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Research Article

Adapting to Cancer with Body, Mind, and Heart: Psychological, Psychophysiological Assessment and Management in Sample of Ovarian Cancer Survivors

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Abstract

Objective: Ovarian cancer survivors often develop severe psychological disorders and impairments in social, familial, and sexual functioning. They experience a withdrawal from intimate relationship, fear and body shame, and a condition of unrelenting distress. Heart rate variability (HRV) is a physiological parameter that, when reduced, is index of higher distress. The quantitative observational study aimed at understanding the relationship between psychological adjustment, distress, and quality of life.

Methods: 44 women, consecutively recruited at the Oncological service of the Gynecological Dept., filled questionnaires investigating social support, body image, coping strategies and quality of life and recorded short-term HRV.

Results: significant correlations appeared between: quality of life functioning scales and body image, perceived social support and coping strategies; perceived support from the significant other and HRV (r=339 p <05), role functioning and HRV (r=479 p<001). Simple regressions on HRV showed the effect of the significant other's support (F=4.27 p<05) and of role functioning (F=9.810 p<001), while body image showed its effect on quality of life (F=4.18 p<05). Multiple regression on HRV showed the effect of body image (β=453), support from friends (β=-435) and avoidance (β=-391) while fatalism showed an effect on quality of life (β=364, p<05).

Conclusion: Higher concerns on body image seem linked to a worsened day-to-day life. Reporting these concerns contributes to raise HRV, while better emotive disclosure reduces emotional distress. Social support positively influences quality of life and HRV. Fatalism facilitates cancer acceptance process. Proper emotive disclosure may have a positive impact on life quality.

Keywords

Body image; Heart rate variability; Ovary cancer; Psychological support; Stress management

Introduction

Current cancer conceptualisation and management focuses on cancer as a chronic disease that can be directly moderated by psychosocial stressors [1]. According to the National Comprehensive Cancer Network (NCNN) 2015 Guidelines, 'an individual is considered a cancer survivor from the time of diagnosis through the balance of his or her life. Ovarian cancer is an aggressive illness associated with poor survival and high recurrence rates. That is because it is usually detected at an advanced stage, with a five-year survival rate of 46% for all stages, and 31% for advanced stages [2]. The management of ovarian cancer, which includes radical pelvic surgery and multiple aggressive courses of chemotherapy, worsens the impact of the illness on patients' quality of life. Ovarian cancer patients and survivors tend to develop psychological disorders, such as anxiety, depression and post-traumatic stress disorder [2,3]. There is evidence of impairments in social, familial, vocational, physical and sexual functioning, not just confined to the diagnosis and treatment period but also present in short- and long-term cancer survivors [4]. Indeed, as the scientific literature highlights, 'the Great Connection' [5] between mind and body in cancer is without doubt an urgent topic. One of the fundamental psychological features of the 'Great Connection' is social support [6]. In ovarian cancer patients, the literature highlights patients' withdrawal from intimate relationships because of feelings of fear and shame about their condition, as well as a strong maladaptive component linked to sexual functioning that leads to marked social retirement [6-9]. The coping strategies employed by individuals with cancer are another fundamental feature. For individuals living with an illness such as advanced cancer, acceptance coping strategies improve quality of life, reducing distress and psychopathological symptoms [10]. Conversely, greater denial and avoidance coping can lead to mood disturbances [11]. The literature points to psychoneuroimmunological (PNEI) mechanisms, such as heart rate variability (HRV), which can play a protective role in cancer survivorship [6]. HRV represents the changes in time intervals between consecutive heartbeats. It is an index of 'top–down' appraisals, mediated by cortical-subcortical pathways, providing an important window on objective distress [12]. The balance between the sympathetic nervous system and parasympathetic nervous system, specifically the vagus nerve, on heart rate [13, 14], determines HRV. A scientific theory has hypothesised and partially demonstrated the presence of a specific anatomical and functional system (the Social Engagement System) which, through the myelinated vagus, may form a close connection between HRV and psychological adaptive features [15, 16]. This study aimed integrate psychological and physiological aspects in a model of the direct influence of specific psychological features on quality of cancer survivorship. Based on Porges's polyvagal theory, we have observed a possible relationship between HRV and the psychological conditions of cancer patients, in particular their social support, coping strategies and body image. The research question we addressed was the protective role that a natural and appropriate physiological activity (HRV high coherence), which is able to reflect a good autonomic balance, might have on cancer survivorship. The main aim of this study was understand the relationship between psychological adjustment to the illness, distress and quality of life, one of the primary issues in chronic cancer care today.

