Evaluation Results of 21th Iranian External Quality Assessment Schemes (EQAS) of Microbiology laboratories in 2007

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Citation

Abstract

The aim of this study was to determine ability of Iranian microbiology laboratories for identification and susceptibility testing of two unknown microorganisms. In Feb 2007 21st run of proficiency testing of Iranian microbiology laboratories carried out by Iranian reference health laboratories. In this survey two unknown microorganisms including Salmonella paratyphi B and Staphylococcus aureus were submitted to 1305 microbiology laboratories. Of 1305 laboratories, 1122(.86%) laboratories participated in our survey and 183 (14%) laboratories did not participated in our program. Of 1122 laboratories, 523(46.6%) laboratories identified S.paratyphi B correctly. The results of susceptibility testing of S.paratyphi B were relatively satisfied for nalidixic acid, ciprofloxacin and trimethoprim-sulfamethoxazole. However the results of susceptibility testing for tetracycline and ampicillin were unsatisfied and only 578 (52.5%) and 558 (49.7%) Of laboratories reported correct answer for tetracycline and ampicillin respectively. Regarding to identification Staphylococus aureus of 1122 laboratories 767 (68.4%) identified this organism correctly It is concluded that the majority of microbiology laboratories were able for identification of S.parathyphi B and S.aureus. Nearly 50% of laboratories produced incorrect susceptibility testing answer according to S.paratyphi B for tetracycline and ampicillin.

INTRODUCTION

Blind retesting of previously analyzed specimens can be used an assessment in number of different areas of the microbiology laboratory, such as appropriate setup based on the source of the unknown organism ,correct identification of unknown organism, appropriate titters of infectious disease of serologies testing and reporting of antimicrobial susceptibility testing results and many more. [1,2,3,4,5].This processes called external quality assessment scheme (EQAS), competency assessment or proficiency testing. There are many benefits for participation in the EQAS for laboratories.(i) participating laboratories are able to assess whether their results are comparable with those of other laboratories. (ii) EQAS can provide a valuable educational stimulates to laboratory staff. (iii) It provides credibility to the participating laboratory by providing evidence that the participating laboratory has a responsible attitude towards quality issues (evidence of participation is required by some acceding agencies); (iv) EQA provides an insight into national performance levels; and (v) EQAS improves national performance levels. [1,5]

The Iranian national external quality assessment scheme for microbiology laboratories were introduced in 1994 for evaluation of performance and competency testing of microbiology laboratories in both governmental and private sectors. The scheme covers a wide range of clinical microbiology activities including identification and susceptibility testing. We annually perform three run of EQAS programs .In microbiology laboratories various steps have been taken to upgrade the EQAS programs. In recent years, the scheme has been actively promoted throughout country resulting increased participation.

In spite of regular performance of EQAS by reference laboratory of Iran, many microbiology laboratories are not able for identification and performance of correct susceptibility testing of some microorganisms. Our recent studies showed that nearly one third of microbiology laboratories in Tehran were not able to identify three unknown microorganisms such as Acinetobacter baumannii, Enerococcus faecalis and Enterobacter agglomerans.[6] The aim of this study was to determine ability of Iranian microbiology laboratories for identification and susceptibility testing of three unknown microorganisms.

METHODS

In Feb 2007 21st run of proficiency testing of Iranian microbiology laboratories carried out by research center and reference laboratories of Iran. In this survey two unknown microorganisms including Salmonella Paratyphi B and Staphylococcus aureus were chosen. Bacterial species were cultured in Trypticase Soy Agar (TSA) medium in screw capped tube. They were incubated in 35°C for 24 hours. After confirming the growth and purity of specimens we performed all conventional identification and susceptibility testing.[2,4,7] Specimens were placed in specially designed package, containing instructions and other paper works. Post mail shipments were labeled in accordance with carrier regulations and were submitted to 1305 microbiology laboratories. All laboratories included both hospital and non-hospital microbiology laboratories in governmental and private sectors. We asked all laboratories to identify each microorganism in species level and performance of susceptibility testing just for S. paratyphi B against tetracycline, nalidixic acid, ciprofloxacin, ampicillim and trimethoprim-sulfamethoxazole. Scoring of results performed according to WHO criteria [8].The maximum score of point for identification of each bacterium was 3 score and 5 score for susceptibility testing (each antibiotic one score) .The results were analyzed by SPSS. The results of EQAS were submitted to all participating laboratories.

