

Outpatient parenteral antibiotic therapy (OPAT) at home in Attica, Greece

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Abstract Outpatient parenteral antibiotic therapy (OPAT) is considered to be a cost-effective and safe alternative treatment strategy to hospitalization. We retrospectively evaluated data regarding the demographic and treatment characteristics of patients that sought medical advice from a network of physicians performing house-call visits and who received OPAT at home during a 17-month period (May 2009 to September 2010) in Attica, Greece. A total of 91 patients (69.2 % females) received intravenous antibiotic therapy at home during the evaluated period. The mean age [\pm standard deviation (SD)] of the patients was 85.3 (\pm 9) years. The main indications were pneumonia [46 patients (50.5 %)], urinary tract infection [25 (27.5 %)], and gastrointestinal tract infection [9 (9.9 %)]. Of the patients, 76.4 % received a beta-lactam, 17.5 % a fluoroquinolone, 15.3 % an imidazole, 8.7 % an aminoglycoside, and 5.4 % a lincosamide. The cure rate was 72.5 % and mortality was 27.5 %. The mean duration (\pm SD) of intravenous antibiotic

treatment was 4.7 (\pm 3.3) days. The mean cost per patient was €637 and was comparable to the mean cost if the patient were to be hospitalized for the same infection. There was significant clinical effectiveness of OPAT at home in this mainly elderly population, at an acceptable cost.

Introduction

Antibiotic treatment is probably one of the most important therapeutic modalities available. This is especially related to the use of inpatient parenteral antibiotics. Nevertheless, outpatient parenteral antibiotic therapy (OPAT) is a well-established effective management approach in developed countries such as the USA, where the past three decades have seen an unprecedented increase in the delivery of therapies in this setting [1, 2].

There are many advantages inherent to outpatient parenteral antibiotic treatment. Meeting patient's personal preferences regarding treatment as an outpatient, and financial savings in an era of limited monetary resources are just a few to name. Since its introduction, OPAT has widely been proven to improve the quality of life of patients for whom the administration of intravenous antibiotics is their primary reason for occupying a hospital bed, also providing many other potential advantages to the patient, hospital, and clinician, including cost savings and reduced risk of hospital-acquired infections due to antibiotic-resistant organisms [3]. For example, OPAT has been mainly used to treat infections that require prolonged antibiotic treatment, such as deep-seated infections, osteomyelitis, septic arthritis, and endocarditis [4].

In addition, there is a trend in some European countries to treat more people in the community setting rather in the hospital, and this may lead to an increase in the use of OPAT. While OPAT is established in the UK and the USA,

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published data from Greece are scarce [5, 6]. In a country with a high rate of antibiotics consumption, we sought to present data from our experience. SOS Doctors is a private network in Athens, Greece, that provides 24/7/365 cover for medical services (including house-call visits) in the Athens metropolitan area of Greece.

Methods

We retrospectively collected and evaluated data regarding the demographic and treatment characteristics of patients that sought medical advice from the SOS Doctors network of physicians performing house-call visits and received OPAT during a 17-month period (May 2009 to September 2010) in Attica, Greece. Diagnosis was at the discretion of the visiting physician and was based on history, clinical examination and point of care tests. SOS Doctors is a private network of physicians that provide house-call visits in Athens, Greece. Among other services, SOS Doctors have a well-established network that provides OPAT in a Hospital at Home setting. Patients were initially evaluated at home by a SOS Doctors physician. If the patient was considered to be in need for hospital admission, he was given a written report that referred him to a hospital. The primary reason for OPAT at home for these individuals was their wish to be treated at home. Patient autonomy was, therefore, the cornerstone of this therapeutic approach. In a number of cases of older patients with dementia or impaired level of consciousness, the caregivers decided not to transfer them to a hospital, due to the patient's will, which had been declared at a previous time. When demented, still an evaluation of whether the patient could make an informed decision was made. OPAT was offered to all these patients in addition to the intravenous provision of fluids/electrolytes/other medications/point of care tests and provision of oxygen (Hospital at Home care), if the attending physician considered the patient eligible (taking into consideration the clinical state, patient's and caregivers' will, capability for co-operation and home conditions). The details of Hospital at Home care, possible risks and adverse effects, cost, etc. were fully explained, and the patient's and caregivers' consent was sought and clearly mentioned in the medical report. SOS Nurses, a network of nurses, was engaged. The nurses were given detailed medical instructions about treatment (antibiotic, intravenous fluids and other medications, route and scheme of administration), monitoring of vital signs, laboratory tests (blood or other specimens collection was done at the bedside). If needed, a chest X-ray or abdominal ultrasound could be arranged at home. The patient was visited regularly by a nurse for drug administration (one, two or three times per day intravenous administration) and monitoring, and a report was given to the attending physician via telephone. Venous access was provided through

