F, Brunet M. Prognostic value of histologic grade nuclear components of Scarff-Bloom Richardson (SBR). *Cancer* 1989, **64**, 1914–1921.
21. Sears HF, Janus C, Levy W, Hopson R, Creech R, Grotzinger P. Breast cancer without axillary metastases. *Cancer* 1982, **50**, 1820–1827.
22. Thorpe SM, Rose C, Rasmussen BB, Mouridsen HT, Bayer T, Keiding N. Prognostic value of steroid hormone receptors: multivariate analysis of systemically untreated patients with node-negative primary breast cancer. *Cancer Res* 1987, **47**, 6126–6133.
23. Sigurdsson H, Baldetorp B, Borg A, *et al.* Indicators of prognosis in node negative breast cancer. *N Engl J Med* 1990, **322**, 1045–1053.
24. Gasparini G, Dal Fior S, Pozza F, Bevilacqua P. Correlation of growth fraction by Ki67 immunohistochemistry with histologic factors and hormone receptors in operable breast carcinoma. *Breast Cancer Res Treat* 1989, **14**, 329–336.
25. Hacene K, Le Doussal V, Rouesse J, Brunet M. Predicting distant metastases in operable breast cancer patients. *Cancer* 1990, **66**, 2034–2043.

Eur J Cancer, Vol. 28A, No. 10, pp. 1680–1686, 1992.
Printed in Great Britain

0964–1947/92 $5.00 + 0.00

The Assessment of Sexual Function in Cancer Patients

Ann M. Cull

The sexual function of cancer patients may be compromised by their disease or treatment. This is infrequently assessed as an outcome variable and methodological differences between reported studies make comparison difficult. Where sexual function is being assessed as one dimension of a more comprehensive assessment of quality of life, a single item concerned with frequency of intercourse or satisfaction may be sufficient, but many studies require more detailed information. Methods developed for clinical assessment of sexual dysfunction are generally too long and detailed for this purpose. The best developed scales for cancer patients are embedded in lengthy and expensive questionnaires. A pool of items can be identified from which a scale could be derived to assess the relevant aspects of sexual experience. The development of an appropriate and psychometrically sound scale is now required to encourage greater consideration of the impact of disease and treatment on cancer patients' sexual function.
Eur J Cancer, Vol. 28A, No. 10, pp. 1680–1686, 1992.

INTRODUCTION

QUALITY OF LIFE measures generally take account of the impact of cancer and its treatment on the physical, functional, emotional and social aspects of patients' lives. Sexual relationships make a significant contribution to the quality of life for many people and may be compromised by disease and treatment, yet sexual function is rarely assessed as a treatment outcome.

Many patients feel reticent about volunteering sexual concerns in the face of cancer and doctors are often reluctant to ask about sexual problems. Clinical estimates are therefore likely to underrepresent the prevalence of sexual difficulties.

The nature and frequency of sexual problems will vary with disease site and treatment. Disruption of sexual function may be anticipated following genital malignancy or radical therapy within the pelvis. However, decrease in the frequency and range of sexual behaviour and dysfunctions of the sexual response cycle have been reported across all disease sites and following all therapeutic modalities. Currently available estimates of the prevalence of sexual morbidity associated with cancers of the breast, bowel, female genital tract, bladder, prostate and testis are discussed in Andersen's review [1]. The treatment of disease at body sites of less obvious sexual significance may also have sexual repercussions. For example, Devlen *et al.* [2] found that 20% of lymphoma patients, disease-free and off treatment, reported a persistent loss of libido which the authors interpreted as a side-effect of chemotherapy. Sugarbaker *et al.* [3] found no difference between limb-spared sarcoma patients and amputees with respect to pain, mobility or treatment trauma, but sexual functioning was more impaired in the conservatively treated group. Sexual morbidity in oncology is therefore a common problem. Indeed Andersen [4] concludes that the majority of previously sexually active cancer patients will experience significant sexual disruption as a result of their disease and treatment.

Clearly the selection of the least disruptive treatment for the same medical endpoint is an important strategy for reducing sexual as for any other morbidity, but even where sexual outcome is assessed it is often difficult to compare results because of substantial methodological differences between studies. For example there is a lack of sound data to support the assumption of an improved psychosexual outcome following breast-conserving therapy [5].

