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Long-term Effects of Cancer Treatment and Consequences of Cure: Cancer Survivors Enjoy Quality Of Life Similar To Their Neighbours

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To assess the long-term effects of cancer treatment and consequences of cure, 102 index cancer cases were compared with 95 neighbourhood controls of similar age and sex and with 78 cardiac controls. The quality of life experienced by these three groups was examined using multiple instruments with proven psychometric properties. All the major quality of life domains (physical, psychological and social) were covered. The findings revealed that the index cases were similar to their neighbours in areas of subjective well-being. However, the index cases exhibited more sexual dysfunction, were more conscientious, determined and emotionally disciplined, and applied the defence mechanisms of displacement and reaction formation more often than the neighbourhood controls. The cardiac controls were older, more anxious, more conventional/less imaginative and used suppression as a defence mechanism to a greater degree than the index cases. In conclusion, young adult cancer survivors enjoy a quality of life similar to their neighbours, whereas coronary bypass survivors adjust less well psychosocially.
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INTRODUCTION

CANCER CURE can be defined as the attainment of normal life expectancy and has three important components: (1) the attainment of complete remission; (2) the survival to a stage where there is minimal or no risk of recurrence; (3) the restoration of physical, developmental, functional and psychosocial aspects of health [1]. Considerable attention has been devoted to the development of treatment programmes which produce complete remissions and long-term disease-free survival. Little attention has been given to the quality of survival and restoration of functional health. However, the value of measuring quality of life (QOL) in cancer care is becoming increasingly recognised. This is evidenced by an increase in the number of published reports containing QOL assessment [2–4]. Recently, the World Health Organization has mandated several collaborating centres to study QOL in cancer care [5].

In this paper we report the results of a study designed to look at the long-term effects of cancer treatment and the consequences of cure. The objectives of the study were:

—To document symptomatic long-term effects of cancer therapy.

—To assess the QOL of young adult cancer long-term survivors and compare them with their neighbours.

—To determine whether such adult cancer survivors adjust as well to their illness and treatment as similar patients treated for other life-threatening conditions such as coronary artery bypass surgery.

—To determine the personality traits of these cancer survivors, to relate them to the initial diagnosis and modes of treatment, and to compare them with neighbourhood controls and coronary artery bypass patients.

PATIENTS AND METHODS

This was a mixed cross-sectional study with two control groups. From a population of 2000 survivors of all forms of cancers, a computerised search produced 158 individuals fulfilling the entry criteria. Young adult cancer patients aged 15–40 years at diagnosis were invited to participate as index cases. Their details were obtained from the South Australian State Cancer Registry and the files of the three participating hospitals. The diagnoses eligible for inclusion were acute leukaemias (lymphoblastic and myeloblastic), Hodgkin's disease, non-Hodgkin lymphoma (diffuse large cell), germ cell tumour of the testis, choriocarcinoma, bone sarcoma and small cell cancer of the lung. Other eligibility criteria included the patient's willingness to participate, accessibility, disease-free status of at least 60 months and being off active therapy for at least 12 months. A neighbourhood control matched to each cancer case by sex, age (±5 years) and postal code, was selected from the South Australian electoral roll. Coronary artery bypass patients who had been hospitalised at the same time as the index cases, whose ages were close to the index cases, were selected from the Royal Adelaide Hospital Cardiac Surgery Unit Registry.

Ethics review board permission was obtained from each

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participating hospital and the Cancer Registry Board. All subjects had their medical history taken, followed by a physical examination which included a complete blood examination (CBE), 20-item multiple blood analysis (MBA_{20}) and a chest roentgenogram.

Instruments

Physical function was measured using the Eastern Cooperative Oncology Group (ECOG) performance status [6]. The Hospital Anxiety and Depression Scale (HADS) [7], the Psychological Adjustment to Illness Scale (PAIS) [8], and the Weissman Social Adjustment Self Report questionnaire [9] were used to assess psychosocial function. Personality traits and defence mechanisms were assessed by Cattell's 16 Personality Factor Inventory (16PF) [10] and Bond Defence Style (BDS) questionnaire [11], respectively. Goldberg's Clinical Interview Schedule (CIS) administered by two of the investigators (PR and GB—senior psychiatrists) was used as a measure of psychological functioning over the previous week.