a peripheral intravenous catheter. The patient was usually examined on the first and second or third day of OPAT by the attending physician, and this was repeated regularly in cases of longer treatments. The patient was also visited emergently in case of clinical deterioration, therapy adverse events, and problems with drug or intravenous fluids administration. The SOS Doctors have a call center through which patients or caregivers could converse with a doctor or nurse at any time. When the physician considered it appropriate, treatment was switched to oral administration of antibiotics and was continued by self or caregivers' administration until cure. Specifically, as soon as the patient showed clinical improvement and was afebrile for a minimum of 24 h and was able to take medications by mouth, treatment was switched to oral. In cases of clinical deterioration, OPAT was discontinued and the patient was referred for admission to hospital.

The primary outcome of our study was the infection outcome. The infection outcome was defined as cure or deterioration (including death). Data regarding referral to hospital and the outcome of their hospitalization was recorded as well.

Results

A total of 91 patients (69.2 % females) received intravenous antibiotic therapy at home during the evaluated period. The mean age [\pm standard deviation (SD)] of the patients was 85.3 (\pm 9) years. The indications for the use of these antibiotics were as follows, in decrescendo frequency: pneumonia in 46 patients (50.5 %) [18 of which were aspiration pneumonia], urinary tract infection in 25 patients (27.5 %) and gastrointestinal tract infection (infectious diarrhea) in 9 (9.9 %), skin and soft tissue infection in 2 (2.2 %), sepsis not further specified in 9 (9.9 %). Out of the 91 patients, 64 (70.3 %) received only one type of antibiotic, while the remainder (29.7 %) received a combination regimen. Specifically, 28 received ampicillin/sulbactam (30.7 %) [24 as monotherapy and four of them in combination with amikacin], 18 received ceftriaxone (19.7 %) [eight as monotherapy, three plus metronidazole, two plus clindamycin, two plus ciprofloxacin, two plus metronidazole and netilmicin, one plus levofloxacin], 12 received cefuroxime (13.1 %) [ten as monotherapy, two plus clindamycin], eight received ciprofloxacin (8.7 %) [four as monotherapy, four in combination with metronidazole], seven received amoxicillin/clavulanate (7.6 %) [six as monotherapy, one in combination with clindamycin], five levofloxacin (5.4 %), five metronidazole (5.4 %), two netilmicin (2.1 %), two clindamycin (2.1 %), two carbapenems (2.1 %) [one meropenem and one imipenem/cilastatin], two piperacillin/tazobactam (2.1 %) [one plus amikacin], and one ceftazidime (1 %). In total (patients receiving monotherapy or combination regimens),

76.4 % of patients received a beta-lactam antibiotic, 17.5 % a fluoroquinolone, 15.3 % an imidazole, 8.7 % an aminoglycoside, and 5.4 % a lincosamide. The cure rate was 72.5 %, while mortality in this elderly cohort was 27.5 %. The mean duration (\pm SD) of intravenous antibiotic treatment was 4.7 (\pm 3.3) days, with a median of 4 days and a range of 1–18 days. Significant comorbidity was present in these patients: dementia in 29 patients (31.8 %), arterial hypertension in 25 (27.4 %), stroke in 15 (16.4 %), diabetes mellitus in 13 (14.2 %), coronary artery disease in 12 (13.1 %), atrial fibrillation in 11 (12 %), Parkinson's disease in 10 (10.9 %), bedridden status in 8 (8.7 %), neoplasm in 8 (8.7 %), chronic obstructive pulmonary disease in 7 (7.6 %), and chronic renal failure in 4 (4.3 %). The mean cost per patient was €637 and the mean daily cost was €164. The daily cost of OPAT in these patients was comparable to the mean daily cost if the patient were to be hospitalized. The range of the daily cost for the treatment of pneumonia in patients with comorbidity in public hospitals in Greece is €190.6–€193.8, €186.6–€195.5 for urinary tract infection, and for gastrointestinal infections, it was €167.5–€224.2. The patient pays for the cost of OPAT at home. We performed a breakdown of costs and included these in Table 1. The cost was determined by the summation of costs for medical staff, nursing staff, medications, and consumables. A formal risk–benefit assessment of the treatment was not undertaken. Nevertheless, SOS Doctors review each case (either house-call visit or OPAT/Hospital at Home provision) to assure the quality of offered medical services and patient/caregiver satisfaction.

Discussion

The main finding of our study is that OPAT administered at home for infections such as pneumonia (including aspiration pneumonia), urinary tract infection, and gastrointestinal tract infection was clinically effective in an elderly cohort with comorbidity in Greece. Of paramount importance, patient autonomy and preferences were respected and taken into account regarding the provision of this type of treatment at home. In addition, the financial cost of this service was comparable to that required for hospitalization. In an era of financial constraints in Greece, this may provide an acceptable alternative for the treatment of the aforementioned infectious diseases at home.

