

ORIGINAL ARTICLE

Emergency Care Capacity in Pediatric Hospitals, Khartoum, Sudan

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ABSTRACT

Introduction: Critical pediatric patients have specific needs, which require special skills, training, equipment, supplies, personnel, and medications. While the knowledge related to enhance survival rate of newborn and children has improved over the past few decades. This study conducted to assess the emergency care capacity in pediatric hospitals at Khartoum state, Sudan. **Methods:** This is a descriptive cross-sectional hospital-based study, it was conducted in three hospitals at Khartoum, Sudan 2017-2018, to assess emergency care capacity in pediatric hospitals. Data was collected using open-ended questionnaire, and observational checklist. The data scored using dichotomous indicators (absent or present). **Results:** The study showed that there is shortage in human resources necessary to provide emergency care. However, much essential equipment for emergency care of children was absent in most hospitals, moreover, only 33% of hospitals had Triage system staffed by a trained person. Further, the clinical practice protocols for managing dehydration, neonatal sepsis, and neonatal resuscitation were not traced at the three hospitals. There are a limited laboratory services in one hospital. **Conclusion:** It is concluded that pediatric specialized hospitals, in Khartoum state, Sudan, have low capacity to provide emergency care for children. Further efforts are needed to improve the emergency care capacity in Khartoum hospitals.

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INTRODUCTION

The care for severely acute pediatric cases at hospitals could improve the survival rate (1, 2). It was reported previously that the emergency care delivery system is inadequate in low- to middle-income countries (LMICs) (3).thus increased the burden recently on the health system which contributes to 45% of deaths (4, 5).

Worldwide researches have shown that children in LMICs are at greater risk to die three times as compared to children in high-income countries (4, 5). Resource-poor countries suffer significantly from the gap in the provision of emergency services to children and some hospitals do not employ pediatrician in the emergency room (6). Furthermore, The main reason for high mortality rate of hospitalized babies in the LMICs refers to delay in going to hospital, inappropriate provision of prehospital care services, and severity of diseases (7). High quality pediatric emergency care has

been recognized as significant priority for improving the hospital care of children in the LMICs (8-11). The quality of hospital care an influencing factor for the health and lives of millions of children annually (8).

Dropping child mortality is one of the eight Millennium Development Goals (MDGs) (12). Despite international efforts, the health of newborn and children remains poor in LMICs (12). Furthermore the maintenance of the triage, diagnosis, treatment guidelines, and supportive care, reduce hospital child mortality and subsequent complications (13). It is important to keep hospitals with the capacity to provide required effective, efficient and high quality care to severely ill infants and children (14-16). The general challenge is to initiate and sustain a comprehensive program that provides this level of care to all children presenting to the PED (17).

There is a lack of evidence on the capacity of pediatric hospital at LMICs which indicates intervention trials as research priority. Economic analysis is another area investigation especially in places where cost and cost-effectiveness information from LMICs is scarce (18). In order to develop an appropriate systems based on reliable evidence that fill these gaps, there is a need

for a systematic analysis (19). The present study aims to assess the emergency care capacity in pediatric hospitals, Khartoum state, Sudan.

MATERIALS AND METHODS

Study design

This is a descriptive cross-sectional hospital based study.

Study setting and duration

The study was conducted at three pediatric hospitals in Khartoum state, (Ahmed Gasim Hospital, Elbluk Hospital, and Mohammed Alamin Hospital). The study was conducted in period extended from September 2017 to January 2018.

Study population

Health care providers (nursing director, medical director, laboratory director and the pharmacist), Triage system, Up to date guidelines, Checklist or admission records, Hygiene and safety, Equipment and consumables by hospital, laboratory and radiology services in addition to medications.

Data collection tool and technique

First tool was an open-ended questionnaire was developed to assess hospital size, human resources, and the availability of laboratory and radiology services and medications. Second tool was a direct observation checklist to assess the availability of Triage system, up to date guidelines, admission records, hygiene and safety, equipment, and consumables. The data was collected by structured interview sheet, designed by researchers based on reviewing of literature and standards of essential emergency equipment and supply list based on the American Academy of Pediatrics, the American College of Emergency Physicians, the Emergency Nurses Association, and WHO guidelines.

