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Antibiotic treatment duration in diverticulitis, complicated urinary tract infection, and endocarditis: a retrospective, single-center study

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ABSTRACT

Objectives: Despite the availability of international guidelines advocating shorter treatment durations, nonadherence to them is common. We assessed duration of antibiotic treatment for diverticulitis, complicated urinary tract infection (UTI), and endocarditis.

Methods: Medical records of patients hospitalized with the previously stated diseases in 2017 and 2018 were randomly selected at a Swiss tertiary care hospital. The appropriateness of antibiotic treatment duration was assessed according to international and local guidelines.

Results: A total of 243 patients were included in the study: 100 with diverticulitis, 200 with complicated UTI, and 43 with endocarditis. The dherence to local and international guidelines was 11% and 18% in diverticulitis, 39% and 40% in complicated UTI, and 84% and 86% in endocarditis, respectively. Nonadherence was primarily due to the prolonged treatment in diverticulitis and complicated UTI with a median duration of antibiotic treatment of 11 days (interquartile range 10-13) and 14 days (interquartile range 10-15), respectively. When pooling diverticulitis and complicated UTI cases, the identification of a pathogen in any microbiological sample was associated with an improved adherence to local guidelines in addition to hospitalization in a medical ward and infectious diseases consultation.

Conclusion: Prolonged courses of antibiotic treatment were common and the treatment adherence to guidelines were poor in diverticulitis, moderate in complicated UTI, and excellent in endocarditis.

Introduction

Antibiotic resistance was declared as one of the top 10 public health threats worldwide by the World Health Organization in 2019 (World Health Organization, 2021). Infections with resistant bacteria are associated with considerable morbidity and mortality (Cassini et al., 2019). The inappropriate use and overuse of antibiotics, such as a longer duration of antibiotic treatment (DAT) than recommended, may increase the risk of antimicrobial resistance development (Barnsteiner et al., 2021; Meropol et al., 2008; Olofsson and Cars, 2007; Teshome et al., 2019), drug-related adverse events, and *Clostridioides difficile* infection (Stevens et al., 2011; Tamma et al., 2017). In 30-50% of patients who are hospitalized, antibiotics are prescribed due to suspected or proven infection (Gürtler et al., 2019; Magill et al., 2014), including urinary tract infections (UTIs) and pneumonia. However, one-third of antibiotic prescriptions are inappropriate (Gürtler et al., 2019). Antimicrobial stewardship (AMS) programs apply important tools to improve antibiotic prescription practices, including the implementation of clinical guidelines, educational programs, formulary restrictions, decision support tools, and antimicrobial resistance surveillance (Cunha, 2018).

Shortening DAT has been shown to be effective and safe in several diseases, including intra-abdominal infections (Daniels et al., 2017; DeCesare et al., 2021; Sawyer et al., 2015), pyelonephritis, and urosepsis (Drekonja et al., 2021; Eliakim-Raz et al., 2013; Molina et al., 2022; Sandberg et al., 2012; Smith et al., 2020; Tansarli et al., 2019; von Dach et al., 2020; Yahav et al., 2019). The translation of these results into clinical practice may strongly impact the total amount of antibiotics administered. In endocarditis, guidelines recommend the consultation of an infectious diseases (ID) specialist to assist in the management of antibiotic therapy, es-

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pecially in patients with *Staphylococcus aureus* infections (Baddour et al., 2015).

The data on guideline adherence in ID in Switzerland are scarce. Considering the recommendations for shorter antibiotic treatments in several infections and the lack of available data, this study aimed to evaluate the adherence to international and local guidelines concerning the antibiotic treatment duration in patients with diverticulitis, complicated UTI, and endocarditis and to identify parameters associated with nonadherence that might be targeted in future AMS interventions.

Material and methods

This is a single-center, observational, quality-control study that was conducted at the University Hospital Basel, a 750-bed academic, tertiary care center in Switzerland. The study protocol was approved by the ethics committee of northwest and central Switzerland (EKNZ 2019-00185) with a waiver for written informed consent. However, patients were excluded if the hospital general research consent for the use of routinely obtained personal and medical data has been previously declined. Patient, clinical, laboratory, and microbiological data were extracted from the electronic medical records of the hospital information system and the microbiological laboratory system.

