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. This is because children need specialized care and transport. The neonates, young infants and young children are susceptible to more peri-operative complications. Furthermore, the incidence of peri-operative cardiac arrests among surgical patients of pediatric age has been reported as 70% deaths and 30% brain damage 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. 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. This study is designed to evaluate the availability of facilities...
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%).

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...
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.17,8,10,14,15 Soyanwo et al. similarly, found that anesthetic equipment for both adult and pediatric patients did not conform to the same standards.13

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.11

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 children17 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,14,15 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 patients17 and ultrasound guided venous and arterial cannulations10 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.

---

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

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


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 anesthetic:
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 ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ........................................................ ...................................................