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Cognitive Rigidity in Patients with Anorexia Nervosa

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Abstract

Anorexia Nervosa (AN) is a psychiatric disorder characterized by significantly low body weight and over-evaluation of weight and shape in self-identity. The complex etiology of Anorexia Nervosa renders many current treatments ineffective, thereby prolonging the course of the illness. Among the many psychological and behavioral features of AN, cognitive features like obsessiveness, rigidity, and perfectionism are often described. Patients hold firm beliefs about an ideal body weight and find it difficult to alter their thinking patterns. Recent studies have identified a pathway to understanding this disorder through characterization of its cognitive features. With this research, advances have been made in identifying cognitive processes that likely mediate symptom expression in AN. This paper will describe the cognitive rigidity observed in patients with AN and will include a discussion of therapeutic approaches to target this feature.

Introduction

Anorexia Nervosa (AN) is an eating disorder characterized by restricted food intake and inability to maintain an appropriate body weight. Individuals with AN engage in extreme weight control behaviors, such as caloric restriction and compulsive exercise. According to the National Institute of Mental Health (2017), AN has an estimated prevalence of 0.6% in adults and has the highest mortality rate of any psychiatric disorder. The onset on AN typically occurs during adolescence and can persist into adulthood, increasing the risk of mortality. Research has demonstrated that risk of mortality is higher for patients with a comorbid psychiatric condition, such as depression and substance abuse disorder (Jordan et al., 2003). One study found that substance use disorders, particularly alcohol use disorder, was associated with increased mortality in individuals with AN (Kask et al., 2016). Furthermore, a meta-analysis of 36 studies showed that the weighted annual mortality for AN was 10 deaths per thousand people (Arcelus et al., 2011). The incidence proportion for AN (10 death per thousand people) is higher than the one for other eating disorders, like Bulimia Nervosa (3 deaths per thousand people).

Diagnostic criteria for AN include: 1. Restriction of energy intake leading to significantly low body weight 2. Intense fear of weight gain or persistent behavior that interferes with weight gain 3. Disturbance in the way in which ones' body weight or shape is perceived (American Psychiatric Association, 2013). The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) includes severity specifiers for AN based on current body mass index (BMI). The level of severity can reflect clinical symptom expression and degree of functional disability in patients with AN.

The etiology of AN is complex; many factors contribute to the development and maintenance of the disorder. Predisposing genetic and personality factors can render an individual susceptible, while environmental and social factors can trigger the onset of the disorder at a vulnerable time. Aside from individual personality factors, previous research has found that cognitive factors play a role in the development and maintenance of the disorder. Specifically, cognitive deficits in working memory, mental flexibility, and set-shifting have been observed in patients with AN.

This paper will examine the neurocognitive deficits found in patients with Anorexia Nervosa, particularly cognitive rigidity and set-shifting. Etiology, maintenance, and therapeutic approaches for

the disorder will be discussed, with a focus on specific treatments targeted at decreasing rigidity in patients with AN.

Methods

This review was conducted using databases like PubMed and ProQuest, through the Touro College library system. Peer-reviewed articles were also retrieved using Google Scholar and Semantic Scholar.

Discussion

Much of the research on AN has been conducted with patients undergoing treatment. Study samples often exclude those individuals who are not actively engaged in outpatient or residential treatment. However, many individuals with AN do not seek treatment due to perceived stigma (Dimitropoulos et al., 2016). As a result, they are not included in study samples and the data obtained may not fully represent the general population. Therefore, this literature review is largely limited to studies that have used clinical samples to obtain data.

Neurocognitive Deficits found in AN

Numerous studies have identified neurocognitive impairments in patients with AN (Phillipou et al., 2015, Chan et al., 2013). Neurocognition encompasses processes, such as planning, attention, visuospatial function, working memory, and concept formation. A broad range of neurocognitive functions have been found to be compromised in patients with AN, particularly cognitive flexibility and set-shifting. Cognitive flexibility refers to the capacity to adapt cognitive processing strategies in the face of new and unexpected conditions in the environment. In patients with AN, this ability is compromised and thus contributes to the behavioral symptomatology of the disorder.