Patient characteristics

The patients who were hospitalized due to diverticulitis, pyelonephritis/urosepsis, or endocarditis in 2017 and 2018 were identified from the local hospital information system using the International Classification of Disease, Tenth Revision codes (main or secondary diagnosis): diverticulitis: K57.03*; pyelonephritis and other UTI: N10.0, N30.0, N39.0; endocarditis: I33.0, I33.9; and sepsis (A40.*, A41.*) as the main diagnosis plus one of the infections mentioned previously as a secondary diagnosis (*including all subcategories in that number). Diverticulitis was categorized into complicated and uncomplicated diverticulitis according to the classification of diverticular disease (Schreyer et al., 2015). The urogenital infections (pyelonephritis, urosepsis, and complicated UTI) are summarized under the term of "complicated UTI."

The patients were randomly selected from an extracted patient list. The patients were excluded in case of any of the following: antibiotic treatment mainly administered in another hospital, additional and simultaneous infections in the case of complicated UTI and diverticulitis (*e.g.,* osteomyelitis) that required longer treatment durations, incomplete or missing documentation of administered antibiotic treatment, in-hospital death without definitive statement regarding DAT, and the decision for end-of-life care. The patients were defined as immunocompromised if they met at least one of the following criteria: treatment with corticosteroids (prednisone equivalent of >10 mg per day for ≥4 weeks), biologicals (*e.g.,* tumor necrosis factor-α-inhibitors), immunosuppressive drugs (*e.g.,* calcineurin inhibitors, mammalian target of rapamycin inhibitors), HIV infection Centers for Disease Control and Prevention category C, liver cirrhosis, chemotherapy within the preceding 4 weeks, presence of neutropenia (<0.5 g/l), primary immunodeficiency, asplenia, and solid organ or hematologic stem cell transplantation.

Definition of appropriate antibiotic treatment duration

The appropriateness was judged according to available international guidelines until 2019 and according to local guidelines (https://webedition.sanfordguide.com/en/weissbuch; updated at least once every 2 years). In addition, evidence from randomized controlled trials and recommendations in reviews published in high-ranking medical journals were considered. For uncomplicated diverticulitis, antibiotic therapy was still recommended in the guidelines during the studied time frame. The recommended treatment durations are shown in Table 1.

Every day with at least 50% of the total daily antibiotic dosage administered was considered as a treatment day. DAT was determined according to the prescriptions and the notes in the medical records. The possibility and appropriateness of switching from intravenous to oral antibiotic treatment were judged according to the study published by Mertz et al. (2009).

Statistical analysis

We aimed to include 50 patients per group and year. The sample size estimation was based on Swiss DAT data from patients with community-acquired pneumonia (Blum et al., 2015) and to detect a difference in the mean DAT of 2 days compared with the recommended DAT in guidelines (power = 90%, α= 0.05, SD = 5.4 days). Although the target sample size was not achieved for endocarditis (<50 patients per year treated at our center), we elected not to expand the time frame for inclusion to maintain comparability between the disease groups. Data were entered in an electronic case report form using EpiData Version 4.4.3.1 (Association EpiData®). Data were analyzed using IBM SPSS Statistics® version 25 and Microsoft Office 365 Excel®. Categorical variables were compared using the chi-square test and the Fisher's exact test, where appropriate. The metric variables were compared with the Mann-Whitney *U*-test and the Kruskal-Wallis-test, where appropriate. The results with a *P*-value below 0.05 were considered statistically significant. Multivariable stepwise logistic regression models that included potentially confounding variables with a univariate *P*-value <0.1 were performed to analyze associations between patient variables and adherence to guidelines and are presented as odds ratios with their 95% confidence interval.

