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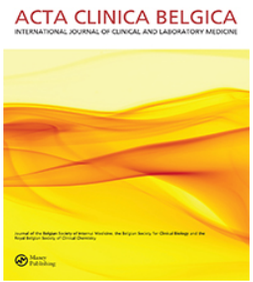

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Clinical characteristics and outcomes of patients receiving outpatient parenteral antibiotic therapy in a Belgian setting: a single-center pilot study

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ABSTRACT

Background: Outpatient parenteral antibiotic therapy (OPAT) was not used in Belgium before 2013, except for patients with cystic fibrosis. Thus, we have performed a pilot study to evaluate clinical characteristics and outcomes of patient receiving OPAT in a Belgian setting.
Methods: The study was a prospective observational single-center study of patients receiving OPAT between 1 September 2013 and 31 December, 2017.
Results: We included 218 OPATs. The median age was 58 years and 71% were men. At the end of the treatment, 92% of the patients on OPAT were cured. Risk factors for treatment failure were obesity, diabetes and diabetic foot infections, longer duration of hospitalization before OPAT, and duration of OPAT >16 days. An average of 24 days of hospitalization per patient discharge was saved, which amounted to 5205 days saved during the project. During the OPAT and 30 days thereafter, 71 (32.6%) of patients were readmitted, but only 26 (12%) readmissions were directly related to OPAT. Risk factors for readmissions were diabetes and diabetic foot infections, endovascular infections, longer duration of hospitalization before OPAT, duration of OPAT >30 days, and history of hospitalizations in the year before OPAT. There were 2.3 intravenous catheter-related events per 1000 days of catheter use. Patients' level of satisfaction was high (99.5%)
Conclusions: In this pilot study, OPAT is found to be efficacious in saving hospitalization's days, with a low rate of readmissions and complications and a high patients' level of satisfaction. We therefore conclude that OPAT is feasible and safe

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KEYWORDS
Outpatient parenteral antibiotic therapy (OPAT); parenteral antibiotic; multidrug-resistant (MDR) bacteria; peripherally inserted central catheter; Belgium

Introduction

Outpatient parenteral antibiotic therapy (OPAT) was originated in the 1970s [1–3]. During the 1980s and 1990s, an increasing number of reports were published, which described OPAT program development and documented its safety and cost effectiveness [4]. Early OPAT programs focused on facilitating the discharge of stable inpatients with infections, who had no need for inpatient care other than prolonged

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intravenous antibiotic therapy. During the past two decades, an increasing number of OPAT programs have attempted to avoid hospitalization altogether for many patients with acute infections [5–9]. Several descriptions for providing OPAT have been published worldwide [7,10]. Two key considerations include method(s) by which the antimicrobial is administered and method(s) by which patients are monitored during therapy. The main administration models are infusion clinics/centers, provider-based in-home health care, and self-administration.

In 2013, the orthopedic and urology surgery departments of our hospital were confronted with patients infected with multidrug-resistant (MDR) bacteria, who were being isolated in a room dedicated for two patients and treated in-hospital for long periods with intravenous antibiotic therapy. This practice prevented the admission of new patients awaiting for acute surgery or urgent care.

Until 2013, OPAT did not exist in Belgium as a recognized procedure of care by medical health authorities except for patients with cystic fibrosis. Thus, we decided to perform a pilot study to evaluate clinical characteristics and outcomes (feasibility, efficacy, and safety) of OPAT in a Belgian setting. Given the context of our hospital, we opted for a model organized from the hospital, with antibiotics administrated at home by home-care nurses, outside the hospital environment.

Patients and methods

Study endpoints

The primary endpoints were the number of days of hospitalization saved, the number of readmissions during the OPAT and within 30 days after cessation of OPAT, and complications related to the treatment. The secondary endpoint was patient's or family's level of satisfaction.