Objectives

Based on previous studies [6, 7] e objectives of this study were:

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I.   To confirm that better psychological adjustment and an higher levels of HRV coherence are associated with a better life style perception by the patients and a better compliance to therapeutic interventions and rules;

II.   To investigate whether poor body image perception and maladaptive coping strategies are associated with poorer quality of life.

Methods

Study design

Quantitative, observational, exploratory, transversal study.

Participants

Women diagnosed with ovarian cancer following a follow-up programme for ovarian cancer at the Gynaecological Dept. of the University Hospital of Parma, were consecutively recruited according to criteria described in Table 1.

The final sample consisted of 44 women aged from 30 to 69 years (Mean=54.01; SD=10.94). The sample was heterogeneous in terms of cancer characteristics (Table 1). Participants voluntarily agree to participate in the study after a brief interview with a clinical psychologist signing the informed consent. In relation to cancer clinical characteristics, the sample was quite heterogeneous as resumed in Table 1. Among these women, 71.67% had a partner, while 28.4% was widow, divorced or single; 57.8% had had children before the onset of cancer. Some more pathological data regarding the type and consistency of the treatment are summarized in Table 2.

Instruments

Psycho-oncological record: A sheet of general information about the patient, the course of the disease and the presence of psychological/psychiatric/psychopharmacological support;

Multidimensional Scale of Perceived Social Support (MSPSS) [17]: A 12-item questionnaire designed to measure perceptions of support from three sources: family, friends and a significant other.

Derriford Appearance Scale-59 (DAS-59) [18, 19]: A 59-item questionnaire designed to generate a comprehensive assessment of the responses of individuals to living with problems of appearance, including disruption to everyday living, difficulties with personal relations, lowering of self-esteem and emotional distress.

As well as a full-scale score (F-S), the DAS59 has five, factorial sub-scales:

1. General self-consciousness about appearance (GSC)

2. Social self-consciousness about appearance (SSC)

3. Sexual and bodily self-consciousness about appearance (SBSC)

4. Negative self-concept (NSC)

5. Self-consciousness about facial appearance (FSC)

Mental Adjustment to Cancer (MAC) [20]: A 40 items questionnaire designed to investigate prevalent patterns of coping with cancer:

1. Fighting spirit (FS), the tendency to confront and actively face the illness;

2. Anxious preoccupation (AP), the tendency to experience the illness as an event source of marked anxiety and tension;

3. Fatalism (F), the tendency to have a resigned and fatalistic attitude towards the illness;

4. Hopelessness/helplessness (H/H), the tendency to adopt a pessimistic attitude about the illness;

5. Avoidance (A), the tendency to avoid direct confrontation with illness-related issues.

EORTC Quality of life questionnaire LQ-30 version 3.0 (EORTC-QLQ30) [21]: An integrated system for assessing the health-related quality of life (QoL) of cancer patients. It is composed of both multi-item scales and single-item measures. These include functioning scales, symptom scales and a global health status / QoL scale. All the scales and single-item measures range in score from 0 to 100. A high score on a functioning scale represents a high level of functioning, a high score on global health status (QL2) represents good quality of life and a high score on a symptom scale / item represents a high level of symptomatology.

The functioning scales are Physical functioning (PF2);Role functioning (RF);Emotional functioning (EF);Cognitive functioning (CF);Social functioning (SF).

Symptoms scales and items are Fatigue; Nausea and vomiting; Pain; Dyspnoea; Insomnia; Appetite loss; Constipation; Diarrhoea; Financial difficulties.

