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Original Article

Effects of Cognitive and Depressive Status on Empathy in Healthy Elderly, Amnestic MCI, and Dementia of the Alzheimer's Type

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ABSTRACT

Background and Purpose: Empathy comprises cognitive and emotional components. However, the impairments in empathy among individuals with mild cognitive impairment (MCI) and dementia of the Alzheimer's type (DAT) are not well understood, particularly in the context of depression, which may exacerbate these deficits. This study aimed to evaluate the effects of neurodegeneration and depression on empathetic abilities.
Methods: The study included 31 healthy elderly (HE) individuals, 30 patients with amnestic multi-domain MCI (amMCI), and 30 patients with DAT. Empathy was assessed using the Korean-Multifaceted Empathy Test (K-MET), and the Interpersonal Response Index (IRI). Participants were classified as depressed or non-depressed using the Geriatric Depression Scale. A two-way MANOVA was conducted to examine differences in empathy based on group and depressive status.
Results: A significant interaction between group and depressive status was found for both cognitive and emotional empathy on the K-MET, but not on the IRI. In the depressed group, cognitive empathy scores were lower in the order of HE, amMCI, and DAT. Similarly, in the non-depressed group, the HE group performed better than both amMCI and DAT, with no significant difference between the latter two. Regarding emotional empathy, the depressed HE group scored higher than both amMCI and DAT, with no significant difference between these groups. In the non-depressed group, emotional empathy declined in the order of HE, amMCI, and DAT.
Conclusions: These findings indicate that both neurodegeneration and depression significantly impair empathetic abilities, with declines in cognitive and emotional empathy evident at the MCI stage, regardless of depressive status.

Keywords: Empathy; Depression; Mild Cognitive Impairment; Dementia of the Alzheimer's Type

INTRODUCTION

Empathy plays a crucial role in understanding and facilitating social functioning by discerning the intentions and behaviors of others.[1,2] It supports effective interpersonal interactions and adaptation to the social world.[3] Empathy can be categorized into two

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main types: cognitive empathy and emotional empathy. Cognitive empathy refers to the ability to understand another person's emotions and perspectives.[4] It involves recognizing emotional cues, such as facial expressions, body language, voice tone, and contextual factors, enabling individuals to discern what others are feeling or thinking. Crucial for effective communication, conflict resolution, and social interaction,[5] cognitive empathy relies on perspective-taking and emotion recognition without necessarily involving sharing emotional experience.[6] In contrast, emotional empathy is characterized by emotional response that occurs when observing or perceiving another person's emotional state.[7,8] This type of empathy allows individuals to resonate with others' feelings and experience a shared emotional connection. Emotional empathy can be spontaneous and automatic. It often triggers feelings of compassion, sorrow, and/or joy in response to another person's emotional expressions. It is important for forming deep emotional bonds and fostering prosocial behaviors such as helping and comforting others.[9] These distinctions have been well-documented in the literature.[10-13] In summary, while cognitive empathy facilitates understanding and navigating social interactions, emotional empathy is essential for emotional bonding and responding with care and concern. Understanding distinction and interaction between these two types of empathy can provide valuable insights into social cognition, mental health, and interpersonal relationships.

Empathy development follows an inverted U-shaped trajectory across the lifespan, with emotional expression and functioning generally increasing in early life but declining in old age. Research has shown that older adults have diminished cognitive empathy compared to younger individuals due to their reliance on stereotypical information and reduced capacity for differentiated perspectives on themselves and others.[14-20] However, findings on emotional empathy in older adults are mixed, with some studies showing no significant age-related differences[1,21,22] while others indicating reduced emotional empathy in older adults.[23]

Previous studies have found empathy impairments in patients with mild cognitive impairment (MCI) and patients with dementia of the Alzheimer's type (DAT), though results are inconsistent. Cognitive empathy is typically reduced in DAT patients compared to cognitively healthy older adults,[24,25] while emotional empathy has been consistently reported to be lower in DAT patients.[26] While it is clear that patients with DAT are generally less empathetic than healthy older adults, findings regarding empathy in MCI are mixed. Some studies have suggested that people with MCI exhibit emotional empathy levels similar to healthy older adults,[27] while others have reported comparable empathy levels between MCI patients and those with DAT.[28,29] These discrepancies might have stemmed from reliance on subjective self-report measures, underscoring the need for more objective assessments of empathy.