OPAT organization

The first key step was the establishment of a multidisciplinary team composed by hospital care professionals (clinical pharmacists, internal and infectious diseases [ID] physicians, orthopedic and urology surgery physicians, nurses, and social workers) and external care professionals (general practitioners, home-care nurses, and care coordinators). The team organizes the protocol of care, with precise criteria for inclusion, the steps of the discharge from the hospital, and care given by home-care providers. Figure 1 summarizes the OPAT process.

OPAT definition

We define OPAT as the expected period of treatment with intravenous antibiotics at home. It can be interrupted in a programmed manner by hospitalization, for example in the context of two-stage surgical management protocols. If the OPAT is interrupted prematurely with readmission related to the process of care e.g problems related to the infection being treated (unfavorable evolution) or to the vascular system (Picc line clogged), it is considered a major adverse event. If, after this interruption, the same intravenous antibiotic treatment at home is resumed, it is considered the same OPAT. If OPAT is interrupted prematurely, without readmission, e.g. patients' illnesses evolving better than expected or prolonged for medical reasons, it is the same OPAT without complication. Finally, some patients can be readmitted and then benefit from a second OPAT with other intravenous antibiotics, or antibiotics not programmed at the beginning; in this case, the OPAT is considered a new one. These definitions are consistent with those that have been published [7,10–14].

Study design

This was a prospective observational single-center study, conducted in a 983-bed tertiary hospital. All patients' files included in the OPAT project between 1 September 2013 and 31 December 2017 were analyzed. Inclusion criteria were (1) patients receiving intravenous antibiotics during hospitalization in which the diagnosis of infection was made with certainty on the clinical grounds and/or bacteriological samples and/or imaging, (2) the projected remaining duration of intravenous antibiotic treatment was at least 6 days, (3) and no change to oral antibiotics was possible. To allow discharge, the patient's home situation had to allow the administration of intravenous drugs, and the patient and his/her family accepted and understood the concept of OPAT as described in the literature [7,12–21]. The list of antibiotics available for OPAT was determined by reimbursement for care outside the hospital, and the number of administrations was limited to three times per day. Therapeutic drug monitoring was not performed for any patients or antibiotics. Drugs such as vancomycin were excluded because of difficulty monitoring their plasma concentrations in outpatients. During the first year of the project, patients of the urology or orthopedic departments were required to live in Brussels, 20 km around the hospital. Subsequently, the study was extended to all hospital departments, including pediatrics, and patients could come from Wallonia or Flemish Brabant. We considered that a patient was cured when the physician decided that the patient was well enough to permit stopping the antibiotic(s).

Ethical issues

Our study was approved by the Ethics Committee (2013/24Mai/291 Belgian No. B403201317726). All included patients signed an informed consent.