Sample size and sampling technique

Convenience sampling technique was done in three public pediatric hospitals in Khartoum state to assess their capacity for providing emergency care.

Data analysis

Descriptive statistics were used to present the data. Availability of the main resources' indicator was scored as absent or present, for each hospital, and are presented as frequencies and percentages.

Ethical considerations

This study was approved by Research Ethics Committee, Faculty of Nursing Science, University of Medical Science and Technology, No. 1024/2017. The study was approved by ethical committee of research in the Ministry of Health, Sudan. Written letters were sent to chairpersons of planning and research committee in the hospitals, written permission was taken from hospitals administration.

RESULTS

Table I shows that only one of the hospitals has an ambulance car. With respect to human resources, all hospitals had at least one pediatrician. In all hospitals, admissions were done by either a generalist physician or a pediatrician. In all surveyed hospitals, there was neither a trauma area nor vascular access room.

Table I: Hospital size, human resources, and triage, Khartoum, Sudan

Hospital size :	H1	H2	H3
Number of pediatric beds per hospital	38	59	33
Number of admission per day per hospital	129	107	88
Number of ambulance per hospital	1		
Human resources			
Pediatricians	3	1	9
Nurses	6	18	6
Lap technicians	14	10	4
Pharmacists	5	8	6
Triage system			
Triage	absent	absent	present
Triage system staffed by a trained person	absent	absent	present
Severely ill children seen in a child specific area	absent	absent	present
Specific clinician to immediately attend to very sick children	present	present	present
Observation area for administering ORS	absent	absent	absent
Observation area for treating asthma in children's OPD area	absent	absent	absent
Trauma area	absent	absent	absent
Vascular access room	absent	absent	absent

Table II reflects unavailability of updated clinical practice protocols across the surveyed hospitals. Table III reveals that sink, clean running water was present in two hospitals. While there were well-secured areas for keeping dangerous items such as drugs in all hospitals, side rails of beds were absent in all surveyed hospitals.

Table IV informs that suction machine, nebulizer, bag valve mask (BVM), nasogastric tubes and nasal cannulas were present in all hospitals surveyed. The table also shows absence of Automatic External Defibrillator (AED), intra-osseous (IO) needles, metered dose inhalers (MDI) with spacer, laryngoscope handle, endotracheal tubes, and nasopharyngeal airways at all hospitals. Incubator and phototherapy machine were present in two of the selected hospitals.

Table V illustrates that limited laboratory services were present in one hospital, while radiography services were present in two hospitals evaluated. Table VI illustrates that atropine, epinephrine, bronchodilators, and anticonvulsant medications were present in all hospitals surveyed, while adenosine, procainamide, and activated

Table II: Availability of up to date clinical practice guidelines and checklists

Up to date guidelines :	H1	H2	H3
Neonatal resuscitation appropriate for clinical area	absent	absent	Absent
Child resuscitation appropriate for clinical area	absent	absent	Absent
Neonatal infection or sepsis	absent	absent	Absent
Management of pneumonia in children	absent	absent	Absent
Management of dehydration in children	absent	absent	Absent
Management of severe malaria in children	absent	absent	Absent
Management of severe malnutrition	absent	absent	Absent
Infection-control practices	present	present	Present
Patient-identification policies	absent	absent	Absent
Policies for reporting medical errors	absent	absent	Absent
Checklist or admission records			
Checklist for emergency materials	absent	absent	Absent
Neonatal Admission Record (NAR)	present	present	Present
Pediatric admission Record (PAR)	present	present	Present

Table III: Availability of hygiene and safety, Khartoum, Sudan

Hygiene and safety	H1	H2	H3
Sink, clean running water	present	absent	Present
Soap and alcohol hand rub or sanitizer	present	absent	Absent
Sharps put in safety boxes and not overflowing safety boxes	present	absent	Present
Lockable area for keeping away dangerous items including drugs	present	present	Present
Toilets clean, dry and accessible to child and/or mother	present	absent	Present
All beds have side rails	absent	absent	Absent
All mattresses covered with a Mackintosh, and clean	absent	absent	Absent
All beds covered with mosquito nets	absent	absent	Absent
Consent form	absent	absent	Absent
Family presence during all aspects of emergency care	present	present	Present
Isolation, and quarantine of families and children	present	present	Present