For each participant we also recorded short-term (five minutes) heart rate variability using:

emWavePro (HeartMath): a recording system that objectively monitors heart rhythm using a pulse sensor connected to the patient's earlobe and plugged into a computer USB port with an flash drive containing an appropriate EKG spectral analysis software. To assess HRV, the standard deviation of NN interval (SDNN) was considered.

Procedure

At the end of the routine follow-up visit, the physician on duty proposed to each patient that she participate in the study and sent

Table 1: Inclusion/exclusion criteria.

1	Ovarian cancer diagnosis in at least the last six months
2	No surgery in at least the last two months
3	Not undergoing chemotherapy treatment at the time of recruitment
4	Good Italian language comprehension (need for the psychological questionnaire administration in Italian)
5	Aged 18 and over
6	Read and signed the informed consent form
7	Not Medical history of previous psychiatric disorders
8	Not undergoing psychopharmacological treatment before the onset of cancer
9	Not undergoing pharmacological treatment with drugs directly affecting heart rate (i.e. beta- blockers)

Table 2: Characteristics of the cancer treatment at the time of Psychological assessment.

	#	Chemo cycles range	Means	SD
Time Diagnosis (6 months or more)	44	1-10	21,6	1.9
Last chemo cycle	23	1-10	28.1	16.6
No chemo cycles at the time	21	5-7	23.7	0.86

her to see the researcher in a private room. Once there, the researcher described the study in detail and gave the patient the informed consent form.

After reading and signing the document, there was a brief clinical interview in order to verify the inclusion and exclusion criteria. Immediately after the interview, the patient was asked to complete the battery of tests (approximately 40 minutes in duration).

Once the patient had finished the battery, she was asked to stay as still and as relaxed as possible while her HRV at rest was recorded. After a few minutes of adaptation (approximately two to three minutes), the short-term recording (five minutes) started.

Data analysis

Kubios HRV 2.2 software (Department of Applied Physics, University of Eastern Finland, Kuopio, Finland) was used to analyse raw R-R interval data recorded through emWave. Statistical analysis was performed using the software SPSS 21, with statistical significance inferred at a p value of less than 0.05. Normal distribution data were assessed by calculating skewness and kurtosis. In the case of non-normal distribution, data were transformed until skewness and kurtosis levels were adequately reduced. To evaluate possible correlations between the constructs, we applied Pearson's correlation for continuous variables. In order to verify the possible causal connection between variables, after verifying data assumptions we conducted simple and multiple regressions to test the goodness of fit of the theoretical model.

Statistical analysis

HRV data were processed by Kubios HRV 2.2 Software (Department of Applied Physics, University of Eastern Finland, Kuopio, Finland), which analyzes raw R–R Interval data registered through emWave, and gives back as result a list of Time–Domain Indexes, Frequency–Domain Indexes and Non-Linear Results. Data were analyzed using descriptive statistics, analysis of the variance looking for possible moderators and comparison within the group using t test. All tests were performed using SPSS, Version 21, and

statistical significance was inferred at a P value of <05. The normality of data distribution was tested computing skewness and kurtosis and then using the Kolmogorov–Smirnoff test. In case of not normal distribution, data were transformed until skewness and kurtosis' levels were adequately reduced.

Results

There were numerous correlations between the questionnaires. In particular, there were significant correlations between the quality of life functioning scales (EORTC-QLQ30) and body image (DAS-59), perceived social support (MSPSS) and coping strategies (MAC), as shown in Table 3.

Significant correlations between coping strategies (MAC), social support (MSPSS) and body image (DAS-59) are shown in Table 4.

There was also a significant correlation between negative self-concept and perceived family support, $r=-360$ p (two-tailed)<05, with $R^2=1296$.

There was a significant correlation between perceived support from a significant other and HRV_SDNN, $r=339$ p (one-tailed)<05, with $R^2=113$.

There was also a significant correlation between the EORTC role functioning scale and HRV_SDNN, $r=479$ p (one-tailed)<001, with $R^2=2294$.

The first outcome considered for regression was HRV SDNN.

A simple regression was performed using as the predictor the MSPSS 'significant other', $F_{(1,38)}=4.27$ p<05. From this regression, it emerged that 11.5% of HRV variation could be explained by perceived support from a significant other.

