studies. Keywords searched included 'avoidable', 'preventable', in combination with 'anaesthetic' and 'death', 'mortality', 'demise'. These searches revealed both prospective and retrospective studies almost all of which were conducted in developing countries. This is an extraordinarily small body of peer-reviewed research papers

considering the importance of the topic. However, it is due to the dearth of studies in developing areas.

RESULTS

Literature review, assessed for eligibility, title review, abstract, full articles review, and references were extracted. Anaesthetic-related deaths were found to be significantly greater in developing countries while developed countries experienced a downward trend[6].

Recorded Origin of Avoidable Anaesthetic Deaths

The first recorded death from anaesthesia following human error occurred in 1847 [8]. This followed the administration of brandy into the lungs to possibly counteract the effects of chloroform. In a report in late 1978, anaesthesia contributed about 82% of direct causes of death. The formation of the Anaesthesia patient safety foundation was initiated because of the concerns the founders of the American Society of Anesthesiologists had to stem the tide of increasing intraoperative deaths from avoidable causes in the United States. In the 1950s through 70s, avoidable anaesthetic deaths were reported to have generated about 12% of medical liability claims[9]. This trend stimulated the drive to constitute the safety and risk management subcommittee of the American Society of Anesthesiologists (ASA) and subsequently birthing the American patient safety foundation (APSF) which has the responsibility to promote the concept of ensuring that all patients under anaesthesia are kept safe from harm. Despite all these efforts to reduce avoidable anaesthetic deaths, closed claim study by the ASA, revealed astonishing results of anaesthetic mishaps resulting in mortalities. The anaesthetic death trends have significantly declined over the past 50 years from 357 per million before the 1970s to 34 per million in the 1990s-2000s [3], with the greatest decline occurring in the developed countries[3] from an estimated rate of 1 in 5,000 three decades ago to about 1 in 200,000 [10]. Conversely, the rates remain high in the sub-Saharan Africa with estimates ranging from 1 in 3,000 in Zimbabwe to 1 in 150 in Togo[10]. However, Blaise et al.[11] in Congo, discovered in their study that there was an overall decrease in mortality in the two teaching hospitals studied from 2011-2015

reflecting an improvement that may be related to gained experience overtime by providers and employment of qualified anaesthetic nurses.

Developing Countries and Avoidable Anaesthetic Deaths

Avoidable anaesthetic deaths had been reported from various observations in Zambia, Malawi, Zimbabwe, Togo[12,13]. Lillie et al. in a study carried out in Zambia, one of the least developed countries in the world, stated that anaesthesia contributed to 32% of deaths occurring in the perioperative period[5], while Blaise et al.[11] in Congo, found that general anaesthesia was implicated directly or indirectly in as much as 45.8% deaths within 24 hours post-operatively. The most noticeable aspects of these reports were the facts that these deaths occurred in young and fit adults[14] and at centers with the requisite capacity in human and materials to manage perioperative safety. On the other hand, however, a Cambodian study carried out by Tao et al. on 1,953 patients in a teaching hospital recorded only one anaesthetic-related death in a 50-year old man who developed cardiac arrest at induction[15]. This may have been due to the fact that 90% of the patients had an American Society of Anesthesiologists (ASA) grade of 1 or 2 and also the fact that the hospital did not perform obstetric and paediatric surgeries.

Anaesthesia is recognized as an independent risk factor for perioperative deaths[16], it was earlier reported that most anaesthetic deaths occur at rural hospitals[1], with all the attendant deficiencies in terms of manpower, equipment, consumables, and resuscitation materials. Suffice it to say that the other reports from countries like Nigeria[14], occurred at tertiary levels of care with relatively advanced facilities to ensure perioperative safety.

Known Determinants

What then are the factors that determine avoidable anaesthetic deaths in our setting with relatively improved training and certification (in Nigerian tertiary hospitals) where anaesthesia is mainly delivered by physicians and trained nurse anaesthetists and availability of advanced monitoring

facilities including the safe surgery saves lives protocols. The following factors have been suggested and include;

Human Factor

Human factors play a key role in contributing to avoidable perioperative deaths[16]. It is estimated that human error independently contributed about 82% of avoidable deaths while overt equipment error assumes 14%[17]. Jones et al. in their report ably surmised the definition of human factor as ''enhancing clinical performance through an understanding of the effects of team work, tasks, equipment, workspace, culture and organization on human behaviour and abilities and application of that knowledge in clinical settings''[18]. Flin et al.[19] observed the interaction of human factor to human error, poor communication as was reported by Ohanaka et al. in a Nigerian study[20], poor training, and team work, deficiencies in equipment, and inadequate systems and processes predispose to loss of situational awareness and subsequent poor decision making. Human error is depicted in the following ways: Distraction during anaesthesia, inadequate communication among personnel and the influence of haste or lack of precaution[16]. Consequently, vigilance plays a role in preventing anaesthetic mishaps in all cases[7].

