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PolyScan: Comprehending Human Polymicrobial Infections for Vector-Borne Disease Diagnostic Purposes

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Abstract : The Germ Theory (one infectious determinant is equal to one disease) has unarguably evolved our capability to diagnose and treat infectious diseases over the years. Nevertheless, the advent of technology, climate change, and volatile human behavior has brought about drastic changes in our environment, leading us to question the relevance of the Germ Theory in our day, i.e. will vector-borne disease (VBD) sufferers produce multiple immune responses when tested for multiple microbes? Vector diseased patients producing multiple immune responses to different microbes would evidently suggest human polymicrobial infections (HPI). Ongoing diagnostic tools are exceedingly unequipped with the current research findings that would aid in diagnosing patients for polymicrobial infections. This shortcoming has caused misdiagnosis at very high rates, consequently diminishing the patient's quality of life due to inadequate treatment. Equipped with the state-of-art scientific knowledge, PolyScan intends to address the pitfalls in current VBD diagnostics. PolyScan is a multiplex and multifunctional enzyme linked Immunosorbent assay (ELISA) platform that can test for numerous VBD microbes and allow simultaneous screening for multiple types of antibodies. To validate PolyScan, Lyme Borreliosis (LB) and spondyloarthritis (SpA) patient groups (n = 54 each) were tested for Borrelia burgdorferi, Borrelia burgdorferi Round Body (RB), Borrelia afzelii, Borrelia garinii, and Ehrlichia chaffeensis against IgM and IgG antibodies. LB serum samples were obtained from Germany and SpA serum samples were obtained from Denmark under relevant ethical approvals. The SpA group represented chronic LB stage because reactive arthritis (SpA subtype) in the form of Lyme arthritis links to LB. It was hypothesized that patients from both the groups will produce multiple immune responses that as a consequence would evidently suggest HPI. It was also hypothesized that the multiple immune response proportion in SpA patient group would be significantly larger when compared to the LB patient group across both antibodies. It was observed that 26% LB patients and 57% SpA patients produced multiple immune responses in contrast to 33% LB patients and 30% SpA patients that produced solitary immune responses when tested against IgM. Similarly, 52% LB patients and an astounding 73% SpA patients produced multiple immune responses in contrast to 30% LB patients and 8% SpA patients that produced solitary immune responses when tested against IgG. Interestingly, IgM immune dysfunction in both the patient groups was also recorded. Atypically, 6% of the unresponsive 18% LB with IgG antibody was recorded producing multiple immune responses with the IgM antibody. Similarly, 12% of the unresponsive 19% SpA with IgG antibody was recorded producing multiple immune responses with the IgM antibody. Thus, results not only supported hypothesis but also suggested that IgM may atypically prevail longer than IgG. The PolyScan concept will aid clinicians to detect patients for early, persistent, late, polymicrobial, & immune dysfunction conditions linked to different VBD. PolyScan provides a paradigm shift for the VBD diagnostic industry to follow that will drastically shorten patient's time to receive adequate treatment.

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