

Thought Disorder as a Neglected Dimension in Schizophrenia

ABSTRACT

Thought disorder (TD) is one of the main symptom domains of schizophrenia. TD is a construct that can be seen in both acute and chronic periods in patients with schizophrenia. It is associated with a poor prognosis and relapses, and it disrupts social-occupational functioning. TD also shows a strong familial aggregation and increases the risk of transition to schizophrenia in subjects with ultra-high risk. Although TD was once thought to be pathognomonic to schizophrenia, now it is known that it is a transdiagnostic symptom that is seen not only in schizophrenia but also in other psychiatric disorders. This article reviews the concept of thought disorder in terms of its history, clinical evaluation, neuro-cognitive features and clinical course in patients with schizophrenia.

Keywords: Prognosis, psychosocial functioning, remission, schizophrenia, thought

Introduction

Thought disorder (TD) has long been considered as one of the main symptom domains of schizophrenia.¹ TD is a multidimensional construct, as it refers to thinking, language, and communication abnormalities.²

TD is found in many patients with schizophrenia during exacerbation of the psychosis. TD symptoms related to acute episodes are reduced by antipsychotic medication, however, it has been shown that residual symptoms continued even after clinical remission has been achieved.^{1,3} Additionally, it has also been suggested that the continuation of the severe TD after the acute period may indicate a worse prognosis in schizophrenia.¹ TD seems to predict relapse, and this predictive value is related to the presence of the symptoms in the early stages of the illness.⁴ Another important issue that has been associated with TD is therapeutic alliance; TD can interfere with verbal communication and, therefore, leads to disruption of treatment.⁵

Considering the studies carried out so far, it is concluded that a relationship exists between TD and social-occupational functioning. Higher rates of readmission to hospital and unemployment were observed in patients with TD during follow-up.¹ Also, TD has been associated with a decrease in work performance⁶ and worse social functioning in patients with schizophrenia.^{7,8}

TD was formerly thought to be specific to schizophrenia. However, we now know that language peculiarities such as clanging, associative loosening, blocking, or skipping from topic to topic not only happen in schizophrenia but also in other psychiatric disorders including mania and depression. People who do not have a psychiatric diagnosis can also show these features, especially when they are distressed or tired.^{9,10}

History of Thought Disorder

It was first mentioned by Esquirol¹¹ in the first half of the 19th century that in psychiatric disorders, pathology may be manifested by a disorder in coordinating thoughts. In the same period, Prichard first used the term "incoherence" for defects observed in the connections between thoughts.¹² Guislain¹³ coined the term "incoherence des idées" (*incoherence of*



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thoughts) for TD, referring to the distinction between thought and speech disorders.

For the first time in 1867, Griesinger distinguished disorders related to the form and content of thought. Then, Ségla distinguished TD from speech and language disorders by saying that variations in speech can be subdivided into 3 categories such as dyslogies (TDs), dysphasia (language disorders), or dislocations (speech disorders). Ségla also mentioned that the TD, which he named "dyslogy," has 4 subtypes namely tempo, form, syntax, and content.¹⁴

In the early 20th century, with Kraepelin introducing dementia praecox as a diagnostic construct, TDs played an important role in the conceptualization of psychosis. He argued that schizophrenia is fundamentally a TD.¹⁵ In 1910, Kraepelin¹⁶ used the term "akataphasia" to refer to TD as a common linguistic manifestation symptom in patients with dementia praecox. He described akataphasia as an inability to find the appropriate expression for a thought.¹⁴

In 1911, Bleuler,¹⁷ a Swiss psychiatrist was the first author to use the term "schizophrenia" to describe "splitting of psychic functions." In his opinion "loosening of association" was pathognomonic of schizophrenia and disruption in associations was causing illogicality and incoherence.² Bleuler¹⁷ mentioned the idiosyncratic structure of the connections between thoughts in schizophrenia and argued that concepts were expressed in a distorted manner as a result of concentration, displacement, and symbolism.¹⁴

Carl Schneider also described concepts, such as derailment, fusion, suspension, and driveling. In his opinion, "constancy, organization, and continuity" components that exist in normal thinking are impaired in schizophrenic thought.^{14,18}

Difficulties exist in naming the concepts of TD phenomenologically. Over time, the same pathology has been expressed by different authors with different terms. Concepts such as "incoherence" by Prichard, "loosening of association" by Bleuler, and "derailment" by Carl Schneider might all point to the same pathology.¹⁴