RESULTS

Of 1305 laboratories only 1122(.86%) laboratories participated in our survey and 183 (14%) laboratories did not participated in this study. Of 1122 laboratories, 523(46.6%) laboratories identified S.paratyphi B correctly and obtained maximum 3 score of points and 488 (43.5%) laboratories partially identified this microorganism (1-2.5 score) and 111(9.9%) laboratories misidentified this microorganism(zero score) In total the mean score for identification of S.paratyphi was 2.6.(Table -1)

The results of susceptibility testing of S.paratyphi B were relatively satisfied for nalidixic acid, ciprofloxacin and trimethoprim-sulfamethoxazole. However the results of susceptibility testing for tetracycline and ampicillin were unsatisfied and only the results of 578 (52.5%) of 1122 laboratories were correct for tetracycline and 558 (49.7%) of laboratories reported correct answer for ampicillin. The mean of score for susceptibility testing of S.paratyphi B was 3.6.(Table -2)

Regarding to identification Staphylococus aureus of 1122 laboratories 767 (68.4%) laboratories identified this organism correctly and obtained maximum three score, 211(18.8%) laboratories produced partially correct answer (1-2.5 three score) and 114 (12.8%) laboratories could not identified S.aureus. In total mean score for identification of this microorganism was 2.3.(Table -3)

DISCUSSION

The main goal of EQAS is to improve the quality and strengthen the capabilities of laboratories. In evaluating the microbiology laboratories in Islamic Republic of Iran it was presumed beforehand that the laboratories were functioning within an acceptable range. Unfortunately our results did not confirm this assumption, and there was a wide range of capabilities of the laboratories for identification different species of microorganisms. In previous study by Abbassi et al [6] they evaluated the results of 10th external quality control assessment results which carried out in reference laboratory of Iran in summer of 2002. They distributed five species bacteria (each laboratories two unknown organism) among 487 microbiology laboratories in Tehran and districts. Of 487 laboratories they received answer from 437 (89.7%) laboratories. Of 291 laboratories 224 (77%) produced correct answer for S. saprophyticus. Of 146 laboratories 102(69.85) for C. freundii Of 114 laboratories,34(30%) for Acinetobater baumanii. Of 146 laboratories 37(25.3%) for E faecalis and 0f 177 laboratories 63((35. 6%) for E. agglomerance. This study and other studies revealed that in our country the majority microbiology laboratories have poor performance for identification some microorganisms[6,9] There are many studies for evaluation and quality assessment in microbiology laboratories worldwide. For example the first external quality assessment of clinical microbiology laboratories in Norway in 1982 included 15 country and regional laboratories. The mean number of incorrect identifications was 2.7 (11.3%). Eleven strains were correctly identified by all laboratories, whereas 4 strains were misidentified by 4 to 7 laboratories, accounting for approximately 50% of all misidentifications [10] According to Richardson and his associates in Canada the number of participating microbiology laboratories in EQAS declined from 335 laboratories in 1974 to 190 laboratories in 1994 In the initial evaluation, 21% of laboratories did not have the expected capabilities. In 1989, 50% of laboratories achieved high points (above 80%) for isolating and identifying the microorganisms. However, 25% of laboratories scored less

than 50% for bacterial sensitivity testing and only 10% of them had high scores (above 80%). This lack of effectiveness was related to inappropriate selection of chemicals reagents ([11])

In another study by Tenover et al to evaluate bacterial resistance, the Centres for Disease Control and Prevention (CDC) and WHO distributed 6 different strains of bacteria among 130 laboratories in the United States and other countries. Most of the laboratories were able to performance of susceptibility testing of S. aureus, Enterococcus faecalis and Klebsiella pneumoniae against methicillin, vancomycin and cephalosporin respectively. However, the rest, especially those that used the disk diffusion method for evaluating the sensitivity of S. pneumoniae against penicillin, had problems. In addition, the majority of laboratories had problems for evaluating reduced sensitivity of S. epidermidis to vancomycin. ([12]) Other study by Engler et al ([13]) showed only 3 of 23 reference laboratories were able to identify correctly 6 lyophilized Corynebacterium diphtheriae strains and to detect the C. diphtheriae toxigenicity A study by Kumasaka in Tokyo ([14]) revealed that poor performance in the EQAS survey was closely related to poor laboratory management, the type of training, experience of the medical technicians, and the supervisory ability of the consultant physicians in independent laboratories .In a study in the United Kingdom, Pitt et al ([15])concluded that the physiological concepts of job satisfaction and climate are factors that might affect external and internal quality control. In study by Matynia et al ([16]) to five consecutive isolates of S .aureus and the corresponding susceptibility l as a part of polish external quality assurance scheme, clinical laboratories were ask tests to the national centre of quality control in microbiology. Of1376 isolates submitted as S.aureus from 276 medical centres 13(< %1) had been misidentified by local laboratories. Of 181 (13.5%) MRSA isolates, most were identified correctly (98% of laboratories)