More systematic assessment is required not only for clinical trials but to inform patient choice. A recent study using the time trade-off technique [6] showed that some men will choose treatment with a poorer chance of survival in order to increase their chance of remaining sexually potent.

Psychological and behavioural interventions to reduce the incidence and severity of problems can be most effective if delivered early, making the case for more systematic screening

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Revised 16 Mar. 1992; accepted 17 Mar. 1992.

among patient groups at high risk of developing sexual difficulties. Competing strategies for relieving sexual problems among cancer patients have yet to be evaluated.

Some standardisation of approach to the assessment of sexual function is now required with due attention to the reliability and validity of the measures used. This paper aims to review published measures of sexual function suitable for use with cancer patients to determine whether an optimal scale can be recommended.

The impetus for this work came from the EORTC Quality of Life Study Group which has already developed a multidimensional quality of life (QL) questionnaire, the QLQ C-30, as a generic measure for use in cancer clinical trials [7] and is now working to develop additional modules to allow complementary assessment of disease- and treatment-specific problems and other QL dimensions relevant to treatment outcome.

SCOPE OF ENQUIRY

Sexual function is influenced by a multitude of physiological, cognitive, affective and interpersonal factors and a wide range of methods exists for investigating dysfunction. Clinical cancer research requires selectivity both in the scope of the enquiry that is appropriate and the choice of measures that can be employed to assess sexual difficulties.

The potential effect of cancer and its treatment on sexuality may be experienced by patients directly or indirectly in quite specific or more generalised ways, e.g.

Direct physical effects.
- Specifically interfering with genital/sexual response and/or reeproductive capacity by damage to genital structures and/or their neurological, vascular or hormonal control.
- Non-specifically making sexual activity difficult or impossible because of pain, general malaise, fatigue, immobility or loss of desire.

Indirect psychological effects.
- On the individual by:
  - loss of sexual attractiveness due to physical change, e.g. stigmatising surgery,
  - concern about potentially harmful effects of sexual activity, e.g. activating disease, contaminating partner,
  - changed attitudes towards sexuality, e.g. related to loss of fertility, altered priorities.
- On the relationship with the partner:
  - reflecting partner's cognitive emotional or sexual response to patient's condition,
  - reflecting change in roles within relationship.
- Mediated by anxiety/depression.

This review focuses mainly on direct effects that are more likely to be of interest in clinical trials. Related questions of gender identity (i.e. masculinity/femininity), marital adjustment or fertility are not included.

Loss of sexual attractiveness, resulting from altered physical appearance is relevant to sexual function but also represents one dimension of the broader concept of body image. The assessment of body image has recently been reviewed by Hopwood [8].

The specific questions to be asked will vary according to whether sexual function is seen as a contributory factor in global quality of life assessment, as might be in a wide range of clinical trials across the spectrum of disease sites or as a central issue in the evaluation of treatment outcome, e.g. for malignancies affecting the genital tract. For the former, changes in the estimated frequency of sexual intercourse, one of the more reliable and valid self-report measures [9] may be sufficient. For the latter several components of the human sexual response may need to be assessed separately.

It is also important to note that impairment of sexual function is not necessarily a source of distress to patients [10] and this should be assessed separately.

SPECIAL CONSIDERATIONS IN ASSESSMENT

Retrospective assessment by self-report is likely to be the only feasible approach in most studies, and clinically such personal information is usually collected by interview. By adopting a non-judgmental approach and careful introduction of sensitive topics, reliable and detailed information can be obtained and rated, but such interviews are time-consuming and impractical in many research settings.

Self-report questionnaires are quicker and generally cheaper for the investigator but there are limitations on the questions which can be asked in this way. Whereas an interviewer can adopt the vocabulary acceptable to the individual patient, the wording of questionnaires must avoid ambiguity yet not be so stark as to give offence to the patient population. There is evidence that it is feasible to use questionnaires to collect reliable and valid data about sexual behaviour [11] provided that three conditions are met. Questions must be appropriate to the sample bearing in mind the importance of cultural mores and age differences in sexual attitudes; the purpose of asking the question should be explained; and confidentiality must be assured.

