Monoclonal Antibodies: an Introduction

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Monoclonal antibodies (MCA) are antibodies that are identical and derived from one type of immune cell, each a clone of a single parent cell. The extraordinarily specific nature of these antibodies is what makes MCA unique and opens up the possibilities of revolutionary applications including targeted therapy and other diagnostic applications (such as pregnancy test and testing for acquired immune deficiency syndrome (AIDS). MCA have dramatically changed how we think about and treat autoimmune diseases such as rheumatoid arthritis (RA), inflammatory bowel disease (IBD) and multiple sclerosis (MS).

The concept of a "magic bullet" has been around for greater than a century. In 1900, Paul Ehrlich, a Nobel laureate, suggested that it may be possible to create a compound which can target diseased cells specifically. His life and achievements were depicted in the 1940 academy award nominated movie, "Dr. Ehrlich's magic bullet," which focused on arsphenamine, his cure for syphilis. Although the concept of a magic bullet was a straightforward one, it would take several more generations to be able to target specific cells with pinpoint precision at a cellular level. The credit for inventing monoclonal antibodies goes to George Kohler and Cesar Milsten. In 1975 both received a Nobel Prize for the discovery. In 1988 Greg Winter pioneered the technique to humanize monoclonal antibodies.

Monoclonal antibodies were typically produced by fusing myeloma cells with splenic cells from a mouse which was immunized against a particular antigen. Mouse antibodies, being slightly different from human antibodies, produced an inflammatory reaction when injected into humans, resulting in infusion reactions and the production of neutralizing antibodies which would render the MCA useless in a small percentage of patients. In order to overcome these difficulties various different kinds of approaches have been used, leading to the production off chimeric (partly mouse and partly human) and fully humanized antibodies.

Treatment with monoclonal antibodies does not usually result in a "cure". Unlike antibiotics, which have the ability to eliminate pathogens, and thus result in a cure, MCA are designed to target and modulate specific immune pathways. Discontinuation of treatment with an MCA may result in re-occurrence of disease activity.

Greater than 20 monoclonal antibodies have been approved by the FDA and are being increasingly used to treat autoimmune and neoplastic disorders. With recent improvements in techniques involved in the production of MCA, the stage is set for science to take yet another leap forward. Greater than 200 monoclonal antibodies are currently in development or are awaiting FDA approval.

Disclosure of Financial Interests

Syed A. Rizvi, MD, discloses the following Consultant/Speakers Bureau/Grant Research Support: Teva, Biogen, Serono, Novartis, Acorda.

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