

Outpatient parenteral antimicrobial therapy

ABSTRACT

Outpatient parenteral antibiotic therapy enables patients to receive intravenous antibiotics without having to be an inpatient. Outpatient parenteral antibiotic therapy can be delivered in an outpatient setting or in the patient's own home by a visiting nurse or the patient can be trained to self-administer antibiotic treatment. The advantages and limitations of each of these methods are discussed in this article. Common clinical situations in which outpatient parenteral antibiotic therapy is used are described. The article also considers the advantages of outpatient parenteral antibiotic therapy, how to ensure that care is safe and effective and how to obtain funding to set up a service.

Outpatient parenteral antibiotic therapy enables patients to receive intravenous antibiotics without having to remain in hospital as an inpatient. Outpatient parenteral antibiotic therapy was first described in the 1970s but until recent years it was limited to a few specialist centres in the UK. It has now become much more widespread and most large hospitals provide a service often in collaboration with community services. Outpatient parenteral antibiotic therapy can be delivered in an outpatient setting or by a specialist nurse or general district nurse visiting the patient's home. The patient (or a relative) can also be taught to self-administer intravenous antibiotics at home. Outpatient parenteral antibiotic therapy is most commonly used to treat skin and soft tissue infections, osteomyelitis, septic arthritis and endocarditis. It is also used for a wide range of other complex infections. As well as describing the different types of outpatient parenteral antibiotic therapy and the patients who can be treated, this review considers the standards that a good outpatient parenteral antibiotic therapy should achieve and the potential benefits.

History of outpatient parenteral antibiotic therapy

Outpatient parenteral antibiotic therapy was first described for patients with cystic fibrosis in 1974 (Rucker and Harrison, 1974). Over the next 30 years it gained wider acceptance across the USA (Tice, 2000) and it was estimated that in 2010 more than 250 000 people across the USA were being treated by outpatient parenteral

Professor Richard Bellamy, Consultant Physician, Centre for Clinical Infection, James Cook University Hospital, Middlesbrough TS4 3BW and Clinical Professor of Medicine, Durham University
(richard.bellamy@stees.nhs.uk)

antibiotic therapy each year (Paladino and Portez, 2010). In the UK the barriers to implementation of an outpatient parenteral antibiotic therapy service perceived by UK infection specialists in the year 2000 included lack of leadership, funding issues, difficulties in coordinating hospital and community care, fragmented distribution of patients, staff training issues and lack of time to organize a service (Seaton and Nathwani, 2000). The development of national (Canadian Advisory Committee on Home IV Antibiotic Therapy, 1994; Williams et al, 1997; Nathwani and Conlon, 1998; Tice et al, 2004; Chapman et al, 2012; Patel et al, 2014) and international guidelines (Nathwani and Zambrowski, 2000) helped overcome these concerns and drive the implementation of outpatient parenteral antibiotic therapy in the UK and the rest of Europe.

Types of outpatient parenteral antibiotic therapy

There are many different models for delivering intravenous antibiotics and managing the care of patients who are not inpatients. Initially outpatient parenteral antibiotic therapy services were usually led by infectious diseases physicians and delivered by specialist nurses. More recently outpatient parenteral antibiotic therapy patients' care has been managed by microbiologists, acute physicians, acute paediatricians, GPs and specialist nurses. There is insufficient space to attempt to describe every possible model of care here. However, outpatient parenteral antibiotic therapy can be categorized as one of three general delivery systems (*Table 1* compares the different types):

Outpatient

The patient attends a clinic in a hospital or community setting usually once daily. This clinic may be a specialist outpatient parenteral antibiotic therapy clinic or may be part of another service such as an acute assessment unit or community patient treatment centre. The main advantage of such a system is that nurses can treat several patients at once and do not spend time travelling between patients' homes. It is therefore relatively efficient. In addition if there is a complication of treatment or if the patient is not improving it is usually relatively easy for the doctor managing the patient's care to review him/her. The main disadvantage for the patient is that he/she has to travel to the treatment centre each day. It is also generally not suitable for administering antibiotics which need to be given more than once daily, unless an infusion device is used.

