P-1286 Checklist for an optimal early switch to oral antibiotics in hospitalized patients

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Introduction

- Several studies have shown that established criteria for switching patients earlier from IV to oral antibiotics can reduce the duration of IV therapy
- Most studies show this for specific medical conditions or types of antibiotics and are therefore difficult to generalize for an unrestricted population on general medical wards
- Very little data is available with respect to using this type of criteria for unselected patients on general medical wards

Objectives of this study:

To evaluate the effect of a printed checklist of criteria for switching to oral antibiotics on treatment duration, outcomes and costs on general medical wards

Methods

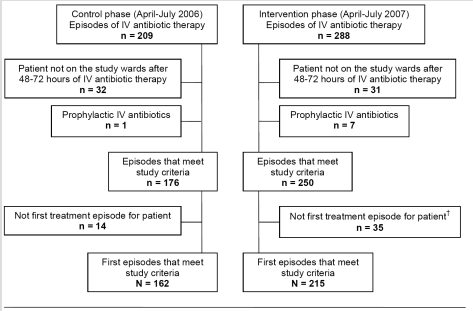
Study design: A 12-month intervention study. Outcome parameters of a 4-month control phase before intervention were compared to a equivalent 4-month period in the intervention phase to control for seasonal confounding (before-after study; April to July 2006 and 2007, respectively)

Study setting: Two general medical wards with annual admissions of 2500 patients and acquisition costs for antibiotics of 280'000 € annually

Participants: 698 consecutively enrolled adult patients receiving IV antibiotics during the intervention (August 2006 to July 2007). Of these, 250 patients were compared to the control group of 176 patients

Intervention: An adapted[1,2], printed checklist –placed in the medical charts– containing bedside criteria for switching from IV to oral antibiotics on the third day of IV therapy. The decision to switch was left to the discretion of the attending physician

Figure 1. **Patient populations**



† Three of these episodes were excluded, because these patients had been included already in the control phase.

Results

Table 1. **Analysis of 698 checklists completed between 1 August 2006 to 31 July 2007**

	n	%
Checklists that indicated cessation of antibiotics after 48-72h	**52**	**7.4**
Checklists that indicated continued antibiotic treatment after 48-72h	**646**	**92.6**
Indications:		
Documented infection	433	67.0
Empiric treatment	213	33.0
Switch to oral therapy planned after 48-72 hours	191	29.6
Reasons indicated for not switching to oral therapy after 48-72 hours†	**455**	**65.2**
Not afebrile > 24 hours	187	41.1
No clinical improvement	185	40.7
Oral administration of fluids not feasible	26	5.7
Oral administration of tablets not feasible	38	8.4
Hematological malignancies or neutropenia	97	21.2
Infections with strict IV indication†	94	20.7
Abscess without incisions, severe soft tissue infection, osteomyelitis, septic arthritis	61	13.4
CNS infections, *Staphylococcus aureus* bacteremia	24	5.3
Endocarditis or intravascular infection	20	4.4
Impaired gastrointestinal absorption	26	5.7
Other exclusion criteria for oral therapy	94	20.7

Abbreviations: CNS = Central nervous system

† More than one reason could be checked per patient as applicable.

Table 2. **Patient characteristics with first episode of antibiotic treatment**

Patient characteristic	Control phase (1 April 2006 - 31 July 2006) n = 162	Intervention phase (1 April 2007 - 31 July 2007) n = 215	*p-value*†
	n (%)	n (%)	
Female gender	73 (45.1)	84 (39.1)	*0.243*
	median (IQR)	median (IQR)	
Age	66 (58-77)	67 (55-78)	*0.950*
Highest CRP value within 72 hours after initiation of antibiotic treatment	151 (89-232)	144 (80-226)	*0.564*
Charlson Comorbidity Index	2 (1-5)	2 (1-4)	*0.301*
	n (%)	n (%)	
Malignancy	54 (33.3)	87 (40.5)	*0.157*
Diabetes mellitus	42 (25.9)	48 (22.3)	*0.417*
HIV positive	3 (1.9)	10 (4.7)	*0.140*
Presumed or documented infectious diseases that were treated with IV antibiotics:			
- Lower respiratory infection	53 (32.7)	68 (31.6)	*0.823*
- Urinary tract infection	23 (14.2)	36 (16.7)	*0.500*
- Intra-abdominal infections‡	22 (13.6)	33 (15.3)	*0.630*
- Fever / SIRS of unknown focus	18 (8.1)	20 (9.3)	*0.564*
- Skin and soft tissue infections	10 (6.2)	19 (8.8)	*0.337*
- Fever in neutropenia	10 (6.2)	12 (5.6)	*0.808*
- Infections of bones or joints	10 (6.2)	8 (3.7)	*0.269*
- Enteritis or colitis	3 (1.9)	3 (1.4)	*0.726*
- Endocarditis	2 (1.2)	3 (1.4)	*0.893*
- CNS infection	4 (2.5)	3 (1.4)	*0.445*
- Other infections	7 (4.3)	10 (4.7)	*0.878*
Consultation by ID specialist	38 (23.5)	59 (27.4)	*0.367*

Abbreviations: CRP = C-reactive protein; IQR = Interquartile range; ID = Infectious disease; IV = Intravenous; CNS = Central nervous system

† Differences between groups using the Mann-Whitney U-test for non-categorical and chi-square test for categorical data.

