The concept of opportunistic infection can be traced to John P. Utz, who in 1962 introduced a symposium on opportunistic fungal infection in which these authors participated.1 Utz described some of the circumstances in which both true pathogens and, to a greater extent, the so-called nonpathogenic fungi are opportunistic, meaning that host conditions were such that the fungi thrived and gave rise to illness.2

About the same time, the term superinfection was used by Louria and Kaminski, in a limited sense in 1962 and in an expanded sense in 1982.3,4 In 1967, compromised host was introduced by Ruskin and Remington.5 This concept was adopted and made more specific in the 1970s. Quie and colleagues in 1980 and 1982 organized the first international meetings on infections in the immunocompromised host, and the Immunocompromised Host Society was formed in 1985.1

Now, after 38 years, the original term, opportunistic, is still remarkably popular. Between 1996 and 1999, about 121 titles and 1072 abstracts cited opportunistic microbes or infections, although 311 titles and 1692 abstracts referred to the immunocompromised host; about 27% of titles and 38% of abstracts used "opportunistic," compared with 71% of titles and 60% of abstracts using "immunocompromised host."

The term opportunistic microbes is usually applied to the protozoa, e.g., Cryptosporidium parvum and Toxoplasma gondii; and microsporida to fungi, e.g., Pneumocystis, Cryptococcus neoformans, Candida spp, Aspergillus, and Rhizopus; to bacteria, e.g., Listeria monocytogenes, Mycobacterium avium complex, Mycobacterium tuberculosis; and to viruses, e.g., cytomegalovirus.6,7

Such infections have increased in numbers and significance in the past 20 years because of the complications of the acquired immunodeficiency syndrome (AIDS), transplant-related immunosuppression, and more aggressive anti-neoplastic therapy, all with the common denominator of an immunocompromised host.

In general, immunocompetent individuals restrict the multiplication of these organisms and sometimes eliminate them, whereas immunocompromised patients may be unable to do so, or become re-infected. However, primary prophylaxis often prevents infection from becoming illness.5

Both normal flora and ordinary pathogens have been considered opportunistic when they produce infection in the immunocompromised host; therefore, the definition does not depend on the microbes involved but on conditions in the host. All the definitions refer to altered hosts. For example:

• The Oxford English Dictionary (2nd ed. 1989) defines opportunistic as "a micro-organism not normally pathogenic but becoming so in certain circumstances, as when the body is rendered vulnerable."

• The Encarta World English Dictionary (1999) defines opportunistic in the medical sense as "life-threatening when immunity is low, as organisms or relatively minor disease that is not normally serious but can become pathogenic or life-threatening when the host has a low level of immunity."

• Stedman's Medical Dictionary (27th ed. 2000) defines opportunistic as "organisms capable of causing disease only in a host whose resistance is lowered (e.g., by other diseases or by drugs)."

Authors of textbooks provide various descriptions of opportunistic infection as caused by normal flora or by transient microbes when the host is immunocompromised, suggesting that the two most important factors are exposure and opportunity, hence "opportunistic." Opportunity produces disease only if there is a defect.

What do authors using the term opportunistic organisms imply? There is an inference to the presence of a microbial quality that permits these organisms to take advantage of the opportunity offered by an immunocompromised state. It implies a pseudocognitive microbial quality by which certain organisms become pathogenic in immunocompromised hosts. However, attributing such anthropomorphic concepts misrepresents...
the capacities of microbes. The infecting microbes do not change their pathogenicity and neither is the reduced defense-potential of immunocompromised hosts selective for microbes.

Hence, speaking of opportunistic microbes makes a distinction without meaning. All pathogenic microbes, and probably all microbes, are opportunistic in the sense that they reproduce when possible under the circumstances present in nature or in the host. Opportunism is a characteristic of living things in their struggle for survival and reproduction. This appears to be better recognized, because in the past 4 years, only 1 title and 20 abstracts referred to opportunistic agents or microbes and most references are to opportunistic infections.

However, analyzed in this sense, "opportunistic infection" no longer is meaningful in a pathogenetic sense. Still, it is used ten times as frequently as "opportunistic microbe." Although the former term is shorter and more euphonious, it is also incongruous.

No common pathogenic microbial factors have been identified with opportunism. Because the decisive factor is the degree of immunocompromise of the host, immunocompromise-dependent infection (IDD) is a more descriptive term. This pathogenetically and semantically compatible term is advantageous for teaching and general communication.

As in politics and literature, word use conveys concepts in medicine. The medical community should strive for a scientific terminology and avoid terms that misrepresent pathogenesis. "Opportunistic microbe" and "opportunistic infection" illustrate how catchy terms used in the introduction of a then novel conference, become rooted, and how meaningless concepts are unthinkingly perpetuated in medical lingo.

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REFERENCES


Comment

Donald Louria, MD

Dr. Frenkel argues for a modicum of precision in the use of words and terms. He is to be commended for that. There is one issue related to his choice of the term immunocompromise-dependent. Suppose the host deficit is in polymorphonuclear leukocyte function or numbers. Most authors consider immune deficits either antibody-related or cell-mediated; polymorphonuclear defects are often not included in the term immunocompromised. Perhaps the overall term should be compromise-dependent infections, "immunocompromise-dependent" being a subcategory.