A simple regression was performed using as the predictor the EORTC-QLQ30 'role functioning' scale, $F_{(1,38)}=9.810$ p<001. It emerged that 22.9% of HRV variance could be explained by this variable.

Table 3: Significant correlations between DAS-59, MSPSS, MAC and EORTC-QLQ30 Function Scales (Note: *p<05, **p<001).

	DAS FS	DAS GSC	DAS NSC	MSPSS Sig. Other	MSPSS Family	MSPSS Total Support	MAC_F	MAC_A
QL2	-327* $R^2=0.1069$	-	-452** $R^2=2043$	-	-	-	0.364* $R^2=0.1324$	-
PF2		-	-3331* $R^2=0.1095$	-	-	-	0.474** $R^2=0.2246$	-
RF	-	-	-	0.554** $R^2=0.3069$	-	-	0.475** $R^2=.2256$	-
EF	-	-	-401* $R^2=0.1680$	0.542** $R^2=0.2937$	-	-	0.495** $R^2=0.2450$	-352* $R^2=0.21239$
CF	-0.356* $R^2=0.1267$	-0.363* $R^2=0.1317$	-480** $R^2=0.2304$	0.473* $R^2=0.2237$	0.418* $R^2=0.1747$	0.411* $R^2=0.1689$	-	-

Table 4: Significant correlations between DAS-59, MSPSS, and MAC (Note: *p<05, **p<001).

	DAS FS	DAS GSC	DAS SSC	DAS NSC	DAS SBSC	MSPSS Significant Other	MSPSS Friends
MAC_H/H	0.500** $R^2=0.25$	0.380* $R^2=0.1444$	0.433** $R^2=0.1874$	0.426** $R^2=0.1814$	0.397* $R^2=0.1576$	-	-
MAC_AP	-	-	-	-	-0.344 $R^2=0.1183$	-	-
MAC_Fs	-	-	-	-	-	-	-0.342* $R^2=0.1169$
MAC_F	-	-	-	-0.513** $R^2=0.2631$	-	0.360* $R^2=0.1296$	-

Table 5: Multiple stepwise regression MSPSS, DAS-59 and MAC by HRV(Note: R^2=0.12 for Step 1, ΔR^2=0.11 for Step 2, ΔR^2=0.14 ($p<0.001$). *$p<0.05$, **$p<0.001$).

		B	(SE) B	β
Step 1	Constant	1.582	0.107	-
	MSPSS Friends	-0.592	0.271	-0.347
Step 2	Constant	1.191	0.2	-
	MSPSS Friends	-0.696	0.26	-0.407
	DAS_ FS	0.005	0.002	0.344*
Step 3	Constant	1.681	0.256	-
	MSPSS Friends	-0.743	0.239	-0.435
	DAS_FS	0.007	0.002	0.453**
	MACa	-0.368	0.134	-0.391

Table 6: Multiple stepwise regression MSPSS, DAS-59 and MAC by EORTC EF(Note: R^2=0.29 for Step 1, ΔR^2=0.10 for Step^2 ($p<0.05$). *$p<0.05$, **$p<0.001$).

		B	(SE)B	β
Step 1	Constant	33.404	9.91	-
	MSPSS Sig. Oth.	49.606	13	0.542**
Step 2	Constant	17.45	11.3	-
	MSPSS Sig. Oth	38.23	13	0.418**
	MAC_ F	456	188.5	0.345*

A stepwise multiple regression was performed, with MSPSS (subscales), DAS-59 (subscales) and MAC (subscales) as predictors (Table 5)

This multiple regression model shows SDNN HRV to be influenced by social support, body image and coping strategy. Together, these predictors explain 38% of HRV variance. In particular, one of the most influential variables was general approach to appearance and body image (β=453), followed by support from friends (β=-435) and the use of an avoidance coping strategy (β=-391).

The second outcome considered was the global Quality of Life scale (QL2).

A simple regression was performed using as the predictor DAS_Full Score, $F(1,38)$=4.18 $p<05$. It emerged that 10.7% of global Quality of Life variance could be explained by perception of body appearance (β=-327).

