INTRODUCTION

Invasive diseases: new vaccines and vaccination strategies

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Invasive bacterial diseases (meningitis, sepsis, bacteremic pneumonia, etc.) are a major cause of morbidity, and are characterized by a high fatality rate and a high frequency of serious and often invalidating complications [1, 2].

The symptoms of these diseases display scant specificity with regard to the etiological agent. However, it is extremely important to know which specific agent is involved, not only for therapeutic purposes and prophylaxis for those who come into contact with the patient, but also to implement primary prevention.

Glycoconjugate vaccines for the prevention of infections due to type b *Haemophilus influenzae* (Hib), types ABC and W135 *Neisseria meningitidis* (meningococcus) and 13 serogroups/types of *Streptococcus pneumoniae* (pneumococcus) are currently available and are efficacious in small children [3- 5]. It is essential to know the epidemiology of the diseases caused by these pathogens, in order to evaluate the percentage of preventable cases and the impact of extensive vaccination campaigns.

In 1994, a special surveillance network was set up by the Istituto Superiore di Sanità. The data gathered by this network have provided, and continue to provide, a precise picture of the trends of these invasive diseases. For example, among 1348 cases of invasive disease reported in 2010, 851 of these were caused by *S. pneumoniae*, 150 by *N. meningitidis* and 70 by *Haemophilus influentiae* [6].

In recent years, we have been witnessing a significant change in the natural history in the spread of infections due to *S. pneumoniae*, thanks to the introduction of the heptavalent conjugate vaccine in many advanced countries. Moreover, the 13-valent conjugate vaccine has been available in Italy for several years, providing an even more effective weapon against the invasive diseases caused by this pathogen, such as meningitis and pneumonia [5].

The monovalent conjugate vaccine against meningococcus C found considerable success in those countries, such as the United Kingdom, where extensive vaccination campaigns had been carried out [7]. Even smaller-scale strategies, such as the vaccination of children at risk,13-month-old infants and adolescents, which was introduced in Italy through the 2005-07 National Vaccination Plan, are beginning to impact on the circulation of meningococci of serogroup C. This is demonstrated by the predominance of serogroup B among the meningococci responsible for invasive disease in Italy in recent years [6].

Given the resemblance between the capsular polysaccharide of meningococcus B and human antigens, the research group of Novartis Vaccines and Diagnostics has made major efforts in the last few years to develop a universal vaccine for meningococcus B [8, 9]. Supported by top-level scientific research, these efforts enabled the elusive mechanisms with which this pathogen is endowed to be better understood. In particular, the identification of proteins which play important roles in the adhesion of the microorganism to the cells of the respiratory tract, in its survival in the bloodstream, etc.

The goal of producing vaccines covering the vast range of possible invasive pathogens has gradually been achieved. However, further research will be necessary, bearing in mind the considerable adaptive capabilities of these potential agents of disease, for which man is the only natural host.

References

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