Research Article

Assessment of Somatic, Distress, Anxiety and Depression Symptoms in Patients during COVID-19 Pandemic: A Pilot Study with Non-Hierarchical Cluster Analysis

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Abstract

The aim of the article is to present results of pilot exploratory study on four groups of symptoms: depressive, anxiety, somatic and distress in group of 36 volunteer patients. There were no any hypotheses because of exploratory character of this research. Three k-means cluster analyses were performed: catastrophic thinking through pain experiences, somatization through pain experiences, and somatization through depressive symptoms intensity. For assessment of chosen symptoms five questionnaires were used: diagnostic survey (sociodemographic data, main symphoms, COVID-19 infection), Four-Dimmensional Symptom Questionnaire (4DSQ), Catastrophic Cognitions Questionnaire - Modified (CCQ-M), Beck Depression Inventory (BDI), and Numerical Rating Scale (NRS). Most of the studied patient's declared affective symptoms, which seems to be differentially distributed in individual groups. They potentially could be divided into somatizing, non-somatizing and intermediate. Somatization scale from 4DSQ is moderate correlated with depressive symptoms (BDI), however, this is not indicative of any causality. Self-rating catastrophic thinking can be further studied as potential predictor for pain catastrophizing. Finally, cluster analysis is effective procedure for grouping patients due to selected parameters.

Keywords: Four-dimensional symptom questionnaire; Beck depression inventory; Numerical rating scale

Introduction

SARS-nCoV2 pandemic have been changing functional aspects of medical care since last year. Increased isolation state in physical and psychiatric patients has an important impact on the course of many mental disorders. Particular risk group are patients with already developed diseases, for instance depression or dysthymia, where the contact with other people is important factor of healing process. They require empathic therapeutic relations [1], and often constant observation for the risk of self-mutilating behaviors [2]. Problems in this area are not only concentrated around the mental symptoms. In the most of diagnostic units with a severe course, neuropharmacotherapy should be recognize as the first-line therapy, which is combined with a psychotherapy. During pandemy, there are some limitations with stationary treatment and correct monitoring of therapeutic improvements. Places for psychiatric patients in many cases must be formed into transitional COVID-19 clinics, so patients are treated in their houses, often in isolation. This isolation has significant influence on patients, who cannot be present on group therapies. Thus, patient's state is into risk of the development of their diseases.

Here, we analyzed several main symptoms of the common diseases in Polish patients, with particular attention on affective disorders. The Diagnostic and Statistical Manual of Mental Disorders - 5 (DSM-5) have indicated following symptoms of the major depression episode depressed mood during the most time of the day; significant decrease in interesting and anhedonia; weight loss without a special reduction in food consumption; insomnia or increased daytime sleepiness; agitation or psychomotor slowing down; fatigue or feeling of loss of energy; feeling of lack of self-worth; decreased thinking ability or concentration; and recurring thoughts about the death, suicide attempts with or without action plan.

Except from depression, patients reported also, for instance, other affective symptoms: bipolar disorder, dysthymia or emotional lability (*labilitas*). One patient declared paranoid schizophrenia with comorbid physical symptoms and next two have reported nightmares and night kicking reflexes. From the anxiety disorders, general anxiety was one of the most numerous syndromes, Secondary to this, was obsessive-compulsive disorder.

General anxiety is one of the first-line symptoms of general anxiety disorder. In DSM-5 it is indexed as 300.02 unit (whereas in ICD-10: F41.1). Main symptoms of this disease are as follows: increased anxiety and fearful anticipation of several acitivities, like work or school performance; anxiety is perceived as a hard for controlling. Anxiety is associated with three (or more) conditions: a feeling of being tense; getting tired easily; difficulties in concentrating; irritability; increased muscle tension; or sleep problems. These symptoms cannot be better explained by other diseases.

In the group of somatic and pain related disorders on the first plan chronic back pain is observed. There are many types of this condition. One of the most numerous is chronic primary low back pain.

Scientific research have indicated that 25-27% is experiencing several forms of back pain. These symptoms may be associated with organic causes, but in part of these patients, their pain have not any medical explanation. In this state, it is called as functional back pain [3,4]. Potential reason of this may be abnormal activity of musculoskeletal system, moderated by a irregularities in the somatosensory cortex. Too strong connections between the cortex and subcortical structures, mainly thalamus, or incorrect activity of sympathetic nervous system or (too strong/weak) excitation of frontal, and parietal regions could be marked out.

