Pediatric Oncall Journal
DOI: https://doi.org/10.7199/ped.oncall.2027.7

PEDIATRIC ONCALL
CHILD HEALTH CARE

ORIGINAL ARTICLE

FIVE YEARS EXPERIENCE OF PAEDIATRIC OUTPATIENT PARENTERAL ANTIMICROBIAL THERAPY IN A PORTUGUESE SECONDARY HOSPITAL

Beatriz Fazendeiro de Andrade[1], Mariana Oliveira[2], Sónia Madeira Gomes[3], Sofia Costa Lima[3].

[1]Pediatrics Department, Hospital Santa Maria, Unidade Local de Saúde de Santa Maria. Lisbon, Portugal,
[2]Pediatrics Department, Unidade Local de Saúde de Gaia e Espinho. Porto, Portugal,
[3]Pediatrics Department, Hospital Beatriz Ângelo, Unidade Local de Saúde Loures-Odivelas. Lisbon, Portugal.

ABSTRACT

Introdution: Paediatric Outpatient Parenteral Antimicrobial Therapy (OPAT) involves parenteral antimicrobial administration for at least two consecutive days without hospitalization. This study aimed to characterize OPAT practices in a portuguese level II hospital.

Materials and Methods: A descriptive, retrospective, single-center study was conducted, including patients under 18 years who underwent OPAT between January 2020, and June 2024. Data were extracted from electronic clinical records, covering demographic data, referral reasons, hospitalization and treatment duration, antimicrobials used, microbiological results, adverse effects, and clinical outcomes. Admission days saved were analyzed.

Results and Discussion: A total of 188 patients underwent 201 OPAT episodes, with 686 ceftriaxone administrations. The average patient age was 4 years (±4.3 years); 54% were male. Most episodes (87%) followed hospitalization, 13% originated on the emergency department. OPAT lasted an average of 3.4 days (range: 1–15; median: 3), saving a total of 152.4 bed days per year.

Common indications included suspected occult bacteremia (32%), fever in patients with sickle cell disease (15%), acute otitis media (14%), pneumonia (11%), suspected bacterial gastroenteritis (8%), acute tonsillitis (5%), and typhoid fever (2%). Isolated pathogens included Campylobacter jejuni (23%) and Salmonella enteritidis (12%) from stool cultures, and Salmonella typhi (15%) from blood cultures. Adverse events were reported in 40 episodes (20%), with the majority being complications related to the vascular device. The clinical outcomes were favorable in all episodes, with no readmissions.

Conclusions: OPAT is a cost-effective and efficient approach for managing pediatric infections, facilitating early discharge or avoiding hospitalization for stable patients with predictable disease courses.

ARTICLE HISTORY

Received: 13 November, 2025

Accepted: 02 February, 2026

KEYWORDS

Paediatric Outpatient Parenteral Antimicrobial Therapy, Antibiotics, Ambulatory.

Introduction

Paediatric Outpatient Parenteral Antimicrobial Therapy (OPAT) has been defined as the parenteral administration of antimicrobials for at least two consecutive days without an intervening hospitalization.[1- 4] Depending on local resources it may involve the child's return to ambulatory centers for assessment and administration of therapy.

The concept of OPAT was first described in 1974 by Rucker et al[1]. in a study detailing the administration of intravenous antibiotics to children with cystic fibrosis who were able to return home overnight. Subsequently, during the late 1970s[5], OPAT began to be implemented for adults with conditions requiring

prolonged hospitalization, such as osteomyelitis. Over time, this practice became widespread in countries such as Canada, Australia, New Zealand, Singapore, Italy, Ireland, the United Kingdom, Belgium, and Spain.[6,7] In Portugal, the Portuguese National Health Service does not have established guidelines or cost- effectiveness assessments for OPAT.