It should be noted that depending on the specificity of the questions to be asked separate items may be required for men and women. It will often be necessary to take account of the availability of a sexual partner and, on occasion, of whether the relationship is heterosexual or homosexual.

Only self-report questionnaire methods will be reviewed here.

QUESTIONNAIRE ASSESSMENT

Three items concerning sexual function are contained within the self-report Social Adjustment Scale [12]. Frequency of intercourse, experience of sexual problems and enjoyment are each rated on a 5-point scale (all the time – not at all). The scale as a whole appears to perform well, and these items may be useful where a superficial overview of sexual function is all that is required.

Schiavi *et al.* [13] collated some data on the psychometric properties of a large number of more detailed measures of sexual attitudes and behaviour. This is now somewhat out of date and relatively few of the scales listed are suitable for cancer patients. The critical reviews by Conte [14] and Bancroft [15] are more informative.

There are three categories of measure to consider: unidimensional and multidimensional scales for general use and scales or items specifically devised for cancer patients.

Unidimensional scales

Normal sexual behaviour has been conceptualised as scalable in the Guttman sense, i.e. cumulative, showing unidimensionality such that individuals experiencing intercourse might be expected also to have experience of items lower down the scale, e.g. intimate touch or kissing. The most substantially developed scales [16, 17] have been established only in young college students and they take no account of the relative frequency

Table 1. Multidimensional scales

Scale	Description	Reliability	Validity	Cross-validation
a. Derogatis Sexual Functioning Inventory (DSFI) [28]	American 258 items 8 scales—Sexual Function Index: Information Attitudes Experience Drive Gender role Fantasy Body image Satisfaction + Global Sexual Satisfaction Index	Test–retest: 0.58–0.93. Internal consistency: 0.56–0.87	Content discriminant	No
b. The Sexual Experience Scales (SES) [29]	Dutch Separate forms for men/women 83 items 4 scales, 14 subscales: 1. Morality 2. Psychosexual stimulation 3. Sexual motivation 4. Attraction to marriage	Test–retest: 0.85–0.94. Internal consistency: 0.80–0.92.	Construct predictive	Yes
c. The Golombok–Rust Inventory of Sexual Satisfaction (GRISS) [30]	British Separate forms for men/women 28 items each 7 subscales: Frequency Dysfunction Satisfaction Anxiety Interest Touch Communication	Split-half: 0.87 (male) 0.94 (female) Internal consistency: 0.61–0.83	Discriminant	Yes

of behaviours. Such scales could conceivably be adapted for establishing the occurrence of specific behaviours among particular groups of cancer patients, for example after mutilating surgery, but it is difficult to foresee any question arising in a clinical trial setting which would require such detailed information about specific sexual behaviours.

The Sexual Experience Scale (SES) of the Derogatis Sexual Functioning Inventory (DSFI) [18] is a scale of this type which is often used, but when tested with a sample of older women with gynaecological cancers [9] the internal structure and scoring of the scale were unreliable. The SES did not detect important behavioural changes or the occurrence of dysfunction and did not correlate with judgments of sexual satisfaction.

There are therefore no unidimensional scales of sexual function suitable for clinical trials.

Multidimensional scales

These have mostly developed from clinical practice with patients who have sexual problems as an aid to diagnostic assessment or the evaluation of outcome of therapy directed towards a sexual problem. These measures vary in the range and complexity of behaviour covered and in the extent to which psychometric properties have been documented. The length and detailed nature of the majority of these questionnaires make them unsuitable for use in clinical trials in their entirety but some have identified subscales which may be useful in cancer research.

The three most relevant measures in this category were the DSFI [18], the SES [19] and The Golombok–Rust Inventory of Sexual Satisfaction (GRISS) [20]. They are described briefly in Table 1.

The DSFI is the least satisfactory of these measures, the psychometric properties of at least some of its subscales being in some doubt [9]. In addition some of its subscales require a high level of reading ability.

