ORIGINAL RESEARCH

Nigerian Journal of Paediatrics 2024; Volume 51(1): 10-14.
https://dx.doi.org/10.4314/njp.v51i1.02

Conventional Oxygen Therapy in Childhood Emergencies at the Albert Royer National Children's Hospital in Dakar: A Retrospective Study

Thiongane Aliou[1], Ba Abou[1], Sow Amadou[2], Keita Younoussa[2], Aliou A. Ndongo[2], Boiro Djrbil[2], Niang Babacar[1], Basse Idrissa[2], Ly Indou Deme[2], Dieng Yaay Joor[1], Faye Papa Moctar[1], Fall Amadou Lamine[1], Ndiaye Ousmane[1]

[1]National Children's Hospital Albert Royer, Fann, Dakar, Senegal
[2]Abass Ndao Hospital Centre, Fann, Dakar, Senegal

Correspondence
Dr Amadou Sow, Abass Ndao Hospital Centre, Fann, Dakar, Senegal, E-mail: amadousoow@hotmail.com.
ORCID – https://orcid.org/0000-0001-5751-3286.

Abstract

Background: Conventional oxygen therapy is administered via various devices (nasal cannula, simple or high-concentration masks, face masks). It is currently the first stage in symptomatic acute respiratory failure (ARF) treatment before introducing non-invasive or invasive mechanical ventilation.

Objective: To evaluate conventional oxygen therapy techniques, the different indications, the duration of use and the outcome.

Methods: This retrospective study was conducted from January to July 2021 at the Albert Royer National Children's Hospital, Dakar, Senegal.

Results: The records of 129 patients were retrieved; this represented 14.4% of total admissions. The mean age was 32.28 months, and the sex ratio was 1.26. The leading diagnoses included bronchiolitis (34.11%), asthma (20.16%), and pneumonia (16.28%). The methods of conventional oxygen delivery included simple nasal cannulas (89.92%), simple masks (9.3%), and masks with high-concentration reservoirs (8.5%). The outcome was good in 83.72% of cases, while 16.28% died.

Conclusion: Conventional oxygen therapy is widely used to manage acute respiratory failure. The outcome remains generally good despite a notably high mortality rate, which may be due to the inadequacy of non-invasive oxygenation methods and diagnostic tools such as blood gas analysis.

Keywords: Conventional Oxygen Therapy, Childhood, Hypoxia, Respiratory distress, Respiratory failure, Senegal.

Introduction

Conventional oxygen therapy is a medical treatment used to restore or maintain normal oxygen saturation in the blood. It is used to correct tissue or cellular hypoxia, whether or not it is secondary to arterial hypoxaemia. [1] Depending on the severity of the situation, oxygen is administered using different devices (nasal cannula, simple or high concentration masks, or face masks) and remains the first stage in the symptomatic treatment of acute respiratory failure (ARF) of any cause, before the introduction of non-invasive mechanical ventilation (high flow cannula, Continuous Positive Airways Pressure (CPAP), Bilevel Positive Airway Pressure (BIPAP) or invasive mechanical ventilation. [2] ARF is a public health problem. [3] In Senegal, ARF is the leading cause

of admission to emergency departments, with a mortality rate of 2.2%. [4] The high rate of emergency admissions in children and the associated mortality highlights the importance of oxygen therapy in conditions associated with ARF. This study aimed to evaluate the different oxygen therapy techniques in acutely ill children and the indications and outcomes.

Methods

This was a retrospective, descriptive study spanning seven months (January to July 2021). The study was conducted at the Emergency Department of the Albert Royer National Children's Hospital (CHNEAR) in Dakar, Senegal. We included children aged between one month and 15 years hospitalised during the study period for respiratory failure with documented hypoxemia (SpO_2<95%) and needed oxygen therapy. Oxygen saturation was measured using a pulse oximeter. Hypoxia was considered mild when oxygen saturation ranged between 90 and 95%, moderate between 85 and 90% and severe if oxygen saturation was below 85%. A data capture form was used to obtain the sociodemographic parameters (age, sex, geographical origin), medical history, clinical and paraclinical signs, oxygen therapy methods, indications and outcome.