Other diagnostic unit, which is especially important in psychosomatic research, is fibromyalgia (which include *fibromyositis*, *fibrositis*, and *myofibrositis*). One patient with this condition was present in our pilot study. Fibromyalgia is characterized by diffuse, dull musculoskeletal pain with multiple points of tenderness with predictable location. Moreover, often the comorbidities can be observed affective disorders, cognitive deficits, short-term memory loss, headaches, fatigue, and sleep that brings no rest or vegetative disorders. Patients report general hypersensitivity on painful stimuli not only around tender places.

In general, fibromyalgia is part of the research area, which is called "functional disorders". Diagnostic units from this are characterized by several properties: any symptoms or physical discomfort reported by patients has not any organic or physiological cause; functional syndromes can coexist with each other; full clinical interview should include psychosocial factors identifications. With functional symptoms, the concept of somatization is very widely associated. Somatization is the translation of mental symptoms into bodily sensations. Often such a phenomenon is identified in depressive disorders, like intensive fatigue, musculoskeletal pains, headaches, or stomach pain. Thus, there is a risk for feedback to mental symptoms and deterioration of the general condition of the patient by these functional syndromes.

For the study five questionnaires were used diagnostic survey (definition of the main symptoms, and comorbidities, age, COVID-19 course, sociodemographic data); Numerical Rating Scale - Polish translation for pain intensity measurement; Four-Dimmensional Symptoms Questionnaire for the assessment of depressive, somatic, anxiety symptoms, and distress [5]; Catastrophic Cognitions Questionnaire - Modified for self-rate on catastrophic thinking [6]; and Beck Depression Inventory for determination of experienced depressive symptoms.

Catastrophic thinking is a pattern of depressive perception of differential situations, described in XX century [7,8]. In general, this is a tendency to exaggeration of perfected danger and overestimation of its potential consequences. It can occur as in mental disorders, like depression as in normal people. In panic disorder, catastrophic thinking symptoms are widely distributed. For example, it can occur through chest pain experiences. Beck has observed that patients who are concentrated on catastrophizing these symptoms cannot to stop increasing anxiety before it will transform into panic [9]. It is possible that catastrophic thinking can be indirectly linked with consolidation and aggravation of depressive or anxiety symptoms, similar to pain catastrophizing [10].

Methods

The research group consisted of 36 people, who reported various mental and psycho-organic problems. All patients agreed to participate in the study and to complete medical and psychological questionnaires. Among the sociodemographic data, it was mentioned that 31.6% of people suffered from COVID-19, 50% of them have a job and most often have secondary education (55.3%). The youngest examined patient was 18 years old, while the oldest one - 72 years old. This group was very diverse in terms of age and each patient declared being in legal age. Reported diseases were grouped into five clusters based on the similarity or associations between symptoms: "Affective Disorders" (AD), "Psychotic Disorders and Sleep Disturbances" (PS), "Somatic and Pain-Related Disorders" (SPR), Anxiety Disorders (AXD), and others (OS). The table below consists their specifications (Table 1).

Variables were indicated, which are the levels of intensity of individual symptoms: somatic (4DSQ), depressive (4DSQ, BDI), distress (4DSQ), anxiety (4DSQ) and pain (NRS). An additional variable was the tendency to catastrophic thinking, measured by CCQ-M. The incidence of COVID-19 can be considered as a separate variable. Other parameters was determined by symptoms experienced by patients.

Overall, the entire study was exploratory. No statistical hypotheses were tested. Patients were fully anonymous and the questionnaires required pseudonyms that could not in any way be related to actual personal data.

The research procedure assumed complete on-line questionnaires in the following order:

- Diagnostic survey - socjodemorgaphic data, providing the main symptoms and comorbities, information on the COVID-19 course;

- NRS - polish version of the Numerical Rating Scale, pain intensity measurement (translated by Łukasz Grabowski);

- 4DSQ - measurement of the somatic, depressive, distress and anxiety symptoms;

- CCQ-M - Polish translation of the Catastrophic Thinking Questionnaire – Modified, subjective assessment of catastrophic thinking (translated by Functional Disorders Research Forum);

- BDI - in-depth assessment of depressive symptoms.

Non-hierarchical cluster analysis with k-means method was performed. 3 main statistical clusters were identificated from quantitative data. COVID-19 proportion have been indicated through the individual groups of patients. In addition, non-parametric rho-Spearman's correlation was used for assessment of associations between following variables: depression - catastrophic thinking, depression - somatization, distress - catastrophic thinking, pain intensity - catastrophic thinking and pain intensity - depression.

Results

Research group was very diverse, but it was possible to detect some associations between patients. These similarities are not so strong, but taking it into account, some conclusions can be indicated.

Table 1: Distributed clusters of diseases (some patients reported more than single disorder).