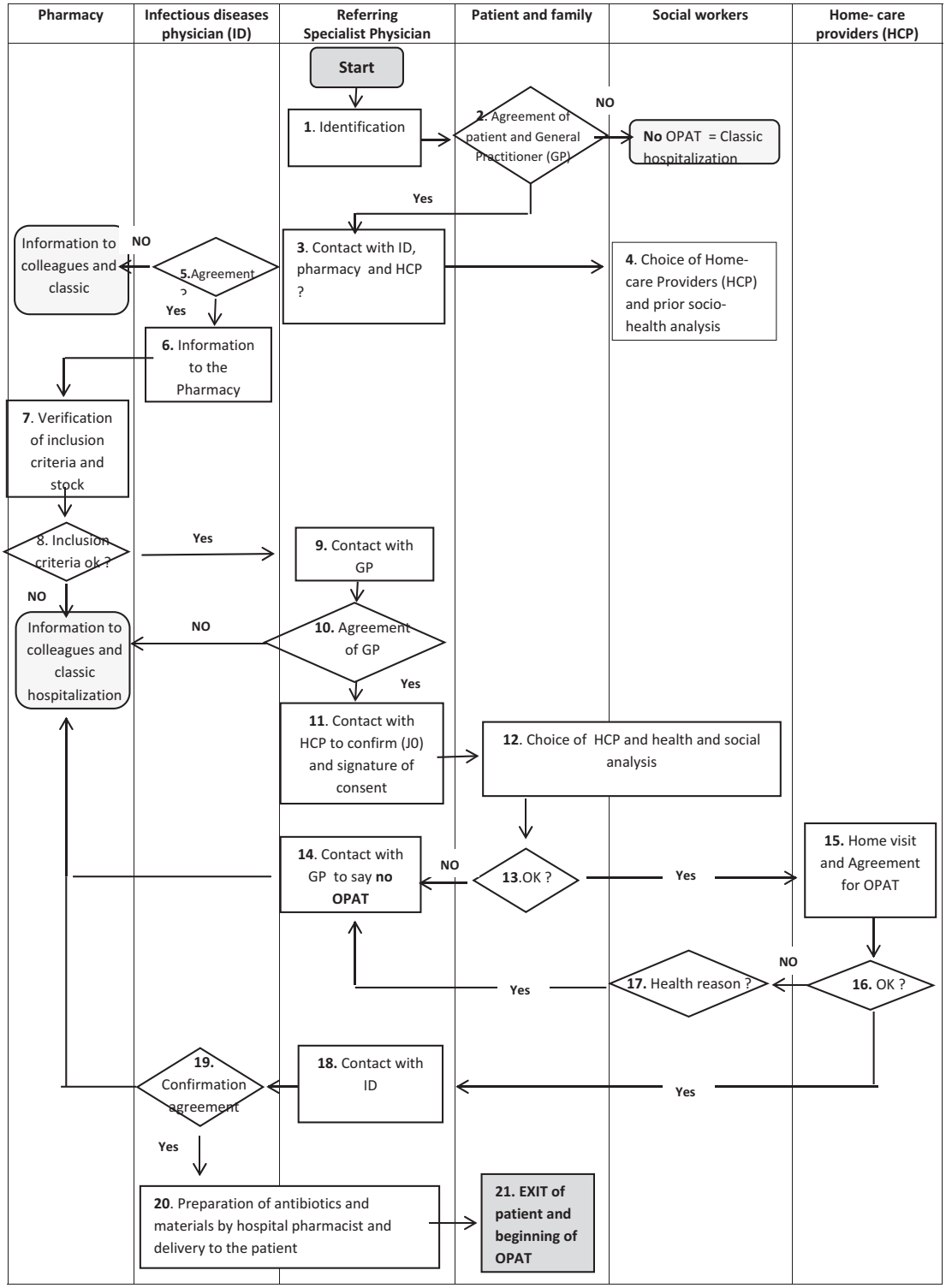

Figure 1. scheme of outpatient parenteral antibiotic therapy (OPAT).

Data collection

We collected demographics (age, gender); clinical characteristics (body mass index); comorbidities; Charlson score (prediction of one-year mortality in patient who may have various comorbidities) was calculated; history of infections with MDR bacteria (more than three classes of antibiotic resistance) and type of MDR bacteria; history of hospitalizations one year before OPAT; the patients' hospital ward; type of infection; type and total duration of antibiotic administration (including administration in the hospital); number of antibiotics co-administered; number of OPATs; duration of each OPAT; outcomes (number of days of hospitalization saved; number and reasons of readmissions; adverse events (side effects of antibiotics, vascular access complications, new infections)); and patient and family satisfaction.

Table 2. Infections, type and duration of antibiotics treatment during OPAT.

Type of infections	*N* (%)	Median duration of OPAT (days, min–max)	Type of antibiotics	% of antibiotics
Pyelonephritis	41 (20)	11 (4–55)	• Ceftriaxone	36
			• Temocillin	34
			• Meropenem	18
Complicated cystitis	10 (5)	11 (7–77*)	• Temocillin	60
Prostatitis**	39 (19)	15 (9–50)	• Ceftriaxone	48
			• Temocillin	33
			• Meropenem	12
Osteoarticular infections	32 (15)	30 (6–80)	• Ceftriaxone	34
			• Meropenem	25
			• Cefazolin	22
Respiratory tract infections	19 (9)	15 (7–73)	• Ceftazidime	37
			• Ceftriaxone	26
			• Piperacillin/ tazobactam	16
Diabetic foot infections	19 (9)	35 (13–80)	• Meropenem	37
			• Ceftriaxone	26
			• Ceftazidime	10
Heart***	17 (8)	21 (7–36)	• Ceftriaxone	83
Liver****	11 (5)	30 (11–70)	• Ceftriaxone	36
			• Meropenem	27