Sample size and statistical methods

Power calculations were complicated by the mixed design and the large number of variables measured. In order to simplify the power analysis, only one variable was considered, namely depression. It was assumed that 10% of controls would likely be depressed, and that this would increase to 20% in cancer cases. Given a one-sided alpha error of 0.05, a power of 0.20, and a matched design, 86 subjects in each group would be required. An attempt was made to recruit 100 subjects in each group allowing for refusals and incomplete data capture.

Only 62 of the 102 cancer cases were successfully matched to neighbourhood controls. In a number of instances, it was possible to obtain more than one neighbourhood control for each cancer case. Therefore, the cancer case–neighbourhood control comparison has been analysed as if the data had not been matched. However, a matched analysis was performed to confirm the results of the final model.

Univariate analyses were performed using the SPSS-PC statistical package (SPSS Inc., 1988). Discrete variables were analysed using conventional uncorrected χ^2 tests. Continuous variables were analysed by Wilcoxon–Rank sum tests. A nonparametric test was selected because of the skewed nature of most of the continuous variables.

Conditional and unconditional logistic regressions were performed using the EPILOG statistical package (Epicenter Software Inc., 1985).

RESULTS

158 cancer survivors were identified as potential participants. 56 did not participate. No response was obtained from 20. In 8 cases follow-up addresses could not be traced. There were 28 refusals (Table 1). Thus, 102 index cancer cases were recruited into the study with 95 neighbourhood and 78 cardiac controls (Table 2). Index cases were significantly younger than the cardiac controls ($P \leq 0.0001$). The index cases also had a smaller proportion of males than both the neighbourhood ($P = 0.11$) and cardiac ($P < 0.0001$) controls. Marital status and levels of education did not differ significantly between the three groups.

The majority of index cases were patients previously treated for Hodgkin's disease (50%) and germ cell tumour of the testis (32%). The remaining 18% were patients who were treated and cured of non-Hodgkin lymphoma, acute leukaemia and bone sarcoma (Fig. 1).

Table 1. Reasons for refusal to participate

Reason	No.
Left the state or country	8
Too busy	6
Psychological distress	4
Looking after daughter with leukaemia	1
Developed cerebrovascular accident	1
Intellectual disabilities*	1
No explanation given	7
Total	28

*Predating cancer therapy therefore precluded psychosocial assessment.

Table 2. Demographic comparison of three groups

Variable	Index cases	Neighbourhood controls	Cardiac bypass controls
n	102	95	78
Mean age	38.6	39.4	46.8
% Male	58.0	68.8	87.2
% Married	76.5	79.7	83.9
% Tertiary education	24.7	29.7	14.5

Comparison of index cases with neighbourhood controls

The only statistically significant difference in variables relating to physical health was with respect to the CBE. A greater number of index cases (29.5%) had an abnormal CBE as compared with controls (5.8%) ($P = 0.0002$). However, if 13 cases with postsplenectomy changes after staging laparotomy are excluded, the differences are no longer significant. MBA_{20} showed 52.1% of the index cases had one or more abnormalities compared with 36.6% of neighbourhood controls. The commonest abnormality was a random serum cholesterol level above the Australian National Heart Foundation recommended safe upper level of 5.5 μmol/l. However, the differences were not statistically significant ($P = 0.0624$).

Table 3 shows those variables relating to mental health that differed significantly ($P < 0.05$) between the two groups based on Wilcoxon–Rank sum tests. There were statistically significant differences on a large number of psychosocial variables.