Affective disorders (AD)	Psychotic disorders and sleep disturbances (PS)	Anxiety disorders (AXD)	Somatic and pain-related disorders (SPR)	Others (OS)
Depression episodes [8 p.]; Dysthymia [2 p.]; Bipolar disorder [1 p.]; Emotional lability/mood swings [4 p.]; Mental breakdown [1 p.]; Depressed mood – not depression [3 p.]; Impulsiveness [1 p.]	Paranoid schizophrenia [1 p.]; Nightmares [1 p.]; Night kicking reflexes [1 p.]	Obsessive-compulsive disorder [5 p.]; General anxiety [8 p.]; Chronic distress with anxiety [2 p.]; Post-traumatic stress disorder [1 p.]	Fibromyalgia [1 p.]; Chronic headaches [2 p.]; Migraine headaches [1 p.]; Chronic back pain [4 p.]; Hashimoto disease [1 p.]; Bronchial asthma [1 p.]; Hypothyroidism [3 p.]	Bulimia nervosa [1 p.]; Addiction [1 p.]; Two strokes of the right hemisphere [1 p.]; Eye micro-tics with a neurological background [1 p.]; Diabetes [1 p.]; Severe allergies [1 p.]; Polycystic ovary syndrome [1 p.]; Cholelithiasis [1 p.]; Atrial fibrillation [1 p.]

P: Person/people.

Table 2: Descriptive statistics for all questionnaires, which have been used in this study.

NRS	4DSQ		CCQ-M	BDI
$M = 13.61$	M (som) = 12.53		$M = 66.44$	$M = 23.00$
	M (str) = 20.67			
	M (anx) = 8.86			
	M (depr) = 6.44			
$S = 6.66$	S (som) = 6.725		$S = 14.847$	$S = 12.588$
	S (str) = 7.29			
	S (anx) = 6.85			
	S (depr) = 4.003			

M: Mean; S: Standard deviation.

The strongest correlation was detected between somatization scale from 4DSQ and BDI, which value is $rho = 0.635$, $p < 0.001$. BDI also was significantly associated with CCQ-M result on the level of $rho = 0.448$, $p = 0.006$. NRS - somatization was not significant. Weak but significant correlation between somatization and CCQ-M was noted: $rho = 0.319$, $p = 0.01$. Other descriptive statistics are given in the Table 2.

First cluster analysis (QUICK CLUSTER from SPSS program by IBM) was performed for somatization through assessment of pain intensity (NRS) with 5 clusters noted that 2 from 5 clusters had to small part of data and were no significant. Therefore, clusters have been reduced to 4, and finally to 3 clusters. In the latest version, clusters were relatively equal. Centers were focused around following values: 1 - 5.86; 2 - 21.10; and 3 - 13.17. Distances between these centers were respectively: 15.243 (1-2); 7.310 (1-3); or 7.933 (2-3). ANOVA for these equalities was significant: $F = 102.071$, $p = 0.001$. According to this, detected distances were significant. Clusters had subsequent number of cases: 1 - 14, 2 - 10, 3 - 12. The dominant was first one.

Second cluster analysis studied variables: catastrophism through pain intensity level. 3 clusters were left, where first one was dominated CCQ-M value: 1 - 84.74; 2 - 46.75; or 3 - 67.00. Distances between these centers were determined: 38.00 (1-2); 17.750 (1-3); and 20.250 (2-3). ANOVA also had significant result in this trial, $F = 49.628$, $p < 0.001$. Third cluster was the most numerous (20), second and first had similar groups (8 patients).

Last analysis was performed with 5 clusters. Patients have been divided on the somatization, with BDI test assessment so the depressive symptoms have been taken into account. In result, two clusters were dominated, one was intermediate, and two were the weakest: 1 - 1.67; 2 - 18.25; 3 - 7.00; 4 - 12.60; and 5 - 24.25. Distances between them have been noticed in following direction: 16.582 (1-2); 5.333 (1-3); 10.933 (1-4); 22.583 (1-5); 11.250 (2-3); 5.650 (2-4); 6.000 (2-5); 5.600 (3-4); 17.250 (3-5); and 11.650 (4-5); where ANOVA had a significant value, $F = 143.117$, $p < 0.001$. Two dominated clusters had number of patients in order: 11 (3) and 10 (4), intermediate cluster 8 patients (2), and rest: 4 (5) or 3 (only 1 patient).

Discussion

In most cases, analysis did not identified any strong associations between variables. Correlations were on moderate or low level. Potential cause of this may be significant differentiation of studied group in the features like age, type of experienced syndrome or too small number of patients. Non-hierarchical cluster analysis showed that these patients could be grouped into 5 and 3 clusters. Thanks to this, it was possible to observe severe similarities within indicated clusters and differences between them (Table 3).