OPAT: Outpatient parenteral antibiotic therapy,*one patient with multiple surgeries of urethral implantation was treated 77 days, otherwise the min was 10 days and maximum 16 days. **Prostatitis: acute and chronic, ***Heart: 17 endocarditis, 1 endovascular infection; ****Liver: 1 liver transplant infection, 4 infected cysts, 4 liver abscesses, 1 cholangitis with thrombophlebitis, 1 cholecystitis with intramural abscess.

Table 1. Demographics and clinical characteristics.

Demographics and clinical characteristics			
Number of patients		193	
Number of OPAT		218	
Median age in years		58 years (3–93 years)	
Gender		71% male	
Pediatrics population		7% (*n* = 16)	
BMI/WHO classification			
Underweight	≤18.5	5%	
Overweight	≥25 < 30	28%	45%
Obesity	≥30	17%	
History of hospitalization during the last year before OPAT			
Number (%)		126 (58%)	
Median number of hospitalization before OPAT		2	Min: 1 Max: 9
Median Charlson score		**3**	
≥a 90% of survival at 10 years		43.6%	
77% of survival at 10 years		15.1%	
53% of survival at 10 years		8.7%	41.3%
21% of survival at 10 years		10.1%	
<2% of survival at 10 years		22.5%	
Comorbidities			
Hypertension (%)		84 (38%)	
Renal insufficiency (eGFR < 30 ml/min)		51 (23%)	
Diabetes		49 (22%)	
Peripheral vascular diseases		33 (15%)	
Peptic ulcer disease		29 (13%)	
History of cancer		28 (13%)	
• Solid tumor		19 (9%)	
• Hematological cancer (leukemia/lymphoma)		9 (4%)	
Chronic obstructive pulmonary diseases		26 (12%)	
Transplantations		27 (12.4%)	
Kidney		17 (7.8%)	
Liver		5 (2.3%)	
Other (Heart, lung, and stem cell)		5 (2.3%)	
Cirrhosis		19 (9%)	
Myocardial infarction		19 (9%)	
Heart failure		11 (5%)	
Stroke		9 (4%)	
Dementia		8 (4%)	
Hemiplegia (vascular and others)		10 (5%)	
Autoimmune diseases		2%	
History of infections with MDR		96/185 (52%)	
Median length of stay before OPAT		11 days (2–107)	

COPD: Chronic obstructive pulmonary diseases; MDR: multidrug–resistant; OPAT: outpatient parenteral antibiotic therapy; BMI: body mass index.

Results

One hundred ninety-three patients who received 218 OPATs were included. Twenty-one patients were included in two OPATs and two patients in three OPATs during the study period. Between 1 September and 31 December 2013, only one patient was included due to our inclusion criteria (living around the hospital). The median age was 58 years (3–93 years), and 71% were men. Patients' demographics and clinical characteristics are summarized in Table 1. The median duration of hospitalization before OPAT was 11 days (2–107 days). Most (60%) of the patients included in the study had two or more comorbidities, according to the Charlson score (median Charlson score at 3). In 217 OPATs (99.5%), antibiotics were administered via a peripherally inserted central catheter Picc line (n = 214), midline (n = 3); treatment for one patient was given via port.

