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Upper Respiratory Tract Infections: To What Extent is the Management Evidence-Based?

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Summary

Over a 2-week period, the management of upper respiratory tract infection by 24 medical officers and medical assistants in Seremban District was studied. Each practitioner recorded clinical data and prescription for twenty consecutive patients using a structured questionnaire. The extent to which the practitioners used "predictive features" (fever, absence of cough, cervical adenopathy, enlarged tonsils and exudates on tonsils) in clinical decision-making was analysed. The mean antibiotic prescription rate was 28.7% (95% CI: 24.6%, 33.0%). The antibiotic prescription rate of medical officers and medical assistants were similar. Five features were independently associated with antibiotic prescription (phlegm, fever, cervical adenopathy, red throat and tonsillar exudates). Antibiotics were prescribed for 22.1% of patients with 0-1 predictive features. High prescribers were 5 times more likely to prescribe antibiotics in this group of patients than low prescribers. To a large extent the clinical decision-making of practitioners in this study was evidence based. However, they were unduly influenced by purulent manifestation (phlegm) and redness of throat. The antibiotic prescription rate in these government health clinics is potentially reducible by means of educational intervention.

Key Words: Upper respiratory tract infection, Sore throat, Streptococcal infection, Antibiotic prescription

Introduction

Upper respiratory tract infection (URTI) is the commonest disease seen in primary care in Malaysia[1,2]. Aljunid[3] reported that the antibiotic prescription rates for upper respiratory tract infection (URTI) were 75.9% and 45.5% respectively for private clinics and government health clinics in Kuala Selangor. This over-prescription of antibiotics appeared to be a universal phenomenon. Gonzales et al[4], for example, showed that up to 50% of patients with URTI in the United States were prescribed antibiotics.

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The aim of this study was to elucidate the prescribing behaviour of local primary care practitioners. A specific objective was to determine whether primary care practitioners prescribed antibiotics in patients with URTI using clinical features that have been shown to be predictive of bacterial infection.

Materials and Methods

From May to June 2000, 16 medical officers (MOs) and 13 medical assistants (MAs) from seven government health clinics in the Seremban District were invited to participate in this study (the eighth clinic, KLIA clinic, was not included in this study because it was newly set up at the time of the study). During the study period, there were 26 MOs and 17 MAs working in these clinics. Thirteen of them were excluded from this study for the following reasons: had postgraduate qualification (3 Family Medicine Specialists), providing maternal and child health care only (2 MOs), performing administrative work only (2 MOs, 4 MAs) and on leave (3 MOs). The primary care practitioners invited for this study were informed that the purpose of the study was to find out how URTI was managed in health clinics. Each practitioner was asked to document clinical data and prescription for twenty consecutive patients with URTI on a one-page questionnaire. All participating practitioners completed data collection within a two-week period.

In this study URTI was defined as "acute infection of upper airways of less than one week duration with any of the following symptoms: cough, runny nose, sore throat." We decided to include patients aged $\geq$ 4 years to ensure proper clinical examination of the upper airway.

No throat culture was taken to confirm the aetiology of the URTI. Instead, practitioners were asked to identify the probable aetiology using their clinical judgement ("presumed aetiology"). This "presumed aetiology" was initially recorded by practitioners on a five-point scale (most likely viral, probably viral, unsure, probably bacterial, most likely bacterial) and recorded later into three categories (viral, unsure, bacterial).

The extent to which the practitioners used certain "predictive features" in the clinical decision-making was also analysed. These "predictive features" were fever, absence of cough, cervical adenopathy, enlarged tonsils and tonsillar exudates. These features have been shown to be significantly associated with positive streptococcal throat culture (see McIsaac et al[5] and Ebell et al[6]).

Statistical analysis

The data were analysed using SPSS version 10. Level of significance was set at 0.05. χ^2 test was used to examine for differences between proportions. Multivariate analysis using logistic regression was performed to look for factors independently associated with antibiotic prescription (dependent variable was antibiotic prescription, independent variables were clinical features). Odds ratio (and 95% confidence interval) was used to assess the strength of relationship between independent and dependent variables.