‡ Includes all (presumed) infections in the abdomen except enteritis and colitis.

Table 3. **Outcomes for the first-episode of antibiotic treatment**

Outcomes	Control phase (1 April 2006 - 31 July 2006) n = 162	Intervention phase (1 April 2007 - 31 July 2007) n = 215	*p-value*†
	median (IQR)	median (IQR)	
Number of days of IV antibiotic treatment per patient	6 (4-11)	5 (3.5-8.5)	***0.005***
Cumulative number of applications of IV antibiotics per patient	15 (8-26)	12 (6-23)	***0.014***
Number of days of subsequent oral antibiotic treatment per patient	0 (0-3)	1 (0-3)	*0.228*
Length of hospital stay per patient (days)	13 (7-24)	12 (8-25)	*0.873*
Restarted IV antibiotic treatment per patient	n (%)	n (%)	
- Overall during the same hospitalization	13 (8.0)	22 (10.2)	*0.465*
- Same diagnosis ≤ 5 days after stopping IV antibiotic therapy	4 (2.5)	8 (3.7)	*0.493*
Complications of IV line per patient‡	9 (5.6)	17 (7.9)	*0.372*
Deaths			
- Overall	13 (8.0)	15 (7.0)	*0.701*
- Due to the treated infections	3 (1.9)	8 (3.7)	*0.286*
- After early switching to oral antibiotic according to checklist§	n/a	0 (0)	*n/a*
Readmissions within 90 days			
- Overall	57 (35.2)	68 (31.6)	*0.468*
- Due to the treated infections	1 (0.6)	2 (0.9)	*0.735*
Primary antibiotic			
- Amoxicillin / Clavulanate	66 (40.7)	75 (34.9)	*0.245*
- Ceftriaxone	35 (21.6)	57 (26.5)	*0.272*
- Piperacillin / Tazobactam	29 (17.9)	*58 (27.0)	*0.863*
- Cefepime	16 (9.9)	*0 (0.0)	
- Meropenem	6 (3.7)	9 (4.2)	*0.813*

Abbreviations: IV = Intravenous; IQR = Interquartile range; n/a = Not applicable

† Differences between groups using the Mann-Whitney U-test for non-categorical and chi-square test for categorical data

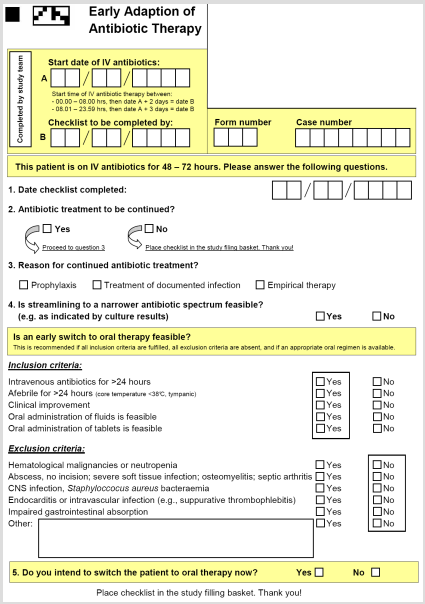
‡ Complications of IV line: phlebitis, septic and non-septic thrombophlebitis

* Cefepime was not available on the Swiss market in 2007 and usually replaced by piperacillin/tazobactam

Adjusted reduction of IV antibiotic treatment: 19% (9%-29%,p=0.001)

Adjusted reduction of # of IV applications per patient: 25% (11%-36%,p<0.001)

Figure 2. **The checklist**



Direct and indirect costs:
- The reduction of workload was 350 hours annually (equal to two months of a nurses salary: 5500 €)
- The corrected cost reduction for antibiotics was 15'000 € over one year (-5.7%) (previous period +19.1%)
- Reduction of direct and indirect costs: 5500 € + 15'000 € = **20'500€**

Adherence to the checklist:
- In the first months of the intervention 48%, at the end of the intervention 68.7%
- Overall, 151 of 246 fulfilling all criteria were switched on the third day of IV therapy

Conclusions

- This study shows that the implementation of a printed checklist, available with the patient's medical chart and with clearly defined bedside criteria for switching patients from IV to oral antibiotics, can shorten the duration of IV therapy (-19%)
- Both, direct and indirect costs, were reduced (20'500 € during one year of the intervention)
- On the third day of IV antibiotic treatment, antibiotics were stopped in 7.4% and switched to oral therapy in 27.3% during the intervention
- The adherence to the checklist increases over time: 49% in the beginning to 69% at the end of the intervention (probably due to a learning effect)
- The criteria can be safely applied to any patient, independent of the indication (empiric or treatment of documented infection), the type of presumed or documented infection, the underlying disease, or the group of antibiotic that is used on general medical wards

Abbrevations

IV = intravenous
# = number

References:

[1] Laing RB, Mackenzie AR, Shaw H, Gould IM, Douglas JG. *J Antimicrob Chemother*. 1998;42;107-111
[2] Senn L, Burnand B, Francioli P, Zanetti G. *J Antimicrob Chemother*. 2004;53;1062-1067