Foreword

Revealing the Mysterious Veil of Prion Diseases Under the Framework of China CDC

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Prion disease (PrD) or transmissible spongiform encephalopathy (TSE) is a group of transmissible and fatal neurodegenerative diseases affecting humans and many animal species. Clinically, PrD, either in humans or in animals, has been documented for more than hundreds of years, e.g., scrapie in the early 18th century and human Creutzfeldt-Jakob disease (CJD) in the early 20th century (*1*–*2*). However, the hypothesis and conception of "prions" have been gradually accepted only since the 1980s. As an unconventional infectious agent without nucleic acids, the principle of the "prion" is unsolved conformational changes from host normal membrane protein PrP^{c} to abnormal pathogenic scrapie-like prion protein (PrP^{Sc}) ((*3*). The hypothesis of the prion concept mostly explains the pathogenesis of PrD; however, there are still many gaps that need to be filled. More importantly, "prion theory" opens a completely new window in biology, possibly highlighting a new type of life.

It has long been known that the tissues of the central nerve system (CNS) from human and animal PrD are infectious; however, animal PrD (e.g., scrapie in sheep and goats) seems to not have the ability to infect humans. The outbreak of bovine spongiform encephalopathy (BSE) in the 1980s and subsequent emergence of variant CJD (vCJD) in the 1990s were one of the largest events in human and animal public health, causing huge panic in society and great economic loss (*4*). Since then, both the World Health Organization and the World Organization for Animal Health have conducted decades-long surveillance for human and animal PrD. After decades of unremitting efforts, the disease burdens of BSE and vCJD and their threats on public health are efficiently reduced.

As a kind of neurodegenerative disease, PrD shares many similarities as other common neurodegenerative diseases, such as Alzheimer's disease (AD) and Parkinson's disease (PD), but displays remarkable differences in clinical, neuropathology, and laboratory examinations. There are three main types of human PrD according to the etiology, namely the sporadic, genetic, and acquired forms. Lacking typical neurological manifestations, PrD is usually indistinguishable from other neurological diseases, especially in the early stages. The definite diagnosis of human PrD still relies on special examinations of brain tissues, mostly postmortem brains. In the past twenty years, many new diagnostic tools for PrD have been established and comprehensively evaluated, among them, real-time quaking-induced conversion (RT-QuIC) that is able to detect the trace of PrP^{Sc} in brain, cerebrospinal fluid, and skin has shown reliable advantages in the diagnosis of PrD (rD (*5*–*6*). However, we are still lacking specific prophylactic and therapeutic tools for PrD.

Due to its unique characteristics in biology, prion studies have been one of the research hot topics in biomedicine worldwide. Historically, there were two Nobel laureates in the field of prions and PrD — Prof. C. Gajdusek in 1976 and Prof. S. Prusiner in 1997, who proposed and proved novel biomedical concepts and theories. In the 1990s, prion study received even more attention because of its biological significance and public health importance. The mysterious veil of prions is gradually being lifted.

Talking about prion study in China, we must honorably mention a respective senior scientist, Academician Prof. Tao Hung from China CDC. He performed the first prion experimental rodent assay in the 1980s, at that time human PrD or CJD was poorly understood in the mainland of China. Afterwards, he and the subsequent staff continued and expanded the prion study. A national surveillance for human PrD has been conducted since 2006 under the leadership of China CDC. A series of laboratory tests for PrD diagnosis based on various types of specimens, including RT-QuIC, was developed in the Department of Prion Disease, National Institute for Viral Disease Control and Prevention, China CDC. Those public health practices revealed the features of Chinese PrD patients, meanwhile, supplied irreplaceable laboratory service for hundreds of hospitals in China. Additionally, several basic and applied research studies in the field of prions were conducted, which contributed greatly to understanding the infectivity, pathogenesis, and neuroinflammation of prions.

The papers in this special issue reviewed and summarized the main findings from the prion research group in

China CDC, focusing on the characteristics of Chinese PrD cases based on surveillance, research, and diagnostic platforms for PrD, the disturbance and dysfunction in CNS during prion infection, and the inflammatory reactions in prion infected brains.

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