A multiple logistic regression analysis was performed to assess which of the above variables could jointly best distinguish cases

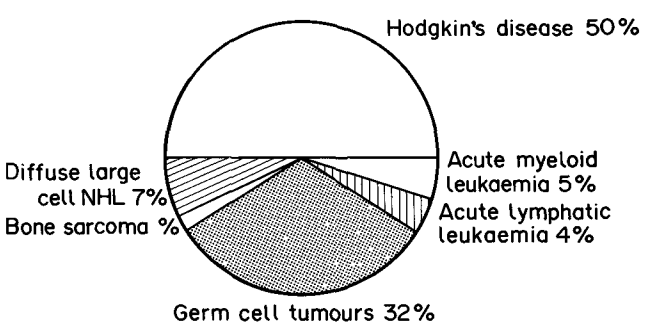

Fig. 1. Pie diagram showing the proportion of various malignancies studied.

Table 3. Differences between cancer cases and neighbourhood controls with respect to mental health

Variable	Mean rank score Index cases	Neighbourhood controls	P*
CIS—total score	93.04	68.44	0.0008
CIS—irritability	89.52	69.06	0.0012
CIS—anxiety	87.84	70.99	0.0083
CIS—phobias	83.52	73.79	0.0355
CIS—sexual dysfunction	84.55	71.44	0.0132
16PF A—reserved/outgoing	67.47	82.84	0.0282
16PF 2nd order—extroversion	68.01	82.27	0.0438
DSM Intermediate/neurotic—total	79.12	62.99	0.0190
DSM Neurotic—undoing	80.41	60.87	0.0042
DSM Neurotic—reaction formation	78.95	58.90	0.0031
DSM Immature—isolation	77.37	63.82	0.0479
DSM Immature—displacement	83.68	57.69	0.0001
Weissman—work at home	25.86	38.94	0.0160
Weissman—permanent relationships	59.00	72.12	0.0438

*Based on Wilcoxon sum test.

Table 4. Results of unconditional multiple logistic regression analysis for cancer cases vs. neighbourhood controls

Variable	B	SE(B)	EXP(B)	P
CIS—sexual dysfunction	−0.55	0.24	0.578	0.0216
16PF G—weak/strong superego	0.33	0.12	1.386	0.0085
DSM neurotic—reaction formation	−0.55	0.19	0.579	0.0044
DSM immature—displacement	−0.27	0.12	0.763	0.0238

from controls. Sex was included in the model as a candidate predictor variable. Table 4 shows that a model containing only four variables provided a highly significant fit to the data ($P < 0.0001$). The above model correctly classified 70% of subjects into their relevant group. None of the physical health variables were statistically significant after adjusting for the psychological variables.

To confirm these results, this last analysis was repeated using the matched data set, and conditional logistic regression. The matched analysis gave substantially the same results, although with a weaker fit to the data ($P = 0.015$).

Comparison of index cases with cardiac controls

Table 5 shows those physical health variables that differed significantly between the index cases and cardiac controls

Table 5. Differences between cancer cases and cardiac controls with respect to physical health

Variable	% Abnormal finding Index cases	Cardiac controls	P*
Cardiovascular system	3.7	30.2	0.0001
Chest roentgenogram	7.1	19.1	0.0498
MBA_{20}	52.1	71.4	0.0209
CBE	29.5	5.0	0.0003

*Based on χ^2 test with one degree of freedom.

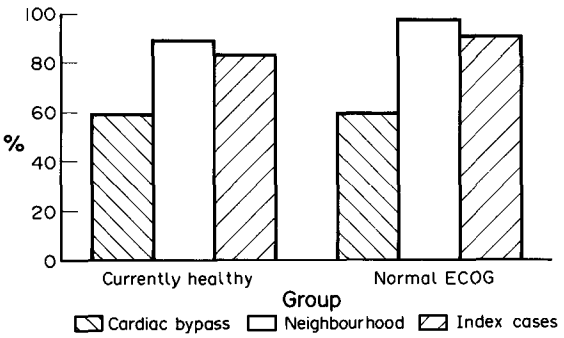

Fig. 2. Bar charts showing (a) % currently healthy, and (b) % with normal ECOG status for the three study groups.