Table 1. Advantages and disadvantages of different types of outpatient parenteral antibiotic therapy

Type of outpatient parenteral antibiotic therapy	Advantages	Disadvantages
Outpatient clinic attendance (usually most suitable option for a single short course of treatment)	<ul style="list-style-type: none"> ■ Reasonably efficient for staff time ■ Specialist medical and nursing assessment most accessible ■ Easiest to maintain a consistently high level of intravenous administration skills ■ Patient can start outpatient parenteral antibiotic therapy immediately ■ Peripheral cannulae, peripherally inserted central cannula lines and tunnelled central venous cannula options can all be used 	<ul style="list-style-type: none"> ■ Least convenient for patient ■ Least suitable for therapy which needs to be given or changed more than once daily ■ Most inconvenient for a patient who lives a long distance from the outpatient parenteral antibiotic therapy clinic
Nurse attending patient's home (most suitable option for a frail patient who cannot attend a daily clinic or self-administer)	<ul style="list-style-type: none"> ■ Specialist medical and nursing staff reasonably accessible ■ Reasonably convenient for patient ■ Reasonably suitable for therapy which needs to be given or changed more than once daily ■ Patient can start outpatient parenteral antibiotic therapy immediately ■ Reasonably convenient for a patient who lives a long distance from the outpatient parenteral antibiotic therapy clinic (providing district nurses can provide care) ■ Peripheral cannulae can only be used if visiting nurse has cannulation skills 	<ul style="list-style-type: none"> ■ Least efficient for staff time ■ Most difficult to maintain a consistently high level of intravenous administration skills (unless number of nurses delivering care is small)
Self-administration by patient or relative (usually most suitable option for prolonged or repeated courses of treatment)	<ul style="list-style-type: none"> ■ Most efficient for staff time (for long-term treatment) ■ Most convenient for patient ■ Most suitable for therapy which needs to be given or changed more than once daily ■ Reasonably easy to maintain a consistently high level of intravenous administration skills (if patient selected carefully and given good training) ■ Most convenient for a patient who lives a long distance from the outpatient parenteral antibiotic therapy clinic 	<ul style="list-style-type: none"> ■ Specialist medical and nursing assessment least accessible ■ Patient cannot start outpatient parenteral antibiotic therapy until taught to self-administer (unless initially attends clinic for treatment and training) ■ Peripheral cannulae cannot be used

Home administration by a nurse

The specialist or general district nurse visits the patient every day to administer the intravenous antibiotic. The main advantage for the patient is that the patient does not have to travel each day for treatment which is particularly useful for patients who are frail or who have mobility problems. The disadvantage is that relatively few patients can be treated as only one patient can be treated at a time and the nurse must travel between the patient's homes which can be time-consuming. This is particularly problematic if the patient is having treatment more than once daily. Less time may be spent on travelling if the service is delivered by a district nurse rather than a specialist nurse as the former are likely to have other patients to see in the same area. Specialist outpatient parenteral antibiotic therapy nurses may spend more time travelling between patients as the distances are likely to be greater. However, a district nurse may have few outpatient parenteral antibiotic therapy patients to treat each year and may have difficulty maintaining the necessary intravenous drug administration skills. A community matron could be a compromise option as the distances travelled and frequency of practice are likely to be midway between those of the specialist outpatient parenteral antibiotic therapy and district nurse.

Self-administration

The patient can be trained to give the intravenous antibiotic him/herself and visit the hospital once each week for medical review. The patient needs to have a tunnelled central line or a peripherally inserted central venous catheter or midline. This is because peripheral cannulae fail too rapidly to be used by the patient who will not be able to perform self-cannulation. The advantages of this system are that the patient becomes an active participant in treatment and does not have to travel to a treatment centre each day. As well as being convenient for patients it has the potential to make large savings in staff time and costs and it does not have the capacity issues of home administration by a nurse. It is probably the best system for carefully-selected patients who can be trained as it has been shown to be as safe as antibiotic administration by a nurse (Matthews et al, 2007).

The main limitation of teaching patients how to self administer intravenous antibiotics is that it generally takes a few days for the patient to be able to perform the procedure competently and safely. Therefore it is not usually suitable for patients with skin and soft tissue infections who are likely to only need a few days of intravenous antibiotics.