In Table 2, the main infections treated, the total duration of treatment, and the type of antibiotics used during OPAT are listed. Bacteriological samples were taken in 99.9% (217/218) of infections. One hundred eighty-six infections (85%) treated during OPAT were bacteriologically documented: Gram-negative bacilli accounted for 58% and Gram-positive rods for 22% of all the pathogens found. In 52% (96/185) of cases, infections were due to MDR bacteria (*Escherichia coli* Extended-spectrum beta-lactamases (ESBL) 49%, other ESBL 18%, *Pseudomonas* sp. 19%, Gram-negative bacteria [GNB] producing *carbapenemases* 3% and GNB producing *cephalosporinases* 6%, *Stenotrophomonas* 1%, and *Candida glabrata* 2%).

The six main hospital departments using OPAT were internal medicine (36%), urology (10%), endocrinology and diabetes (diabetic foot infections) (9%), nephrology (8%), orthopedic surgery (6%), and cardiovascular surgery (6%). Table 3 summarizes the number of OPAT and the cumulative number of days of hospitalization saved during the study period. The median duration of OPAT was 16 days. Twenty-seven OPATs (12%) were prolonged, with a median duration of 10 days (1–48 days). Twenty-seven OPATs (12%) were stopped earlier, with a median duration of 6 days (1–76 days). Antibiotics used during the OPAT are listed in Table 4. The three main antibiotics used were ceftriaxone, meropenem, and temocillin. Two or three class combinations of antibiotics were used in 22% of OPAT (n = 47). In 19% cases (n = 41), intravenous antibiotic therapy was combined with oral therapy, and in 3% (n = 6), multiple intravenous antibiotics were used. Double or triple therapies were used in bone infections (25%), diabetic foot infections (37%), and respiratory tract infections (63%). Treatment was completed with administration by nebulization in two OPATs (0.92%).

Table 4. Anti-infective agents used during OPAT.

Antibiotics	N = 218 (100%)	
Ceftriaxone	90	41.3%
Meropenem	41	18.8%
Temocillin	34	15.6%
Ceftazidime	16	7.3%
Piperacillin–tazobactam	12	5.5%
Cefazolin	12	5.5%
Anidulafungin	3	1.4%
Teicoplanin	2	0.9%
Amoxicillin– clavulanic acid	2	0.9%
Amikacin	2	0.9%
Tigecycline	2	0.9%
Aztreonam	1	0.5%
Glucantime	1	0.5%

Clinical outcomes were evaluated by physicians in charge of the patients with the advice of ID physicians. In 92% (200/218) of OPAT, the infections were cured; in 6% (n = 14), the antibiotic treatment failed to cure the infection. For four (2%) OPATs in three patients, antibiotic treatment was not intended to cure the infection, but to control it during a preoperative period before surgery. In Table 5, the 14 patients in whom treatment failed are compared to the total cohort of patients in the study. Risk factors for treatment failure in OPAT were overweight/obesity, diabetes and diabetic foot infection, longer duration of hospitalization before OPAT, and longer duration of OPAT (>16 days). Our OPAT project saved an average of 24 days of hospitalization per stay for patients discharged in OPAT, which is a total of 5205 hospital days saved during the project.

During the OPAT and 30 days after, there were 71 (32.6%) readmissions: 33 during OPAT and 38 after 30 days of OPAT cessation. However, only 26 (12%) of the readmissions were directly related to OPAT (antibiotic-related side effects: diarrhea, hepatic toxicities, allergies, unfavorable evolution of the initial infection, and vascular access problems). Risk factors for readmissions were diabetes and diabetic foot infection, endovascular infections, longer duration of hospitalization before OPAT, duration of OPAT >30 days, and history of hospitalizations in the year before OPAT (Table 5). We have summarized

Table 3. Duration of OPAT and cumulative number of days of hospitalization saved between 2014 and 2017.

	Total	2014*	2015	2016	2017
Number of OPAT	218	17	44	76	81
Cumulative number of days of hospitalization saved	5205	423	862	2006	1914
Median duration/OPAT	16 (4–85)	16 (6–82)	16 (8–77)	18 (4–85)	17 (6–75)

*Between 1 September and 31 December 2013, we included only one patient. There were several patients who can benefit from OPAT but they were not included due to our inclusion criteria (living around the hospital).