Results

Patient characteristics

A total of 243 patients were included in the analysis: 100 patients with diverticulitis, 100 with complicated UTI, and 43 with endocarditis (Supplement Figure S1). The median age was 63 years (interquartile range [IQR]: 46-74) and 53.1% of the patients were female (Table 2). The baseline characteristics within each group did not demonstrate significant differences between 2017 and 2018 (data not shown). Female patients with complicated UTI were younger (median age 54 years [IQR 30-76] vs 69 years [IQR 57-83], P = 0.015] and had less comorbidities (median Charlson comorbidity index of 3 [IQR 0-6] vs 6 [IQR 2.5-9], P = 0.001) than male patients. Patients with diverticulitis and endocarditis were frequently treated in a surgical ward (85% and 56%), whereas patients with complicated UTI were mainly admitted to a medical ward (68%). Complicated diverticulitis was observed in 38% of the patients (38/100). The majority of patients with endocarditis had native valve endocarditis (39/43 [90.7%]). Complications (*e.g.,* abscess) were observed in 29/43 patients with endocarditis (67.4%), of whom 44.7% (n = 17/29) had metastatic spread of the infection.

Blood culture (BC) positivity rate ranged from 86% in endocarditis to 44% in complicated UTI and 11% in diverticulitis (Table 2). The most frequently detected pathogen in BC was *S. aureus* in endocarditis and *Escherichia coli* in complicated UTI. ID specialists were involved in 100% of the endocarditis patients and in 5/100 (5%) patients with diverticulitis.

Table 1
Treatment duration recommendations according to local and international guidelines (complemented by evidence from randomized controlled trials and expert opinions published in review articles).

Diagnosis	International guidelines complemented by evidence from randomized, controlled trials and recommendations in review articles	Local guidelines[c]
Diverticulitis		
Uncomplicated, mild to moderate	4-7 days (Sawyer et al., 2015; Solomkin et al., 2010; Wenzel and Edmond, 2015; Young-Fadok, 2018)	4-7 days
Complicated e.g. with positive blood culture, drained abscess	7-10 days (Sawyer et al., 2015; Solomkin et al., 2010; Tansarli et al., 2019; von Dach et al., 2020; Young-Fadok, 2018)	7-14 days
Urinary tract infection		
Pyelonephritis and complicated urinary tract infection	5-14 days according to antibiotic[a], sex and risk factors[b] (Drekonja et al., 2021; Gupta et al., 2011; Johnson and Russo, 2018; Stamm et al., 1987)	7-14 days according to antibiotic[a], sex and risk factors[b]
Urosepsis	7-14 days according to risk factors[b] (Eliakim-Raz et al., 2013; Tansarli et al., 2019; von Dach et al., 2020)	7-14 days according to risk factors[c]
Endocarditis		
Native valve endocarditis	2-4 weeks (Baddour et al., 2015; Habib et al., 2015; Hoen and Duval, 2013)	
Prosthetic valve ecndocarditis	6 weeks (Baddour et al., 2015; Habib et al., 2015; Hoen and Duval, 2013)	

[a] e.g. trimethoprim/sulfamethoxazole, ciprofloxacin.
[b] pregnancy, obstruction, chronic kidney disease, male sex, immunosuppression, kidney stones, anatomic/ functional urinary tract abnormality.
[c] local guidelines are incorporated into the Sanford Guide ("infektioStandards") and accessible online (https://webedition.sanfordguide.com/en/weissbuch).

Table 2
Overall baseline characteristics.