The concerns of this paper are the causes that are directly caused by anaesthesia and not the indirect causes which are system based. The prevalence of human errors in the causation of anaesthetic deaths have been highlighted in several reports[2,7,18,20], especially the confidential reports on maternal or perioperative deaths and this remains the platform to reassess the principles and practice of safe anaesthesia within the confines of limited resources. The attributable factors that contribute to avoidable anaesthetic deaths are in the following aspects of anaesthesia: airway mismanagement resulting in aspiration and asphyxia, as was noted by Arbous et al.[21], who reported that about 10% of the anaesthesia-related deaths observed were associated with substandard respiratory management ranging from inappropriate use of a laryngeal mask airway instead of endotracheal intubation and sedation of agitated, hypoxaemic patients to failure to administer oxygen to a

hypoxaemic patient. Other contributory factors include medication errors[22], poor preoperative optimization of patients which could be risky for patients presenting for spinal anaesthesia especially the hypo hydrated patients, unrecognized hypoxia, especially during endoscopy with limited light sources, hypovolemia, hypotension/ high sensory block from spinal or epidural anaesthesia, improper monitoring of patients both intraoperatively or at recovery.

Poor understanding of the pathophysiological changes in patient positioning during surgery and recovery and rapid fluid shifts in patients with large losses into third spaces are key determinants of anaesthetic risks of mortality if it is not promptly recognised and addressed. With the advent of the surgical safety checklist, poor adherence to the protocols and dictates of the checklist could result in avoidable death.

It is imperative that safe anaesthesia is dependent on a couple of factors such as the presence of skilled physician handling functioning anaesthetic equipment with appropriate monitoring devices, medications and supporting staff[1]. A Zambian study[5] identified failure to recognize and treat patient deterioration and failure of intensive care management when needed as the most common anaesthesia factors related to post-operative deaths. This contrasts with a similar study done at the same facility 25 years earlier which found poor airway management to be the most common anaesthesia contributor to death[23]. This could be due to training of personnel over the years.

Lack of Availability of Equipment/ Equipment Malfunction

Despite recent advances in surgery and anaesthesia which significantly improve safety, many health facilities in low-and middle-income countries (LMICs) remain chronically under-resourced. A study carried out by Epiu et al. in Uganda showed that there was a significant lack of essential equipment for the delivery of safe anaesthesia across the region[24]. According to Lillie et al.[5] in a Zambian teaching hospital, there were only 10 ICU beds for more than 1,600 hospital beds; also, basic equipment such as syringe pumps were lacking. Furthermore, inability of the anaesthetist to interface and manage

the following inadvertent situations have the tendency to result in a disaster: Disconnection of breathing circuits, inadvertent changes in gas flow, drug syringe errors, intravenous apparatus disconnection, equipment malfunction, premature extubation, organizational factors etc.

Consequences of Avoidable Anaesthetic Deaths

Death occurs occasionally because of anaesthesia and the consequences are disturbing and stressful for the relatives, for the anaesthetist and for other members of hospital staff[2]. There is a communal feeling of pain and hopelessness among surgical team members. The effects of a loss are often associated with emotional distress, feeling of guilt, blame game, physical assault by the bereaved family and a tendency to abandon practice to medico legal issues. Ogunbiyi et al. reported that 86% of the fifty-six responding Nigerian physician anaesthetists in their survey reported psychological effects including lingering bad memories, sleep disorders, feeling of guilt, and feeling of not going back to work, depression, and cardiac dysrhythmias[25].

Suggested Initiatives to Prevent Avoidable Anaesthetic Deaths

It is expedient to evaluate the circumstances that could result in anaesthetic disasters and work towards prevention. The identified areas of improvement include and is not limited to the following: Training and retraining of skilled manpower, strict adherence to protocols and guidelines including the use of checklists. Adequate preoperative optimization of the patient and early recognition of one's limitation in knowledge and skills to conduct anaesthesia. It is vital for all practitioners to inculcate the habit of reporting system or equipment failures to the appropriate levels of interventions and not wait for disaster to happen for issues to be sorted out. The importance of Intraoperative vigilance and adequate monitoring till patient is stable cannot be overlooked. It is expedient to avoid unnecessary intraoperative bickering by the operating room team because it can cause perioperative disaster. Self-audit to evaluate critical incidences. Excellent team work/ team and communication as well as situational awareness and the ability to recognise every form of Anaesthesia as a potential

risk for morbidity and mortality (the concept of 'NO small anaesthesia') is paramount to satisfactory outcome.

LIMITATION

Limitations of the studies in this review include the fact that some studies were carried out in hospitals where some surgeries like Paediatrics, obstetric, cardiac and neurosurgeries were not being done. This affected the results with one study having an anaesthesia related death of 0.05% only. Also, most of the studies were retrospective resulting in incomplete data due to loss of records from patients' folders. Furthermore, the studies varied making it difficult to draw conclusions.

CONCLUSION

Avoidable anaesthetic death can result in posttraumatic stress disorder in the anaesthetic, surgical teams and patients' families and it should be prevented by allowing excellent working environment and strict compliance with standardized checklists and protocols.