($P < 0.05$). Not surprisingly, the cardiac controls had a significantly higher prevalence ($P < 0.0001$) of abnormal cardiovascular symptoms (angina, dyspnea, oedema, palpitations) and signs; abnormal chest roentgenograms ($P < 0.0498$) and significantly higher average diastolic blood pressure ($P = 0.02$) than index cases. Index cases had a significantly higher proportion with abnormal CBE but cardiac controls had more with abnormal MBA. As with the index case–neighbourhood control comparison, when the staging laparotomy cases were excluded, the CBE differences ceased to be significant. Overall, 82.7% of index cases viewed themselves as currently healthy, compared with only 58.5% of cardiac controls ($P = 0.0012$) (Fig. 2). While 90% of index cases were assigned a normal ECOG status, only 59% of cardiac controls were regarded as normal ($P < 0.0001$).

There were fewer significant mental health differences between index cases and cardiac controls (Table 6) than between index cases and neighbourhood controls. Multiple logistic regression analysis was performed to assess which of the above physical and mental health variables best jointly distinguished cases from controls. Age and sex were added to the model as candidate predictor variables. A model containing only four variables (Table 7) provided a highly significant fit to the data ($P < 0.0001$). The above model correctly predicted the group membership of 85% of the study subjects. Again, none of the physical health variables were statistically significant after adjusting for the psychological variables.

DISCUSSION

The present study differs from previous QOL research in cancer patients which were restricted to single diagnostic cate-

Table 6. Differences between cancer cases and cardiac controls with respect to mental health

Variable	Mean rank score Index cases	Cardiac controls	P*
CIS—irritability	66.39	76.56	0.0239
16PF L—trusting/suspicious	62.93	76.56	0.0434
16PF M—conventional/imaginative	77.92	57.89	0.0028
HADS—anxiety	66.96	80.86	0.0473
DSM mature—suppression	71.63	57.38	0.0301
DSM neurotic—undoing	71.15	57.92	0.0443
DSM immature—splitting	58.20	72.82	0.0262

*Based on Wilcoxon–Rank sum test.

Table 7. Results of unconditional multiple logistic regression analysis for cancer cases vs. cardiac bypass controls

Variable	B	SE(B)	EXP(B)	P
16PF M—conventional/imaginative	−0.44	0.17	0.643	0.0092
Age	0.34	0.07	1.407	<0.0001
HADS anxiety	0.19	0.09	1.215	0.0242
DSM mature—suppression	−0.38	0.19	0.684	0.0427

gories [13–18]. Several groups of curable cancers affecting young adults were included in this study, and most index cases had at least one and often two age- and sex-matched controls.

There was a preponderance of patients with Hodgkin's disease and germ cell tumour of the testis. This may be because these two are the most curable malignancies in the age group selected. Hodgkin's disease is curable by both radiotherapy and chemotherapy. Testis cancer survivors represent an ideal group for the study of psychosocial factors, curative therapies and health care outcomes. Testis cancer is an age-specific disease. It has dramatic cure rates even at an advanced stage, and it threatens an organ associated with self esteem, sexuality and masculinity.

The lack of appropriate instruments to assess QOL has been a major impediment to the introduction of this measure of success into clinical trials [19]. The application of multiple instruments enabled us to cover the principal domains currently recognised as constituting QOL, namely physical and psychosocial functioning and somatic comfort [20–22].

Based on history, physical examination findings and ECOG performance status it can be generally stated that the index cases were physically as healthy and functionally as active as their neighbours. This is confirmed by the sense of subjective well-being as expressed by the two groups revealing no significant differences. It is interesting to note that the index cases were actually healthier than their neighbours as far as the CVS is concerned (Table 5). One would have expected the index cases, and especially the germ cell sub group, having received potentially nephrotoxic therapies to exhibit long-term sequela of renal damage, i.e. hypertension [13]. The explanation for our differing findings is not clear.