Results

Study setting and participating practitioners

The eight health clinics (including the KLIA clinic) in Seremban District had 266,688 outpatient attendances in the year 2000. In 85,485 cases where diagnoses were available, 47.53% were classified as Diseases of the Respiratory System.[7]

Twenty-five out of the 29 primary care practitioners participated in this study (response rate 86.2%). Table I is a list of the clinics and practitioners who participated in this study. All the MAs were males, while 10 out of 13 MOs were females.

The analysis was based on 464 questionnaires; 247 (53.2%) were from MOs and 217 (46.8%) were from MAs. Eight questionnaires were excluded based on inclusion criteria (age and duration of illness), and 28 incomplete questionnaires were also excluded.

Patient particulars

Demographic profile of the patients is given in Table II. The mean age of the patients was 24.4 years (range 4-80 years, SD = 17 years).

Symptoms and signs of patients

The median duration of the symptoms was 2 days (range 1-7 days, SD = 1.3 days). Among the symptoms, fever, cough and runny nose were very common and were reported by more than three-quarters of the patients (Table III). In terms of signs, documented fever (temperature $\geq$ 38°C) and red throat were relatively more common compared to the other signs.

There were significant differences in the prevalence of four clinical features among the patients seen by MOs and MAs (Table III). However, in terms of number of predictive features (Table IV), there was no significant difference, suggesting that the severity of URTI in both groups was probably similar. Four hundred patients (86.2%) included in this study had 0-1 predictive features, thus the majority of these patients were probably of viral origin (Group A streptococcus isolation from the throat was only 3.7% in the McIsaac's study[3]).

Antibiotic prescribing behaviour

Antibiotic prescription rate and antibiotic choice

The antibiotic prescription rate was 28.7% (95% CI: 24.6%, 33.0%). There was no significant difference between the antibiotic prescription rate of MOs and MAs (26.4% versus 31.8%, χ^2 = 1.6, p =0.207).

Seven types of antibiotics were prescribed but by far erythromycin (the ethylsuccinate salt, EES) was the most commonly chosen one (Table V). Among antibiotics prescribed (n=133), erythromycin was chosen by 50.8% of the MOs and 86.8% of the MAs (χ^2 = 20.19, p<0.001).

Clinical decision-making of practitioners

The antibiotic prescription was not influenced by age, sex, race, co-morbidity and duration of symptoms (data not shown). Nine clinical features were associated with antibiotic prescription in bivariate analysis. In multivariate analysis, five of them remained independently associated with antibiotic prescription (Table VI). They were phlegm, documented fever (temperature $\geq$ 38°C), cervical adenopathy, red throat and exudate on tonsils. Separate analysis comparing MOs and MAs showed that MOs were influenced by phlegm, cervical adenopathy and exudate on tonsils, while the MAs were influenced by phlegm, documented fever and red throat.

As a group, the practitioners were influenced to prescribe antibiotics by the colour of the phlegm (χ^2 for trend = 70.37, p<0.001) and severity of red throat (χ^2 for trend = 59.47, p<0.001).

To what extent is the clinical diagnosis made consistent with the available evidence? As throat cultures were not taken, this question was analysed by comparing the presumed aetiology and the number of predictive features.

As shown in Table VII, the proportion of presumed bacterial infection increased with the number of predictive features while the proportion of presumed viral infection has an inverse relationship (χ^2 for trend = 51.01, p<0.001). About one-quarter of patients with 0-1 predictive features were thought to have bacterial infection.

Antibiotics were prescribed for 22.1% of this group.

High and low prescribers

The practitioners can be categorised into low (prescribing rate < mean) and high prescribers (prescribing rate > mean). Nine (37.5%) primary care practitioners were high prescribers. The proportions of high prescribers were similar among MOs and MAs (MOs 38.5%, MAs 36.4%, χ^2 = 0.011, p=0.916). For patients with 0-1 predictive feature, antibiotics were prescribed in 11.1% and 40.7% by low and high prescribers respectively (Table VIII). High prescribers were 5 times more likely to prescribe antibiotics in this group of patients than low prescribers (OR=5.5, 95% CI 3.3, 9.2).