Table 5. Comparison of main characteristics of patients with treatment failure during OPAT (N = 14) and patients readmitted during OPAT (N = 26) with the total cohort (N = 218).

	Total OPAT	OPAT with unfavorable evolution	*P* value	OPAT with readmission	*P* value
Number	218	14	–	26	–
Male	71%	86%	–	77%	–
Median age (years)	58 (3–93)	59.5 (25–80)	–	59.5 (14–80)	–
Percentage of OPAT with history of hospitalization during the last year	58%	79%	0.1176	88%	0.0027
Median number hospital stay during the year before OPAT	2 (0–9)	3 (0–4)	–	2 (0–6)	–
Median duration of hospital stay before OPAT (days)	11 (2–107)	24 (5–58)	0.0016	15.5 (7–50)	0.0370
Median duration of OPAT (days)	16 (4–85)	30 (11–75)		26 (8–85)	
Duration of OPAT days >16 days			0.0139		0.1963
Duration of OPAT days >30 days			0.0018		0.0368
Number of prolonged OPAT	27 (12%)	2 (14%)		1 (4%)	
Number of shortened OPAT* (%)	27 (12%)	8 (57%)	<0.0001	10 (38%)	0.0001
Readmission during OPAT and 30 day post OPAT directly due to OPAT (%)	(12%)	100%	<0.0001	100%	<0.0001
Overweight (%)	28% 45%	50% 71%	0.0462	31% 54%	0.3091
Obesity (%)	17%	21%		23%	
Median Charlson score	3 (0–14)	5.5 (0–8)		4 (0–8)	
≥53% of survival at 10 years	67%	36%	0.0143	62%	0.4956
<53% of survival at 10 years	33%	64%	0.0143	38%	
History of infections with multi-resistant bacteria (%)	27%	36%	0.4544	42%	0.067
Comorbidities (%)					
Hypertension (%)	38%	50%	0.3661	38 %	0.9937
Renal insufficiency (eGFR < 30 ml/min)	23%	43%	0.085	23%	0.9675
Diabetes (%)	22%	**71%**	**0.0001**	**46%**	**0.0032**
Peripheral vascular diseases (%)	19%	29%	0.3667	23%	0.525
Peptic ulcer disease (%)	13%	7%	0.5594	19%	0.3472
Chronic obstructive pulmonary diseases	12%	14%	0.6026	27%	0.0163
Main infections treated in OPAT					
Diabetic foot infections (%)	9%	**50%**	**<0.0001**	**38%**	**<0.0001**
Respiration tract infections (%)	9%	14%	–	19%	0.0519
Endovascular infections (%)	3%	36%	–	12%	**0.0226**
Urinary tract infections (%)	20%			12%	0.2509

*Number of shortened OPAT was less in case of failure as a consequence of unfavorable evolution. It was not a risk factor for failure because antibiotic was stop. COPD: Chronic obstructive pulmonary diseases; OPAT: outpatient parenteral antibiotic therapy.
Bold values are those statistically significant

in Table 6 the reasons for readmission and sources of infection. Readmissions were due to unfavorable evolution or relapse of infection (n = 19, 27%), adverse events (n = 7, 9.8%), new infection (n = 11, 15.5%), and unrelated to OPAT in 48% (n = 34) of cases. Among the 71 readmissions, 30% (n = 21) were related to the treatment of urinary tract infections (n = 21), 17% (n = 12) for diabetic foot infections, and 10% (n = 7) for bone infections. Readmissions related to the treatment of urinary tract infections were mostly for programmed readmissions for surgery (prostatectomy, urethral reimplantation, and installation of a double J catheter) or new infections (new bacteria); readmission for bone infections were mostly programmed readmissions in the case of two-stage surgical management protocols.