Results

Epidemiologic data

The study population consisted of 129 children out of 895 hospitalised during the study period. This represented a frequency of 14.4%. The mean age of the patients was 32.28±39.28 months (range: 1 month to 168 months). Children aged between 1 and 24 months accounted for 57.36% (Figure 1). The sex ratio of boys to girls was 1.26.

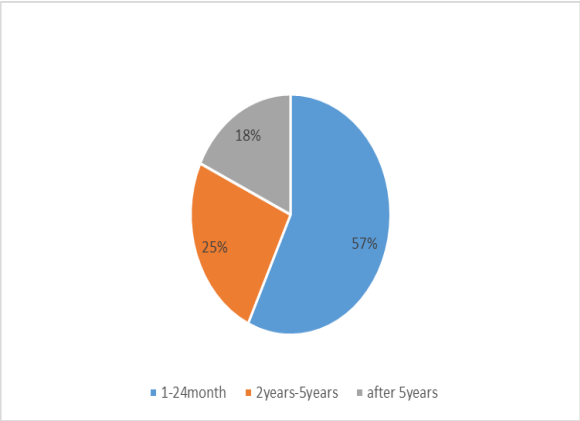


Figure 1: Distribution of children according to age

Clinical and Paraclinical Data

The leading underlying medical conditions were congenital heart diseases and asthma (15.50% and 13.95% respectively). Dyspnea was the main reason for presentation in 78% of children, followed by cough (46%) and fever (36%). Tachypnea was present in 79.84% and tachycardia in 43.41%. Hypoxia was present in all the children, with a mean oxygen saturation of 88.78%. Hypoxia was mild in 82.17%, moderate in 9.3%, and severe in 8.53% of children. Chest radiographs showed bronchiolitis in 55.81%, pneumonia in 13.18%, and cardiomegaly in 9.30%. Twenty-three (23) patients underwent echocardiography. Of these, 22.72% had cyanotic congenital heart disease and 77.28% had acyanotic congenital heart disease. The recorded diagnoses were bronchiolitis in 34.11%, asthma in 20.16%, pneumonia in 16.28%, and decompensated heart disease in 12.40% (Figure 2).

Treatment and Outcome

All the children received oxygen therapy. Oxygen therapy was achieved by a simple nasal cannula in 89.92% of cases, simple masks in 9.3%, high concentration reservoir masks in 8.52%, and high flow nasal cannula or CPAP in 14.73% (Figure 3). Two children (1.55%) required endotracheal intubations. Of those who initially received a single nasal cannula, 89% were initially mildly hypoxic and progressed well. In comparison, 11% required other oxygen delivery devices because they still showed signs of hypoxia. Of the children who started on

simple masks and had moderate hypoxia, 97% progressed well, and 3% benefited from oxygen therapy with a high-concentration mask. Of those who initially received a high-concentration mask, 98% progressed well, and 2% subsequently required to be intubated. The mean duration of oxygen therapy was 1.86 days, ranging from one day to 13 days. The mean hospital stay was also 3.22 days. The outcome was good in 83.72% of cases, while the mortality rate was 16.28%.

