

# Anesthetic equipment, facilities and services available for pediatric anesthesia in Nigeria

P Adudu

Department of Anaesthesiology, College of Medical Sciences, University of Benin, Benin, Nigeria

## Abstract

**Background:** Facilities and equipment are known to contribute to improved patient care and outcome. Hospitals for sub-specialized pediatric anesthetic service are routinely available worldwide. In Nigeria, such hospitals now exist. It is therefore relevant to study the facilities and equipment available for pediatric anesthetic service to measure the quality of care in a health institution.

**Materials and Methods:** A prospective study of the anesthetic equipment, facilities and services available for pediatric anesthesia was carried out in Nigerian hospitals using anonymously administered questionnaires from October, 2008 to October, 2009, after relevant ethics approval.

**Result:** Ten of the 30 hospitals studied had intensive care unit facilities (33.3%) and only three of them had organized ambulatory anesthesia units for pediatric patients (10%). Facilities available for pediatric anesthetic care were service delivery oriented and not information technology based (automated anesthesia information management services - AIMS). A quarter of the hospitals studied (7) had their facilities and equipment updated recently. Also, there were no reception rooms nor post anesthetic care units specifically designed for pediatric patients. Equipment for acute pain service such as infusion pumps and patient controlled analgesia pumps (PCA pumps) and for capnography were found in only two hospitals (6.6%) at the time of the study. The anesthetic equipment used did not conform to the same standards (98%) even in the same hospital. Also, the use of disposable anesthetic equipment was low.

**Conclusion:** We conclude that anesthetic services for pediatric patients should be based on the use of automated anesthesia information technology service. Anesthetic equipment should conform to the same standards and should be computerized. Disposable anesthetic equipment should also be used where applicable to minimize the incidence of nosocomial infections. This would result in improved peri-operative care in pediatric patients.

**Key words:** Anesthetic equipment, anesthetic services, facilities, pediatric anesthetic practice

**Date of Acceptance:** 09-Apr-2011

## Introduction

The pediatric patients need special considerations for good anesthetic outcome.<sup>[1]</sup> This is because children need specialized care and transport.<sup>[2]</sup> The neonates, young infants and young children are susceptible to more peri-operative complications.<sup>[3]</sup> Furthermore, the incidence of peri-operative cardiac arrests among surgical patients of pediatric age has been reported as 70% deaths<sup>[4,5]</sup> and 30% brain damage<sup>[6]</sup> in closed claims studies. Also, high

morbidity and mortality in pediatric surgical patients including those in the intensive care unit (ICU) have been reported in Nigeria.<sup>[7,8]</sup> Sub specialized hospitals for pediatric anesthesia are now available in Nigeria. Facilities, including equipment are known as contributory factors to good anesthetic outcome even in pediatric patients.<sup>[9]</sup> This study is designed to evaluate the availability of facilities

### Address for correspondence:

Dr. Philomena Adudu,  
Department of Anaesthesiology, College of Medical Sciences,  
University of Benin, Benin - City, Nigeria.  
E-mail: opadudu@yahoo.com

### Access this article online

#### Quick Response Code:



Website: [www.njcponline.com](http://www.njcponline.com)

DOI: 10.4103/1119-3077.94103

PMID: 22437095

and anesthetic equipment for pediatric anesthetic practice in Nigeria.

## Materials and Methods

After relevant ethics approval from the Health institution of the primary investigator, a prospective study based on an anonymously administered questionnaire was carried out in 30 secondary care and tertiary care hospitals in Nigeria, from October, 2008 to October, 2009.

The study used relevant markers for anesthetic equipment and ancillary equipment including monitors available for pediatric anesthesia practice. We sought: The type of facilities available including type of ambulatory anesthesia units, post anesthetic care units (PACU) and ICU. The anesthetic services available such as acute pain services, the presence of computerized libraries and other research oriented details such as information technology based data and care for patients in the automated anesthesia information technology management service (AIMS) was also sought. The use of pediatric formulation of drug such as acetaminophen and the use of disposable and same standard of anesthetic equipment by physician anesthetists was collated. Intervention by seeking if new knowledge was gained by responding to the questionnaire was determined. Our findings were compared to the standards available in developed economies.

## Results

We studied 30 hospitals (85.8% of the 35 questionnaires that were sent out). The hospitals included eight tertiary teaching hospitals, two tertiary specialist hospitals, six secondary federal medical centers and fourteen secondary general hospitals demo-geographically spread in Nigeria [Table 1].

While ten of the thirty hospitals studied had ICU facilities (33.3%), only three of them had organized ambulatory anesthesia units for pediatric patients (10%). Acute pain service as an organized unit was not found in any of the hospitals studied. Equipment for acute pain service such as infusion pumps and patient controlled analgesia pumps (PCA pumps) and capnography were found in only two hospitals (6.6%) at the time of study. Other equipment found in the study include blood gas machines found in two hospitals (6.6%). Pediatric defibrillator pads, electrically heated body warming blankets and fluid warmers were found in nine hospitals (30%).