Silvano Arieti has comprehensively described the system of thought that produces delusion. While the human brain changes from concrete to abstract in the evolutionary process, concrete forms of thought reappear in schizophrenia. This thinking system, which dominates among children, in dreams and during psychosis, has been named "paleological thought," since it belongs to the earlier stages of social and mental development. Three main features distinguish paleological thought from Aristotelian thought. The laws of identity, contradiction, and excluded middle are canceled in paleological thinking. Patients with schizophrenia tend to think in a paleological way based on common qualities. According to the law of identity in paleological thinking, it is sufficient for 2 objects to have one common feature for them to be identical. For example, a patient thinks that she is the Virgin Mary because she is a virgin and so was Mary.¹⁹

An important development in the historical process of the TD concept is that recent approaches question the unitary structure of TD and its specificity to schizophrenia. Nancy Andreasen,^{2,9} a researcher who has made significant contributions to this field, criticized the assessment of TD as a unitary dimension and argued that the disorders seen under the concept of TD should be regrouped under

the name of thought, language, and communication disorders. Andreasen^{2,9} disagreed with the view that it is specific to schizophrenia, and states that it can be seen in other psychiatric illnesses and may not even be seen in many patients with schizophrenia.

TD is still considered as a unitary concept in The Diagnostic and Statistical Manual of Mental Disorders (DSM) and The International Classification of Diseases (ICD) (the World Health Organization's International Classification of Diseases) diagnostic systems. DSM-IV has named TD "disorganized speech," and this definition is preserved in DSM-5.^{20,21} Notably, this approach ignores the complex nature and importance of TD and reduces its importance in the diagnosis of schizophrenia.¹⁵ Indeed, TD has been studied by many researchers, and it seems impossible to explain it with a single model.

Thought Disorder

Different terms such as TD, formal TD (FTD), language disorder, speech disorder, and communication disorder are used to describe in the literature.

TD is divided into 2 subcategories: disorders of thought form and disorders of thought content. Thought content disorders are determined by evaluating the meanings of thoughts. The most prominent thought content disorder seen in schizophrenia is delusions. There are overvalued thoughts at some point between normal thinking and delusion. Obsessions, mystical and metaphysical thoughts also reflect abnormal thought content.²²

FTDs are defined by any deficiency of organizing words, concepts, phrases, and ideas in a logical order to express a certain purpose. This deficiency can be grouped under 2 main headings: negative and positive FTDs. Negative TD is identified by poverty of speech, alogia, and poverty in the content of speech, while positive TD is defined by circumstantiality, tangentiality, derailment, clanging, neologism, illogicality, perseveration, blocking, and incoherence.⁹

Andreasen¹⁰ stated that the most common TDs were derailment, loss of goal, poverty of content, and tangentiality in patients with schizophrenia, but these are not all equally pathological. Poverty of speech, poverty of content, tangentiality, derailment, incoherence, pressure of speech, distractible speech, illogicality, clanging, neologisms, and word approximations have been listed as more pathological types of TD.^{10,23}

Clinical Assessment of Thought Disorder

General psychopathological scales, which are used to determine the severity of symptoms in the clinical setting (e.g., scale for the assessment of positive symptoms [SAPS], scale for the assessment of negative symptoms [SANS], the positive and negative syndrome scale [PANSS] for schizophrenia) contain only a few items to evaluate positive and negative TD.²⁴

Various FTD scales exist. One of the widely used clinician-rated assessment scales is the "Thought, Language, and Communication Disorders (TLC) scale" developed by Andreasen⁹ in 1979. It is a measure of positive and negative TD, based on 18 symptoms of FTD.¹⁰ However, the subjective symptoms are not coded, and this scale does not include all FTD symptoms.²⁴ It is also a more clinical scale that reflects explicit pathology and is quite insensitive to subtle abnormalities in the speech of relatives of patients with schizophrenia.²⁵

The Thought Disorder Index (TDI) is another rating scale for TD. It was developed by Johnston and Holzman in 1979²⁶ and includes 23 TD categories. TDI scores are usually obtained from verbal responses to the Rorschach Test and verbal subscales of the Wechsler Adult Intelligence Test.²⁷ In contrast to the thought, language, and communication scale, it was designed to also measure mild level disorders.²⁸ However, the TDI is time-consuming, and a well-trained rater is needed for assessment.²⁷

The bizarre-idiosyncratic thinking was developed by Marengo et al²⁹ in 1986 to measure positive TD, and it focuses only on positive FTD. This measure comprises of 5 categories which are linguistic form and structure, content of statement, intermixing, relationship between question and response, and behavior. It has been used to assess the severity of TD and longitudinal changes in TD symptoms over time.²⁹