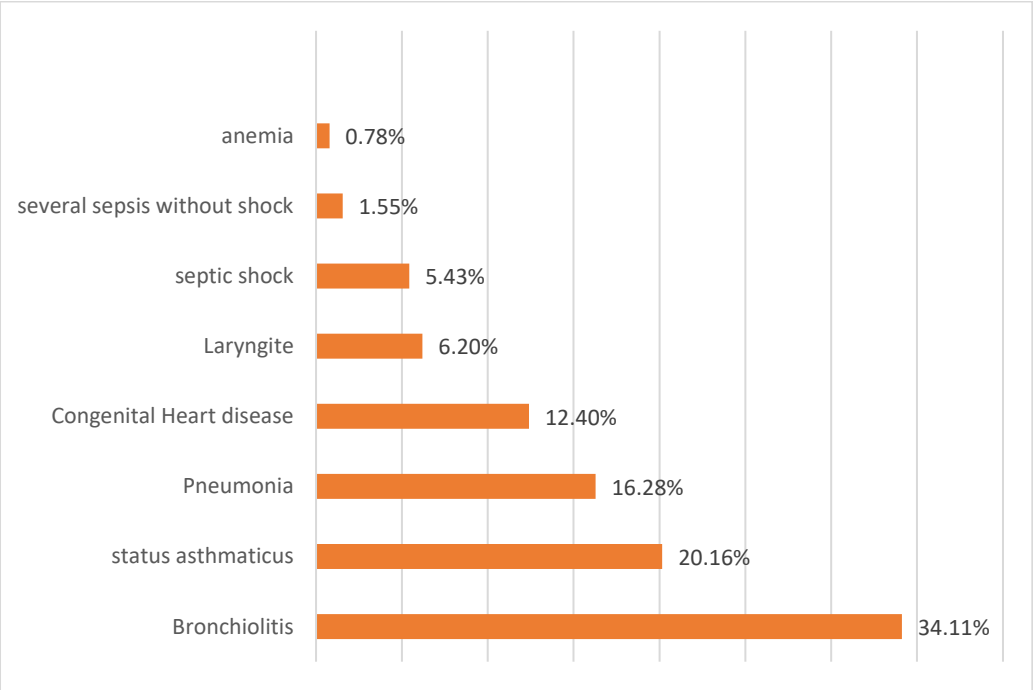
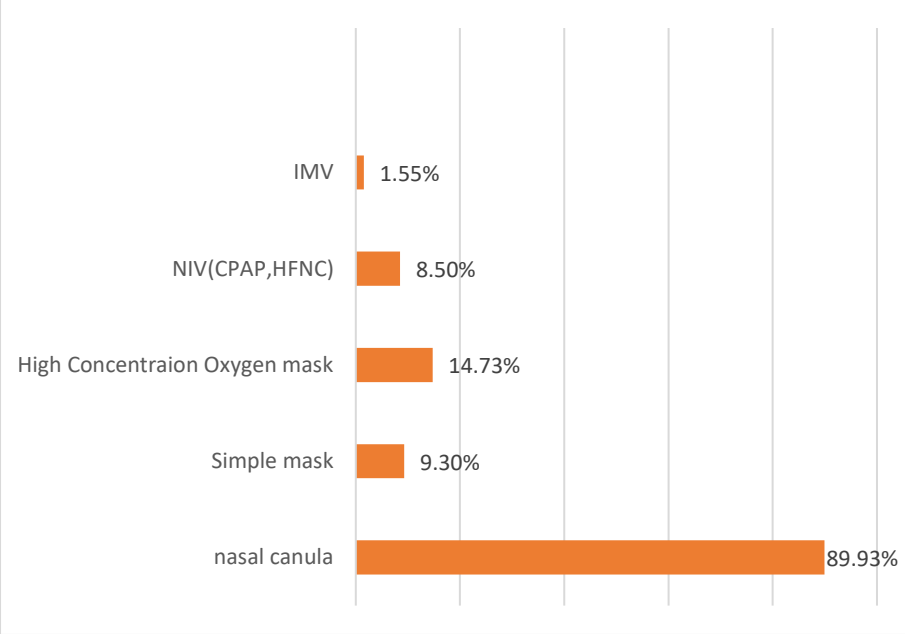


Figure 2: Indications for oxygen therapy



NIV- Non-invasive Ventilation, IMV - Invasive Mechanical Ventilation, HFNC - High Flow Nasal Cannula
Figure 3: Types of oxygen delivery devices used