The microbiology laboratory serves as the first steep in identification and performing of susceptibility testing of microorganisms isolated from patients specimens The main goal of EQAS is to improve the quality and strengthen the capabilities of laboratories for correct identification and susceptibility testing The experiences of error as reported for the various groups of laboratories in our programs in the different microbiology EQAS programs was relative and may not represent the exact rate of error experienced in actual practice. Because of following(i)the generally

accepted opinion that external proficiency testing results represent the best effort of some laboratories ,and it has been reported that the proficiency of laboratories as measured in blinded studies ,in which laboratories did not know they were being tested ,was lower than their proficiency testing under condition when the laboratories knew they were being tested, (ii) The differences among the laboratories in the extent of identification reported for certain types of samples;(iii)the variation in occurrence of microbial species in different patients population ,(iv)the differences in frequency with which various microbial; species encountered by individual laboratories and the difference in the types and quality of patients specimens tested by individual laboratories. ([11,17])

Many laboratories were restructured so that they no longer had experienced medical technologist or pathologist /or medical microbiologist dedicated to the performance of microbiology testing. However, they still chose to perform all levels of laboratory testing for diagnosis of infectious disease .The laboratories that were not restructured and that maintained testing done by experienced, dedicated personnel continued to show improvement in performance on the proficiency tests samples, by the end of the observation period, they made errors in bacterial identification and susceptibility testing <5% of the time. Those laboratories that were restructured and staffed with generalists as well as increased the variety of what they offered continued to make many serious errors in identification and susceptibility testing .This finding is likely because they down-graded their technical expertise by employing less- experienced personnel ,in contrast to the laboratories that maintained staff with focused expertise . In doing some the restructured laboratories double the number of errors made in bacterial identification. ([17,18,19])

There are other factors that may affected the identification and susceptibility tests and standardized methods are more likely to be reproducible than unstandardized methods. Quality assurance is the overall process by which the quality results can be guaranteed. A major part of this process is the internal quality control testing which is routinely undertaken to monitor the precision and accuracy of the test procedures, the performance of regents, and the performance of the person carry out the tests. However, there are additional aspects that contribute to quality assurance, including regular participation in external quality assessment schemes, internal quality assessment of material such as culture media,

reagents and the validation process, in which atypical or contradictory results can be detected. Education is an important benefit of the quality assurance process as an understanding of the techniques, together with their limitations and pitfalls. Contributors in EQAS significantly to the recognition, resolution and avoidance of errors [3,17,18] Unfortunately many of laboratories in our county do not have material and reagents for performance these tests and internal quality controls are very poor. For this reason the majority of laboratories have problems for identification of unusual microorganisms.

Figure 1

Table 1: Results of identification and Susceptibility testing of

No	Region	Lab No	P	NP	Three Score	Intermediate Score	Zero Score	ID Mean Score	AST Mean Score
1	Tehran	271	250	21	128	109	13	2.44	4.14
2	Other cities	1034	872	162	395	379	98	2.17	3.5
3	Total	1305	1122	183	523	488	111	2.6	3.6
Percent	-	-	-	86	14	46.6	43.5	9.9	-	-

P= participated .NP= No participated, ID= Identification, AST= Antimicrobial Susceptibility Testing

Figure 2

Table 2:Results of susceptibility testing for

	TE	NA	CIP	AM	SXT
Tehran	132(52.8%)	217(86.8%)	241(96.4%)	160(64%)	227(90.8%)
Other Cities	446(51.2%)	706(81%)	806(92.4%)	398(45.6%)	781(89.6%)
Total Mean Score	0.5	0.8	0.9	0.5	0.9
Mean Score of Tehran	0.5	0.9	0.96	0.6	0.9
Mean Score f Other Cities	0.5	0.8	0.9	0.45	0.9

TE= Tetracycline, NA=Nalidixic acid, CIP=Ciprofloxacin, AM=Ampicillin, SXT trimethoprim-sulfamethoxazole.

Figure 3

Table 3: Results of identification of

No	Region	Lab No	P	NP	Three Score	Intermediate Score	Zero Score	ID Mean Score
1	Tehran	271	250	21	184	42	24	2.41
2	Other cities	1034	872	162	583	169	120	1.77
3	Total	1305	1122	183	767	211	144	2.3
Percent	-	-	-	86	14	68.4	18.8	12.8	

P= participated ,NP= No participated, ID= Identification,

CONCLUSION

This study revealed that the majority of microbiology laboratories were able for identification of S.parathyphi B and S.aureus. Nearly 50% of laboratories produced incorrect susceptibility testing answer according to S.paratyphi B for tetracycline and ampicillin.

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