Characteristics	Number
Hospitals studied	30
Consultant anesthetists	37
Anesthesia residents (12 Principal medical officers, 25 Senior Registrars, 105 other cadres)	142

Various sizes of disposable endotracheal tubes, disposable suction catheters and various types of the pediatric breathing systems, the Ayre's T- piece: Disposable and non disposable, were found in the 30 hospitals studied. Disposable and non disposable oropharyngeal airways non disposable Laryngeal mask airways (pro Seal intersurgical i- gel, supreme standard etc.), laryngoscope blade and blood pressure cuffs in various sizes were available for pediatric patients, in the hospitals studied.

Ventilators for pediatric patients were found in eight hospitals (25.4%) and the only drug formulation specific for analgesia in pediatric patients was oral and parenteral paracetamol.

Monitoring equipment found in the hospitals include pulse oximeters, ECG, non invasive blood pressure monitors, and temperature monitors in nine hospitals.

The use of anesthetic equipment conforming to the same standards for the same equipment type even within the same hospital was low (2%). Laboratory services, blood banks and libraries were present in the hospitals studied, but did not give computerized services except for the libraries (70%).

Patient information records were not computerized and there was no evidence of computerized patient care [Table 2].

There were no patient reception room and post anesthetic care units designed for use in pediatric patients in the study even in the only specialist hospital dedicated to the care of children at the time of the study.

Seven hospitals (22.1%), had their facilities and equipment recently updated by government.

## Discussion

Our study established the absence of information technology based anesthetic care (AIMS), which will improve with time even for adult patients. Also, we found that the current upgrading of anesthetic equipment and facilities by the Nigerian government in its hospitals was carried out without specific attention to the needs of the pediatric patients based on the findings in a quarter of the hospitals in the study.

The absence of anesthetic equipment which conform to the same standards for the same type of equipment, the absence of research oriented anesthetic service delivery, the absence of information technology based patient data and care (AIMS) and the low use of disposable anesthetic equipment is worrisome. It results in high costs of hospital care, cumbersome recall of patients' records for use in patient care and research and the increased risk of

**Table 2: Availability of study markers for anesthetic equipment, facilities and services**

Marker	Availability
<b>Equipment</b>	
For laryngoscopy	All (only non disposable).
For monitoring	All
For oropharyngeal toilet	All (disposable suction catheters/ non disposable suction receptacle)
For resuscitation	
Airway ventilators	Available
ABG machine	8 (25.4%)
Warming blankets/fluid warmers	2 (6.6%) 9 (30%)
<b>Facilities</b>	
<b>ICU</b>	
ICU	10 (33.3%)
PACU as organized unit for pediatric patients.	None
Child friendly holding room.	None
Day ward/in patient ward.	None/(30)100%
<b>Research oriented service</b>	
Data banks,	None
IT based library	None
<b>Services</b>	
Anaesthesia for ambulatory surgery	3 (10%)
Acute pain service as an organized unit	None
Equipment for acute pain service found in study – PCA and infusion pumps.	2 (6.6%)
Ancillary services - laboratories, blood bank, radiological, library, pharmacy	30 (100%) (none is IT based except 70% libraries).
Drugs - pediatric formulation	Only oral and IM paracetamol
Others - IT-based patient care and prescriptions (AIMS)	None

transmission of nosocomial infections respectively. These lead to poor patient outcome in our developing economy which is at variance with the better outcome in developing economies.<sup>[7,8,10]</sup> Soyawo *et al.* similarly, found that anesthetic equipment for both adult and pediatric patients did not conform to the same standards.<sup>[13]</sup>

Anesthetic services for care of pediatric patients include ambulatory anesthesia and acute pain services. Ambulatory anesthesia improves peri-operative care by minimizing hospital costs with reduction in anxiety due to economic factors. It also minimizes the disruption of family and school life leading to the prevention of psychological trauma in children because of separation from parents and home.<sup>[11]</sup>

The existence of acute pain service for the post anesthetic period is a more effective facility than individualized pain prescriptions because it effectively minimizes psychological trauma due to memories of uncontrolled pain in later life in children<sup>[12]</sup> and decreases hospital stay by reducing morbidity associated with pain. It also minimizes deleterious

systemic effects in the body due to untreated pain with better outcome. These two facilities were non-existent as organized services in many of the hospitals studied.