Discussion

This study's modal age group was one month to 24 months. This can be explained by the susceptibility of children in this age group to respiratory diseases. In this study, the frequency of oxygen therapy varied according to the month, with peaks in January, March and June. This may be explained by the predominance of ARI in the peri-winter period, with climate change and air pollution. [5]

The leading diagnoses in this study were bronchiolitis, asthma and pneumonia. In another study in Dakar, respiratory pathologies accounted for 26% of emergency admissions. [6] The most common infections are pneumonia and bronchiolitis; these account for most cases of hypoxemia in children in developing countries. [7]

In this study, 89.92% were initially treated with a simple nasal cannula, 9.3% with a simple mask, 8.52% with non-invasive ventilation (high-flow cannula and CPAP) and 1.55% with invasive ventilation. Similar results were found in another study, with 83.82% on single nasal cannula, 8.82% on high flow mask, 4.4% on single nasal cannula and 2.94% on intubation. [8] The massive use of these oxygen delivery methods may be justified by the availability of conventional oxygen therapy devices and their ease of use compared to non-invasive ventilation devices that require disposable interfaces. The outcome of oxygen therapy was good in 83.72% of cases after medical treatment and stabilisation after hospitalisation. However, we recorded 21 deaths at a rate of 16.28%. This high mortality rate could be attributed to the fact that the study was carried out in a referral unit for severely ill children in respiratory distress. The limited availability of resources, in particular, the lack of non-invasive ventilation methods (high-flow goggles, CPAP, BIPAP) for cases of severe hypoxia and also the lack of a blood gas analyser for a more precise assessment of the severity of gas exchange, may be contributory.

Conclusion

Conventional oxygen therapy is widely used in childhood emergencies for the management of acute respiratory failure. The clinical outcome remains favourable in many cases despite a high mortality rate due to the inadequacy of non-invasive oxygen therapy devices and diagnostic facilities such as blood gas analysers. This underscores the need to improve the technical platform in facilities that care for acutely ill children to limit mortality.

Authors' Contributions: TA, BA and SA conceived and designed the study. SA, KY, NAA and DB did literature review, data analysis and interpretation. NB, BI, DI and DY drafted the manuscript. FAL, FPM, NO revised the draft and approved the final version of the manuscript.
Conflicts of Interest: None declared.
Financial Supports: None.
Accepted for publication: 22nd January 2024.

References

1. Gut-Gobert C, L'Her E. Indications and practical issues concerning oxygen therapy. *Revue des maladies respiratoires*. 2006;23:13-23.
2. Frat JP, Ricard D. Oxygénothérapie. Elsevier Masson SAS Reanimation, 2020.
3. Lacroix J, Gauthier M, Hubert P. Urgences et soins intensifs pédiatriques, Paris, Masson, 2007;2:1-368.
4. Ba ID, Diagne G, Ba A. Epidemiological, clinical, microbiological, therapeutic and evolutionary aspects of acute respiratory infections in children: A prospective study at the Albert-Royer Center in Dakar. *Revue des maladies respiratoires.* 2019;36:221-222.
5. Raurell-Torredà M, Argilaga-Molero E, Colomer-Plana M. Optimising non-invasive mechanical ventilation: which unit should care for these patients? A cohort study. *Aust Crit Care Off J Confed Aust Crit Care Nurses*. 2017;30(4):225-233.
6. Thiongane A, Ndongo AA, Sow A. Epidemiology of admissions in a pediatric emergency department in Albert Royer Hospital Dakar. *Open Journal of Pediatrics*. 2022;12:188-195.

7. World Health Organization. Oxygen therapy for children: Manual for use by health workers. Available at https://apps.who.int/ Accessed 27/01/2023.
8. Kane A. Evaluation of the management of vital emergencies according to the recommendations of the EPILS to the declutching at the Children's Hospital Albert Royer of Dakar. PhD in Med, UCAD 2019, Number 101.