Highly significant differences emerged between the index cases and neighbourhood controls in the CBE. The abnormal CBE appeared to be a manifestation of the postsplenectomy syndrome as exclusion of the 13 splenectomised individuals eliminated the statistically significant differences observed. The abnormal MBA results were mostly due to cholesterol levels above the recommended safe limit. Other investigators have observed hypercholesterolaemia after cisplatin-containing combination chemotherapy for germ cell tumour [23]. It is tempting to speculate that cancer cure may lead to increased dietary indiscretion or perhaps a predisposition to elevated cholesterol and cancer may somehow be interrelated.

Despite using multiple measures of QOL, sexual dysfunction as determined by Goldberg's CIS was the only symptomatic long-term sequelae of cancer treatment in index cases compared to neighbourhood controls. 17% of index cases admitted to having sexual dysfunction and a substantial proportion of these (41%) had difficulties directly attributable to treatment given. Premature menopause was the most commonly cited abnormality. It is not clear at this stage whether the dysfunction observed occurred in all subgroups. Various studies of testis cancer survivors reported significantly more infertility and performance distress (inability to achieve and sustain erection, to ejaculate and reach orgasm) than in appropriate controls [13, 14]. Similarly, up to 30% of Hodgkin's disease patients, especially those with systemic symptoms of fever [24], diaphoresis and weight loss are known to be azoospermic at the time of diagnosis and combination chemotherapy with mustagen, oncovin, procarbazine and prednisone (MOPP) may cause further gonadal cell damage [25, 26]. The sexual dysfunction in our index cases deserves further study to determine whether it can be prevented and, if not, whether the subjects so identified could benefit from appropriate counselling, hormone replacement and prosthetics.

Several studies have documented psychological distress among cancer patients as compared with rates found in primary care populations [27, 28]. The most commonly reported disorders in cancer patients are depression and anxiety [29–34]. In our study the HADS score demonstrated a high degree of anxiety among cardiac controls but it did not detect significant level of depression in any of the three study groups. PAIS did not reveal any affective disorder. It might be argued that both instruments were not sensitive enough since our findings are at variance with previously reported studies [35–36]. It is conceivable that the low level of affective disorders observed in our study is due to the application of the HADS which excludes symptoms that reflect somatic manifestations of psychological disturbance. It is also possible that both anxiety and depression are not as common as previously thought, especially in long-term cancer survivors. One previous study had a similar suggestion for depression [37]. On the basis of the self-report questionnaire of Weissman, the index cases were observed to be as socially adjusted as the neighbourhood controls except for work at home where the neighbourhood controls coped better than the index cases. However, this feature was not one of the predictor variables on multiple logistic regression analysis. It would thus appear that although cancer and its treatment might be stressful, this does not continue indefinitely, and most subjects (at least young adults with the kind of malignancies we studied) recover well physically and psychosocially.

The relationship between personality and successful adaptation to cancer cure was explored using Cattell's 16PF [10] and the BDS questionnaire [11]. The index cases differed from neighbourhood controls on several variables. Factor G on the 16PF showed that the former group scored significantly higher on the weak/strong superego dimension. This indicates that the cancer patients studied were more conscientious, determined, moralistic and emotionally disciplined than controls. This finding is consistent with other studies which have found similar personality characteristics in patients with various types of cancer and hence lends some support to the concept of cancer-prone personalities. However, it is not possible to determine whether these personality characteristics are representative of the group of patients who develop these illnesses or whether they represent characteristics of those cured of their illness and hence have survival advantage.