In Chen et al³⁰ developed a scale considering psycholinguistic features. Clinical Language (CLANG) considers 17 symptoms classified according to the linguistic structure. This scale evaluates 3 different types of language disorders: syntax, semantics, and production. It also includes a detailed examination of sound quality and articulation and speech style, not just thought or discourse. So, it allows fluency, voice quality, and articulation to be evaluated.²³

The Thought and Language Index (TLI) developed by Liddle et al²⁸ in 2002 consists of impoverishment of thought and disorganization of thought subscales and evaluates 8 abnormalities of speech. The participant is asked to produce eight 1-min speech samples in response to the pictures of Rorschach³¹ or thematic apperception test.³² Then, recorded verbal transcripts are assessed. This scale is a reliable measure of thought and language disorders which is also sensitive to subtle impairments.²⁸

The Thought and Language Disorder (TALD) scale is a comprehensive measure developed by Kircher et al³³ in 2014. The scale consists of 30 FTD symptoms and distinguishes objective and subjective FTD symptoms. Evaluation is made during the 50-min clinical interview and includes 2 parts. In the first part of the interview, individuals are asked about common subjects (e.g., daily issues, hobbies, etc.) A semi-structured interview is then conducted. TALD can also be used in the evaluation of prodromal patients and relatives with self-experienced FTD.³³

The Dokuz Eylül University Thought Disorder Scale (DTDS) was developed by Yalınçetin et al³⁴ in 2020. This scale consists of a 3-factor structure. The first factor is positive TD (PosTD) and includes accelerated thought process, disturbance in staying on topic, loosening in thought process, idiosyncratic word use, and illogical thinking. The second factor is negative TD (NegTD), which is comprised of poverty of speech, poverty in content of speech, and disruption in the flow of speech. The third factor is pragmatic comprehension disorder, and 2 subtitles are examined in this area: understanding the intents of others and comprehension of abstract expressions. Stories containing metaphor, irony, and faux pas are used to assess understanding of abstract expression. According to the results of the validity and reliability study, the Cronbach α value of the whole scale was found to be 0.86. A high degree of correlation was found between the DTDS PosTD subscale items and the SAPS positive formal TD items ($P < .001$). A high degree of correlation was also found between the items of the DTDS NegTD subscale and the SANS-Alogy items ($P < .001$). DTDS is

an original scale that can be used to evaluate TD in schizophrenia. This work has not been published yet. One of the advantages of this scale is that it is practical as it is based on the clinical interview, similar to SANS, SAPS, and PANSS, unlike many other scales found in the literature. Another strength of DTDS is that it assesses the PosDB and NegDB dimensions as clustered, condensing these dimensions and scoring hierarchically for severity. The fact that it includes pragmatic comprehension disorders brings a novelty to the literature, differing from other scales.

In summary, the weakness of TLC is that it misses mild disturbances. Unlike TLC, TDI and TLI are susceptible to subtle disturbances. Although TDI has the advantage of detecting subtle abnormalities, it is a very time-consuming scale for routine use, and its scoring requires extensive training. TALD can also be used to detect subtle abnormalities for both prodromal patients and relatives. Another advantage of TALD is that it distinguishes objective and subjective FTD and provides a multidimensional assessment opportunity. Differing from other scales, CLANG is a scale that could also measure speech style.

When the tools developed to measure TDs are examined, it is evident that the notion of TD is limited only to positive and negative TD and mostly focuses on the positive dimension. Comprehensive scales for both postTD and negTD take time due to the long application and evaluation process.

Thought Disorder in Populations at High-Risk for Schizophrenia

Studies of high-risk psychosis states have become increasingly important in recent years. These studies aimed to determine the risk factors that can predict transition to schizophrenia or another psychotic disorder. FTD is one of the features that increase the risk of transition to psychosis.³⁵ FTD may be an endophenotypic marker. People at ultra-high risk for psychosis have TDs similar to those with psychotic disorders, but less severe.³⁶ In a study that evaluated 100 individuals with clinically high risk of psychosis for 2.5 years, it was shown that subthreshold TD tends to persist and lead to the onset of psychosis.³⁷ These findings are in the same line with the clustering of FTD in relatives of patients with schizophrenia, and it suggests that genetic factors may play a role in the basis of TD.^{24,38} Especially deviant verbalizations, peculiar word use, and verbal fluency are seen prominently in first degree relatives of individuals with schizophrenia.³⁸⁻⁴¹ In another longitudinal study of offspring of parents with schizophrenia or affective disorder and normal controls, it was found that negative FTD is related to schizophrenia to a greater degree, whereas positive FTD is associated with affective symptoms.⁴² This could mean that negative FTD is better at predicting conversion to schizophrenia.