Depression, linked to difficulties in emotion regulation and heightened sensitivity to others' distress, can lead to emotional overwhelm.[30-32] Studies on cognitive empathy in patients with major depressive disorder have consistently found impairments.[33-37] However, research on emotional empathy have yielded mixed results, with some studies indicating that depressed individuals perform worse than non-depressed individuals,[35,38-41] while others reporting no significant differences.[36]

In late life, reactive depression often arises due to stressors such as physical decline, reduced social contact, and loss of a spouse. Depression affects empathy across various age groups, including both older adults and non-elderly individuals. It is also prevalent among patients with MCI and DAT.[42-44] In addition to clinical depression, subclinical depression is also common in both neurodegenerative and non-neurodegenerative elderly populations and serves as a risk factor for developing clinical depression and impaired social functioning.[45,46] Therefore, further investigation into the impact of depression on social functioning, particularly empathy, is needed, especially in older populations. Furthermore, given that depression is a known risk factor for conversion of MCI to dementia,[47] exploring the interplay between depression, empathy, and dementia is also crucial.

This study aimed to investigate whether cognitive and emotional empathy decline with neurodegeneration and to evaluate the impact of depression and neurodegeneration on empathy. By addressing these objectives, this study sought to enhance our understanding of empathy in the context of aging and neurodegenerative disorders, with the potential to inform more effective interventions and support strategies.

METHODS

Participants

This study included 31 healthy elderly (HE) individuals from a local community who consented to participate. These participants passed a health screening questionnaire[48] and scored above the 16th percentile on the Korean Mini-Mental State Examination, 2nd Edition: Standard Version (K-MMSE~2:SV).[49] Their Korean-Instrumental Activities of Daily Living (K-IADL)[50] scores were below 0.40, indicating normal daily living functions.

Amnestic multi-domain MCI (amMCI) and DAT groups each consisted of 30 patients with memory deficits who had visited the neurology department. These patients underwent a comprehensive neuropsychological assessment using the Seoul Neuropsychological Screening Battery, 2nd Edition (SNSB-II),[51] the K-IADL, and the Clinical Dementia Rating (CDR).[52] Clinical diagnoses of amMCI and DAT were based on the results of these tests and brain imaging evaluated by two neurologists.

amMCI patients were diagnosed based on modified Petersen's criteria,[53] with performance at least 1.0 standard deviation below the norm in memory and one or more other cognitive domains of the SNSB-II. They scored 0.5 for CDR-Global Scores (CDR-GS) with K-IADL scores below 0.40, indicating no significant impairment in daily living. DAT patients were diagnosed according to the NINCDS-ADRDA criteria.[54] They showed a decline of 1.0 standard deviation or more below the norm in memory and one or more other cognitive domains of the SNSB-II. Their CDR-GS scores were 1 and their K-IADL scores were 0.40 or higher, indicating significant impairment in daily living.

All participants were divided into a depressed group (n=46) and a non-depressed group (n=45) based on a Geriatric Depression Scale (GDS)[55] cutoff score of 18.[56] The depressed group included 16 HE individuals, 15 patients with amMCI, and 15 patients with DAT. The non-depressed group similarly comprised 15 HE individuals, 15 patients with amMCI, and 15 patients with DAT.

Measures

Participants underwent a variety of cognitive assessments and self-report questionnaires, including the K-MMSE~2:SV, K-IADL, SNSB-II, CDR, and GDS, to ensure that they met inclusion and diagnostic criteria. The Korean Multifaceted Empathy Test (K-MET,

Supplementary Data 1)[57] and the Interpersonal Reactivity Index (IRI, **Supplementary Data 2**)[5] were administered to assess participants' cognitive and emotional empathy.

K-MET

The Multifaceted Empathy Test (MET) was originally developed by Dziobek[12] and later validated by Lee in Korea,[57] where it became known as the K-MET. The K-MET comprises 20 images depicting real-life situations, each followed by two types of questions. The first type contains cognitive empathy questions to assess participants' ability to identify emotions of individuals in images, with questions such as "What emotion do you think this person is feeling?" These questions were in a multiple-choice format. Each question was scored 1 point with a maximum score of 20 points. The second type contains explicit emotional empathy questions to measure participants' emotional responses to images with questions like "How sad (or happy) do you feel when you see this person?" These questions were rated on a 9-point Likert scale, ranging from 1 (not at all) to 9 (very much so), capturing the degree to which participants could emotionally identify with the emotion depicted. In this study, the overall empathy score was calculated by averaging responses to the 20 questions, which resulted in a score between 1 and 9, with a higher score indicating a greater capacity for emotional empathy.