Frenken and Vennix' SES are more widely used, more reliable and better validated. In particular, SES 3, which refers to sexual interaction, would seem to have some potential for clinical trial use. It has five subscales: enjoyment potential; orgasm adequacy during intercourse; sexual inhibition; frequency of sexual intercourse and length of foreplay, and has been found useful as a measure of change, for example in relation to hysterectomy [15]. This scale is also copyright and marketed.

The GRISS is a clearly worded, relatively short scale which appears to discriminate well between those with and without sexual problems in the small samples on which it has been tested. In using a 5-point frequency scale (never – always) its format is more compatible with the EORTC core quality of life questionnaire than the other scales reviewed in this section. The handbook for this measure is available through the British Library, The American Library of Congress and from the authors.

Vennix [21] has also produced the Intimate Bodily Contact Scale (ILKS) on separate forms for men and women. There are 22 subscales including sexual dissatisfaction and perception of physical condition interfering with sex. Internal consistency values lie in the range 0.73 – 0.91. The scale is published in Dutch and no additional information was available in translation at the time of review. van de Wiel *et al.* [22], using the ILKS, found women treated for cervical cancer less satisfied with their sexual relationship and less positive in view of themselves as sexual partners than non-patient controls. There were no significant differences between the groups on other subscales. Further evaluation of this scale is required before its use can be recommended.

Thus the GRISS appears the most useful measure in this

Table 2. Assessment of sexuality in cancer patients

Scale	Description	Reliability	Validity	Cross-validation
a. Sexual Function after Gynaecological Illness Scale (SFAGIS) [23]	Fresh 30 items 15 topics including: desire, fears about sexual activity, frequency of intercourse/orgasm, post-treatment change	Split-half:0.80 Internal consistency: 0.76	No data	No data
b. Lasry Sexual Functioning Scale for Breast Cancer Patients [24]	Canadian 15 items Topics include: change in partners/partner's sex drive, frequency of intercourse, satisfaction with sexual relationship and with body	Internal consistency: 0.84	No data	No data
c. Psychosocial Adjustment to Illness Scale (PAIS-SR) [25]	American Self-report form. 6-item subscale within larger questionnaire: Quality of relationship Interest Frequency of activity Satisfaction Dysfunction Conflict	Sex Scale: internal consistency: 0.83	Construct discriminant	Yes
d. Cancer Rehabilitation Evaluation System (CARES) [26]	American 8-item scale within a larger questionnaire: Attractiveness Interest Frequency of activity Dysfunction 3-item short-form	Sex Scale: internal consistency: 0.82–0.88 test–retest: 0.84	Content concurrent	Yes

category but it is too long and detailed for most clinical trial purposes.

Measures of sexual function for use with cancer patients

Having been designed specifically for cancer patients, these are potentially the most promising instruments for clinical research in this area: sources range from single items or subscales referring to sexual function within a larger quality of life questionnaire, to a separate instrument assessing sexual issues. In spite of obvious overlap of subject matter items are worded and scored in a manner idiosyncratic to each scale, and on the whole there is little published data about the reliability or validity of these measures. This hampers interpretation and comparison of data, and further cooperative effort is needed to establish the psychometric credentials of some of these scales. Existing scales for the assessment of sexual function specifically in cancer patients are summarised in Table 2.

Sexual Function After Gynaecological Illness (SFAGIS) [23] This 30-item multiple-choice scale was developed in a very small sample of women treated for cervical, uterine or ovarian cancer. The choice of five, sometimes lengthy, responses increases the time patients need to complete this measure relative to others with the same number of items. The authors' analysis suggested an 18-item version would be as effective but this requires testing. No formal validation has been reported and interpretation of the aggregate score is open to question. This scale does provide a basis for collecting useful descriptive information in the appropriate clinical setting but is underdeveloped for clinical trial use.

Lasry Sexual Functioning Scale for Breast Cancer Patients [24]. Lasry developed a sexual functioning scale specifically for inclusion in a multicentre trial comparing segmental and total mastectomy along with measures of depression, body image, fear of recurrence and marital adjustment. Not surprisingly there was some loss of compliance owing to the total questionnaire burden for patients but the sexual functioning scale is relatively short. In fact what is measured is dysfunction with higher scores representing more problems. The scoring system is idiosyncratic and psychometric properties of the scale have been insufficiently tested, but the face validity of this questionnaire is high for breast cancer patients and it warrants further study.