Table 2. Benefits of outpatient parenteral antibiotic therapy compared to inpatient care

Releases inpatient beds, reducing staffing requirements or creating additional capacity
Saves money
Preferred by most patients
Improves patients' quality of life
Antimicrobial decisions are made by an infection expert potentially improving outcome
Direct involvement of antimicrobial pharmacist facilitates better antimicrobial stewardship
Reduced exposure to health-care-associated infections such as methicillin-resistant <i>Staphylococcus aureus</i> and <i>Clostridium difficile</i>
Provision of intravenous antimicrobials by a small number of highly trained staff makes it easier to provide high standards of line care
Outcomes should be easier to monitor as all patients are under one service
Moves care from hospital to the community

Benefits of outpatient parenteral antibiotic therapy

Outpatient parenteral antibiotic therapy has been shown to be cost saving compared to inpatient treatment and releases beds which can be used for other purposes (Parker et al, 1998; Nathwani et al, 1999; Seaton et al, 1999; Tice, 2000; Chapman et al, 2009; Jones et al, 2015). Outpatient parenteral antibiotic therapy is generally liked by patients and has been shown to improve the quality of life of those receiving treatment compared to those receiving treatment as inpatients (Goodfellow et al, 2002; Corwin et al, 2005). Outpatient parenteral antibiotic therapy has the potential to improve the quality of care and patient outcomes if all of the patients are being managed and regularly reviewed by a clinician with a specialist interest in managing infection. Initial assessment by an infection expert leads to 39% of patients immediately switching to oral therapy and 89% having a change in antibiotic treatment (Sharma et al, 2005). Therefore a service coordinated by an infection expert should reduce unnecessary or inappropriate intravenous antibiotic treatment.

Inpatients are given antibiotics by a very large number of nursing staff. This makes it challenging to ensure uniformly high standards of care, as there are hundreds or even thousands of staff who must be trained and repeatedly assessed for competency. In an outpatient parenteral antibiotic therapy clinic there are usually far fewer staff administering the antibiotics and therefore it should be possible to ensure consistently very high standards in aseptic technique and intravenous administration. An outpatient parenteral antibiotic therapy clinic should therefore ideally achieve zero bacteraemias associated with intravenous line care. If the patient is receiving home therapy there may be more people involved in the service but there are generally fewer than in a hospital setting, so training should be simpler to maintain and it should be possible to achieve lower infection rates than for inpatients.

For patients who self-administer antibiotics the safety depends upon careful assessment of patient suitability

and the adequacy of training. If this is done carefully and the patient is only signed off once competence has been assessed and demonstrated, it should be safer than administration by a health-care professional. This is because the patient's training and assessment will have been much more recent than that of most staff. Patients receiving outpatient parenteral antibiotic therapy also have less direct contact with other patients and the hospital environment and should therefore have a lower incidence of health-care-associated infections including *Clostridium difficile* and methicillin-resistant *Staphylococcus aureus*. Table 2 gives a summary of the benefits of outpatient parenteral antibiotic therapy.

Who can be treated by outpatient parenteral antibiotic therapy?

In case series and cohort studies outpatient parenteral antibiotic therapy has been shown to be safe and effective in treating a wide range of conditions including cellulitis, osteomyelitis, septic arthritis, endocarditis, pneumonia, lung abscess, meningitis and intravenous line infections (Parker et al, 1998; Andrews and von Reyn, 2001; Bernard et al, 2001; Tice et al, 2003a,b). However, there is very little evidence from randomized controlled trials and outpatient parenteral antibiotic therapy is so widespread that it is unlikely such studies will ever be performed. Even in the year 2000, when outpatient parenteral antibiotic therapy was very limited in its availability, an international workshop on outpatient parenteral antibiotic therapy felt that randomized controlled trials were no longer feasible or ethical (Nathwani and Zambrowski, 2000). *Case studies 1 and 2* give examples where outpatient parenteral antibiotic therapy is commonly used.

Perhaps the best evidence for the safety and effectiveness of outpatient parenteral antibiotic therapy is for cellulitis, where an adequately powered randomized controlled trial has been performed (Corwin et al, 2005). However, in this study two thirds of the patients screened were felt to be unsuitable for outpatient parenteral antibiotic therapy.

This is a surprisingly high figure and may be explained by the large number of relative exclusions in the study, which many infection specialists would not regard as a contraindication to outpatient parenteral antibiotic therapy (e.g. pregnancy, obesity, immunosuppression, peripheral vascular disease, severe cellulitis or cellulitis of the face or hands). The conservative approach in this study should serve as a reminder that outpatient parenteral antibiotic therapy is only safe if patients are carefully selected before commencing outpatient parenteral antibiotic therapy treatment.

