

Motor Function Test Protocol for Parkinsonian Triad in Rodent Model of Parkinson's Disease

Abstract

Over the years, there has been an increase in research on parkinsonism in basic and translational neuroscience. Parkinson's disease (PD) is a progressive neurodegenerative disorder vehemently associated with motor function deficits and other unique features collectively called the Parkinsonian triad, which slightly differs from other movement disorders such as Wilson's disease, tardive dyskinesia, chorea, and athetosis. Parkinsonian triad combines three major motor phenotypes of PD including bradykinesia, rigidity, and resting tremors. Hence, there is a need to review motor deficits protocols to create a set of behavioral protocols that critically address the parkinsonian triad's quantification in PD models. Literature search on Medline and PubMed was conducted to access the articles on the motor function test in a rodent model of Parkinsonism. Search terms include parkinsonism, parkinsonian triad, bradykinesia, rigidity, resting tremors, stepping test, parallel bar test, pole test, and cylinder test. This review shows that bradykinesia characterized by difficulty in movement initiation could be assessed using a stepping test by measuring stepping length and time taken to initiate movement on a wooden ramp. It can also be assessed using a parallel bar test by measuring the time taken to make 90° turn. This turning hesitation is one of the critical features of akinesia. Rigidity is associated with an increase in muscle tone; it is assessed by using a pole test to measure the time taken for the rodent to slide down a smooth pole. Resting tremors is an involuntary, oscillatory movement of the distal part of the upper limb when not performing an action. It could be graded using a cylinder test when the rodent suspends its forelimb on the air in an attempt to climb the wall of the cylinder. In conclusion, the examinations and quantifications of the Parkinsonian triad are required to diagnose parkinsonism in rodent models.

Keywords: Cylinder test, bradykinesia, parallel bar test, parkinsonian triad, parkinsonism, pole test, resting tremors, rigidity, stepping test

Introduction

Parkinson's disease (PD) is a chronic and progressive brain disorder associated with many motor and nonmotor deficits.^[1,2] These deficits result from progressive degeneration of dopamine neurons in the substantia nigra pars compacta (SNc), leading to loss of dopamine in the basal ganglia.^[3-5] In most cases, PD occurs sporadically and is proposed to result from a complex interaction between environmental and genetic factors.^[6,7]

For an excellent research to be carried out on parkinsonism using an animal model, it should fulfill the following criteria;^[8] first, face validity criterion; the animal model should express major and most common

phenotypes of human PD, otherwise known as the parkinsonian triad. Second, constructive validity criterion; the model should be created with a sound scientific rationale, and finally, the predictive validity criterion, which indicates that the model should have the propensity to respond to therapy comparably to clinical therapy.

Parkinsonian Triad

Parkinsonian triad is the combination of bradykinesia, rigidity, and resting tremor, which are the three main phenotypes of PD.^[8,9] These three phenotypes are collectively called Parkinsonism or Parkinsonian syndrome.^[10] The diagnoses of Parkinsonism can be made with the clinical manifestations of at least two of the triad.^[10,11]

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