Personality Traits in AN

Personality traits associated with AN include perfectionistic tendencies, introversion, and rigidity. These traits impact the way patients with AN perceive and react to people and their environments. Patients with AN have been described as having high harm avoidance and persistence, and low novelty seeking. These dimensions correspond with behaviors exhibited by those with AN, such as avoidance of weight gain and determination to reach a low body weight. Additionally, patients with

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AN often endorse a rigid cognitive style and are unable to alter their cognitions related to eating behavior. They exhibit inflexible behaviors such as counting calories, compulsively exercising, and preoccupation with rigid rituals.

Possible Causes of Cognitive Rigidity in AN

A considerable amount of research supports the familial nature of neurocognitive deficits in AN. One study found that when compared to healthy controls, mothers of patients with AN displayed a more rigid thinking style on a neuropsychological measure of cognitive rigidity (Lang et al., 2016). Neurocognitive impairments have also been noted in healthy siblings of patients with AN, suggesting that these disturbances are not solely the result of the illness (Hason et al., 2011). Rather, these individuals may have biologically-based predispositions to respond to their environments in particular ways. Another study found that patients with AN had poor cognitive flexibility irrespective of the duration of their illness, highlighting the trait nature of cognitive rigidity in patients with AN (Tchanturia et al., 2011).

From a neurocognitive perspective, a rigid cognitive style stems from a lack of mental flexibility. Mental flexibility is the ability to think about multiple concepts simultaneously and to transition from thinking about one concept to another. Mental inflexibility can result in rigid thinking patterns, such as dichotomous thinking (black-and-white thinking) and inability to alter cognitions and behaviors. Individuals with rigid cognitive style are unable to change beliefs or behaviors that are ineffective in helping them achieve their goals. There are several processes that are compromised in individuals with cognitive rigidity; one example is set-shifting ability. Individuals with impaired set-shifting ability cannot efficiently adapt to new situations in response to changing environmental demands. Similarly, individuals with AN have been found to perform poorly on tests of mental flexibility in relation to healthy controls. For example, one study found that compared to healthy controls, patients with AN showed fewer fluctuations in their patterns of response in a test of perceptual judgement, even when their answers were incorrect (Tchanturia et al., 2001). In other words, patients with AN did not attempt to change their incorrect response patterns as frequently as healthy controls.

Assessment of Cognitive Rigidity in Patients with AN

One commonly used neuropsychological measure of cognitive rigidity is the Wisconsin Card Sorting Test (WCST). The WCST assesses set-shifting ability which is the ability to move back and forth between tasks, operations, or mental sets in response to changing goals or environmental demands. In this test, an individual must classify items according to one of four rules, while receiving feedback only when the rule that was used is correct. The classification rule changes every ten cards; therefore, once the participant has figured out the rule, the rule may quickly change.

This task measures how well individuals can adapt to the changing rules and if they are able to change their behavior accordingly.

In one study, researchers hypothesized that patients with AN will have lower set-shifting scores on the WCST when compared to healthy controls. In their study, the AN group consisted of 24 adolescent females, and the control group consisted of 37 healthy adolescent females with no prior history of eating disorders. The adolescents in the AN group had lower set-shifting scores than the healthy controls (McAnarney et al., 2011). In a similar study, the WCST was used to measure of set-shifting ability in two groups: one had patients with AN and one was healthy controls. All participants were female and ranged in age from 18 and 55 years. Results of the study indicated that patients with AN performed poorly in relation to the healthy controls (Tchanturia et al., 2012). Another study demonstrated that children and adolescents share a similar cognitive profile with adults with AN, providing support to the idea that these cognitive deficits may be underlying traits in all patients with AN (Lang et al., 2015). However, in contrast to this finding, a meta-analysis found that problems with set-shifting that are observed in adults with AN were not as prevalent in children with AN (Lang et al., 2014). This observation suggests that set-shifting inability may directly result from long-term starvation and is related to duration of the illness.