Similar difficulties emerge when interpreting the results from the BDS questionnaire. The index cases appear to use two mental defence mechanisms to a significantly greater degree than the neighbourhood controls. These are "reaction formation" (a mechanism in which the person substitutes behaviour, thoughts or feelings that are diametrically opposed to his or her own acceptable ones) and "displacement" (a mechanism in which the person generalises or redirects a feeling about an object or a response to an object onto another usually less threatening

object). Scores on the BDS questionnaire relabelled in accord with a draft diagnostic and statistical manual (DSM) DSM-III—R glossary of defence mechanism can be represented by three factors designated "mature" (sublimation, suppression, etc.), "neurotic" (undoing, reaction formation, etc.), and "immature" (projection, acting out, displacement, etc.). This represents a promising new way of eliciting manifestations of a subject's characteristic style of dealing with conflict whether conscious or unconscious. It is based on the assumption that people can accurately comment on their unconscious adaptive style. The excessive utilisation of reaction formation and displacement by the index cancer patients again gives further credence to the concept that some cancer patients have particular difficulties in their capacity for emotional discharge such as angry feelings.

The cardiac group scored lower on Cattell's 16PF Scale Factor M (conventional/imaginative) indicating that they were more conventional and less imaginative than the index group. As for the BDS questionnaire the index cases showed a more "mature" style personality with the mental mechanism of suppression being utilised to a significantly greater degree. Suppression is a mechanism by which the person intentionally avoids thinking about disturbing problems, desires, feelings or experiences.

This study identified one *symptomatic* long-term sequela of cancer treatment, namely sexual dysfunction. The index cancer cases had excellent physical function and performance status. Psychosocially the cancer patients had at the time of study, adjusted as well as their neighbours. This study shows conclusively that these potentially cured cancer patients (in the group we studied) will return and enjoy a normal lifestyle (QOL) similar to that of their neighbours. In contrast, the cardiac patients continue to exhibit poor function both physically and psychosocially after therapy.

