IMPACT OF IMPLEMENTING A GLOBAL COLLABORATIVE PHYSICIAN-PHARMACIST STRATEGY ON PROPHYLACTIC ANTIBIOTIC PRACTICES IN A UNIVERSITY HOSPITAL CENTER

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BACKGROUND

Antibiotic prophylaxis is substantially important to prevent surgical site infections (SSIs). Surgical antibiotic prophylaxis (SAP) is an important quality criteria integrated in the 2014-2019 strategic plan of the Belgian Antibiotic Policy Coordination Committee (BAPCOC) (1). The risk of SSIs is cut in half when SAP is compliant with recommendations (2). To evaluate this compliance, several criteria for SAP prescriptions can be observed: the indication, the antibiotic molecule, the antibiotic dose, the route of administration, the timing, the number of administrations, the duration of the prophylaxis, any additional administrations. According to previous published papers, surgical antibiotic prophylaxis (SAP) practices could be optimized by the implementation of a persuasive strategy (3, 4, 5).

OBJECTIVES

A) To identify risk factors associated with non-compliance towards prophylactic antibiotic guidelines

B) To test the impact of a combined intervention strategy on compliance towards prophylactic antibiotic guidelines

METHODS

Monocentric quasi-experimental study with a pre-test–post-test evaluation

Pre-test phase
Evaluation of the pre-test group regarding the compliance towards prophylactic antibiotic guidelines

Test phase
Combination of persuasive interventions
(From December 2016 to April 2017)

Post-test phase
Evaluation of the test group regarding the compliance towards prophylactic antibiotic guidelines

Interventions performed in the operating area between January 11, 2016 and April 22, 2016 (obtained through computer extraction)

Inclusion criteria*

Patients > 18 years old

Patients who had one of the following 5 interventions: total hip prosthesis, coronary artery bypass grafting, colo-rectal surgery, transurethral resection of the prostate and endoscopic retrograde cholangiopancreatography

Exclusion criteria**

Patients < 18 years old

Patients with a documented infection at the time of the intervention

Data collection and analysis for included interventions

Pre-test group

A) Risk factors of non-compliance in the pre-test group?

Retrospective observational transversal study

→ using a multivariate statistical analysis (Logistic regression models and Wald Tests)

→ with Odds Ratios (ORs) determination for the relationships between each independent variable and the outcome variables :

INDEPENDENT VARIABLES

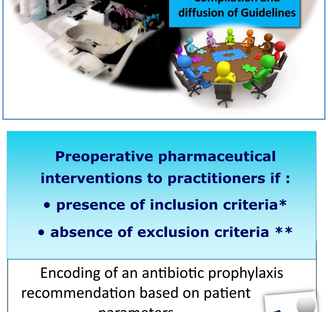
- Age
- Obesity
- Gender
- IgE Mediated Penicillin (or Ciprofloxacin) Allergy
- Multidrug-resistant organisms
- American Society of Anaesthesiologists Score > 2
- Length of Preoperative Stay
- Type of Intervention
- Surgeon or Gastroenterologist
- Anesthetist
- Presence of a nurse anesthetist during the intervention
- Duration of the intervention
- Blood loss during surgery ≥ 1,5L

OUTCOME VARIABLES

Compliance in terms of 11 items:

- Indication
- Molecule(s)
- Dose(s)
- Route of administration
- Time of administration
- Number of administration(s)
- Duration of prophylaxis
- Additional molecule(s)
- Additional Dose(s)
- Route of administration for Additional molecule(s)
- Time of additional administration(s)

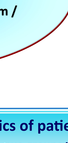
Collaborative Physician-Pharmacist Strategy



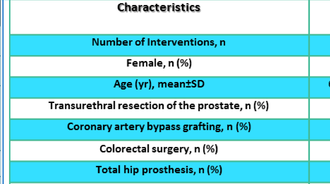
Preoperative pharmaceutical interventions to practitioners if :

- **presence of inclusion criteria***
- **absence of exclusion criteria ****

Encoding of an antibiotic prophylaxis recommendation based on patient parameters
⇒accessible in patients' computerized records



Pre-operative delivery of nominative kits containing the antibiotics with a recommendation paper



Interventions performed in the operating area between January 9, 2017 and April 21, 2017 (obtained on the basis of the presence of pharmaceutical interventions)

Data collection and analysis

Test group

B) Impact of the combined intervention strategy on compliance towards prophylactic antibiotic guidelines ?

1) Similarity between the pre-test group and the test group ?

- χ2 test for categorical variables (gender, number of patients per type of intervention, number of long duration interventions (> 3 hours), number of patients who received prophylactic antibiotics)
- Student's t-test for the age variable

2) Difference of compliance between the pre-test group and the test group ?