The pediatric patients' susceptibility to infection especially nosocomial,<sup>[14-16]</sup> makes the use of disposable anesthetic equipment mandatory. This is important also in the era of HIV and hepatitis B and C pandemic. The low use of disposable anesthetic equipment found in the study is therefore unacceptable. We recommend that the use of disposable anesthetic equipment should be the routine. Therefore, disposable anesthetic face masks, disposable oropharyngeal airways and Ayre's T-piece should be used. We recommend the use of disposable suction canisters in their non-disposable receptacles, disposable pulse oximetry probes and capnography catheters, anesthetic machine filters and disposable body warming devices for pediatric patients such as the Bair Hugger therapy using electrically heated air.

The use of disposable probes for peripheral nerve stimulators for pediatric patients<sup>[17]</sup> and ultrasound-guided venous and arterial cannulations<sup>[18]</sup> is recommended for improved perioperative care.

The limitations of the study include the low number of hospitals with ICU found in the study because the unit represents one of the anesthetic facilities with a high number of anesthetic equipment and services. This may be accounted for by the low number of tertiary care hospitals studied. Also, only government hospitals were studied.

The study was designed to be interventional by seeking if new knowledge was gained from the contents of the questionnaire. However, this could not be ascertained due to incomplete data on this aspect by a significant number of respondents.

Other limitations include the low number of hospitals studied out of the over 200 government hospitals of the same cadre available. This was due to logistics although the studied hospitals were still geo-demographically spread and hence representative of a developing economy. However, it does not diminish the value of our findings that the organization of anesthetic services for pediatric patients in Nigeria does not conform to the standards available routinely in developed economies.

## Conclusion

The study findings include the provision of anesthetic facilities and services that are not based on information technology (AIMS) making patient care cumbersome. Also, we found that anesthetic equipment did not conform to the same standards leading to high cost of maintenance.

The use of disposable anesthetic equipment was low with increased risk of transmission of nosocomial infections. Efforts should be directed to improve perioperative anesthetic care in pediatric patients by adequate provision of AIMS, anesthetic equipment that conform to the same standards and increased use of disposable anesthetic equipment.

An audit of equipment and facilities for anesthetic care in pediatric patients is important and should be carried out periodically to appraise the situation for upgrading of essential anesthetic facilities and equipment.

**Appendix A. 18<sup>th</sup> March, 2008.**

**Questionnaire on study of anaesthetic equipment, facilities and services available for pediatric anaesthetic service in nigerian hospitals.**

We are carrying out this anonymous study on anesthetic equipment, facilities and services available for pediatric anesthetic practice in Nigeria as well as an updated review of the number of practicing physician anesthetists and subspecialists with the aim of developing strategies from the results obtained to improve pediatric anesthetic care.

Filling the questionnaire implies consent. We thank you for your willingness to participate in the study.

Dr. O.P. Adudu,  
Corresponding Author.

- 1) Institution type/address .....
- 2) Has the facilities at the hospital been recently updated:  
Yes.....No .....
- 3) If yes, what date was this done.....
- 4) Please state the number of consultant anesthetists/their gender in your center .....
- 5) Please state the number of trainee anesthetists/gender in your center .....
- 6) Please state the rank of the trainee anesthetists.....
- 7) Please state the number of pediatric anesthetists/other anesthesia sub specialists in your center .....
- 8) Please tick the surgical subspecialist available in your center:  
a) Urology

- b) ENT
- c) Burns/plastics
- d) Cardiothoracic
- e) Renal
- f) General surgery
- g) Maxillo-facial surgery
- h) Radio- diagnostic surgery
- i) Neurosurgery
- j) Please specify any other subspecialty .....

Facilities/equipment available for pediatric anethesia:  
 Ambulatory pediatric surgical unit: Yes No  
 Pediatric ICU/or special baby care unit: Yes No  
 Acute Pain Services: Yes No

Ancillary services e g laboratory, blood bank/library/ state if computerized .....

Pediatric blood pressure cuffs: Yes No

Please state the sizes of pediatric blood pressure cuffs available .....

- 9) Availability of pediatric size pulse oximetry probes:  
Yes No
- 10) Availability of pediatric ECG probes: Yes No
- 11) Pediatric defibrillator pads: Yes No
- 12) Pediatric infusion sets: Yes No
- 13) Pediatric blood giving sets: Yes No
- 14) Pediatric size epidural needles/catheters: Yes No
- 15) Pediatric electrically heated warming blankets/or Bair Hugger: Yes No
- 16) Drug infusion pump: Yes No
- 17) PCA machine: Yes No
- 18) Fluid warmer: Yes No
- 19) Pediatric breathing systems/state if disposable or not:  
Yes No
- 20) Pediatric ventilators/or with low tidal volumes:  
Yes No
- 21) Pediatric temperature probes: Yes No
- 22) Capnography: Yes No