First cluster analysis classified following number of cases

The above analysis showed some similarities and differences between these clusters. Individual groups of patients who report indicated symptoms are almost equal quantitatively (excluding AD, which dominate in first and third clusters). Comprehensive analysis suggests that catastrophic thinking may have significant impact on

Table 3: Cluster analysis for: Catastrophic thinking through pain experiences.

Cluster 1	Cluster 2	Cluster 3
Affective disorders(AD) [7 p.]	Affective disorders (AD) [3 p.]	Affective disorders (AD) [14 p.]
Psychotic disorders and sleep disturbances (PS) [1 p.]	Psychotic disorders and sleep disturbances (PS) [1 p.]	Psychotic disorders and sleep disturbances (PS) [1 p.]
Anxiety disorders (AXD) [3 p.]	Anxiety disorders (AXD) [3 p.]	Anxiety disorders (AXD) [4 p.]
Somatic and pain-related disorders (SPR) [3 p.]	Somatic and pain-related disorders (SPR) [4 p.]	Somatic and pain-related disorders (SPR) [5 p.]
Others (OS) [3 p.]	Others (OS) [2 p.]	Others (OS) [3 p.]

P: Person/people.

Table 4: Cluster analysis for: Somatization through pain experiences.

Cluster 1	Cluster 2	Cluster 3
Affective disorders (AD) [7 p.]	Affective disorders (AD) [10 p.]	Affective disorders (AD) [6 p.]
Psychotic disorders and sleep disturbances (PS) [0 p.];	Psychotic disorders and sleep disturbances (PS) [1 p.]	Psychotic disorders and sleep disturbances (PS) [3 p.]
Anxiety disorders (AXD) [4 p.]	Anxiety disorders (AXD) [4 p.]	Anxiety disorders (AXD) [2 p.]
Somatic and pain-related disorders (SPR) [6 p.]	Somatic and pain-related disorders (SPR) [2 p.]	Somatic and pain-related disorders (SPR) [3 p.]
Others (OS) [3 p.]	Others (OS) [2 p.]	Others (OS) [3 p.]

P: Person/people.

Table 5: Cluster analysis for: Somatization through depressive symptoms intensity.

Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
Affective disorders (AD) [1 p.]	Affective disorders (AD) [8 p.]	Affective disorders (AD) [5 p.]	Affective disorders (AD) [5 p.]	Affective disorders (AD) [4 p.]
Psychotic disorders and sleep disturbances (PS) [0 p.]	Psychotic disorders and sleep disturbances (PS) [0 p.]	Psychotic disorders and sleep disturbances (PS) [0 p.]	Psychotic disorders and sleep disturbances (PS) [3 p.]	Psychotic disorders and sleep disturbances (PS) [1 p.]
Anxiety disorders (AXD) [1 p.]	Anxiety disorders (AXD) [0 p.]	Anxiety disorders (AXD) [4 p.]	Anxiety disorders (AXD) [2 p.]	Anxiety disorders (AXD) [3 p.]
Somatic and pain-related disorders (SPR) [1 p.]	Somatic and pain-related disorders (SPR) [2 p.]	Somatic and pain-related disorders (SPR) [4 p.]	Somatic and pain-related disorders (SPR) [2 p.]	Somatic and pain-related disorders (SPR) [0 p.]
Others (OS) [2 p.]	Others (OS) [0 p.]	Others (OS) [1 p.]	Others (OS) [3 p.]	Others (OS) [0 p.]

P: Person/people.

pain experiences, and patients may display individual differences on this issue. Potential mediator of these phenomena is central sensitization (CS) of pain (it can exists in fibromyalgia - Price et al. [11], or chronic fatigue syndrome - Nijs et al. [12]). CS is defined as changes within pre- and post-synaptical states, which include nervous tissue plasticity and result in development of hypersensitivity in spinal cord neurons and on higher parts of central nervous system. Very important in these processes seems to be voltage-gated Ca2+ channels. For example, through nerve injury, increased expression of α2σ1 subunit can be observed. It is supposed that a similar mechanism may take place in CS. According to this, increased pain experiences may be associated with these abnormalities. Moreover, psychopathological syndrome, which is called the pain catastrophism seems to be indirectly linked with CS in various groups of people [13,14]. Perhaps patients from 3 cluster were characterized by some kind of pain catastrophizing, compared to other clusters. Interestingly, this cluster is the most numerous in AD patients. Potential factor of this state may be common occurring of catastrophic thinking in patients with depression or mood disorders, following Beck's cognitive distortions theory (Table 4).