Although potentially any condition requiring intravenous antibiotics could be treated by outpatient parenteral antibiotic therapy, that does not mean that any individual patient can be treated by outpatient parenteral antibiotic therapy. It is important to think carefully about whether it will be safe or not for each individual. It would not be helpful to provide a list of conditions which should be exclusions for outpatient parenteral antibiotic therapy as what patients can be managed safely depends on how the service is run. However, if a patient is sufficiently unwell that he/she requires pulse, temperature and blood pressure recording every 4 hours then outpatient parenteral antibiotic therapy would not be safe. If a patient required daily medical assessments then outpatient parenteral antibiotic therapy would not be safe unless the service was set up to provide this. Therefore outpatient parenteral antibiotic therapy is not safe for patients who are clinically unstable. Outpatient parenteral antibiotic therapy is also not suitable for patients who are too frail to manage at home while unwell, unless the appropriate home support can be provided rapidly. It is also not suitable for patients who are too frail to make the daily journey to the hospital unless outpatient parenteral antibiotic therapy is being provided in the patient's home. Outpatient parenteral antibiotic therapy is not usually a safe option if it is uncertain that the patient will cooperate fully and this is particularly relevant to injecting drug users and those with alcohol or mental health problems.

Some outpatient parenteral antibiotic therapy services can only provide once-daily intravenous antibiotics so patients requiring more frequent antibiotic administration are not suitable. Some services can only cover certain areas either because of incomplete nurse coverage or because if patients are travelling to an outpatient parenteral antibiotic therapy clinic some areas are unrealistically far away. This is particularly relevant in a tertiary hospital where specialty patients may have travelled a very long distance. That hospital's outpatient parenteral antibiotic therapy service is unlikely to be able to provide care although there may be more local services which can do so. Each outpatient parenteral antibiotic therapy service must consider carefully what should be the inclusion and exclusion criteria for treatment and develop protocols to ensure they are adhered to. Without such protocols, outpatient parenteral antibiotic therapy treatment may become unsafe.

Ensuring care is safe and effective

UK guidance for adult and paediatric outpatient parenteral antibiotic therapy services has been produced by the British Infection Association, British Society for Antimicrobial Chemotherapy and British Paediatric Allergy, Immunity and Infection Group (Chapman et al, 2012; Patel et al, 2014). Guidance is provided on the following five key areas for an adult outpatient parenteral antibiotic therapy service:

Outpatient parenteral antibiotic therapy service structure

There should be clear lines of responsibility in the outpatient parenteral antibiotic therapy team. The team should include as a minimum a medically-qualified lead clinician (with time in job plan), an infection specialist, a specialist nurse and an antimicrobial pharmacist. There should be a clear patient management plan, documentation of who is responsible for the patient's care (outpatient parenteral antibiotic therapy clinician, referring clinician or both) and clear communication between the outpatient parenteral antibiotic therapy

CASE STUDY 1

A 24-year-old woman presented to the emergency department with a 6-day history of bilateral, painful, erythematous rash affecting both calves. She had no significant past medical history but she had had a sore throat 2 weeks previously. She was afebrile and her pulse and blood pressure were normal. She was diagnosed with cellulitis and was given one dose of intravenous ceftriaxone. She was referred to the outpatient parenteral antibiotic therapy clinic for continuation of therapy. The outpatient parenteral antibiotic therapy consultant noted that the erythema was made up of multiple nodules each of which was about 2 cm in diameter. The nodules were very tender. The patient's peripheral white cell count and C-reactive protein were within normal limits. The outpatient parenteral antibiotic therapy consultant diagnosed erythema nodosum and stopped the antibiotics. An anti-streptolysin O titre was performed and was significantly elevated indicating the recent sore throat was probably a group A streptococcal infection. This case illustrates that cellulitis very rarely affects both legs at the same time and that alternative diagnoses should be considered.

CASE STUDY 2

A 70-year-old man presented to the emergency department with a 3-day history of a painful and swollen right leg. He had had venous eczema for 5 years and had taken several previous courses of antibiotics for suspected cellulitis. On examination he had a temperature of 38.4°C and his pulse and blood pressure were normal. The leg was swollen to the mid-calf and there was some blistering. He was diagnosed with cellulitis and referred to the outpatient parenteral antibiotic therapy clinic for treatment with intravenous ceftriaxone. The patient was reviewed 2 days after and it was noted that the cellulitis had spread, the leg had become more swollen and new blisters had developed. The treatment was changed to intravenous teicoplanin and a meticillin-resistant *Staphylococcus aureus* screen was performed. Meticillin-resistant *S. aureus* was isolated from nose, groin and blister fluid. This case illustrates that when an infection fails to respond to the usual empirical antibiotics, it is essential to consider which antibiotic-resistant organisms may be responsible.

