Impact of the inpatient infectious disease consultations at a tertiary care university hospital

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Abstract

Background: The role of the infectious disease specialist continues to evolve. The purpose of this study is to evaluate the value of infectious disease consultation in the inpatient setting.

Methods: This is a prospective cohort study that took place in a tertiary care university hospital. During the period from April to June 2016, 224 cases of patients receiving antibiotics in the hospital with the request of an infectious diseases' consultation, were evaluated. The following variables were assessed: the referring department, purpose of the consultation, the antibiotic used before requesting the infectious diseases consultation, the antibiotic adjustments after the infectious disease's visit, whenever the antibiotic usage was switched to a mono or combination therapy.

Results: The most frequent requesting departments were Oncology (23.2%) and Urology (21.4%). The purpose of consultations was diagnosis (29%), therapy (41%), both diagnosis and therapy (21%), and prophylaxis (9%). An infectious diseases consultation was given at a rate of 4.9 consultations per 100 hospitalized patients. Antibiotic was discontinued in 14.7% of cases. There was no indication for the antibiotic treatment in 11.6% of cases. Modifying the antibiotic therapy was done in 25.4% of cases. Adjusting the antibiotic dosage was done in only one case. Carbapenem antibiotics were discontinued in 31.6% of cases and Quinolones discontinuation accounted for 22.7% of cases.

Conclusion: Infectious disease consults contributed to the optimization of the diagnostic and therapeutic approaches for suspected or confirmed infections in hospitalized patients.

Introduction

Global antimicrobial resistance is growing and poses a public health threat [1]. Patients with infections caused by multidrug resistant bacteria have a higher risk of poor outcome and death compared to patients with non-resistant bacteria [2]. The rate of multi-drug resistant bacteria is on the risewhile only a limited number of new antimicrobial drugs are being developed [3]. Prolonged and misuse of antibiotics in the healthcare setting has been demonstrated to increase the spread of resistant bacteria [4].

Antibiotic stewardship programs (ASPs) help optimize antibiotic usage. They are defined by the Infectious Diseases Society of America as "coordinated interventions designed to improve and measure the appropriate use of antimicrobials by promoting the selection of the optimal antimicrobial drug regimen, dose, duration of therapy and route of administration" [5]. Several studies reported the importance of such programs to decrease the economic cost and improve effectiveness of antibiotic usage [6-7]. The role of the infectious disease (ID) specialist has been constantly evolving during the past decade [8]. The ID consultant is not only required to assist in the diagnosis, management and treatment of patients, but also to manage the hospital's infection control [9, 10].

In view of that, the need to point out the importance of the ID role in the hospital is essential. The aim of this study is to emphasize the role of infectious disease specialists in providing consultations to patients admitted to a tertiary care hospital.

Methods

Study design

This is a prospective descriptive study that took place in a tertiary care university hospital, Hotel Dieu de France, located in Beirut, Lebanon. This hospital accounts for a total of 430 care beds. The analysis was conducted over 3 months from April to June 2016. During the study period, the ID department consisted of 3 full-time ID consultants and two fellow residents. The ID consultations are typically initiated by a primary ("attending") physician. The antibiotic control policy of the hospital is that broad-spectrum antimicrobials are restricted, and their use requires approval by an ID physician.

Data and study selection procedure

The population studied was all adult patients (18 years and older) that were admitted during the studied period with an infection (primary or secondary) for whom an initial formal ID consultation request was made. All stays transferred to the ID department and stays outside the studied period were excluded. There was no direct patient approach and cases were followed through an electronic medical record. Each unique consultation was considered as the unit of analysis. There were 224 cases during that period. The medical committee of the hospital approved this study. The paper and electronic medical records (DX care version 7.7.2) were assessed searching for an infectious disease consultation.

Studied variables, outcome, and analysis

The following variables were collected using a standardized data collection form: referring department, purpose of the consultation, antibiotic used before the ID consultation was requested, antibiotic modifications after the ID's visit (changing the type, dose or range of the antibiotic when applicable, modifying the duration of antibiotic use), whenever the antibiotic usage was switched to a mono or combination therapy. The primary outcome was to evaluate the antibiotic changes done following the ID consultation and to study the patients' characteristics in this po-

pulation. The secondary outcome was to study the diagnosis posed following the ID consult and the interventions done per diagnosis. All analyses were performed using Excel version 16.0 (Microsoft Corporation).

Results

During the study period, 224 cases of patients receiving antibiotics for an infection in the hospital with the request of an ID consultation, were evaluated. The mean age of the population was 63 years with a standard deviation of 17.9 and a median of 67. The characteristics of the population can be found in **Table 1**. The most frequent requesting medical and surgical departments were oncology (52 patients) and urology (48 patients), respectively.