Psychosocial Adjustment to Illness Scale—Self Report (PAIS-SR)[25]. By contrast the PAIS-SR is an extremely well-developed measure. Its only drawback as a quality of life instrument is the lack of coverage of physical symptoms and side-effects. In its entirety it is probably too long for many clinical trials. It does, however, incorporate a useful short scale covering aspects of sexual function, suitable for men or women. Each item offers four brief response categories. It is also available

Table 3. Quality of life questionnaires including an item on sexual function

Name of scale	Content	Response style
Sickness Impact Profile (SIP)[28]	Activity	Binary
Linear Analogue Self-Assessment (LASA)[30]	Sex relationship	10 cm line
Nottingham Health Profile (NHP)[29]	Problem	Binary
Rotterdam Symptom Checklist (RSCL)[31]	Sexual interest	4-point scale

as an interview schedule and can be adapted for use with partners.

Scores are converted to standardised T-scores and norms are available for the interview, from lung cancer patients and for the questionnaire from a mixed group of cancer patients. Centile equivalents are also given. The psychometric development of the scale is extensively documented in the handbook. The only obstacle to the use of this instrument is its cost.

Cancer Rehabilitation Evaluation System (CARES) [26]. CARES consists of a comprehensive list of 139 statements referring to problems cancer patients may encounter that may be amenable to intervention, and as such is an instrument for clinical rather than research use. Problem severity is rated on a 5-point scale (0=not at all, 4=very much) and patients circle 'yes' or 'no' for each problem endorsed to indicate whether they would like help. The CARES incorporates an 8-item scale concerned with sexual function; 1 item has separate questions for men and women concerning physiological arousal. There is no item relating to sexual satisfaction in this scale.

The development of the scale is extensively documented in the accompanying manual with normative data from a substantial sample including subgroups of breast and prostate cancer patients. The authors found the sexual subscale more dichotomous than other subscales of the CARES, i.e. sexual problems when they existed appeared to be severe.

The full scale is too long to be practical in many settings but there is a short form (59 items) — CARES-SF — developed for use in research protocols, which is still being evaluated. It contains two sexual items concerned with interest and one with dysfunction. Both scales are protected by copyright and are marketed.

Basic Oncology Scale (BOS) [27]. This Dutch scale was developed to assess anxiety, depression, body image, self-esteem and well-being, as well as relationship with the partner in women treated for gynaecological malignancy. Functional items concerning arousal, vaginal lubrication and pain are scored present/absent, and other items relate to sexual need. The full questionnaire has not been published and only partial information is available about its structure. More qualitative in character, it is a clinical rather than research instrument.

QUALITY OF LIFE QUESTIONNAIRES INCLUDING SEXUAL ITEMS

Sexual function is assessed by a single item in several well-known quality of life instruments (Table 3). Comparability across measures is impossible because of differences in the instructions, content and scoring of these scales.

The Sickness Impact Profile (SIP) [28] and the Nottingham Health Profile (NHP) [29] usefully ask patients to endorse items with respect to the impact of their health status on their sexual functioning. The items document decreased activity and adverse effect, respectively. LASA [30] compounds quality and quantity in the verbal labels used at the poles of the 10 cm line. The Rotterdam Symptom Checklist (RSCL) [31] has been used in a variety of forms asking about the extent to which the patient was bothered by symptoms or simply how the patient feels. Although the format of the scale is very clear with a 4-point response scale (0=not at all, 3=very much) the sexual item is negatively worded, 'lack of sexual interest' or sometimes 'decreased sexual interest', and this may lead to some confusion in response. At best single items give limited information and in practice such items may be omitted if patients find them difficult to answer or inappropriate in the context of the rest of the questionnaire.

EORTC Quality of Life Study Group

Sexual function was not assessed in the core quality of life questionnaire but relevant items have appeared in modules developed for other research studies. In addition to protocols of the EORTC Genito-urinary and Brain Tumour Cooperative Groups, modules including sexual assessment have been introduced in 10 studies in Britain, The Netherlands, Denmark, France, Germany, Switzerland and the USA, involving assessment of treatment for breast, gynaecological, testicular and prostate cancer and lymphoma as well as the outcome of bone marrow transplantation. Questions are generally worded to be compatible with the Likert-scale format used in the core questionnaire and items tapping interest, arousal, frequency of activity, satisfaction and pain are in use. At present there is no published data about the performance of these modules but further information is available from the authors through the Study Group.