Table I: Participating clinics and primary care practitioners

Clinics	Medical officers	Medical assistants	Outpatient attendance
KK Seremban	10	0	138,451
KK Sendayan	1	1	10,952
KK Ampangan	0	2	33,493
KK Mantin	1	2	20,530
KK Rantau	1	2	20,428
KK Lenggeng	0	2	15,179
KK Nilai	1	2	22,915
Total	**14**	**11**	**261,948**

Table II: Demographic data of patients

Characteristics	Number (%) of patients
Age group (n=464)	
Children*	137 (29.5)
Adults*	327 (70.5)
Gender (n=443)	
Male	221 (49.9)
Female	222 (50.1)
Ethnic group (n=464)	
Malay	260 (56.0)
Chinese	70 (15.1)
Indian	128 (27.6)
Others	6 (1.3)

*Children: Age < 12 years, adults: Age ≥ 12 years

Table III: Clinical features of URTI

Clinical features	Number (%) of patients Seen by MOs	Seen by MAs	Total	P value
Symptoms				
Fever	187 (75.7)	183 (84.3)	370 (79.7)	0.021*
Cough	215 (87.0)	202 (93.1)	417 (89.9)	0.031*
Runny nose	195 (78.9)	175 (80.6)	370 (79.7)	0.650
Hoarseness	13 (5.3)	17 (7.8)	30 (6.5)	0.261
Sore throat	147 (59.5)	114 (52.5)	261 (56.3)	0.130
Phlegm	117 (47.4)	119 (54.8)	236 (50.9)	0.108
Signs				
Temperature ≥ 38°C	62 (25.1)	77 (35.5)	139 (30.0)	0.015*
Cervical adenopathy	14 (5.7)	21 (9.7)	35 (7.5)	0.103
Red throat	143 (57.9)	128 (59.0)	271 (58.4)	0.812
Enlarged tonsil	30 (12.1)	17 (7.8)	47 (10.1)	0.125
Exudate	16 (6.5)	2 (0.9)	18 (3.9)	0.002*

* Significant at the 5% level

Table IV: Comparison of the clinical features of URTIs seen by MOs and MAs

	Number of predictive features				
	0	1	2	3	4
MOs	141 (57.1)	72 (29.1)	22 (8.9)	11 (4.5)	1 (0.4)
MAs	120 (55.3)	67 (30.9)	26 (12.0)	4 (1.8)	0
Total	261 (56.3)	139 (30.0)	48 (10.3)	15 (3.2)	1 (0.2)

Table V: Choice of antibiotics by practitioners

Antibiotic	Number (%)
Erythromycin	92 (69.2)
Amoxycillin	21 (15.8)
Co-trimoxazole	9 (6.8)
Penicillin V	3 (2.3)
Cephalexin	3 (2.3)
Ampicillin	3 (2.3)
Cloxacillin	2 (1.5)

Table VI: Clinical features associated with antibiotic prescription

Clinical features	Number (%) prescribed antibiotics	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Fever (n=366)	119 (32.5)	2.8 (1.5, 5.1)*	1.5 (0.7, 3.1)
Cough (n=413)	123 (29.8)	1.6 (0.8, 3.3)	-
Runny nose (n=367)	103 (28.1)	0.8 (0.5, 1.3)	-
Hoarseness (n=28)	15 (53.6)	3.0 (1.4, 6.6)*	2.5 (0.9, 7.3)
Sore throat (n=258)	97 (37.6)	2.6 (1.7, 4.1)**	1.3 (0.7, 2.4)
Phlegm (n=233)	92 (39.5)	3.0 (1.9, 4.5)**	2.6 (1.5, 4.4)**
Temperature ≥ 38°C (n=138)	68 (49.3)	3.8 (2.5, 5.9)**	3.0 (1.7, 5.3)**
Cervical adenopathy (n=34)	26 (76.5)	9.7 (4.3, 22.0)**	4.6 (1.8, 11.5)*
Red throat (n=269)	101 (37.5)	3.0 (1.9, 4.7)**	1.9 (1.0, 3.4)*
Enlarged tonsils (n=46)	31 (67.4)	6.3 (3.3, 12.2)**	2.1 (0.9, 4.7)
Exudates on tonsils (n=18)	17 (94.4)	47.8 (6.3, 363.0)**	24.3 (2.9, 203.3)*