Table 1. Characteristics of the 224 patients followed by the infectious disease specialist during this study.

Characteristics	No. of patients
Neoplasm[a]	90
Arterial hypertension	67
Diabetes	40
Chronic kidney disease	17
End stage renal disease	17
Immunosuppression[b]	7

a: Neoplasm included solid and hematologic cancers; b: Immunosuppression consisted of patients treated for Crohn's disease, renal transplant, myasthenia gravis and a case of severe combined immunodeficiency.

The purpose of consultations was diagnosis (29%), therapy (41%), both diagnosis and therapy (21%), and prophylaxis (9%). An ID consultation was given at a rate of 4.9 consultations per 100 hospitalized patients.

Antibiotic was discontinued in 14.7% (33 patients) of cases. There was no indication for the antibiotic treatment in 11.6% (26 patients) of cases. Modifying the antibiotic therapy was done in 25.4% (57 patients) of cases (whenever empirically, after the results of a culture, or based on guidelines). The most frequently isolated bacteria were gram negative with *Escherichia Coli* and *Klebsiella pneumoniae* being the most common (42% of cases). As for gram positives, *Staphylococcus aureus* followed by *Enterococcus* were the most isolated bacteria (17% of cases). Extended spectrum beta-lactamase producing *Enterobacteriaceae* were isolated in 42% of gram-negative bacteria. Methicillin resistant *Staphylococcus aureus* was isolated only in 10% of *Staphylococcus spp.*

Changing to a broader spectrum antibiotic was carried in 23 patients (10.2% out of total patients and 20.1% out of those already on broad spectrum antibiotics) whereas changing to an antibiotic with a narrower spectrum of action was conducted in 29 cases. Adjusting the antibiotic dosage was done in only one case. Carbapenem antibiotics were discontinued in 31.6% of cases (31 out of 98 patients) and Quinolones discontinuation accounted for 22.7% of cases (5 out of 22 patients). Adjusting the antibiotic duration was performed in 20 cases, with prolonging or shortening the duration of the antibiotic therapy in 7 and 13 cases, respectively. A combination antibiotic therapy was indicated in 3.57% of patients (8 cases). Changing the treatment to monotherapy was performed in 54.1% (13 out of 24 cases). Antibiotic was already started in 132 cases (59%) before an ID consultation was requested. 87 (39%) cases were on antibiotics listed in the restricted antimicrobial list of the hospital. Details are shown in **Table 2**. The top referring departments are detailed in **Table 3**. ID diagnosis are shown in **Table 4**.

Table 2. Different characteristics of the 224 patients receiving antibiotics followed during their stay in the hospital (percentage in parentheses).

Diagnosis	Cases			
	No		Yes	
	No.	%	No.	%
Antibiotic discontinuation	190	84.8	33	14.7
Changing the antibiotic class	167	74.5	57	25.4
Carbapenem discontinuation	67	68.3	31	31.6
Quinolone discontinuation	17	77.2	5	22.7
Changing to an antibiotic with a broader spectrum of action	201	89.7	23	10.2
Changing to an antibiotic with a narrower spectrum of action	195	87	29	13
Antibiotic dosage adjustment	223	100	1	0
Prolonging the duration of treatment	217	96.8	7	3.1
Shortening the duration of treatment	211	94.2	13	5.8
Antibiotic not indicated	198	88.4	26	11.6
Combined antibiotic needed instead of monotherapy	216	96.4	8	3.57
Monotherapy needed instead of a combination of antibiotic therapy	211	94	13	5.8
Antibiotic already started before ID consult	92	41	132	59
Antibiotic used listed on the restricted antimicrobial list of the hospital	137	61.1	87	38.8

Table 3. Number of infectious disease consultations per referring department.

Referring department	Total of patients	
	No.	%
Oncology	52	23.2
Urology	48	21.4
Cardiology	21	9.3
Gastroenterology	15	6.7
Neurology	11	4.9
Pulmonology	14	6.25
Nephrology	14	6.25
General surgery	14	6.25
Gynecology	10	4.4
Orthopedics	7	3
Endocrinology	4	1.7
Neurosurgery	3	1.3
Cardiac surgery	4	1.7
Otolaryngology	3	1.3
Dermatology	2	0.9
Rheumatology	2	0.9

Discussion

This study performed over a short period of time shows the impact of the ASPs and ID consultations in reducing of the inpatient antibiotic consumption. The percentage of antibiotic discontinuation obtained (14.7%) was slightly lower than the one seen in other studies. [11-12]. The most frequent requests for ID consultations came from the Oncology department, probably reflecting the complexity and disease severity in these patients.