- 23) Please state the sizes of endotracheal tubes available in your center for pediatric patients .....
- 24) Please state the sizes of preformed endotracheal tubes available in your center for pediatric patients .....
- 25) Please state the sizes of LMA available in your center for pediatric patients .....
- 26 Please state the sizes of anesthetic face masks available for pediatric patients in your center.....
- 27) Please state the type/sizes of laryngoscopes available for pediatric patients in your center.....
- 28) What sizes of oropharyngeal airway are available for pediatric patients in your center .....
- 29) Please state the disposable anesthetic equipment available for use in your center .....
- 30) Is anesthetic equipment standardized in your center/ specify these .....
- 31) Are drugs specially formulated for pediatric use available in your center: Yes No
- Please tick those available from the list below:  
 Oral midazolam  
 EMLA patch  
 Fentanyl patch  
 Rectal acetaminophen suppository  
 Ketamine lollipops
- Please specify any others .....
- 32) Availability of nerve stimulators with pediatric size probes: Yes No
- 33) Acid base blood gas machine: Yes No
- 34) Please state any special considerations in the clinical practice of pediatric anesthesia in your center eg internet based patient data collection/patient care .....
- 35) Please state if reception room/PACU are child friendly .....
- 36) Is there any new knowledge gained from filling this questionnaire: Yes No
- 37) If yes, please state this .....

## References

1. Patel R, Lenczyk KM, Hanallah RS, McGill WA. Age and onset of desaturation in apnoeic children. *Can J Anaesth* 1994;41:771-4.
2. Dobb GJ. Paediatric Intensive Care. *Intensive Care World* 1993;4:165-71.
3. Mcloskey KA, Orr PA. Paediatric transport issues in emergency medicine. *Emer Med Clin North America* 1991;9:475-89.
4. Morray JP, Geiduschek JM, Caplan RA, Posner KL, Gild WM, Cheney FW. A comparison of paediatric and adult anaesthesia closed claims. *Anesthesiology* 1993;78:461-7.
5. Zoumenu E, Gbenu S, Assouto P. Paediatric anaesthesia in developing countries: Experience in the two main university teaching hospitals of Benin in West Africa. *Pediatr Anesth* 2010; 20:741-7.
6. Morray JP. Anaesthesia related cardiac arrest in children. *Anesthesiol Clin North America* 2002;20:1-28.
7. Adudu OP, Adudu OG. Audit of morbidity and mortality among paediatric patients in the Intensive Care Unit in Benin City, Nigeria. *Afr J Anaesth Int Care* 2006;7:6-10.
8. Kushimo OT, Okeke CI, Ffoulkes-crabbe DJ. Paediatric admissions into the Intensive Care Unit of Lagos University Teaching Hospital. *Nig Quart J Hosp Med* 1998;8:52-5.
9. Brahams D. Anaesthesia and low monitoring. *Anesthesia* 1989;44:606-7.
10. Downey GB, O'Connell JO. Audit of unbooked paediatric post anaesthesia admissions into the Intensive Care. *Anaesth Intensive Care* 1996;24:464-71.
11. Ivani G, Tonetti F, Mossetti V. Update on post operative analgesia in children (Review). *Minerva Anestesiologica* 2005;71:501-5.
12. American Academy of Pediatrics. The assessment and management of pain in infants, children and adolescents. *Pediatrics* 2001;108:793-7.
13. Soyawo OA, Oduntan SA, Faponle F. Anaesthetic manpower and facilities in Nigeria. *Afr J Anaesth Int Care* 1997;3:11-5.
14. Olowu WA, Oyetunji TG. Nosocomial significant bacteriuria: Prevalence and pattern of bacterial pathogens among children hospitalized for non infective urinary tract disorders. *West Afr J Med* 2003;22:72-5.
15. Odugbemi T, Coker AO. Prevalent hospital acquired infection in Nigeria: Prevention and cure. *Postgrad Doctor* 1988;10:280-3.
16. World Health Organization: Meeting on Hospital Infection Prevalence. Geneva, 1986, WHO/MIM/MIC/871.
17. Arnot-Smith J, Smith AF. Patient safety incidents involving neuromuscular blockade: Analysis of the UK National Reporting and Learning system data from 2006-2008. *Anaesthesia* 2010;65:1106-13.
18. Aouad MT, Kanazi GE, Abdallah FW, Moukaddem FH, Turbay MJ, Obeid MY, et al. Femoral vein cannulations performed by residents: A comparison between ultrasound-guided and landmark techniques in infants and children undergoing cardiac surgery. *Anesth Analg* 2010;111:724-8.

**How to cite this article:** Adudu P. Anesthetic equipment, facilities and services available for pediatric anesthesia in Nigeria. *Niger J Clin Pract* 2012;15:75-9.

**Source of Support:** Nil, **Conflict of Interest:** None declared.