Table 3. Areas of uncertainty in outpatient parenteral antibiotic therapy care

Which types of outpatient parenteral antibiotic therapy are most effective and cost-effective and in what circumstances?
Which types of outpatient parenteral antibiotic therapy delivery are safest and in what circumstances?
Which types of outpatient parenteral antibiotic therapy are preferred by patients and in what circumstances?
How should outpatient parenteral antibiotic therapy be funded and should there be a national tariff? Should the tariff be different for those attending a clinic, those receiving outpatient parenteral antibiotic therapy from a nurse at home and those self-administering?
Which delivery systems should be preferred for antibiotic administration: in particular do continuous infusion devices offer advantages in terms of effectiveness, cost-effectiveness, safety and patient preference?
Should there be a formal written qualification or credential for those wishing to lead an outpatient parenteral antibiotic therapy clinic?
Should patients accepted to outpatient parenteral antibiotic therapy receive assessment and/or treatment for deep vein thrombosis prophylaxis?
Should there be a national database of outpatient parenteral antibiotic therapy which could be interrogated to identify potential patient safety issues, evaluate treatment effectiveness and assess patient satisfaction?
Could a national database be used as a basis for designing future research projects?

team, referring clinician and GP. The multidisciplinary team communication should be available to relevant staff out-of-hours.

Patient selection

Suitability criteria for outpatient parenteral antibiotic therapy should be formulated by the infection specialist and each patient referred should be assessed against these by a competent team member before acceptance for outpatient parenteral antibiotic therapy. Patients judged suitable for outpatient parenteral antibiotic therapy should be fully informed about it and given a choice as to whether they wish to accept it or not. Patients who were given venous thromboprophylaxis as inpatients should be assessed as to whether this needs to continue during outpatient parenteral antibiotic therapy.

Antimicrobial management

The treatment plan should be agreed before commencing outpatient parenteral antibiotic therapy, although usually the plan will be flexible to allow for variability in response. The antimicrobial management plan is the responsibility of the infection specialist and should take account of local antimicrobial guidelines. The outpatient parenteral antibiotic therapy team is responsible for the choice of intravenous access, safe insertion and maintenance of the device and safe administration of antimicrobials. If the patient or a relative is to be trained in administration this must follow Royal College of Nursing standards. The

patient or carer should not be signed off as competent until he/she and the outpatient parenteral antibiotic therapy specialist nurse are satisfied. All doses of antimicrobial administered should be recorded on a medication card even if the patient is self-administering. The first dose of any intravenous antimicrobial must be supervised by someone trained and competent in the management of anaphylaxis.

Patient monitoring

Patients with skin and soft tissue infections should be reviewed daily to enable early switching to oral therapy. Patients on longer term treatment should be reviewed regularly by the multidisciplinary outpatient parenteral antibiotic therapy team. They should have weekly blood tests (e.g. renal and liver function, a full blood count and C-reactive protein and potentially additional tests in selected patients) unless they have been treated for more than a month when twice-monthly blood tests may sometimes be sufficient. The outpatient parenteral antibiotic therapy team will monitor the patient's response to treatment and determine if any change in plan is required. The patient should be informed verbally and in writing how to obtain advice in an emergency 24 hours per day.

Clinical governance

Outpatient parenteral antibiotic therapy outcomes should be collected prospectively and recorded in a local database. Outcomes should include treatment success or failure, readmission rates, adverse drug reactions, complications with vascular access devices, development of health-care-associated infections such as line-associated bacteraemia, *Clostridium difficile* infection and colonization or infection with methicillin-resistant *Staphylococcus aureus* and multidrug-resistant Gram-negative bacteria. Surveys of patient experience and satisfaction should be performed regularly. Risk assessments should be performed before introducing new procedures and these should be audited. All team members should participate fully in continuing professional development.

Table 3 lists current areas of uncertainty for outpatient parenteral antibiotic therapy care.