Because OPAT is practiced differently across the globe due to variations in local health delivery systems, geography, availability of specialist services, and the diverse socioeconomic needs of patients, the impact of these differences on OPAT outcomes remains largely unstudied.[7,8] Most existing reports on safety, efficacy, and cost-effectiveness are based on studies conducted within a single health system, center, or specific geographical area.[2,7,9,10]

The stated benefits include reduced hospital stays and the initiation of antibiotic treatment without prior hospitalization. It also promotes faster patient recovery by minimizing hospital-associated complications and enabling patients to return to their family, social, work, or school environments earlier.[6,10,11] Additionally, OPAT

Address for Correspondance: Beatriz Fazendeiro de Andrade, Rua Tomás da Fonseca n40, 7ºBB 1600-27 Lisbon, Portugal.
Email: beatrizfazendeirodeandrade@gmail.com

provides significant savings in hospital bed occupancy and associated healthcare costs.[2,6,7,12]

Studies have demonstrated that OPAT is a safe, effective, and efficient alternative to conventional hospitalization, though most research has focused on adult patients.[10] There is limited literature addressing the pediatric population.[2,3,12,13]

At the hospital where this study was conducted, the Pediatric Day Care Unit sessions facilitate the OPAT modality. Eligible patients are those who lack viable oral antibiotic options, are clinically stable, and have a supportive and responsible caregiver capable of managing peripheral venous access and ensuring adherence to the prescribed treatment plan. During each session, patients are assessed by a physician and a nurse before, during, and after antibiotic administration. Following the administration, the patient and caregiver are provided with instructions on vascular access care and educated on recognizing alarm signs. The patient is then discharged until the next scheduled administration.

Methods & Materials

This was an observational, retrospective, single-center study conducted at the Pediatrics Department of Hospital Beatriz Ângelo, Lisbon, Portugal. The study period spanned from January 2020 to June 2024.

The hospital's electronic medical records from the Pediatric Day Care Unit sessions were reviewed, and all patients who underwent OPAT sessions during the study period were identified. Patients were selected through consecutive sampling, including all eligible cases meeting the inclusion criteria during the defined period.

Inclusion criteria comprised all patients under 18 years of age who received at least one OPAT administration between January 1, 2020, and June 30, 2024. Exclusion criteria included incomplete clinical records or cases where OPAT was scheduled but not performed due to logistical constraints.

The collected data included demographic variables (sex, age, comorbidities, previous hospitalizations), prior OPAT history, source of referral (inpatient ward or emergency department), therapeutic indication, length of hospitalization and treatment duration, antimicrobial agents administered, number of OPAT administrations, microbiological results (type of culture and isolated microorganism), occurrence of adverse effects, and final clinical outcome. Data on saved admission days was also analyzed.

Statistical analysis consisted of calculating medians with interquartile ranges (IQR) or means with standard deviations (SD), depending on variable distribution, using Microsoft Excel 2024 (Microsoft Corporation, Redmond, WA, USA). No inferential statistical tests were applied, as the analysis was descriptive.

Results and Discussion

A total of 188 patients were included in the study, with a mean age of 4 years (± 4.3 years, ranging from 2 months to 17 years), 54% were male.

These patients underwent 201 OPAT episodes over a five-year period, receiving 686 ceftriaxone administrations (100% of administrations). The average duration of OPAT was 3.4 days (range: 1 - 15 days; median: 3 days). Of these treatment episodes, 174 (87%) originated from inpatient care, following an average hospital stay of 4.3 days; 27 (13%) were initiated directly from the emergency department. About 19 patients (10%) had previously undergone OPAT.

The most common conditions treated included suspected occult bacteremia (n=67, 32%), fever in patients with sickle cell disease (n=30, 15%), acute otitis media (n=28, 14%), pneumonia (n=24, 11%), bacterial gastroenteritis (n=17, 8%), acute tonsillitis (n=11, 5%), and typhoid fever (n=4, 2%).

Pathogens were identified in 6 cases (13%). Salmonella spp. was the most frequently isolated microorganism, with Salmonella enteritidis (n = 3, 13%) isolated from stool cultures and Salmonella typhi (n = 4, 15%) from blood cultures. Campylobacter jejuni was isolated from stool cultures (n = 6, 23%). Notably, none of the suspected occult bacteremia cases yielded a positive blood culture.