*p<0.05
**p<0.001

Table VII: Comparison of presumed aetiology and number of predictive features (n=452)

Presumed aetiology	Number of predictive features (%)				
	0	1	2	3	4
Viral	192 (76.2)	87 (63.5)	21 (43.8)	1 (7.1)	0
Unsure	12 (4.8)	3 (2.2)	2 (4.2)	0	0
Bacterial	48 (19.0)	47 (34.3)	25 (52.1)	13 (92.9)	1 (100)

Table VIII: Influence of the number of predictive features on the antibiotic prescription rate in low and high prescribers

No. of predictive features	Antibiotic prescription in low prescribers (%)	Antibiotic prescription in high prescribers (%)
	Yes	Yes
0-1	28 (11.1)	59 (40.7)
2-4	19 (59.4)	27 (87.1)

Discussion

The antibiotic prescription rate of primary care practitioners in the Health Clinics in Seremban District was 28.7%. The antibiotic prescription rate in this study appeared to be lower than that reported by Aljunid (45.5%)[3].

The main reason for treating bacterial URTI is to treat Group A β-haemolytic Streptococcus, thus the choice of antibiotic was largely appropriate except for the use of co-trimoxazole and cloxacillin. Erythromycin was the favourite choice; this was more so among the medical assistants. The medical officers used a wider range of antibiotics probably because of their greater familiarity. Penicillin V is underused (only 2.5% of all antibiotics).

Five clinical features were found to be independently associated with the prescribing of

antibiotic in this study. They were phlegm, red throat, documented fever, cervical adenopathy and exudates on tonsils. In keeping with the studies by Gonzales[8] and Schwartz,[9] both the MOs and MAs in our study were also influenced by purulent manifestations of URTI. Despite commonly held belief, randomized controlled trials[10,11] failed to find a major clinical benefit of antibiotic treatment of adults with cough who had purulent sputum. Some of the practitioners in our study (especially the MAs) were also influenced by the redness of throat, a physical finding that has been shown by Howie[12] to be clinically unreliable. Ebell et al[6], in a systematic review of 9 studies, confirmed that injected pharynx could not discriminate between patients with or without streptococcal throat infection. Fever, cervical adenopathy and exudates were appropriately used in the practitioners' clinical decision making.

In the comparison of "presumed aetiology" and number of predictive features (Table VIII), the practitioners appropriately diagnosed more bacterial infection in keeping with the number of predictive features. However, about one-quarter of those patients with 0-1 predictive features were thought to have bacterial infection. The high prescribers were five times more likely to prescribe antibiotics to this group of patients than the low prescribers. In view of the fact that 85.5% of patients had 0-1 predictive feature, over prescription of antibiotics in this group of patients should be the target of educational intervention.

Overuse of antibiotics in ambulatory care is a complex phenomenon, the factors contributing to this include lack of knowledge among the prescribers, patient expectation and economic incentives[13]. In this study, we have merely scratched the surface of this issue by exploring the clinical decision-making of the prescribers.

Conclusion

In this URTI study carried out in the Health Clinics, we have documented several important findings useful in future intervention programme of URTI management. Firstly, the antibiotic prescription rate is potentially reducible since the majority of patients have low likelihood of bacterial infection. Secondly, clinical decision making of practitioners in this study was founded on clinical features, some of which were not evidence-based. In particular, the practitioners were unduly influenced by purulent manifestation (phlegm) and redness of throat that have previously been shown to correlate poorly with a bacterial aetiology.

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