It is interesting that, despite the advanced age of our patients, OPAT was successful in a significant number of patients in terms of medical effectiveness. This beneficial effect is in accordance with published data [7], although contradicting results have also been reported [8]. Our results have some additional differences from those reported in the literature. Firstly, our patients received OPAT exclusively at

home, while those in various other countries received OPAT both in the outpatient hospital setting as well as in the community setting (home) [3]. Secondly, the age of our patients (mean 85.3 years) receiving OPAT is significantly more advanced than that reported elsewhere. For example, in a paper addressing the UK experience, the age of patients with soft tissue infection was 57.1 years and that of those treated for other infections was 45.9 years [3]. Nevertheless, OPAT was effective in our senile patient cohort. Mortality data have to be assessed in this context of older age and the comorbidity of the patients included in this study.

Another interesting difference is that the diagnoses responsible for the administration of antibiotics in our patients were as follows, in decrescendo frequency: pneumonia, urinary tract infections, and gastrointestinal tract infections. In contrast, the most common types of infections reported in other studies were bone and joint infections, soft tissue infections, central nervous system, cardiovascular system, and intraabdominal infections, while genitourinary tract infections and pulmonary infections ranked low [3, 9]. In concordance with the difference of diagnoses, a relatively short period of treatment was provided in the majority of cases. This is explained by the responsible diagnoses and by the fact that OPAT at home was used at times as a transition to oral treatment. It has been reported in the literature that an early switch from intravenous to oral treatment has been used successfully in the treatment of CAP and acute uncomplicated pyelonephritis [10].

The type of antibiotics was similar to those used in other studies, i.e., beta-lactams and fluoroquinolones. Another interesting point is that the financial aspect of OPAT at home is not to be underestimated, especially in an era of economic turmoil. The cost of OPAT at home was acceptable and comparable to that of hospitalization for the same reason. In addition, it is not to be ignored that nosocomial infections can be avoided and the frequency of delirium can be decreased with the OPAT at home approach. The approach of moving some components of hospital care to the community setting is an acceptable and safe alternative, provided some criteria are fulfilled [11].

Potential limitations of the administration of antibiotics at home may include potential allergic reactions or other adverse events at a time when no health care provider is available instantly [12]. In addition, technical issues (difficult venous access) may lead to some interruption of the intravenous treatment. The monitoring of laboratory parameters and imaging may be more cumbersome to follow. Nevertheless, in a real-world setting, the clinical effectiveness of OPAT at home in our patients has proved beneficial to patients, including the monetary aspects of this management approach.

In this specific clinical setting, OPAT administered at home in Greece was clinically effective when administered

Table 1 Characteristics and outcomes of the included patients that received outpatient parenteral antibiotic therapy (OPAT) during the study period

| | Patients that received OPAT (N=91) | | | |
|--|------------------------------------|--------|---------|---------|
| | Average | Median | Minimum | Maximum |
| Study period: May 18, 2009 to September 28, 2010 | | | | |
| <i>n/N</i> (%) | | | | |
| Demographic characteristics | | | | |
| Sex [female] | 63/91 (69.2) | | | |
| Age (years), mean (\pm SD), median, range | 85.3 (\pm 9), 85, 53–103 | | | |
| Comorbidity | | | | |
| Dementia | 29/91 (31.8) | | | |
| Arterial hypertension | 25/91 (27.4) | | | |
| Stroke | 15/91 (16.4) | | | |
| Diabetes mellitus | 13/91 (14.2) | | | |
| Coronary artery disease | 12/91 (13.1) | | | |
| Atrial fibrillation | 11/91 (12) | | | |
| Parkinson's disease | 10/91 (10.9) | | | |
| Bedridden | 8/91 (8.7) | | | |
| Cancer | 8/91 (8.7) | | | |
| COPD | 7/91 (7.6) | | | |
| Chronic renal failure | 4/91 (4.3) | | | |
| Types of infection | | | | |
| Pneumonia | 46/91 (50.5) | | | |
| Urinary tract infection | 25/91 (27.5) | | | |
| Gastrointestinal tract infection | 9/91 (9.9) | | | |
| Skin and soft tissue infection | 2/91 (2.2) | | | |
| Sepsis | 9/91 (9.9) | | | |
| Antibiotics used | | | | |
| Monotherapy | 71/91 (78) | | | |
| Combination therapy | 20/91 (22) | | | |
| Monotherapy type | | | | |
| Ampicillin/sulbactam | 24/91 (26.3) | | | |
| Cefuroxime | 10/91 (10.9) | | | |
| Ceftriaxone | 8/91 (8.7) | | | |
| Amoxicillin/clavulanate | 6/91 (6.5) | | | |
| Levofloxacin | 5/91 (5.4) | | | |
| Metronidazole | 5/91 (5.4) | | | |
| Ciprofloxacin | 4/91 (4.3) | | | |
| Netilmicin | 2/91 (2.1) | | | |
| Clindamycin | 2/91 (2.1) | | | |
| Carbapenems | 2/91 (2.1) | | | |
| Piperacillin/tazobactam | 2/91 (2.1) | | | |
| Ceftazidime | 1/91 (1) | | | |
| Duration (days), mean (\pm SD), median, range | 4.7 (\pm 3.3), 4, 1–18 | | | |
| Cost (€) | | | | |
| | Per patient | | | |
| | Average | Median | Minimum | Maximum |
| Cost of drugs | 156 | 90 | 8 | 1,050 |
| Cost of nursing services | 351 | 315 | 52 | 1,400 |
| Cost of medical visits and exams | 130 | 80 | 70 | 475 |
| Total cost | 637 | 485 | 130 | 2,925 |
| OPAT outcome | | | | |
| Cure | 66/91 (72.5) | | | |
| Overall mortality | 25/91 (27.5) | | | |
| Admission to hospital | 13/91 (14.2) | | | |
| In-hospital mortality | 3/13 (23.1) | | | |