OTHER MEASURES

Three other studies assessing the sexual function of cancer patients have developed methods which look promising for adaptation to clinical trial use [32–34]. In each case a small number of readily scored items was administered but the exact wording used is not always cited and there is no information about psychometric properties. The patient groups studied were of younger patients with curable disease where the sexual outcome was recognised as important.

Campion *et al.* [32] investigated the sexual behaviour of women with abnormal cervical smears indicating cervical intraepithelial neoplasia. Frequency of spontaneous sexual interest and intercourse were each rated on a 7-point scale: never; rarely; 1/month; 2–4/month; 1/week; 2–6/week; daily. Frequency of (1) adequate vaginal lubrication, (2) orgasm with intercourse, (3) dyspareunia, and (4) negative feelings towards intercourse were scored on a 5-point scale; never; rarely (25%); occasionally (50%); frequently (75%); usually. The scale was administered as an interview but would lend itself to questionnaire use with appropriate introduction.

Rieker [33] developed a comparable 5-point frequency scale to examine the outcome of treatment for testicular cancer. In this case the incriptors used were: nearly always a problem (about 90% of the time); usually a problem (75%); sometimes a problem (50%); seldom a problem (25%); not a problem. The

items rated were: not being able to ejaculate, to get or keep an erection or to reach orgasm; not finding sexual relations satisfying; not feeling sexual desire; not having sexual intercourse and not being fertile.

This scale was used in retrospective review 2–10 years after treatment with $\frac{1}{4} - \frac{1}{2}$ the sample reported some type of sexual impairment. 36% of those questioned indicated they could not discuss sexual functioning with their doctors, suggesting more accurate estimates of the prevalence of sexual problems may be obtained by using measures of this kind.

The retrospective review of testicular cancer patients reported by Gritz *et al.* [34] also suggests a relatively small number of questions which invite further study. They scored change in (a) sexual satisfaction and (b) frequency of intercourse, on a 5-point scale (much less–much worse) and problems in (a) achieving and (b) maintaining an erection on a 4-point scale (none–all the time). Experience of (a) loss of drive, (b) inability to ejaculate, (c) reduction/absence of semen, (d) decreased quality of orgasm, and (e) partner avoidance, were scored for presence/absence with an estimate of the duration of the problem. These last two items were not included in the Rieker Scale.

In each of these studies responses were reported separately for each item. The potential utility of a summary score for sexual function derived from these scales has not been addressed.

CONCLUSION

A review of the literature reveals no brief well-researched self-report measure of sexual function that can immediately be recommended for use in its entirety in cancer clinical trials. There is, however, an adequate pool of items already in use from which an appropriate scale could be constructed.

In any such scale it is desirable to indicate explicitly that it is the impact of the patient's disease or treatment on sexual function which is being investigated. It is necessary to be clear which questions may be answered by all patients, e.g. sexual interest, which depend on the patient having a sexual partner, e.g. frequency of intercourse, and which are relevant only if the patient is sexually active, e.g. ability to ejaculate. It is desirable to specify the time frame, which in many studies will need to be longer than the customary 'in the past week'. Estimates of frequency are to be preferred as less ambiguous than estimates of change.

It should now be possible to construct a measure appropriate to both sexes with a small number of questions concerning specific dysfunctions which are gender- and/or disease- and/or treatment-specific which can be incorporated as appropriate.

Where a single item is required to tap sexual function this will most often be concerned with frequency of intercourse or general sexual satisfaction. Where greater detail is required the items listed in Section (a), Table 4 should be assessed. Depending on the research question the scale could be extended to incorporate topics listed in Section (b). Mood disturbance should be assessed separately.

Some agreement is required on item format and scoring. The EORTC Quality of Life Study Group has tended to favour Likert items, i.e. verbal statements with a 4-point categorical scale,but the 5-point frequency scales used by Campion [32] and Rieker [33] have also proved useful. The psychometric properties of any new scale thus devised then need to be tested.