IRI

The IRI, developed by Davis[5] and translated into Korean by Park,[58] is a self-report questionnaire designed to measure both cognitive and emotional empathy. It consists of 28 items across four subscales (Perspective-Taking, Fantasy, Empathic Concern, and Personal Distress), with seven items per subscale. However, prior studies have typically used only the Perspective-Taking and Empathic Concern subscales, excluding the Fantasy and Personal Distress subscales[59] due to their low correlations with interpersonal function and sensitivity to others. This trend is further supported by evidence that the Fantasy subscale is influenced by linguistic function and the Personal Distress subscale shows low correlation with empathy in older adults.[60] Consequently, this study focused solely on Perspective-Taking and Emphatic Concern subscales. The Perspective-Taking subscale assesses cognitive empathy (e.g., "When I'm upset at someone, I usually try to 'put myself in his shoes' for a while"), while the Empathic Concern subscale evaluates emotional empathy (e.g., "Other people's misfortunes do not usually disturb me a great deal"). Participants rated each item on a 5-point Likert scale (0: not at all, 4: very much so), with higher scores indicating greater empathy. The maximum possible score for each subscale was 28.

Experimental procedure

For the HE group, eligible participants who voluntarily expressed their willingness to participate in this study gave informed consent by signing a consent form. Following this, a preliminary examination was conducted. For the amMCI and DAT groups, individuals diagnosed with amMCI or DAT based on clinical evaluations and diagnostic criteria by neurologists were approached. They signed the consent form if they agreed to participate. For patients with legal guardians, the study was explained to their guardians and their consent was obtained before they participated in this study.

Participants who met the selection criteria subsequently completed the K-MET and the IRI. The K-MET was administered using Python 3.8 on a PC with an Intel® Core™ i5-7300HQ CPU. Stimuli were displayed on a 13.3-inch LED monitor with a resolution of 1920 x 1080 and a refresh rate of 2.50 GHz. Responses were recorded via a keyboard. The testing session lasted approximately 20–25 minutes per individual. After completing experiments, participants were debriefed about this study and received a token of appreciation.

Statistical analysis

A series of one-way analyses of variance (ANOVA) were performed to examine differences in age, years of education, cognitive function, instrumental activities of daily living, and CDR across the HE, amMCI, and DAT groups. Post-hoc analyses with Bonferroni correction were performed to further investigate significant findings. Sex differences across groups were assessed using a chi-squared test.

This study employed a 3 (groups: HE, amMCI, DAT)×2 (depressive status: depressed, non-depressed) between-subjects design, with both factors as independent variables. The dependent variables were cognitive empathy and emotional empathy, assessed using the K-MET and the IRI, respectively. To examine differences in empathy based on group and depressive status, a two-way multivariate analysis of variance (MANOVA) was performed. For cases showing significant main effects or interactions, post-hoc tests and simple main effects analysis were conducted. All statistical analyses were carried out using SPSS version 29.0 (IBM Corp., Armonk, NY, USA).

Ethics statement

The present study protocol was reviewed and approved by Institutional Review Board (IRB) of Hallym University Sacred Heart Hospital (2022-01-013-001) and IRB of Hallym University Dongtan Sacred Heart Hospital (2022-03-009-004).

RESULTS

Demographic characteristics of participants

Age, sex, and years of education did not differ significantly among the HE, amMCI, and DAT groups. However, K-MMSE~2:SV, K-IADL, and CDR showed significant differences (**Table 1**). Specifically, K-MMSE~2:SV was significantly higher in the HE group than in both the amMCI and DAT groups. It was also significantly higher in the amMCI group than in the DAT group. K-IADL scores were significantly lower in the HE and amMCI groups than in the DAT group, but not significantly different between the HE and amMCI groups. CDR-GS and CDR-Sum of Boxes (CDR-SB) were significantly higher in the DAT group than in the HE and amMCI groups. They were also significantly higher in the amMCI group than in the HE group.