Variable	Overall (N = 243)	Infectious disease		
		Diverticulitis (N = 100)	Complicated urinary tract infection (N = 100)	Endocarditis (N = 43)
Sex: female, N (%)	129 (53.1)	48 (48.0)	68 (68.0)	13 (30.2)
Age in years, median (IQR)	63 (46-74)	65 (51-74)	62 (38-78)	62 (50-72)
Length of stay in days, median (IQR)	6 (4-11)	4 (3-6)	6 (4-9)	20 (14-29)
Admission to medical ward, N (%)	100 (41.2)	15 (15)	68 (68)	17 (39.5)
Admission to surgical ward, N (%)	139 (57.2)	85 (85)	30 (30)	24 (55.8)
Intensive care unit admission, N (%)	44 (18.1)	3 (3.0)	7 (7.0)	34 (79.1)
Penicillin allergy, N (%)	31 (12.8)	15 (15.0)	10 (10.0)	6 (14.0)
Charlson comorbidity index, median (IQR)	3 (1-6)	2 (1-5)	4 (0-7)	3 (1-6)
Immunosuppression, N (%)	32 (13.2)	12 (12.0)	15 (15.0)	5 (11.6)
Procalcitonin measurement on day 0, N (%)	61 (25.1)	9 (9.0)	37 (37.0)	15 (34.9)
Identification of a pathogen, N (%)	140 (57.6)	13 (13.0)	86 (86.0)	41 (95.3)
BC collection, N (%)	178 (73.3)	45 (45.0)	90 (90.0)	43 (100)
Positive BC result of collected BC, N (%)	82 (46.1)	5 (11.1)	40 (44.4)	37 (86.0)
Urine culture collection, N (%)	104 (42.8)	2 (2.0)	94 (94.0)	8 (18.6)
Positive urine culture result of collected urine cultures, N (%)	87 (83.7)	0 (0)	82 (87.2)	5 (62.5)
Infectious diseases consultation, N (%)	65 (26.7)	5 (5.0)	17 (17.0)	43 (100)

Abbreviations: BC, blood culture; N, number.

Duration of antibiotic treatment

The median DAT was 11 days (IQR 10-13) in diverticulitis, 14 days (IQR 10-15) in complicated UTI, and 43 days (IQR 31-59) in endocarditis (Table 3). In diverticulitis, the median DAT was significantly shorter in 2017 (10 days [IQR 9-13]) than in 2018 (12 days [IQR 10-14], *P*-value = 0.022) and was associated with the disease severity (uncomplicated diverticulitis: median 10 days [IQR 8-13] vs median 13 days [IQR 11-14] in complicated diverticulitis, $P < 0.001$).

In patients with complicated UTI, the median DAT was similar in 2017 and 2018 (14 vs 11.5 days, $P = 0.558$) and decreased if ciprofloxacin was administered (11 days [IQR 9-14] vs 14 days [IQR 11-15], $P = 0.002$]). A positive BC result was not associated with a change in the median DAT (14 vs 12 days, $P = 0.244$). DAT was shorter in female patients than male patients (median 11 days [IQR 10-15] vs median 14 days [IQR 12-16], $P = 0.008$). Of note, the median DAT in female patients treated with ciprofloxacin was 11 days (IQR 9-14). The median DAT in patients with endocarditis was 43 days (IQR 31-59).

A switch to oral antibiotic treatment was performed after a median of 3 and 5 days in diverticulitis and complicated UTI, respectively. In patients with endocarditis, a switch to oral treatment was performed in patients requiring prolonged antibiotic treatment due to metastatic spread of the disease (Table 3). The minority of patients were discharged without antibiotic treatment: 12/100 (12%) in diverticulitis, 14/100 (14%) in complicated UTI, and 6/43 (14%) in endocarditis.

Adherence to guidelines

Overall, guideline adherence differed significantly between patients treated for endocarditis compared with the group of patients with diverticulitis and complicated UTI (adherence to international guidelines were 86% vs 25%, respectively, $P < 0.0001$) (**Table 3**). In diverticulitis, the DAT exceeded the recommended length in 80% of patients. In the surgical departments, 77/87 (90.6%) patients were treated longer than recommended, with a median DAT of 12 days (IQR 10-14) compared with 9 days (IQR 7.5-10) in the medical departments ($P < 0.0001$). The DAT in patients with complicated UTI was in accordance with local and international guidelines in 39% and 40% of patients, respectively (Figure 1). Between 2017 and 2018, the percentage of complicated patients with UTI treated shorter than recommended in local and international guidelines in-

Table 3
DAT and assessment of its appropriateness according to local and international guidelines.