Adverse events were reported in 40 episodes (20%), with the majority related to peripheral intravenous (IV) access complications, including loss of peripheral IV access (n=33, 82%) and inflammatory signs at the access site (n=6, 15%). One patient developed an urticarial rash and periocular edema during ceftriaxone administration. The clinical outcomes were favorable in all episodes, with no readmissions.

The OPAT program resulted in a significant reduction in hospital bed utilization, with an estimated 152,4 bed days per year saved. A summary of the epidemiological and clinical outcomes is presented in table 1.

Table 1: Summary of epidemiological and clinical outcomes

Summary of epidemiological and clinical outcomes. OPAT: Outpatient Parenteral Antimicrobial Therapy

Patient demographics	
Total patients	188
Mean age	4 ± 4.3
Age range	2 months – 17 years
Male, %	54%
Provenance Source	
Inpatient care	174 (87%)
Emergency department	27 (13%)
Most Frequent Diagnoses	
Suspected occult bacteremia	67 (32%)
Fever in patients with sickle cell disease	30 (15%)
Acute otitis media	28 (14%)
Pneumonia	24 (11%)
Bacterial gastroenteritis	17 (8%)
Acute tonsillitis	11 (5%)
Typhoid fever	4 (2%)
Acute Pyelonephritis	3 (1.5%)

Sepsis	3 (1.5%)
Toxic Shock Syndrome	2 (1%)
Lymphadenitis	2 (1%)
Phlegmonous adenitis	2 (1%)
Other diagnoses	6 (3%)
Treatment Duration	
Mean (days)	3.4
Median (days)	3
Range (days)	1 - 15
Total Ceftriaxone Administrations	686
Microbiological Findings	
Campylobacter jejuni, stool culture	6
Salmonella typhi, blood culture	4
Salmonella enteritidis, stool culture	3
Adverse Events	
Loss of vascular access	33 (82%)
Inflammatory signs at access site	6 (15%)
Allergic reaction	1 (<1%)
Hospitalization Impact	
Total OPAT Episodes	201
Total Hospital Bed Days Saved per Year	152.4

This study describes pediatric OPAT utilization in a secondary center.

While the use of OPAT in managing cystic fibrosis exacerbations and osteoarticular infections is well-documented in the literature,[1,5,14] given the stability of these patients and the requirement for prolonged antibiotic therapy, our secondary hospital cohort did not reflect these pathologies. Instead, the most frequently treated conditions included suspected occult bacteremia (n=67, 32%), fever in patients with sickle cell disease (n=30, 15%), acute otitis media (n=28, 14%), pneumonia (n=24, 11%), bacterial gastroenteritis (n=17, 8%), acute tonsillitis (n= 11, 5%), and typhoid fever (n=4, 2%).

These cases represent a diverse range of infections with varying clinical presentations and generally require shorter courses of antibiotics. This pattern highlights a potential shift towards the utilization of OPAT for newer indications, expanding its traditional scope.

It is important to highlight the low microbiological yield observed in this study, with positive results obtained in only in 13 episodes (7%) of episodes. Among the isolated microorganisms, Campylobacter jejuni (n=6) and Salmonella enteritidis (n=3) were the most frequently identified from stool cultures, while Salmonella typhi (n=4) was predominantly isolated from blood cultures. The lack of pathogen isolation in cases of suspected occult bacteremia is noteworthy and suggests that these episodes may have had a viral or non-bacterial etiology, or that the pathogens were not present in detectable quantities in the bloodstream. This finding underscores the potential challenges in microbiological diagnosis and the need for a careful approach in interpreting clinical presentations, particularly in cases of suspected occult bacteremia, where blood cultures may not always yield a positive result. Further studies could explore the reasons behind the low microbiological positivity rate and investigate other diagnostic methods or biomarkers that may improve pathogen detection.