Table IV: Availability of equipment and consumables by hospital

Equipment and consumables					H1	H2	H3
Monitor, Defibrillator							
Cardiac monitor/defibrillator					present	present	Present
Automatic External Defibrillator (AED)					absent	absent	Absent
Suction	H1	H1	H3	Asthma			
Suction machine	present	present	present	Nebulizer	present	present	Present
Warming				Phototherapy			
Incubator	absent	present	present	Phototherapy machine	absent	present	Present
Weighing scale				BP measurement,			
Infants	present	present	present	Blood pressure cuffs	absent	absent	Absent
Children	present	present	present				
Assessment tools							
Pain scales	absent	absent	absent				
Documentation sheets	present	present	present				
Vascular Access Supplies							
	H1	H2	H3				
Intraosseous needles or device - Pediatric	absent	absent	absent				
- Adult	absent	absent	absent				
Respiratory					H1	H2	H3
Oxygen (Tank or concentrator)					present	present	Present
BVM for children					present	present	Absent
BVM for newborns					present	present	Present
Oxygen mask with reservoir					present	present	Absent
Laryngoscope handle					absent	absent	Absent
	H1	H2	H3				
Nasogastric tubes:	present	present	present	Nasal cannulas	present	present	Present
Laryngoscope blades	absent	absent	absent	Oropharyngeal airways	absent	absent	Absent
Endotracheal tubes	absent	absent	absent	Tracheostomy tubes	absent	absent	Absent
				Nasopharyngeal airway	absent	absent	Absent
Equipment/Supplies: Fracture-Management Devices							
Extremity splints: Femur splints, pediatric sizes					absent	absent	Absent
Spine-stabilization devices appropriate for children of all ages					absent	absent	Absent

Table V: Availability of laboratory and radiology services by hospital, Khartoum, Sudan

Laboratory and radiology services							
Biochemistry	H1	H2	H3	Microbiology and Parasitology	H1	H2	H3
Glycaemia	absent	present	absent	CSF microscopy & Gram stain	absent	present	Absent
Bilirubin	absent	present	absent	CSF microscopy & Gram stain	absent	present	Absent
Hematology				Malaria microscopy	present	present	Present
Hemoglobin	absent	present	present	Stool microscopy	present	present	Present
Full Blood Count	present	present	absent	CSF culture	absent	present	Absent
Sickle cell test	present	present	absent	Pleural fluid culture	absent	present	Absent
Cross match & blood bank	present	present	absent	Joint aspirates culture	absent	absent	Absent
Immunology				Urine culture	absent	present	Absent
HIV testing	present	present	absent	Blood culture	absent	present	Absent
Radiology							
Radiography service	present	present	absent				

Table VI: Availability of Medications, Khartoum, Sudan

Medications	H1	H2	H3		H1	H2	H3
Atropine	Present	Present	Present	Topical, oral, and parenteral	present	present	Present
Adenosine	absent	absent	absent	analgesics			
Amiodarone	absent	absent	present	Antimicrobial	present	present	Present
Antiemetic agents	absent	present	absent	agents			
Calcium chloride	absent	present	absent	Anticonvulsant medications	present	present	present
Dextrose (D10W, D50W)	present	present	present	Antidotes (common antidotes should	absent	present	Present
Epinephrine	present	present	present	be accessible to the ED)			
Lidocaine	absent	present	Absent	• Antipyretic drugs	present	absent	Present
Magnesium sulfate	absent	present	Absent	• Inotropic agents	present	absent	present
Naloxone hydrochloride	absent	present	Absent	• Neuromuscular blockers	present	absent	Present
Procainamide	absent	absent	Absent	• Sedatives			
-Sodium bicarbonate	present	present	Absent	• Vaccines	present	absent	present
Activated charcoal	absent	absent	Absent		present	present	present
Bronchodilators	present	present	Present	Vasopressor agents	present	absent	Present
Corticosteroids	present	present	Present				

charcoal were absent.