Funding an outpatient parenteral antibiotic therapy service

An outpatient parenteral antibiotic therapy service will only survive if it is adequately resourced. Funding in the NHS is complex and it has been shown that the income gained from 'payment by results' (which is linked to activity) varies depending on how outpatient parenteral antibiotic therapy patients are classified. In England a 7-day inpatient episode for cellulitis generated £1361 of income, but an outpatient parenteral antibiotic therapy episode generated between £773 and £2084 depending on the tariff applied, for the same duration of treatment (Jones et al, 2015). Most likely the providing trust would prefer to receive £2084 for the treatment episode, but the purchasing clinical

commissioning group would prefer to pay £773. Probably neither of these extremes would be fair. Purchasers and providers should ideally agree by negotiation what tariff will be applied for treating outpatient parenteral antibiotic therapy patients with specific conditions. In that way both the purchaser and provider will be aware of what the costs are going to be.

Conclusions

Outpatient parenteral antibiotic therapy can provide effective antimicrobial therapy for a wide range of clinical conditions. Outpatient parenteral antibiotic therapy saves money and releases beds and is preferred by the majority of patients. It should produce outcomes which are as good or better than inpatient care and should reduce the risk of line-associated infections and health-care-associated infections. However, robust protocols and careful patient selection are essential to ensure that the service is safe. Outcome data should be collected and shared with relevant stakeholders. Funding arrangements need to be agreed with stakeholders to ensure that the outpatient parenteral antibiotic therapy service has a secure future. **BJHM**

Conflict of interest: none.

Andrews MM, von Reyn CF (2001) Patient selection criteria and management guidelines for outpatient parenteral antibiotic therapy for native valve endocarditis. *Clin Infect Dis* **33**(2): 203–209. <https://doi.org/10.1086/321814>

Bernard L, El-Hajj, Pron B et al; Groupe d'Etude sur l'Ostéite (2001) Outpatient parenteral antimicrobial therapy (OPAT) for the treatment of osteomyelitis: evaluation of efficacy, tolerance and cost. *J Clin Pharm Ther* **26**(6): 445–451. <https://doi.org/10.1046/j.1365-2710.2001.00380.x>

Canadian Advisory Committee on Home IV Antibiotic Therapy (1994) Canadian home IV guidelines. Highlights of a Canadian Consensus Conference, 11–12th November, Toronto, Canada: 1–9

Chapman ALN, 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. <https://doi.org/10.1093/jac/dkp343>

Chapman AL, Seaton RA, Cooper MA et al, on behalf of the BSAC/BIA OPAT Project Good Practice Recommendations Group (2012) Good practice recommendations for outpatient parenteral antimicrobial therapy (OPAT) in adults in the UK: a consensus statement. *J Antimicrob Chemother* **67**: 1053–1062. <https://doi.org/10.1093/jac/dks003>

Corwin P, Toop L, McGeoch G et al (2005) Randomised controlled trial of intravenous antibiotic treatment for cellulitis at home compared with hospital. *BMJ* **330**: 129–134. <https://doi.org/10.1136/bmj.38309.447975.EB>

Goodfellow AF, Wai AO, Frighetto L et al (2002) Quality of life assessment in an outpatient parenteral antibiotic program. *Ann Pharmacother* **36**(12): 1851–1855. <https://doi.org/10.1345/aph.1C153>

Jones GR, Cumming DV, Honeywell G et al, on behalf of the BSAC OPAT Standing committee (2015) How is income generated by outpatient parenteral antibiotic treatment (OPAT) in the UK? Analysis of payment tariffs for cellulitis. *J Antimicrob Chemother* **70**: 1236–1240. <https://doi.org/10.1093/jac/dku541>

Matthews PC, Conlon CP, Berendt AR, Kayley J, Jefferies L, Atkins BL, Byren I (2007) Outpatient parenteral antimicrobial therapy (OPAT): is it safe for selected patients to self-administer at home? *J Antimicrob Chemother* **60**: 356–362. <https://doi.org/10.1093/jac/dkm210>

Nathwani D, Conlon C on behalf of the OPAT UK workshop (1998) Outpatient and home parenteral antibiotic therapy (OHPAT) in