- χ2 test comparing the % of compliance between the two groups for each of the 11 items audited and for the 11 items together

RESULTS AND DISCUSSION

A) Identification of non-compliance risk factors in the pre-test group

Risk factor of non Compliance[(i)]	Compliance item impacted	Z-test	P	OR (95% IC)
IgE Mediated Penicillin (or Ciprofloxacin) Allergy	Indication	-2,383	0,0172	0,0345 (0,0022-0,5502)
	Molecule(s)	-2,012	0,0442	0,1282 (0,0173-0,9481)
	Additional molecule(s)	-1,966	0,0493	0,0840 (0,0071-0,9924)
Duration of the intervention (HH:mm:ss)	Time of additional administration(s)	-5,028	4,96E-07	0,5042 (0,3861-0,6585)
Colorectal surgery	Molecule(s)	-3,233	0,0012	0,0187 (0,0017-0,2086)
	Dose(s)	-3,321	0,0009	0,0623 (0,0194-0,2007)
	Additional molecule(s)	-5,346	8,98E-08	0,0114 (0,0022-0,0588)
	Additional Dose(s)	-4,365	1,27E-05	0,0479 (0,0122-0,1875)
	Route of administration for Additional molecule(s)	-4,924	8,50E-07	0,0133 (0,0024-0,0743)
	Time of additional administration(s)	-2,06	0,0394	0,2354 (0,0594-0,9323)
Transurethral resection of the prostate	Molecule(s)	-3,07	0,021	0,0933 (0,0205-0,4243)
	Dose(s)	-2,824	0,0047	0,1614 (0,0455-0,5724)
	Route of administration	-4,44	2,37E-09	0,0393 (0,0094-0,1641)
	Time of administration	-6,093	1,33E-09	0,0293 (0,0094-0,0918)
	Route of administration for Additional molecule(s)	-3,487	0,0005	0,0549 (0,0107-0,2805)
Total hip prosthesis	Duration of prophylaxis	-5,002	5,66E-07	0,0602 (0,0200-0,1811)

[(i)]Some anesthetists and surgeons have also emerged as risk factors of non-compliance. However, we cannot exclude a dependence between independent variables (cf. link between practitioners and certain types of intervention).

⇒**These findings are consistent with those described in the literature that also revealed as risk factors of non-compliance: allergy to β-lactams and certain types of surgery as urological surgery and digestive surgery (6).**

⇒**Lack of education and incomplete professional rules were probably the main barriers associated with the risk factors identified in the pre-test group.**

⇒**The results of this observational study indicated that it was necessary to implement improvement actions of practices.**

B.1) General characteristics of patients in the pre-test group and the test group

→ **Similarity between the two groups in terms of clinical and demographic characteristics**
(p> 0.05 except for the number of transurethral resection of the prostate)

Characteristics	Pre-test	Test	Total	p [(a)]
Number of Interventions, n	130	118	248	
Female, n (%)	48 (36,92)	49 (41,53)	97 (39,1)	0,46[NS]
Age (yr), mean±SD	66,32 ± 11,68	68,36 ± 13,75	67,29 ± 12,73	0,21[NS]
Transurethral resection of the prostate, n (%)	26 (20)	11 (9,32)	37 (14,92)	0,02*
Coronary artery bypass grafting, n (%)	38 (29,23)	34 (28,81)	72 (29,03)	0,94[NS]
Colorectal surgery, n (%)	17 (13,08)	22 (18,64)	39 (15,73)	0,23[NS]
Total hip prosthesis, n (%)	30 (23,08)	34 (28,81)	64 (25,81)	0,30[NS]
Endoscopic retrograde cholangiopancreatography, n (%)	19 (14,62)	17 (14,41)	36 (14,52)	0,96[NS]
Duration of intervention > 3h, n (%)	48 (36,92)	52 (44,07)	100 (40,32)	0,25[NS]
Number of interventions for which prophylactic antibiotics were administered, n (%)	113 (86,92)	109 (92,37)	222 (89,52)	0,16[NS]

(a) Comparing the pretest group with the test group: NS, not significant; *significant

B.2) Comparison of antibiotic prophylaxis practices in the pre-test group (n = 130) versus the test group (n = 118)

→ **Improved compliance for all items assessed (test group vs. pre-test group)**
(P <0.05 for all items assessed)

⇒**This positive impact revealed a culture change, an interest and an awareness observed within the practitioner's teams**

CONCLUSIONS & PERSPECTIVES

This study shows that optimization of SAP practices is achievable within a proactive multidisciplinary approach.
The results presented in this work could be exploited as part of the the Deming Cycle for Continuous Quality Improvement. Following the assessment made in the pre-test group with identification of non-compliance risk factors, a combination of interventions was planned (Plan) and performed (Do). In the test group, including 118 interventions carried out in the operating area, a large number of scenarios appeared. These cases covered, for the most part, the various antibiotic prophylaxis regimens which have been greatly respected by the practitioners in the operating area (Check). Therefore, the plan implemented in this work, as well as the number of interventions and patients included in the study, allowed exploiting the quantitative and qualitative information observed to extend the guidelines implementation to other types of surgery and to plan new actions (Act). One of the new actions implemented is the development of a SAP prescription assistance software available for surgeons and anesthetists (https://db.serv-idb.net/antibiopropH).
Repetition of active interventions and audits as well as analysis of clinical outcomes, antimicrobial resistance and nosocomial infections are interesting avenues for continuing the work.

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