Throughout the study period, 45 (20.6%) OPAT cases had at least one adverse event related to vascular access. Thirty-five were managed at home, and 17 were treated in the emergency room with 3 hospitalizations: venous thrombosis (n = 1), clogged Picc line with clogged resolved (n = 6), Picc line cracked or broken with Picc line replacement (n = 1), Picc line clogged with replacement of Picc line (n = 4), and others (n = 5). Twelve catheter-related adverse events were considered major adverse events, contributing to 2.3 incidents per 1000 days catheter use.

A questionnaire was submitted to each patient and his/her family (friends and relatives) at the end of OPAT, inquiring about their level of satisfaction with OPAT. Nearly all patients were satisfied: 99.5% recommend this type of home care, and there was no statistically significant difference between the views of the patients and friends. Problems in the OPAT programs were also revealed. A minority of unsatisfied patients considered the involvement of the attending physician (8%) and the management of pain (9%) unsatisfactory, and some complained of lack of information (4%) and coordination (8%).

Discussion

The most important finding of this pilot study was that OPAT was feasible and safe in a Belgian setting. OPAT had a high rate (92%) of cure of infection, even in patients with numerous comorbidities. Many days of hospitalization were saved (24 days per patient discharge), the rate of adverse events was low (12% of OPAT cases was readmitted; 2.3 incidents per 1000 days of catheter use), and patients and family reported a high level of satisfaction (99.5%). These

Table 6. Reasons for readmissions during OPAT and 30 days post OPAT.

$N = 218$	Readmissions via ED with hospitalization	Readmission via outclinic	Hospitalizations 30 days post OPAT	Total	% ($n = 71$)	Summary
Unfavorable evolution or relapse	3		6	9	12.7%	26.8%
Unfavorable wound evolution	1	6	3	10	14.1%	
Clostridium difficile	1		1	2	2.8%	9.8%
Antibiotics toxicities	2		0	2	2.8%	
Picc line	3		0	3	4.2%	
Readmissions directly related to OPAT	16		10	26	36.6 % ($n = 71$) 12% ($n = 218$)	
New infection	2		9	11	15.5%	15.5%
Readmission not related to infection	5	1	4	10	14.1%	47.9%
Programmed readmissions		9	15	24	33.8%	
Total readmissions	17	16	38	71		

ED: Emergency department; OPAT: outpatient parenteral antibiotic therapy.

observations correspond well with data on OPAT from other countries, as discussed below.

The main infections treated in OPAT were comparable to those described in the literature [15–19,22–29], but in different proportions. The number of 'double infections' (3%) is higher than in a similar study, where they constituted less than 1% [25]. Infections treated in the hospital, before OPAT, were complicated by 31% (67/218) of bacteremia. A comparable study [22] mentions 25%. Double and triple therapies (22%) were equivalent to the 26% in the literature [22]. In our study, there was a majority of GNB infections with a larger proportion of MDR, whereas in some studies, conducted in the years 1993–2005, there was a higher proportion of Gram-positive rods [25,30].

This study included a high number of patients with multiple comorbidities, as indicated by the median Charlson score at 3. In two other studies, the Charlson score was 2 and 1.33 [22,31]. Thus, despite our patients' higher Charlson scores, the cure rate (92% at the end of OPAT and 89 % with the 30 days post OPAT period included) was comparable to data reported by others: 87% [23], 88% [24], 92% [25], and 95% [31]. In our study, risk factors for treatment failure in OPAT were overweight/obesity, diabetes and diabetic foot infection, longer duration of hospitalization before OPAT, and longer duration of OPAT (>16 days). It is surprising that age does not influence outcome (success) because age has been reported a risk factor for failure or readmission [11,22].

The length of hospital stays preceding the OPAT varied from 2 to 107 days, highlighting two types of situations in which the OPAT is needed [5–9]. In one hand, it is intended for acute infections such as pyelonephritis, prostatitis in stable patients with suspected resistance to quinolones for which OPAT can be initiated at the beginning of hospitalization while awaiting bacteriological results. On the other hand, it is aimed at frail patients who have been hospitalized for a long time for severe diseases and may be discharged even if they still require intravenous antibiotic therapy. The median duration of hospitalization before OPAT was 11 days. This is slightly longer than in other studies, where the median duration was between 6 and 7 days [22]. This difference might be explained in part by the severity of the infections treated in hospital before the OPAT and the number of comorbidities of the patients, but it also might be explained by a delay in discharge of OPAT patients because of logistic difficulties, such delay in setting up Picc lines (48–72 h in our hospital).