Variable	Disease		
	Diverticulitis (N = 100)	Complicated urinary tract infection (N = 100)	Endocarditis (N = 43)
DAT (days), median (IQR)	11 (10-13)	14 (10-15)	43 (31-59)
DAT according to international guidelines[a]			
Yes, N (%)	18 (18)	40 (40)	37 (86)
Too long, N (%)	79 (79)	46 (46)	4 (9)
Too short, N (%)	3 (3)	12 (12)	1 (2)
DAT according to local guidelines[a]			
Yes, N (%)	11 (11)	39 (39)	36 (84)
Too long, N (%)	87 (87)	43 (43)	4 (9)
Too short, N (%)	2 (2)	15 (15)	1 (2)
Time to switch to oral antibiotics (days), median (IQR)	3 (3-5)	5 (4-6)	33 (28-46)[b]
Discharge without antibiotics, N (%)	12 (12)	14 (14)	6 (14)
Length of stay (days), median (IQR)	4 (3-6)	6 (4-9)	20 (14-29)
In-hospital mortality, N (%)	0 (0)	2 (2)	1 (2)
30-day readmission, N (%)	6 (6)	12 (12)	5 (12)

Abbreviations: DAT, duration of antibiotic treatment; N, number.
[a] missing data to 100%: no guidelines applicable.
[b] switch to oral treatment in case of metastatic infection requiring prolonged treatment.

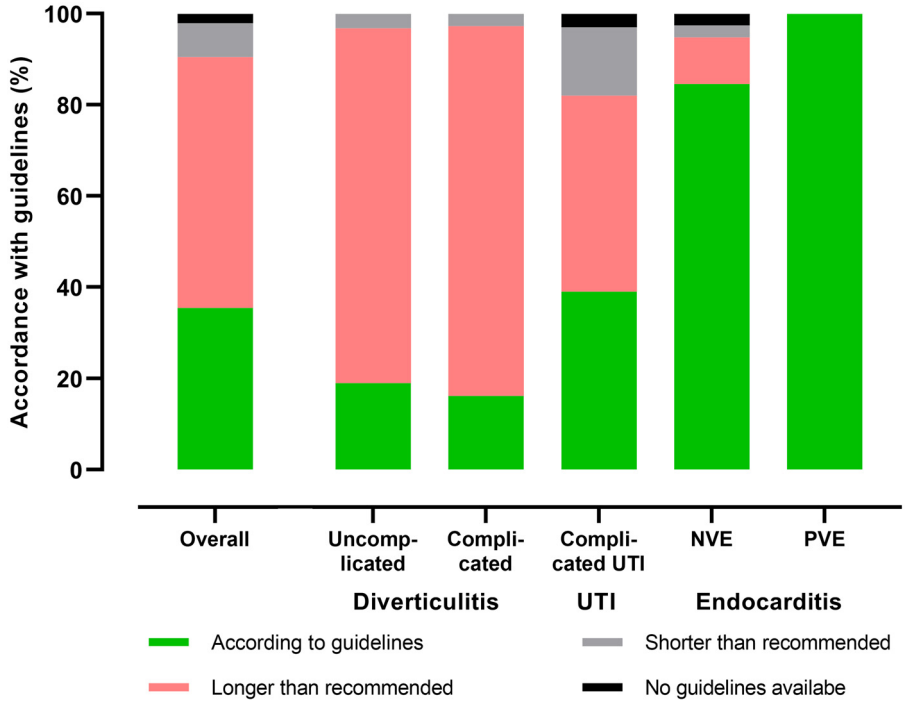

Figure 1. Compliance of antibiotic treatment duration according to local guidelines.
Abbreviations: NVE, native valve endocarditis; PVE, prosthetic valve endocarditis; UTI, urinary tract infection.
No local guideline was available for the antibiotic treatment duration of *Tropheryma whipplei* endocarditis and complicated UTIs involving foreign bodies (*e.g.,* double-J stents).

creased from 8% to 22% and from 6% to 18%, respectively. In endocarditis, adherence to local and international guidelines was high (84% [n = 36/43] and 86% [n = 37/43]), respectively (Figure 1).

Parameters associated with guideline adherence in patients with diverticulitis or complicated urinary tract infection

Because patients with endocarditis differed distinctly from patients with diverticulitis or complicated UTI, such as regarding the severity of disease, total DAT, stay in the intensive care unit, and ID consultation, we decided to pool the complicated UTI and diverticulitis population to identify parameters associated with guideline adherence and excess treatment duration (Table 4). After adjustment, treatment in a medical department, ID consultation, and the detection of a pathogen in any microbiological sample were independently associated with higher odds of adherence to local guidelines. When focusing on treatment adherence according to international guidelines, only the detection of any pathogen in microbiological samples was identified as independent parameter associated with guideline adherence (data not shown).