A stepwise multiple regression using as predictors MSPSS (subscales), DAS-59 (subscales) and MAC (subscales) was performed. The stepwise regression retained only the fatalism coping strategy. Fatalism (β=0.364, $R2$=0.132*) explained 13.2% of global Quality of Life variance.

Finally, the Emotional Functioning scale was considered as a regression outcome and a multiple regression using as the predictors MSPSS (subscales), DAS-59 (subscales) and MAC (subscales), performed (Table 6).

The stepwise regression kept as the predictor perceived support from a significant other and the coping strategy fatalism. Together, these predictors explained 39.0% of Emotional Functioning.

In particular, one of the most influential variables was perceived support from a significant other (β=0.418), followed by a fatalism coping strategy (β=0.345).

Discussion

The results of the present study confirm that higher levels of HRV coherence are associated with better psychological adjustment. Furthermore, we wanted to examine whether poor body image perception and maladaptive coping strategies were associated with poorer quality of life [6,7].

The results that emerged from this sample of ovarian cancer survivors then confirm the presence of an integrated model of physiological and psychological adjustment that could have a strong impact on overall quality of life, and ultimately on survivorship, here meaning living a valuable life from the time of diagnosis.

Furthermore, results show a strong relationship between body image and quality of life. Obtained data suggest that greater concern about body image, in particular negative self-concept, is linked to poorer everyday functioning. The relationship between negative self-concept and a reduction in emotional functioning is understandable in terms of possible distress arising from the perception of body appearance, as documented in the literature [22]. In addition, the relationship between negative self-concept and physical functioning might be interpreted as the effect of reduced physical functionality on the wider concept of appearance.

Moving on to the relationship between social support and quality of life, the results from our sample confirm the evidence in the literature of a strong relationship between greater social support and better everyday functioning [23-25].

Another interesting association is that between fatalism, as the prevailing coping strategy, and general functioning. In this sample, fatalism was associated with better physical, role and emotional functioning, which accords with the small volume of scientific research that has traced a similar effect of this coping strategy [6,7,26]. In our sample, greater avoidance was associated with reduced emotional functioning, mirroring data from other scientific research [10].

Further associations were found between coping strategies and body image. A helplessness/hopelessness approach to cancer was closely linked to poor body image perception. Here again our data suggest the importance of fatalism as a coping strategy, showing a negative association between this strategy and negative self-concept.

One more interesting association was found between coping strategies and social support. That is, the coping strategy fighting spirit was associated with lower perceived support from friends. We might hypothesise that this is the result of greater perceived independence and self-determination. We also found that fatalism

was associated with greater support from a significant other, which could be mediated by higher rate of appreciation of the significant figure.

For the relationship between greater support from the family and reduced negative self-concept, we might hypothesise that family support may have a 'buffer effect' on acceptance of one's own body image.

Turning to HRV, the significant relationship between greater support from a significant other and higher SDNN HRV gave us our first insight into the connection between psychological and physiological adjustment, mirroring what we had found in the literature [6, 7, 15, 16, 27].

Lastly, the significant association between role functioning and SDNN HRV might indicate that role functioning, meaning the safe ability to perceive oneself as effective in one's own social environment, is associated with a healthier HRV.

We observed that support from a significant other positively affected HRV, giving a causal direction to this association and confirming the literature [7, 15, 16, 27]. In this sample of women, we would suggest that the presence of good support activates their Social Engagement System, improving their HRV.

Another result was the effect of higher role functioning on higher SDNN HRV. We hypothesise that in these women, perceiving themselves to be effective in their environment and preserving role functioning positively affects their physiology, probably following the same physiological pathway, i.e. the Social Engagement System.

The third significant result in terms of psychological-physiological integration was that the greater presence of concerns about appearance contributes to a higher HRV. We hypothesise that women with higher DAS_FS are prone to better emotional disclosure and thus are better able to acknowledge their difficulties and body appearance concerns more freely. Such proneness to disclosure appears to reduce emotional distress, improving HRV and global health in turn [28]. Last, emotional avoidance can generate higher distress, thus worsening HRV.