REFERENCES

1. Walker IA, Iain HW. Anaesthesia in developing countries-a risk for patients. Lancet 2008(3); 371:968-969.
2. Aitkenhead AR. Anaesthetic disasters: Handling the aftermath. Anaesthesia 1997; 52(iss 5):477-82
3. Bainbridge D, Martin J, Arango M, Cheng D. Perioperative and anaesthetic-related mortality in developed and developing countries: a systematic review and metaanalysis. Lancet 2012; 380(9847):1075-1081. Doi:10.1016/S0140-6736(12)60990-8
4. Tudjegbe SO, Amadasun FE. What is Anaesthetic death. Annals of Biomedical Sciences 2010; vol.9): 66579
5. Lillie EM, Holmes CJ, O'Donohoe EA, Bowen L, Ngwisha CL, Ahmed Y, Snell DM, Kinnear JA, Bould MD. Avoidable perioperative mortality at the University Teaching Hospital, Lusaka,

Zambia: a retrospective cohort study. Can J Anaesth. 2015 Dec; 62(12):1259-67. doi: 10.1007/s12630-015-0483-z.

6. Cronje L. A review of paediatric anaesthetic-related mortality, serious adverse events, and critical incidents. Southern Afr J of Anaes and analgesia,2015; 21:6 147-153
7. Steadman J, Catalani B, Sharp C, and Cooper L. life-threatening perioperative anaesthetic complications: major issues surrounding perioperative morbidity and mortality. Trauma Surg Acute Care Open 2017; 2:1-7
8. Vassalo SA. The first death associated with anaesthesia. Anaesthesiology 1997; 87: 928
9. Stoelting RK. Anaesthesia patient safety: History, Mission and Vision Statements. www.apsf.org. Accessed 18/03/2022.
10. World alliance for patient safety: WHO guidelines for safe surgery. Geneva: World Health Organization; 2009. http://whqlibdoc.who.int/publications/2009/9789241598552_eng.pdf Accessed 15/03/2022.
11. Blaise P FN, Malisawa A, Barrat-due A, Namboya F, Pollach G. General anaesthesia related mortality in a limited resource settings region: a retrospective study in two teaching hospitals of Butembo. BMC Anesthesiology 2021; 21; 60. doi.org/10.1186/s12871-021-01280-2
12. McKenzie AG. Mortality associated with anaesthesia at Zimbabwean Teaching hospital. South Afri Med J. 1996; 86:338-42
13. Maman AF, Tomta K, Ahouangbevi S, Chobli M. Deaths associated with anaesthesia in Togo, West Africa. Trop Doct. 2005; 35:220-222
14. Enohumah KO, Imarengiaye CO. Factors associated with anaesthesia-related maternal mortality in a tertiary hospital in Nigeria. Acta Anaesthesiol Scand 2006;50;206210
15. Tao K, Sokha S, Yuan H. the challenge of safe anaesthesia in developing countries: defining the problems in a medical center in Cambodia. BMC Health Serv Res 2020; 20:204

16. Cooper JB, New bower RS, Long CD, McPeak B. Preventable anaesthesia mishaps: A study of human factors. Anaesthesiology 1978; 49(6): 399-406. Doi: 10.1097/00000542197812000-00004.
17. Mueenullah K, Fauzia A. Anaesthetic deaths in a developing country. Middle East J Anaesthesiol 2007; 19(1):159-72.
18. Jones et al. Catchpole K. Department of health human factors reference group interim report. National Quality Board 2012. Accessed 28/06/2021.
19. Flin R, Fioratou E, Frerk C, Trotter C, Cook TM. Human factors in the development of complications of airway management: Preliminary evaluation of an interview tool. Anaesthesia 2013; 68: 817-25.
20. Ohanaka CE, Imarengiaye C. perioperative deaths in a Nigerian tertiary teaching hospital. Turk J Med Sci 2007:37(4):219-222.
21. Arbous MS, Grobbee DG, Van Lateef JW et al. mortality associated with anaesthesia, a qualitative analysis to identify risk factors. Anaesthesia 2001; 56:1141-1153.
22. Hansen D, Gausi SC, Meri Kebu M. Anaesthesia in Malawi: Complications and deaths. Trop doct. 2000; 30:146-149
23. Heywood AJ, Wilson IH, Sinclair JR. Perioperative mortality in Zambia. Annals of the Royal College of Surgeons of England 1989; 71:354-8.
24. Epiu I, Wabule A, Kambugu A, Mayanja-kizza H, Tindimwebwa JVB and Dubowitz G. Key bottlenecks to the provision of safe obstetric anaesthesia in low-income countries; a cross-sectional survey of 64 hospitals in Uganda. BMC pregnancy Childbirth 2017; 17(1): 387 doi: 10.1186/s12884-017-1566-3
25. Ogunbiyi OA, Eguma SA, Mato CN. Attitude of anaesthetists to intra-operative catastrophies: a questionnaire survey. South Afr J Anaesth Analg 2006; 12:58-60.