A study that combined automated speech analyses with machine learning to predict later psychosis onset in youths at clinical high-risk for psychosis found that psychosis could be predicted. Although the sample size was small in this initial study, these novel speech measures provided important information about the potential predictive capacity.⁴³

Thought Disorder in First-Episode Psychosis

FTD is a powerful predictor of the transition of patients from first-episode psychosis (FEP) to schizophrenia.⁴⁴ Therefore, it is important

to determine the subtypes and reveal their relations with the clinical course.

One study that compared an FEP sample to a healthy control group for subtypes of FTD found that FEP patients had notable thought abnormalities compared with healthy controls in terms of poverty of speech, perseveration, and peculiar word use. Additionally, although the impoverishment in thought processes decreased with an increase in the years of education in FEP patients, no relationship was found between the increase in the years of education and disorganization of thought.⁴⁵

In another study with patients with FEP, disorganization of thought was the only dimension of FTD associated with functional outcome, especially with social function. Moreover, disorganization of thought in first-episode psychosis also predicted the higher number of hospitalizations.⁴⁶

Effect of Thought Disorder on Prognosis of Schizophrenia

The course of TD varies widely among patients. In some schizophrenia patients, TD continues irrespective of the course of psychosis.⁴⁷ This finding is consistent with the view that TD is a semi-independent dimension in schizophrenia.⁴⁸

The presence of TD, especially negTD from the early stages of schizophrenia, has a poor prognostic value and also is predictive for relapse.⁴ The probability of going into remission is lower in patients with negTD.⁴⁹

NegTD is more persistent than posTD in a clinical course. Although FTD can predict the outcome, types of TD differ according to their prognostic effects. Even if positive forms of TD are not related to the course and chronicity of the disease; negTD, especially poverty of speech and poverty of content, might be predictive for poor prognosis.^{4,49,50}

However, in an earlier study, it was stated that posTD could also predict prognosis. It has been shown that severe TD that persists after an acute episode shows a poor clinical course and low functionality and predicts subsequent delusions. In conclusion, to predict the severity of illness, TD that continues after the acute period is an indicator.¹

PosTD seems to be more severe during acute episodes. Remission can be observed after an acute episode.⁴⁹ Although antipsychotic therapy reduces the thought impairment concerning acute episodes, the milder residual thought pathology perseveres even after clinical remission is reached. Less severe TD benefits less from antipsychotic treatment than severe TD, as they are selective to the type of thought pathology rather than the degree of severity.³

Poverty of speech and peculiar logic have been found to be associated with social functioning and symptomatic remission. These areas can distinguish schizophrenia patients with and without remission.⁸

Moreover, various forms of TDS were not seen with the same frequency in different diagnostic categories. Relative to bipolar disorder and schizoaffective disorder, patients of schizophrenia had poverty of speech and thought content more frequently.⁵⁰ This situation is not surprising given the difference in the courses of the diseases. While positive thinking disorder is more prominent in patients with

mania, negative thinking disorder is more prominent in patients with schizophrenia. Considering the subcategories of TD, fluency and productivity of language behavior are useful areas to distinguish between affective psychosis and schizophrenia.⁴⁹

Impact of Thought Disorder on Psychosocial Functioning

In serious psychiatric illnesses such as schizophrenia, social and occupational functioning are as important as the symptoms of the illness. These are perhaps even more important, as social functioning is the most important area that determines one's participation in life. Functioning may not improve even if symptoms improve.⁵¹

Communication skills of the patients may be impaired due to FTD.⁹ Thought is an important part of communication, and communication is an important part of social functioning. Therefore, interpersonal communication skills and, accordingly social functioning are affected as expected in the presence of TD.⁶

As mentioned, patients of schizophrenia have poverty of speech and peculiar logic, which are in an intimate relationship with social functioning. It has also been shown that poverty of speech, as well as goal weakening, are associated with aggressive behaviors. Social beneficial activities, disturbing and aggressive behaviors, personal and social relationships, and self-care are subdivisions of social functioning; and the only TLI component related to these subdivisions is speech poverty.⁸

It has been found that disconnected speech has a relationship with social politeness; however, verbal underproductivity is associated with social engagement and fewer friendships among chronically hospitalized schizophrenia patients.⁵² In the same direction, it has been shown that in individuals with schizophrenia living in the community, verbal underproductivity predicts social behavior rated by the observer, while disconnected speech predicts socially acceptable behavior.⁷ In a study examining the relationship between TD in schizophrenia patients and quality of life index of them, it was found that verbal underproductivity (negTD) affects daily functioning and social contact, whereas pressured speech (posTD) influences satisfaction with life. Verbal fluency is thought to be an important factor that predicts daily problem-solving skills.^{53,54} Given the relationship between quality of life and verbal underproductivity, it may be an appropriate target in schizophrenia rehabilitation.⁵⁵ Moreover, an 8-year follow-up study showed that positive FTD predicted the patients' occupational functioning years later.⁶