DISCUSSION

The study undertaken to assess emergency care capacity in public pediatrics hospitals in Khartoum state, first of all Khartoum state contains the country’s largest cities by population (Omdurman, Khartoum, and Bahri). Unfortunately, there is only one pediatric hospital in Khartoum city and it does not contain emergency department; however the other two cities (Omdurman and Bahri) contain three pediatrics hospitals and provide emergency care for children. Still hospitals considered not enough.

Study findings reveal that there was shortage in human resources necessary to provide emergency care. Similar result reported by study conducted in Rwanda (12). Also, this study showed only one of three hospitals had Triage, and Triage system staffed by a trained person. Study conducted in Rwanda stated that previous research has showed insufficient emergency equipment, triage,

assessment, and treatment for severely ill children which is one of the major contributing factors to high hospital mortality rates among children younger than five years (23). Moreover, the findings from one study in Malawi showed that the training of hospital staff in emergency, triage assessment and treatment had reduced early hospital mortality in children under-five, from 47.6 to 37.9 deaths per 1000 admissions (20).

One of the famous Sudanese cultures that the researcher noticed it in the hospitals is accompany of patients by friends and family, so presence of family during all aspects of emergency care reported to be present in all hospitals evaluated in this study. Previous study reported that 95% of the families attending the emergency care for their relatives and this is their preferences (21).

Despite these facts, the guidelines enhance quality by mitigating healthcare variations, improving diagnostic precision, promoting effective treatment, and depressing useless or possibly hazardous interventions (22). This study found that the clinical practice guidelines for

managing pneumonia, dehydration, malnutrition malaria and neonatal sepsis, and neonatal resuscitation were absent in all hospitals. Even though checklists are an important tools that could help completing tasks smoothly (23). This study revealed that checklist for emergency materials was absent in all hospitals.

Pediatric admission records were present in all hospitals included in the current assessment as well as application of infection control measures, such as hand wash and use of personal protective equipment. Study conducted in Kenya suggested that the use of a admission records will be associated with improving documentation (24).

The previous studies in several countries have constantly labelled a inadequate availability of resources for emergency care to sick children (12). Likewise, current study reveals that much essential equipment for emergency care of children were absent in most hospitals. Furthermore, a study conducted in United States noted that emergency equipment such as laryngeal airways, umbilical catheters, central venous catheters, tracheostomy tubes, laryngoscope blades, pediatric Magill forceps, and infant and child nasopharyngeal airways were absent in more than 15% of EDs (25). Results of current study reported that automatic external defibrillator, umbilical vein catheters, central venous catheters, intraosseous needles or device, oropharyngeal airways, and endotracheal tubes were absent in all hospitals surveyed, on the other hand nebulizer, suction machine, suction catheters, and nasogastric tubes were present in all hospitals. Phototherapy machine and Incubator were present in two of three hospitals. This is less than what been reported in Rwanda study that nebulizer was present in 75% of the hospitals (26).

With regards to laboratory services among Eds, this study showed that there were a limited laboratory services in one hospital, however laboratory services in the emergency setting should meet the patient's requirements (27). This study report that the following laboratory tests glycaemia, bilirubin, hemoglobin, full blood count (CBC), and cross match & blood bank tests were available in two of three EDs hospitals, and malaria microscopy and stool microscopy were present in all EDs, while radiography services were present in two of three EDs.

With regards to essential emergency medications, this study noticed that atropine, epinephrine, bronchodilators, and anticonvulsant medications were present in all hospitals, while adenosine, procainamide, and activated charcoal were absent. However, these medications are lifesaving and necessary for resuscitation and emergency care.

One of the study limitations is that this study to assess emergency care capacity in only three children's hospitals. Unfortunately, all EDs in pediatrics hospitals

surveyed do not receive traumatic cases which require surgical intervention during study period. Furthermore, what was absent at the time of the survey was considered absent, but it is possible that the object was usually present before the survey.

CONCLUSION

Pediatric specialized hospitals in Khartoum state have low capacity to provide emergency care for children. Availability of resources, equipment, supply, and medications were varied in hospitals; but no hospital has all recommended equipment, supply, or medications needed to provide emergency care for children.

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