In our study, during the OPAT and the following 30 days, there were 32.6% ($n = 71$) readmissions, but only 12% ($n = 26$) were directly related to OPAT. Others centers reported readmissions rate of 7.60% [25], 14.3% [31], and 26% [22]. These variations of readmissions rate are dependent of definition of readmissions, type of infections, and patient characteristics. In our study, risk factors for readmission were diabetes and diabetic foot infection, endovascular infections, longer duration of hospitalization before OPAT, duration of OPAT >30 days, and history of hospitalizations in the year before OPAT. Those risk factors have been also found in others studies [11,22]. However, being elderly and having a cancer have been found also to be risk factors of readmissions in those studies [11,22]. In our study, readmissions were due to unfavorable evolution of infection (27%), adverse events (9.8%), new infection (15.5%), or unrelated to OPAT (48%). In the study of Yan et al., only a minority of readmissions (29%) were unrelated [11].

Our OPAT project saved an average of 24 days of hospitalization per stay for patients discharged in OPAT, which corresponds with literature reports of 13–24 days [25,26]. On average, a hospital bed corresponds to 300 days a year. If our rate of saved hospital days is maintained at the level of the past two years, we can expect to save an average of 1960 days of hospitalization per year, or 6.5 hospital beds. Over the last two years, we have an average of 6.5 OPATs monthly. In two similar studies, in London [25] and Toronto [11], the average number of OPAT per month was 7 and 8.6, respectively. Thus, universally, OPAT has been found to save hospital days and likely is overall cost-effective in patients'

management. The amount of money saved will depend on the health-care system of the country. It's important to mention that our duration of antibiotic treatment was long. With actual recommendations to reduce duration of antibiotics (short is better), the number of day of hospitalization saved will be less than what we found.

In our study, most patients and their families were satisfied with OPAT and recommended it for other patients. Similar satisfaction rates have been reported in other studies of OPAT [11,22].

In this pilot study with OPAT, we encountered problems and limitations that required adjustments. Coordination among members of the care-delivery team was sometimes problematic. For example, we could not use vancomycin because of a lack of timely communication between the laboratory monitoring plasma concentrations, the dose-adjusting physician, the pharmacist, and the nursing staff. Also, since home-care nurses do not make home visits at night, the administration of antibiotics that require thrice daily dosing (meropenem, ceftazidime, and piperacillin–tazobactam) remains difficult. Administration of some antibiotics (ceftazidime, piperacillin–tazobactam,) by elastomeric pumps could reduce the number of costly nursing visits and increase the effectiveness of time-dependent antibiotics, for which maintaining plasma concentrations above of the minimal inhibitor concentration is important. However, meropenem, which is stable for only about 3 h, cannot be administered by pump. Pharmacokinetic study in the future may help us to know how to effectively use these antibiotics with multiple dosages in OPAT. We also did not make a real economic evaluation of OPAT (cost-effectiveness or cost-saving). The amount of money saved will depend on the country health-care system. Nevertheless, OPAT has been shown in many countries with different health-care system to be cost-effective. This specific issue will be addressed in a national pilot project that is underway.

Conclusion

This pilot study established that OPAT can be used safely and effectively in a Belgian setting, as it has been used elsewhere in the world. OPAT reduced the days of hospitalization needed for treating bacterial infections that require long-term intravenous administration of antibiotics. OPAT has high efficacy and low rates of readmissions and complications, despite patients having numerous comorbidities and high Charlson scores. Patient and family satisfaction level with OPAT was high.

Disclosure statement

No potential conflict of interest was reported by the authors.

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