Female sex, department, lack of BC collection, and pathogen identification were parameters associated with a longer than locally recommended DAT in the multivariable analysis (Supplemental Table S1), with similar results when applying international recommendations (data not shown).

Discussion

The current study assessed the adherence to local and international guidelines in patients with diverticulitis, complicated UTI,

Table 4
Parameters associated with adherence to local and international guidelines in a pooled patient population suffering from complicated urinary tract infection and diverticulitis.

Variable	Univariable odds ratio (95% CI)	*P*-value	Multivariable odds ratio (95% CI)	*P*-value
Accordance to local guidelines				
Age[a]	1.01 (0.99, 1.03)	0.220		
Male sex	1.00 (0.52, 1.92)	1.000		
Antimicrobial allergy	1.17 (0.48, 2.84)	0.730		
Charlson comorbidity index[b]	1.14 (1.04, 1.23)	0.005		
Chronic kidney disease	3.14 (1.59, 6.20)	0.001		
Immunosuppression	2.84 (1.23, 6.58)	0.015		
Department (medical vs surgical)	3.88 (1.97, 7.64)	<0.001	2.53 (1.16, 5.09)	0.019
Intensive care unit admission	4.98 (1.34, 18.43)	0.016		
Identification of any pathogen	6.17 (2.87, 13.29)	<0.001	3.94 (1.73, 8.98)	0.001
Multi-drug resistant gram-negative bacteria	6.95 (2.00, 24.23)	0.002		
Collection of blood culture	3.87 (1.63, 9.19)	0.002		
Positive blood culture result	2.56 (1.26, 5.22)	0.010		
Infectious diseases consultation	4.42 (1.78, 11.01)	0.001	2.67 (1.00, 7.11)	0.050

[a] per 1 year increase.
[b] per one point increment.

and endocarditis. Our findings showed that the treatment duration in diverticulitis and complicated UTI was in accordance with guidelines in only 15% and 40% of patients, respectively, but was much higher (84%) in endocarditis. These three disorders are characterized by very different treatment approaches. Patients with diverticulitis are primarily treated in surgical departments, where the main treatment focuses on surgical intervention rather than on antibiotic treatment (Charani et al., 2017). In pyelonephritis, there are many high-quality trials available, showing that shorter treatment durations are effective and safe (Drekonja et al., 2021; Eliakim-Raz et al., 2013; Sandberg et al., 2012; Tansarli et al., 2019; von Dach et al., 2020; Yahav et al., 2019). In endocarditis, ID specialists are usually involved in the management of antibiotic treatment (Baddour et al., 2015; Habib et al., 2015).

The adherence rates observed in diverticulitis were substantially lower than the results of a Dutch study, which assessed guideline adherence in intra-abdominal infections (15% vs 82%) (Akhloufi et al., 2015) and was similar to published data in pyelonephritis (Chardavoyne and Kasmire, 2020; Hecker et al., 2014). However, comparability between studies might be challenging due to the use of different guidelines. The rate of appropriate treatment would have increased up to 90% in our studied population if Dutch guidelines, recommending 7 to 14 days of antibiotic treatment in intra-abdominal infections, would have been applied. Of note, between 2017 and 2018, DAT shorter than recommended in local and international guidelines doubled for patients with complicated UTI. This observation might be related to the publication of several trials in this time, showing noninferiority of shorter antibiotic treatment in this patient population (Drekonja et al., 2021; Eliakim-Raz et al., 2013; Molina et al., 2022; Sandberg et al., 2012; Smith et al., 2020; Tansarli et al., 2019; von Dach et al., 2020; Yahav et al., 2019). However, women with a negative BC result who were treated with ciprofloxacin were at risk to receive a prolonged course of antibiotic treatment; although, they were younger, had less comorbidities, and represent a group of patients in whom shorter treatment durations (5-7 days) are investigated most frequently (Gupta et al., 2011; Johnson and Russo, 2018).

