

Diagnosis of Bioagents and Emerging Diseases

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Abstract

We have developed a program to assist the physician in the diagnosis of a patient suspected of suffering from exposure to a biological agent or an emerging disease. Since physicians may need the program in a variety of situations, it has been implemented with a web interface allowing access from any computer with internet access. The program uses the symptoms and examination findings that will be available early in the patient encounter, enabling the physician to take appropriate measures. It uses a knowledge base of probabilities of the findings given the causes and computes the probability of each possible cause assuming uniform priors. From this it puts together a differential of the most likely causes. The program has shown in limited testing that it produces diagnoses reasonably consistent with those of an expert.

Keywords: diagnosis, web-based, bioagent, bioterrorism

Introduction

Occasionally physicians encounter patients with unusual symptom complexes that represent a rare disease or a new disease. This may occur as the result of an attack with a biological weapon or the outbreak of an emerging disease such as SARS not previously encountered in the locale of the physician. In both cases, the physician is confronted with a set of findings and circumstances for which past experience may be insufficient to determine an appropriate diagnosis. We have developed a web-based diagnosis program to assist the physician in diagnosing such patients.

There have been two main approaches to assisting physicians with unusual diagnoses. Traditionally, physicians have relied on educational courses, textbooks or journals to provide such information. With the advent of the Internet, medical information has been more widely accessible. A search of the Web reveals a variety of materials, ranging from those provided by the CDC to ones customized to local health organizations[1]. One limitation with such an approach is that the physician may not adequately consider rare diagnoses when confronted by a patient with suspect symptoms. Most physicians may be unfamiliar with unusual disease processes and may not have adequate diagnostic resources. The resulting misdiagnoses and delay may lead to greater morbidity and mortality in the community[2].

The second approach is surveillance[3]. That is, detecting the presence of unusual diseases by presenting symptom complexes among the patient population. Because of the similarity of the initial findings of many biological agents and new infections to common diseases, unusual patterns in patient demographics or numbers may be the strongest clue that an outbreak is occurring. Thus, surveillance should be a component in any program to detect unusual diseases. However, even if clinicians are alerted to a possible outbreak, they are still confronted with the problem of

diagnosing patients with unusual symptoms. The program reported here is designed to assist the physician who suspects that the patient's illness is due to an emerging disease or biological agent.

Conclusion

We have developed a program for the diagnosis of biological agents and emerging diseases. The program has a web interface that allows access from any computer with internet access. The program uses the symptoms and examination findings that will be available early on in the patient encounter, enabling the physician to take appropriate measures. Thus, whenever the physician suspects that such a disease might be involved, either because of external warnings or internal surveillance, this program can be used to narrow the focus to the possible agents involved. Since the program has no way of determining prior probabilities for the diseases, the physician still needs to weigh this information against other possible causes for the findings. The program has shown in limited trials that it produces diagnoses reasonably consistent with those of an expert.

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