1. Hammond GD. The cure of childhood cancers. *Cancer* 1986, **58**, 408–413.
2. Hollandsworth JG Jr. Re-evaluating the impact of medical treatment on quality of life: a 5-year update. *Soc Sci Med* 1988, **26**, 425–434.
3. Najman JM, Levine S. Evaluating the impact of medical care and technologies on the quality of life: a review and critique. *Soc Sci Med* 1981, **15**, 107–115.
4. Aaranson NK. Quality of Life: what is it? How should it be measured? *Oncology* 1988, **2**, 69–74.
5. Teoh N, Stjernsward J. WHO and its collaborating centres. *Palliative Med* 1991, **5**, 4–5.
6. Zubrod CG, Schneiderman M, Frei E, *et al.* Appraisal of methods for the study of chemotherapy of cancer in man: comparative therapeutic trials of nitrogen mustard and triethylene thiophosphoramide. *J Chron Dis* 1960, **11**, 7–33.
7. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiat Scand* 1983, **67**, 361–370.
8. Derogatis LR, Lopez MC. *The Psychosocial Adjustment to Illness Scale (PAIS-PAIS -SR) Administration Scoring and Procedures Manual.* Baltimore: Clinical Psychometric Research, 1983.
9. Weissman A, Warden J. Psychosocial analysis of cancer deaths. *Omega* 1975, **6**, 61–75.
10. Cattell RB, Eber HW, Tatsuoka MM. *Handbook for the* 16 *Personality Factor Questionnaire.* Illinois: I.P.A.T. Champaign, 1970.
11. Bond M, Gardiner ST, Christian J, Sigel JJ. An empirical examination of defence mechanisms. *Arch Gen Psychiatry* 1983, **40**, 333–338.
12. Goldberg RJ, Cullen LA. Factors important to psychosocial adjustment to cancer: a review of the evidence. *Soc Sci Med* 1985, **20**, 803–807.
13. Stoter G, Koopman A, Vendrik CPJ, *et al.* Ten year survival and late sequela in testicular cancer patients treated with cisplatin, vinblastine, and bleomycin. *J Clin Oncol* 1989, **7**, 1099–1104.
14. Rieker PP, Fitzgerald EM, Kalesh LA, *et al.* Psychosocial factors, curative therapies and behavioural outcomes. *Cancer* 1989, **64**, 2399–2407.
15. Schuler D, Bakos M, Borsi J, *et al.* Neuropsychologic and CT examinations in leukaemia patients surviving 10 years or more. *Med Pediatric Oncol* 1990, **18**, 123–125.
16. Kornblith AB, Anderson J, Cella DF, *et al.* Comparison of psychosocial and sexual function in Hodgkin's disease survivors treated by MOPP, ABVD, or MOPP/ABVD. *ASCO Proc* 1990.
17. Johnson B, Grayson J, Makuch RW, *et al.* 10-year survival of patients with small cell lung cancer treated with combination chemotherapy with or without irradiation. *J Natl Cancer Inst 1990,* **8**, 396–401.
18. Sugarbaker PH, Barofsky I, Rosenberg SA, Gianda FJ. Quality of life assessment of patients in extremity sarcoma clinical trials. *Surgery* 1982, **91**, 17–23.
19. Skeel RT. Quality of life assessment in cancer clinical trials—its time to catch up. *J Natl Cancer Inst* 1989, **81**, 472–473.
20. Ochs J, Mulhern R, Kun L. Quality of life assessment in cancer patients. *J Clin Oncol* 1988, **4**, 415–421.
21. Schipper H, Clinch J, McMurray A, Levitt M. Measuring the quality of life in cancer patients: the functional living index-cancer-development and validation. *J Clin Oncol* 1984, **2**, 472–483.
22. Donovan K, Sanson-Fisher RW, Redman S. Measuring quality of life in cancer patients. *J Clin Oncol* 1989, **7**, 959–968.
23. Raghaven D, Cox K, Childs A, Grygiel J, Sullivan D. Hypercholesterolemia after chemotherapy for testis cancer. *J Clin Oncol* 1992, **10**, 1386–1389.
24. Marmor D, Elefant E, Danchez C, Roux C. Semen analysis in Hodgkin's disease before the onset of treatment. *Cancer* 1986, **57**, 1986–1987.
25. Whitehead E, Shalet SM, Blackledge G, Todd I, Crowther D, Beardwell CG. The effects of Hodgkin's disease and combination chemotherapy on gonadal function in adult males. *Cancer* 1982, **49**, 418–422.
26. Sherins RJ, Olweny CL, Ziegler JL. Gynaecomastia and gonadal dysfunction in adolescent boys treated with combination chemotherapy for Hodgkin's disease. *N Engl J Med* 1978, **299**, 12–16.
27. Craig TJ, Abeldoff MD. Psychiatric symptomatology among hospitalized cancer patients. *Am J Psychiatry* 1974, **131**, 1323–1327.
28. Derogatis LR, Morrow GR, Fetting JR, *et al.* The prevalence of psychiatric disorders among cancer patients. *JAMA* 1983, **249**, 741–757.
29. Endicott J. Measurement of depression in patients with cancer. *Cancer* 1983, **53** (Suppl. 10), 2243–2248.
30. Maguire GP, Lee EG, Berington DJ, Kuchemann CS, Crabtree RJ, Cornell CE. Psychiatric problems in the first year after mastectomy. *Br Med J* 1978, **1**, 963–965.
31. Massie JM, Holland JC. Diagnosis and treatment of depression in the cancer patient. *J Clin Psychiatry* 1984, **2**, 25–28.
32. Gottschalk LA. Vulnerability to "stress". *Am J Psychoth* 1983, **37**, 5–23.
33. Mitchell GW, Glicksman AS. Cancer patients: knowledge and attitudes. *Cancer* 1977, **40**, 61–66.
34. Peck A, Boland J. Emotional reactions to radiation treatment. *Cancer* 1977, **40**, 180–184.
35. Goddong PR, Khansur T, Little DD. Two brief measures of depression for cancer patients and their spouses. *ASCO Proc* 1990.
36. Tross S. *Psychological Sequela of Cured Cancer: Testicular Cancer, a Model. Current Concepts in Psycho-Oncology.* New York: Memorial Sloan-Kettering, 1984, 17–25.
37. Lanksy SB, List MA, Herrmann CA, *et al.* Absence of major depressive disorder in female cancer patients. *J Clin Onc* 1985, **3**, 1553–1560.

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