In diverticulitis and complicated UTI, a majority of patients were treated for almost twice as long as recommended in the guidelines and investigated in randomized trials (Daniels et al., 2017; DeCesare et al., 2021; Drekonja et al., 2021; Eliakim-Raz et al., 2013; Sandberg et al., 2012; Sawyer et al., 2015; Solomkin et al., 2010; Tansarli et al., 2019; von Dach et al., 2020; Yahav et al., 2019; Young-Fadok, 2018). In patients with uncomplicated diverticulitis, previous studies have shown that antibiotic treatment can even be omitted (Daniels et al., 2017; Sawyer et al., 2015), highlighting the need to reduce treatment duration to a minimum while at the same time being effective and safe. Interestingly, 83% of patients were discharged with oral antibiotic treatment for diverticulitis and complicated UTI. This is in line with results of a study by Vaughn et al. (2021), reporting an overuse of antibiotic treatment after discharge in 38.7% of patients with UTI. Because our rate was twice as high, this should be targeted by future AMS intervention because it is known that up to 70% of antibiotic courses prescribed at discharge can be either improved by narrowing the spectrum, reduced in duration, or stopped (Scarpato et al., 2017; Vaughn et al., 2021; Yogo et al., 2015).

In the pooled analysis, treatment in medical departments was associated with a better adherence to guidelines. Surgeons may be less familiar with the concept of AMS and likely are focusing more on surgical interventions than on antibiotic prescriptions (Charani et al., 2017). These results are in line with a study from England, which showed that patients in surgical wards were at risk to receive more frequent and longer antibiotic treatment courses compared with patients hospitalized in medical wards (Charani et al., 2019). Although only borderline statistically significant, there was a trend toward better adherence to guidelines in the pooled analysis when ID specialists were involved in treatment decisions. Accordingly, in patients with endocarditis, where the involvement of an ID specialist is standard of care and recommended (Baddour et al., 2015; Habib et al., 2015), adherence rate increased to >80% in line with adherence rates of a published Spanish study (Escolà-Vergé et al., 2021). A positive association between ID consultations and guideline adherence has been reported (Byl et al., 1999; Gürtler et al., 2019; Livorsi et al., 2021).

Furthermore, the detection of a relevant pathogen in any microbiological sample was associated with a better adherence to guidelines, especially in patients with complicated UTI. The determination of the causative pathogen might be an important principle to enable optimal antibiotic treatment, as we observed the highest adherence to guidelines in endocarditis with the highest positivity rate, followed by complicated UTI and diverticulitis with the lowest positivity rate in the latter case.

Our results show that despite the availability of local and international treatment guidelines, adherence to them was low in diverticulitis and only moderate in complicated UTI. Our study highlights that the sole implementation and availability of guidelines might not be sufficient to improve antibiotic prescription practices. The implementation of AMS programs may help to overcome this issue and increase adherence to guidelines to shorten DAT. Interventions to improve guideline adherence may include educational efforts to improve knowledge, audit, and feedback or the imple-

mentation of an electronic prescribing support system (Di Bella et al., 2020). Antibiotic overuse after discharge was identified as one important target to focus on.

Our study has several limitations, including the single-center design, which limits generalizability. Another limitation is its retrospective design and the reliance on medical record review.

Conclusion

The adherence to local and international guidelines regarding DAT was low in diverticulitis, moderate in complicated UTI, and excellent in endocarditis. Consequently, a majority of patients received a prolonged course of antibiotic treatment. Pathogen identification was associated with improved adherence to guidelines. The implementation of AMS programs, involvement of ID specialists, and educational efforts may help to improve adherence to guidelines and to reduce unnecessary antibiotic prescriptions, especially after discharge.

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Ethics approval and consent to participate

The study protocol was approved by the ethics committee of northwest and central Switzerland (EKNZ 2019-00185) with a waiver for informed consent

Author contributions

NF and MO had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. NF and MO designed the study. NF collected the data. FN, MO, SD, and MW analyzed the data. NF and SD prepared a first manuscript draft. All authors contributed substantially to the writing of the manuscript and critically revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

Declaration of Competing Interest

The authors have no competing interests to declare.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.ijid.2022.09.025.

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