Looking at quality of life as an outcome, we found some interesting results. A poor perception of body appearance can negatively affect quality of life. This result appears to align with previous research on other cancer sites such as the breast, and the head and neck [29, 30], even if it seems to contradict the effect that body image has on HRV. However, we can attempt to explain this result using the concept of 'response fragmentation' [31], whereby cognitive, behavioural and physiological responses are partially independent. Hence, disclosure of body appearance concerns might improve adaptation on the physiological level but could cause suffering on the cognitive level.

In our sample, the use of the coping strategy fatalism had a positive impact on global quality of life, reinforcing the observed correlation in an apparent contradiction of the literature [32-34]. Women using this strategy seemed to have a positive approach to life and to everyday difficulties arising from their condition. Hence, we can more concretely hypothesise that fatalism is closer than fighting spirit to acceptance. In fact, we could interpret this scale as a 'Living-each-Day' scale, mirroring the tendency to live a valuable life in the present, which could explain the positive impact it has on quality of life.

We explored emotional functioning as an outcome. Here we found that good and satisfying social support, in particular coming from one important person, seems to improve emotional functioning in everyday life, probably by making it easier to share the emotional burden caused by the disease itself as well as the associated stigma and fear. With this outcome, we see again that the coping strategy that seems to work best in emotional adjustment is fatalism. We should remember that support from an important person and fatalism are strongly related to each other, giving more depth to the interpretation of this interesting result.

In order to verify the effect of categorical variables as the age of diagnosis, multivariate analysis of variance (MANOVA) and "t test" were applied. We split the sample in two groups: reproductive age (< 51) versus non-reproductive age ($\geq$ 51) at the time of first diagnosis. As well known in the scientific literature [35], 51 years is considered the threshold for the menopause onset. Who was diagnosed in the reproductive age, seem to have higher HRV (Me=32.9) than women not in reproductive age (Me=23.930; t (34)=− 2.99, p< 0.005). This effect was controlled splitting the sample basing on the Median age 53 but no significant difference was found. Moreover, considering as outcomes EORTC functional scale, using Pillai's trace, there was a significant effect of the age of diagnosis on the Emotional Functioning Scale, V=0.28, F(1, 35)=2.5, p<05. Considering as outcomes EORTC symptoms scale, there was a significant effect of the age of diagnosis on Fatigue, V=0.28, F (1. 35)=2.5, p<0001 and Pain, V=0.28, F (1.35)=8.7 p<005.

Conclusion

The main purpose of the present study was to further delineate a model of integration between psychological features, physiological patterns and cancer survivorship quality.

What we found can be seen as preliminary evidence for the existence of this 'integrated model of defence', which should be investigated further in cancer survivors.

We also found, thanks to HRV data, that level of distress, to be favorably influenced by the presence of a significant figure and, more particularly, we believe, by appropriate emotional disclosure with people who are significant in patients' lives. In addition, continuing to function in one's own environment is reflected in higher HRV, perhaps by preserving a sense of self and thus reducing the distress caused by cancer. Hence, we can answer yes to our first research question: in these women, a good coherence level of HRV seems to be strictly associated with a better psychological adjustment.

Moreover, we found that quality of life for these women is deeply influenced by body appearance perception, giving us an affirmative answer to our second research question. This is an innovative aspect of the present study because, since in this kind of sample, the scar the women have is covered and not readily visible, it is rarely considered. However, these women more or less consciously see the scar and feel intimately damaged by it.

Last, our findings in relation to coping style were surprising. In these women, fatalism seemed to be protective and to facilitate the process of cancer acceptance. Thus, in accordance with the literature, the concept of fatalism should be redefined as the ability to live life day-by-day, giving value to each day and to each person sharing that day. This improves social relationships and quality of life.

Study limitations

The small number of participants and the heterogeneity of cancer characteristics make it very difficult to generalise the findings to the wider population of ovarian cancer patients.

We sincerely hope that future research will overcome the size limitations of this study and consider the use of more specific instruments to better assess coping avoidance and gain more 'positive' insight into life after this traumatic event.

Clinical implications

Gathering more evidence on this topic would help to identify practical protocols that could be effective in adjusting to illness and stress reduction, thereby increasing quality of life in this population.

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