n: number of observations, *N*: total number of patients, SD: standard deviation

to elderly patients. Further data are necessary in order to draw firm conclusions regarding the role of OPAT at home for patients of various age groups.

Conflict of interest None.

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References

1. Paladino JA, Poretz D (2010) Outpatient parenteral antimicrobial therapy today. *Clin Infect Dis* 51(Suppl 2):S198–S208
2. Ross Nolet B (2010) Update and overview of outpatient parenteral antimicrobial therapy regulations and reimbursement. *Clin Infect Dis* 51(Suppl 2):S216–S219
3. Chapman AL, Dixon S, Andrews D, Lillie PJ, Bazaz R, Patchett JD (2009) Clinical efficacy and cost-effectiveness of outpatient parenteral antibiotic therapy (OPAT): a UK perspective. *J Antimicrob Chemother* 64:1316–1324
4. Nathwani D (2009) Developments in outpatient parenteral antimicrobial therapy (OPAT) for Gram-positive infections in Europe, and the potential impact of daptomycin. *J Antimicrob Chemother* 64:447–453
5. Skoutelis A, Petrochilos J, Bassaris H (1994) Successful treatment of thoracic actinomycosis with ceftriaxone. *Clin Infect Dis* 19:161–162
6. Karachalios GN, Georgiopoulos AN, Kanatakis S (1989) Treatment of various infections in an outpatient practice by intramuscular ceftriaxone: home parenteral therapy. *Chemotherapy* 35:389–392
7. Carratalà J, Fernández-Sabé N, Ortega L, Castellsagué X, Rosón B, Dorca J, Fernández-Agüera A, Verdaguer R, Martínez J, Manresa F, Gudiol F (2005) Outpatient care compared with hospitalization for community-acquired pneumonia: a randomized trial in low-risk patients. *Ann Intern Med* 142(3):165–172
8. Ingram PR, Cerbe L, Hassell M, Wilson M, Dyer JR (2008) Limited role for outpatient parenteral antibiotic therapy for community-acquired pneumonia. *Respirology* 13:893–896
9. Esposito S, Leone S, Noviello S, Ianniello F, Russo M, Foti G, Carpentieri MS, Cellesi C, Zanelli G, Cellini A, Girmenia C, De Lalla F, Maiello A, Maio P, Acone N, Marranconi F, Sabbatani S, Pantaleoni M, Ghinelli F, Soranzo ML, Viganò P, Re T, Viale P, Scudeller L; Registro Nazionale OPAT (2009) Outpatient parenteral antibiotic therapy in the elderly: an Italian observational multicenter study. *J Chemother* 21:193–198
10. Athanassa Z, Makris G, Dimopoulos G, Falagas ME (2008) Early switch to oral treatment in patients with moderate to severe community-acquired pneumonia: a meta-analysis. *Drugs* 68:2469–2481
11. Shepperd S, Doll H, Angus RM, Clarke MJ, Iliffe S, Kalra L, Ricauda NA, Tibaldi V, Wilson AD (2009) Avoiding hospital admission through provision of hospital care at home: a systematic review and meta-analysis of individual patient data. *CMAJ* 180:175–182
12. Gilchrist M, Franklin BD, Patel JP (2008) An outpatient parenteral antibiotic therapy (OPAT) map to identify risks associated with an OPAT service. *J Antimicrob Chemother* 62:177–183