ORIGINAL ARTICLE

Implementing criteria-based early switch/early discharge programmes: a European perspective

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Abstract

Early switch (ES) from intravenous (IV) to oral antibiotic therapy programmes is increasingly included as a component of hospital antimicrobial stewardship initiatives that aim to optimize antimicrobial therapy while limiting toxicity and resistance. In terms of prioritizing the most cost-effective stewardship interventions, ES has been seen as a 'low-hanging fruit', which refers to selecting the most obtainable targets rather than confronting more complicated issues. Administration of highly bioavailable oral antibiotics should be considered for nearly all non-critically ill patients and has been recommended as an effective and safe strategy for over two decades. However, to accrue the most benefit from ES, it should be combined with an early discharge (ED) plan, protocol, or care pathway. Benefits of this combined approach include improved patient comfort and mobility, reduced incidence of IV-line-related adverse effects, reduced IV antimicrobial preparation time, decreased hospital stays, reduced antimicrobial purchasing and administration costs, decreased patient deconditioning, and shortened recovery times. Results from published studies document decreases in healthcare resource use and costs following implementation of ES programmes, which in most studies facilitate the opportunity for ED and ED programmes. Barriers to the implementation of these programmes include clinician misconceptions, practical considerations, organizational factors, and a striking lack of awareness of IV to oral switch guidance. These and other barriers will need to be addressed to maximize the effectiveness of ES and ED programmes. As national antimicrobial stewardship programmes dictate the inclusion of ES and ED programmes within healthcare facilities, programmes must be developed and success must be documented.

Keywords: Antibiotic stewardship, antibiotic switch, implementation, intravenous to oral switch, methicillin-resistant *Staphylococcus aureus*
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Introduction

Intravenous (IV) antibiotics are typically prescribed for hospitalized patients with serious, often life-threatening, infections. Results from a European point prevalence survey in acute-care hospitals showed that the majority of patients with hospital-acquired infections (70%) received IV antibiotic therapy, although the rate ranged from a low of 50% in Scotland and Wales (UK) and Sweden to a high of 90% in Greece and Romania [1]. The duration of IV antibiotic therapy and hospital stays also varied widely among European countries [2,3]. Results from a study evaluating the treatment of patients with methicillin-resistant *Staphylococcus aureus* (MRSA) complicated skin and soft-tissue infections (cSSTIs) showed that duration of IV antibiotic therapy ranged from a low of 10.1 days in the UK to a high of 18.6 days in Poland. Mean hospital length of stay

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ranged from a low of 15.2 days in the UK to a high of 25.0 days in Portugal [2].

In many cases, patients remain hospitalized for the full duration of IV antibiotic therapy. Although outpatient parenteral antibiotic therapy (OPAT) may be an option to reduce length of stay for some patients, these programmes are much more suited to areas where protracted parenteral antibiotic treatment is required (e.g. in bone and joint infections) or the availability of an effective, well-tolerated oral agent is limited. Furthermore, these programmes are not uniformly available throughout Europe [4], and evidence suggests that many patients who require home antibiotic therapy can be treated with an oral agent at hospital discharge, particularly where the course of antibiotic therapy is not prolonged [5]. Additionally, the burden of OPAT for both the patient and medical professional can be high. Patients require a line *in situ* which increases their risk of IV-line-related infections and, depending on OPAT model (e.g. OPAT centre, hospital unit administration), transportation to an outpatient infusion centre [6]. The impact of emerging novel single-dose or two-dose infusion therapies on the need for such OPAT infrastructure remains to be seen.

With the availability of potent, highly bioavailable oral antibiotics, there is an opportunity to promote switching from IV to oral therapy earlier and potentially reduce length of stay as a result. The availability of potent, highly bioavailable agents such as oral quinolones, macrolides and cephalosporins over the last two decades has transformed our ability to safely and effectively manage patients with a range of infections [7]. However, conversion from IV glycopeptides to oral therapy when treating serious, resistant Gram-positive infections remained a challenge until the introduction of linezolid in the early part of the last decade [2].

In this narrative review we discuss from a hospital standpoint the evidence to support the criteria for early switch (ES) and early discharge (ED), the value of these clinical programmes from a European perspective, and their implementation.

Early switch/early discharge criteria: defined

Many hospitals are including ES and ED criteria as part of their antimicrobial stewardship programmes. Antimicrobial stewardship is defined as

> "coordinated interventions designed to improve and measure the appropriate use of antimicrobial agents by promoting the selection of the optimal antimicrobial drug regimen including dosing, duration of therapy, and route of administrations. The major objectives of antimicrobial stewardship are to achieve best clinical outcomes related to antimicrobial use while minimizing toxicity and other adverse events, thereby limiting the selective pressure on bacterial populations that drives the emergence of antimicrobial-resistant strains. Antimicrobial stewardship may also reduce excessive costs attributable to suboptimal antimicrobial use" [8].

Such stewardship programmes aim to promote the appropriate use of antibiotics through the use of standards and guidelines, education, communication and audit [9]. Early switch programmes focus on optimizing drug regimens and should be used in conjunction with other stewardship programmes that focus on minimizing antibiotic resistance.

Although criteria to use in ES programmes for patients with community-acquired pneumonia are provided in national guidelines [10,11], guidance for patients with other types of infections is less clearly defined. Numerous criteria were evaluated in studies evaluating ES and ED programmes in patients with various types of infections including lower respiratory tract infections, urinary tract infections, SSTIs, intra-abdominal infections (Table 1) [7,9,12–25]. Most programmes assessed ES and ED eligibility 2–4 days following initiation of IV antibiotic therapy. Typically at this time, culture and sensitivity results are available and the decision to continue or change treatment course can be made. Intravenous antibiotic therapy is only recommended for patients who are severely ill, are unable to tolerate oral antibiotic therapy, or need antimicrobial coverage or tissue penetration not obtainable with oral antibiotic therapy [26].

Intravenous to oral switch programmes are described in detail in the medical literature [9,12,14,16,17,19–21,23,24,27]. Although various criteria are included in these programmes, in general, criteria can be divided into those that assess available oral therapies, the patient's clinical status, and the patient's ability to adequately absorb orally administered therapy. Examples of IV antibiotics that have an oral equivalent include many penicillins, fluoroquinolones and linezolid. Examples of

TABLE 1. Criteria used to determine patient eligibility for intravenous to oral antimicrobial switch therapy

Criteria
Temperature <38°C or >36°C for 24–48 h; normalizing body temperature; afebrile for at least 8–24 h [5,9,12,14,16–18,20,21,23,25]
No unexplained tachycardia, haemodynamic instability [7,9,14,16,21,23,25]
Clinical improvement, no clinical indication for intravenous therapy [5,7,9,12,17–20,23,25]
Oral fluids/food tolerated, no reason to believe oral absorption of antimicrobials may be poor; may be by nasogastric/gastric feeding tube [5,7,9,12,14–20,22,23,25]
Improving white blood cell count [5,9,12,14,16,17,20,23,25]
Improving C-reactive protein [5,9]
Suitable oral antimicrobial therapy [9,12,23,24,33]
No surgery scheduled within next 24–36 h [16,25]