Second numerous group are SPR. In 3rd cluster there are more of them than in other clusters. This is possible that patients with affective disorders like depression and comorbid somatic symptoms have increased tendency to catastrophizing their state.

In the first cluster the domination of AD and SPR can be observed. It indicates that some patients with AD may have increased tendency to pain experiences, somatization, and conceptualization of that kind of symptoms. In the second cluster AD is also a dominated group, but without significant elevation in SPR syndromes. Perhaps, there are internal differences between affective patients in somatization of their symptoms. Therefore, therapies for particular subgroups of these people should be orientated towards different assumptions. In non-somatizing group it would be concentrated rather on improvement in their strategies for dealing with unfavorable thinking, and emotional patterns, whereas in somatizing group attention could be focused on reducing somatic symptoms through relaxation or neuro feedback, so that patient could focus on shaping favorable styles of thinking

and emotional processing. According to this, division AD patients to non-somatizing and somatizing groups may be potentially useful for planning therapeutic targets and algorithms.

Last cluster is intermediate and have more or less equal number of patients. It can be considered that this group is a combination of the other groups and patients are intermediate on the somatizing and non-somatizing AD continuum. Probably somatic symptoms are not as intensive as in first cluster patients (Table 5).

Second cluster consists only AD patients, where two of them have SPR. It is possible that in this part may be relations between two of them. The *rho* correlation indicates this potential association (0,635). In third cluster mainly AD, AXD and SPR occur without significant domination of any group. It may be caused by some similarities between these patients in somatic symptoms. In this group, intensification of depressive symptoms may similarly translate into somatization and vice versa, somatization into depressive symptoms. It could have a few clinical interpretations. Among others, if group AD and AXD patients could have a similar conceptualization of somatizing symptoms, a therapy plan with shared assumptions could prove to be a benefit to them. Differences would be mainly concentrated on the axial symptoms of AD and AXD, which require special therapeutic paradigms. In the 4th cluster the number of AD and PS patients can be observed, and there is the main cluster with PS patients. The last, 5th cluster accumulates mainly AD and AXD patients. Probably in these groups, patients could have similar properties in somatization and depressive symptoms.

Grabowski prepared a hypothesis about functional symptoms development [15]. Most of the somatizing patients experienced significant distress and affective symptoms intensity, which mostly impact the environment perception. Moreover, distress, especially chronic, is associated with hypothalamic-pituitary-adrenal axis (HPA overactivity). This schema is based on feedbacks between individual factors. However, it still require more interdisciplinary data to accept it, and preparing therapies in this basis.

Conclusion

- Most of the studied patients declared affective symptoms,

which seems to be differentialy distributed in individual clusters.

• Cluster analysis is effective procedure for grouping patients due to selected parameters.

• Cluster analysis can be used in identifying subgroups of patients in psychiatric research.

• Patients with AD can be divided into somatizing, non somatizing and intermediate.

• Somatization (4DSQ) is moderate correlated with depressive symptoms (BDI); however, this is not indicative of any causality.

• Self-rating catastrophism could be further studied as a predictor of pain catastrophism.

Summary and Final Comments

In conclusion, this exploratory pilot study was performed without any hypothesis; the aim was to identify clusters of patients who were similar to each other through self-rating parameters. Three cluster analyzes were performed: catastrophic thinking through pain experiences, somatization through pain experiences, and somatization through depressive symptoms. The main finding is that patients can be described in different subgroups by tendency to somatize affective symptoms. According to this, it could be possible to plan different therapeutic procedures for individual subgroups: for those with somatization, without somatization or intermediate. Nevertheless, more data for this is required. Huge limitation of this study is too small group of patients. To better confirmation of our conclusion, there should be a more homogeneous group, concentrated around depressive patients. Physical syndromes should not be acceptable for further research on somatizing – non-somatizing subgroups.

It is very important to establish the nature of somatization symptoms. If the depression is secondary to somatization, this syndrome is called a functional disorder (psychosomatic) and have not any organic cause. Patient is experiencing several pain symptoms without any medical explanation, and depression is caused by functional symptoms and helplessness for them. Previously it was considered as a neurosis. Newer diagnostic classifications treat that kind of syndromes as a somatoform disorders (F45 in ICD-10) or disorders of bodily distress or bodily experience (for instance 6C20 in ICD-11). DSM-5 include that kind of diseases as a disorders with somatic symptoms and others associated with them. Whereas depressive patients who have a tendency to somatize their symptoms indicate depression on first-line symptoms, and somatic symptoms are secondary to them. The exclusion of organic cause and functional disorder is the key for further research on depressive subgroups.

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