Neural Basis for Cognitive Rigidity in AN

In addition to causes like heritability, research has pointed to neurological differences between patients with AN and healthy controls. These differences in brain structure may be responsible for features of cognitive rigidity. Prior research has established the role of the prefrontal cortex in executive function and cognitive control. Specifically, one prefrontal subregion, the anterior cingulate cortex, mediates complex cognitive functions such as affect regulation, cognitive control, and decision making (Stevens et al., 2011). Cognitive control is required during neuropsychological tests that measure cognitive flexibility, such as the WCST. During this test, individuals must change their behavior if previously successful responses fail to yield reinforcement. Researchers used animal models to determine the role of the anterior cingulate cortex in cognitive control. After creating lesions in the anterior cingulate cortex of rats, they found that the rats had difficulty adjusting cognitive control, demonstrating that hypoactivity in this brain region can interfere with cognitive function (Newman et al., 2015).

Similarly, in a literature review on cognitive rigidity in AN, researchers suggested that the hippocampi and anterior cingulate showed a reduced thickness in gray matter in individuals with AN; therefore, processes associated with these structures, like working memory and set-shifting, have been impaired in AN patients (Kucharska et al., 2019). Likewise, another study found that during a test of set-shifting, patients with AN showed

hypoactivity in the dorsal anterior cingulate cortex (Zastro et al., 2009). This finding suggests that patients with AN have reduced motivation and initiative to complete tasks in a non-routine way.

The Effect of Cognitive Rigidity on Treatment Outcomes

A rigid cognitive style can influence treatment outcomes for patients with AN. Patients commonly have rigid rules about how many calories they can consume and the restricted range of foods they can consume (Tchanturia et al., 2001). This rigid thinking style can prevent behavioral change and can negatively affect treatment outcomes. Behavioral therapies intended to change perceptions of eating behavior can be ineffective for patients with a rigid and inflexible thinking pattern. Therefore, treatments aimed at decreasing cognitive rigidity can help promote new and adaptive thinking patterns in patients with AN. Recent translational research has begun to focus on characterizing the cognitive features of AN and adapting existing treatments accordingly.

Therapeutic Approaches Aimed at Decreasing Cognitive Rigidity in AN

Cognitive remediation therapy (CRT) is a method designed to improve neurocognitive abilities, such as cognitive flexibility, set-shifting, and attention. This form of therapy can lead to improved psychosocial functioning in individuals who have cognitive distortions. CRT consists of a set of mental exercises aimed at improving cognitive strategies and increasing holistic thinking. CRT was initially developed for patients with brain injuries and has more recently been adapted for patients with AN. It aims to address two primary features found in patients with AN: a lack of cognitive flexibility, and a preoccupation with details. Unlike traditional treatments for AN, CRT does not directly address behaviors related to eating disorders. Rather, CRT interventions for AN address these deficits by focusing on the patients' process of thinking, rather than on the content of their thoughts, thus helping patients develop a metacognitive awareness of their own thinking style.

A study on the efficacy of CRT in improving cognitive function has demonstrated that cognitive flexibility improved significantly after a ten-week CRT training (Kucharska et al., 2019). Furthermore, one study noted clinical changes following ten CRT sessions, notably, patients became more aware of their own cognitive deficits and were able to apply alternative strategies that were demonstrated during the CRT sessions (Wood et al., 2011).

Conclusion

Anorexia Nervosa is a complex illness with both behavioral and cognitive features. One of the main cognitive deficits found in AN is cognitive rigidity, or an inability to think about multiple

perspectives simultaneously and to change one's view on an issue. Several studies have suggested that this deficit is heritable and is found in healthy siblings and parents of AN patients. Other studies have shown that level of cognitive rigidity is correlated to duration of illness, suggesting that this deficit may be a result of long-term starvation. Cognitive rigidity contributes to the maintenance of AN by making it difficult for patients to alter their cognitive distortions surrounding the disorder. Treatments that address secondary symptoms of the disorder, such as weight loss and food avoidance, can be ineffective if the underlying cognitive features of the disorder are not properly addressed. A considerable body of research has demonstrated that cognitive remediation therapy is effective in increasing cognitive flexibility in patients with AN. This form of treatment can allow patients to see their behaviors as maladaptive and can help promote behavioral change.

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