The population in this study showed that the most common sites of infection were urinary (32%) followed by pulmonary/ENT infections (18%) and skin and soft tissue infections (17%) respectively. The rate of ID consults per admission (4.9/100 admissions) is comparable to the one in other studies [13].

There is a rise in the multidrug resistant germs especially in the hospital setting [14-17]. Prior antimicro-

Table 4. Shows the ID diagnosis of the 224 patients receiving antibiotics with the most important ID interventions per diagnosis.

Diagnosis	Urinary infections		Pulmonary and ear-nose -throat infections		Skin and soft tissue infections		Gastrointestinal tract		Perioperative prophylaxis		Undetermined infections		Febrile neutropenia		Bacteremia		Neurologic tract infections		Gynecologic tract infections	
	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Antibiotic discontinuation	68	3	34	5	35	6	28	4	15	7	3	3	5	1	5	0	3	0	0	2
Changing the antibiotic class	55	16	31	8	26	12	18	14	20	2	5	1	5	1	3	2	2	1	0	0
Antibiotic not indicated	62	9	32	7	29	8	31	1	17	5	4	2	5	1	5	0	3	0	0	0
Combined antibiotic needed instead of monotherapy	71	0	36	3	34	4	31	1	22	0	6	0	6	0	5	0	3	0	0	0
Mono-therapy needed instead of a combination of antibiotic therapy	65	6	37	2	36	2	29	3	22	0	6	0	6	0	5	0	3	0	0	0
Antibiotc already started before ID consult	34	37	16	23	17	21	5	27	13	9	1	5	2	4	2	3	1	2	0	0
Antibiotic used listed on the restricted antimicrobial list of the hospital	39	32	24	15	22	16	26	6	12	10	5	1	3	3	3	2	2	1	2	0

bial therapy, especially with a broad-spectrum agent, has been demonstrated to be a risk factor for multidrug resistant infections [16]. A multidrug resistant infection is associated with an increased mortality rate [16, 18-19]. A wide variety of nosocomial infections may occur in patients during their stay in the hospital. In addition to that, antimicrobial resistance has been increasing in the Middle East and particularly in Lebanon [20-21]. This study demonstrates the importance of the ID consultation in preventing these complications: 14.7% had their antibiotic discontinued, 25.4% had an antibiotic modification, carbapenem and quinolones usage was reduced.

This study features the importance of the ID consultation in patients receiving antibiotics during their hospitalization. It highlights the discontinuation in antibiotic treatment when not indicated, the adjustments brought to the treatment and to its duration. It also demonstrates the competence of the infectious diseases specialists in sparing the antibiotics with broad spectrum of action (specially carbapenems). Protocols for antibiotic use for the most frequently encountered conditions should be implemented to reduce the dependency on ID advice.

The various purposes of ID consultations shown in this study illustrates the diversity of their work: from antibiotic prophylaxis, antibiotic stewardship, and diagnosis to individual patient management.

Several articles in the literature describe the importance of the ID consultants' activities and roles in the hospital [13, 22]. They play a major role in the diagnosis, optimal use of antimicrobials and prevention of infections in certain populations.

There are some limitations to this study: it was conducted at a single center, and the results may not apply to other settings with different consultation styles. It did not evaluate the cost effectiveness nor the outcome of patients. We could not calculate the percentage of ID consults done out of the ones needed because the ASP in the hospital imposes an ID consultation on every broad-spectrum antibiotic used. This study lacks to determine the effect of the ID consultations' intervention on patients' bacterial colonization.

Conclusion

ID consultation in patients receiving antibiotics during their hospitalization is very important in terms of adjusting the treatment and its duration. ID specialists contribute to the optimization of diagnostic and therapeutic approaches for suspected or established infections. Our data showed the diversity of work of ID specialists. ID clinicians currently have challenging work that requires a considerable knowledge of infectious diseases and frequent interaction with other subspecialists and clinicians.

Declarations

Ethics approval and consent to participate
The medical committee of the hospital (Hotel Dieu de France, Beirut, Lebanon) approved this study.

Consent for publication
Not applicable.

Availability of data and materials
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests
The authors declare that they have no competing interests

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Authors'contributions
DJ collected the data. RW drafted the original manuscript. DJ and EH helped to draft the manuscript.

MC participated in the design of the study. JC and GS conceived the study and participated in its design and coordination. All authors read and approved the final manuscript.

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