Intravenous β-lactam antibiotics are essential in OPAT settings for managing bacterial infections of varying severity, from moderate to life-threatening. In this study, all 686 antibiotic administrations involved ceftriaxone, aligning with its frequent use in previous studies.[15,16] The once-daily dosing regimen of ceftriaxone offers a significant advantage in the OPAT setting, as more frequent administrations can complicate the logistics of scheduling and delivering care.

The average duration of OPAT in our study was 3,4 days (ranging from 1 to 15 days, with a median of 3 days), which is lower to that reported by other pediatric OPAT centers.[2,14,17] Given the limited high-quality evidence available on the optimal timing for transitioning from intravenous to oral antibiotics,[2,4,7] comparing the duration of antibiotic therapy across OPAT centers for specific conditions could yield valuable insights to inform future clinical practice. It is crucial for OPAT clinicians to uphold antimicrobial stewardship principles by avoiding unnecessary extensions of intravenous therapy. This consideration is particularly relevant given the convenience of OPAT administration, which imposes minimal disruption on families.[11,12]

Peripheral IV access is commonly utilized in OPAT due to its ease of placement, removal, and the low incidence of serious complications.[2,3,7] However, its short dwell time often necessitates frequent replacements, leading to patient discomfort and an increased occurrence of non-serious complications.[7,16] This method is generally unsuitable for prolonged therapy, as it carries risks such as extravasation and catheter-related bloodstream infections, both of which require careful monitoring. In this study population, 100% of patients had peripheral IV access. Notably, nearly all adverse events reported (n=40 episodes, accounting for 20% of cases) were related to the vascular device. The most frequent complications included loss of peripheral IV access (n=33, 82%) and inflammatory signs at the access site (n=6, 15%). The total percentage of vascular acess related complications was higher than the reported from in terciary centers of the UK and Australia (9-11%),[2,4] but similar to the reported from the USA (22%).[14]

There was only one patient with antibiotic allergic reaction, that developed an urticarial rash and periocular edema during ceftriaxone administration. Symptoms resolved after treatment with corticosteroids and antihistamines, and the patient was referred for an immunoallergology consultation.

The literature shows a prevalence of hospital readmissions of 3.8-26%[3]. However, this study reported no readmissions, which is lower than the literature's findings, suggesting effective management in the OPAT protocol.

The OPAT program significantly reduced hospital bed utilization, saving an estimated 152.4 bed days annually.

This finding is consistent with previous studies, which have demonstrated that OPAT is an effective strategy to reduce inpatient admissions and length of hospital stay without compromising patient safety or treatment efficacy.[10,11,16] In pediatric populations, studies have shown that well-structured OPAT programs not only decrease bed occupancy but also improve patient and caregiver satisfaction by allowing children to recover in their home environment.[11,12,16]

The limitations of this study include its single-center design, which limits the generalizability of the findings to other institutions. Conducted at a secondary care center with a narrower range of pathologies, the study's findings may not reflect the broader spectrum of conditions seen in tertiary care settings. Furthermore, the study did not assess antibiotic prescribing practices or evaluate the appropriateness of the treatments administered, which could have provided additional insights into the effectiveness of OPAT. These factors may restrict the broader applicability of the results. In addition, the lack of available financial data precluded the possibility of conducting a local cost-effectiveness analysis.

The strengths of this study include its real-world data from a secondary care setting, a substantial cohort of 201 treatment episodes, and comprehensive outcome measures, such as infection types, microbiological results, adverse events, and clinical outcomes. The study also highlights the potential cost-effectiveness of OPAT by reporting avoided bed-days and demonstrates its safety and effectiveness, with no readmissions. Furthermore, the diverse range of treated conditions supports OPAT's versatility in pediatric infections.

Conclusion

OPAT represents a cost-effective and clinically efficient method for managing diverse infectious conditions. This approach facilitates early hospital discharge or prevents the need for hospitalization in stable patients with predictable clinical trajectories. Evidence indicates that, with meticulous patient selection and ongoing monitoring, OPAT can serve as a feasible and effective strategy for delivering necessary antimicrobial treatment to carefully chosen pediatric populations.

Compliance with Ethical Standards
Funding: None
Conflict of Interest: None

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