In a recent study evaluating the relationship of FTD with cognitive impairment and functionality, TD has been evaluated in 4 dimensions as positive, negative, objective, and subjective. It has been shown that a relationship exists between objective positive FTD and social functionality, and between objective negative FTD and physical quality of life, and social functioning. Besides, subjective negative FTD was found to be strongly correlated with quality of life. Since recovery in schizophrenia cannot be considered independently of functionality, psychosocial treatments should focus more specifically on different dimensions of TD.⁵⁶

Relation Between Thought Disorder and Cognitive Dysfunctions in Schizophrenia

The mechanisms of TD are still not fully elucidated.¹⁵ Many studies have shown that there is a relationship between cognitive deficits and TD in schizophrenia.^{57,58}

In many studies to date, a relationship has been established between FTD and executive function.⁵⁸⁻⁶⁰ Although the specific basis of posTD and negTD in schizophrenia is unclear, and some findings suggest that positive and negative FTD might be related to different cognitive domains.^{56,58}

A recent meta-analysis found that a significant association exists between both positive and negative FTD and neurocognitive deficits, executive dysfunction, and semantic processing abnormalities in schizophrenia. However, syntactic deficiencies were more specific to positive FTD, and executive functions also differed in different types of TD, supporting that the neurobiological basis of negative FTD and positive FTD are probably different.⁶¹ The findings of another study showed that objective positive FTD was associated with deficits in executive functions, while objective negative FTD was associated with deficits in all cognitive domains, consistent with this meta-analysis. These findings support the idea that different subgroups of FTD in schizophrenia may be associated with different cognitive impairments.⁵⁶

The results of imaging studies in patients with schizophrenia support the relationship between neurocognition and TD. PosFTD was related to aberrations in the anterior cingulate cortex and orbitofrontal cortex, and volume reductions in both Broca's and Wernicke's areas, while negFTD was associated with decreases in the medial frontal/orbitofrontal cortex and abnormalities in fronto-cingular and striatal abnormalities. As these findings show, there may be pathology in brain regions related to language and executive functions in schizophrenia, and understanding this relationship may enable us to better comprehend TD.^{24,61-63}

Conclusion

TD is a multidimensional construct that can be seen in some psychiatric conditions and healthy individuals and refers to thinking, language, and communication abnormalities.

TD, mostly negTD, is related to poor prognosis in schizophrenia and tends to be more permanent in the clinical course than posTD. Furthermore, persistent TD is associated with poor social and occupational functioning and could predict relapse. Its negative impact on therapeutic alliance and its relationship with re-hospitalization should not be forgotten. For these reasons, clinical studies for the treatment of FTD are needed.

As TD occurs not only in patients with schizophrenia but also in their relatives, it is thought to be an important genetic component. In line with this, FTD also enhances the risk of transition to schizophrenia in subjects with ultra-high risk. Even if not alone, when evaluated together with other psychosis risk factors, it can be useful in detecting future psychosis. A combination of automated speech analyses with machine learning could predict later psychosis onset in youths at clinical high risk for psychosis.

Many scales have been developed that assess TD from different aspects including linguistics, posTD, negTD, and pragmatic disorder. It takes time to make an assessment covering all areas. Considering the studies in the literature, the heterogeneity in the use of the scales makes it difficult to evaluate the results together. More widespread use of computerized tools for TD analysis may help to eliminate these problems. They also have some important advantages such as being

unbiased, objective, repeatable, and faster. Using automated speech analysis such as computational natural language methods, complex networks, and quantitative linguistics to evaluate speech are some of the new and promising approaches.⁶⁴

Considering the relationship of TD with functioning and recovery in schizophrenia, it is very important to elucidate the pathogenesis of FTD more precisely. Increasing evidence on the relationship between TD and neurocognitive features indicates that neuroimaging studies can contribute to this field.

TD is now thought to be a transdiagnostic symptom that is seen not only in schizophrenia but also in other psychiatric illnesses and even in healthy individuals. Determining how TD domains are affected in different psychiatric diseases will contribute to our understanding of the pathophysiology of diseases. Considering the transdiagnostic approach, it will be useful to identify clusters of overlap with other psychiatric diseases.

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