KEY POINTS

- Intravenous antimicrobial treatment can be delivered in an outpatient clinic, by a nurse performing home visits or by teaching the patient to self-administer therapy.
- Outpatient parenteral antibiotic therapy enables patients to be discharged from hospital earlier and facilitates admission avoidance which saves money and releases inpatient beds.
- A wide range of different infections can be treated by outpatient parenteral antibiotic therapy.
- The quality of care of patients with infection can be improved by outpatient parenteral antibiotic therapy providing the service is well-led and delivered.
- Good governance arrangements should include monitoring and reporting of outcomes and complications.

the UK: a consensus statement by a working party. *Clin Microbiol Infect* **4**: 537–551. <https://doi.org/10.1111/j.1469-0691.1998.tb00413.x>

Nathwani D, Zambrowski JJ on behalf of the Adhoc workshop (2000) Advisory group on Home-based and Outpatient Care (AdHOC): an international consensus statement on non-inpatient parenteral therapy. *Clin Microbiol Infect* **6**(9): 464–476. <https://doi.org/10.1046/j.1469-0691.2000.00113.x>

Nathwani D, Morrison J, Seaton RA, France AJ, Davey P, Gray K (1999) Outpatient and home parenteral antibiotic therapy (OHPAT): evaluation of the impact of one year's experience in Tayside. *Health Bull (Edinb)* **57**(5): 332–337.

Paladino JA, Poretz JA (2010) Outpatient parenteral antimicrobial therapy today. *Clin Infect Dis* **51**(suppl 2): S198–S208. <https://doi.org/10.1086/653520>

Parker SE, Nathwani D, O'Reilly D, Parkinson S, Davey PG (1998) Evaluation of the impact of non-inpatient i.v. antibiotic treatment for acute infections on the hospital, primary care services and the patient. *J Antimicrob Chemother* **42**(3): 373–380. <https://doi.org/10.1093/jac/42.3.373>

Patel S, Abrahamson E, Goldring S, Green H, Wickens H, Laundry M (2014) Good practice recommendations for paediatric outpatient parenteral antibiotic therapy (p-OPAT) in the UK: a consensus statement. *J Antimicrob Chemother* **70**(2): 360–373. <https://doi.org/10.1093/jac/dku401>

Rucker RW, Harrison GM (1974) Outpatient intravenous medications in the management of cystic fibrosis. *Pediatrics* **54**: 358–360.

Seaton RA, Nathwani D (2000) Outpatient and home parenteral antibiotic therapy (OHPAT) in the UK: survey of infection specialists' experience and views. *Clin Microbiol Infect* **6**(7): 385–388. <https://doi.org/10.1046/j.1469-0691.2000.00112.x>

Seaton RA, Nathwani D, Williams FLR, Boyter AC (1999) Feasibility of an outpatient and home parenteral antibiotic therapy (OHPAT) programme in Tayside, Scotland. *J Infect* **39**(2): 129–133. [https://doi.org/10.1016/S0163-4453\(99\)90004-X](https://doi.org/10.1016/S0163-4453(99)90004-X)

Sharma R, Loomis W, Brown RB (2005) Impact of mandatory inpatient infectious disease consultation on outpatient parenteral antibiotic therapy. *Am J Med Sci* **330**: 60–64. <https://doi.org/10.1097/00000441-200508000-00002>

Tice AD (2000) Pharmacoeconomic considerations in the ambulatory use of parenteral cephalosporins. *Drugs* **59**(suppl 3): 29–35.

Tice AD, Hoaglund PA, Shoultz DA (2003a) Outcomes of osteomyelitis among patients treated with outpatient parenteral antimicrobial therapy. *Am J Med* **114**(9): 723–728. [https://doi.org/10.1016/S0002-9343\(03\)00231-6](https://doi.org/10.1016/S0002-9343(03)00231-6)

Tice AD, Hoaglund PA, Shoultz DA (2003b) Risk factors and treatment outcomes in osteomyelitis. *J Antimicrob Chemother* **51**: 1261–1268. <https://doi.org/10.1093/jac/dkg186>

Tice AD, Rehm SJ, Dalovisio JR et al; IDSA (2004) Practice guidelines for outpatient parenteral antimicrobial therapy. *Clin Infect Dis* **38**: 1651–1672. <https://doi.org/10.1086/420939>

Williams DN, Rehm SJ, Tice AD, Bradley JS, Kind AC, Craig WA (1997) Practice guidelines for community-based parenteral anti-infective therapy. ISDA Practice Guidelines Committee. *Clin Infect Dis* **25**(4): 787–801. <https://doi.org/10.1086/515552>