The scale thus derived will then need to be validated. Andersen [1] has proposed a brief interview assessment model designed to assess both important sexual behaviour and the sexual response cycle which may prove useful in this context.

Table 4. Suggested topics for sexual function scale

(a)	Spontaneous sexual interest
	Frequency of sexual intercourse
	Adequacy of arousal, i.e. lubrication/erection
	Orgasm
	Pain
	General satisfaction/enjoyment
(b)	Specific sexual dysfunctions, e.g. failure to ejaculate
	Body image/sexual attractiveness
	Fertility
	Fear of causing harm, e.g. pain, contamination
	Partner relationship

Cooperative effect is now required to achieve some standardisation of approach to the assessment of sexual function in cancer patients. This would be amply rewarded by the increased capacity for recognising potentially treatable problems and for comparing treatment outcomes in this sensitive area.

1. Andersen BL. How cancer affects sexual functioning. Oncology 1990, **4**, 81–88.
2. Devlen J, Maguire P, Phillips P, *et al.* Psychological problems associated with diagnosis and treatment of lymphomas II: prospective study. *Br Med J* 1987, **295**, 955–957.
3. Sugarbaker PH, Barofsky I, Rosenberg SA, *et al.* Quality of life assessment of patients in extremity sarcoma clinical trials. Surgery 1981, 91, 1. 17–23.
4. Andersen BL. Sexual functioning morbidity among cancer survivors. *Cancer* 1985, **55**, 1835–1842.
5. Singer PA, Tasch ES, Stocking C,*et al.* Sex or survival: trade offs between quality and quantity of life. *J Clin Oncol* 1991, **9**, 328–334.
6. Hall A, Fallowfield L. Psychological outcome of treatment for early breast cancer: a review. *Stress Med* 1989, **5**, 167–175.
7. Aaronson NK, Ahmedzai S, Bullinger M, *et al.* The EORTC Core Quality of Life Questionnaire: results of an international field study. In: Osoba MD, ed. *Effect of Cancer on Quality of Life.* Florida, CRC Press; 1991.
8. Hopwood P. The assessment of body image in cancer patients. (In press.)
9. Andersen BL, Broffitt B. Is there a reliable and valid self measure for sexual behaviour. *Arch Sex Behav* 1988, **17**, 509–525.
10. Andersen BL. Sexual difficulties for women following cancer treatment. In: Andersen BL, ed. *Women with Cancer.* New York, Springer, 1986, 257–288.
11. Conte HR. Development and use of self report techniques for assessing sexual functioning: a review and critique. *Arch Sex Behav* 1983, **12**, 555–576.
12. Cooper P, Osborn M, Gath D, *et al.* Evaluation of a modified self report measure of social adjustment. *Br J Psychiat* 1982, **141**, 68–75.
13. Schiavi RC, Derogatis LR, Kuriansky J, O'Connor D, Sharpe L. The assessment of sexual function and marital interaction. *J Sex Marital Ther* 1979, **5**, 169–224.
14. Conte HR. Development and use of self report techniques for assessing sexual functioning: a review and critique. *Arch Sex Behav* **12**, 555–576.
15. Bancroft J. Sexual Behaviour In: Peck DF, Shapiro C, eds. *Measuring Human Behaviour* New York, Wiley, 1990.
16. Bentler PM. Heterosexual behaviour assessment. I. Males. *Behav Res Ther* 1968, **6**, 21–25.
17. Bentler PM. Heterosexual behaviour assessment. II. Females. *Behav Res Ther* 1968, **6**, 27–30.
18. Derogatis LR, Melisaratos N. The DSFI: A Multidimensional Measure of Sexual Functioning. *J Sex Marital Therapy* 1979, **5**, 244–281.
19. Frenken J, Vennix P. *Sexuality Experience Scales; Manual.* Lisse, Swets & Zeitlinger, BV, 1981.
20. Rust J, Golombok S. The Golombok–Rust Inventory of Sexual Satisfaction (GRISS). *Br J Clin Psychol* 1985, **24**, 63–64.

21. Vennix P. *De ILKS gedachte*. Nisso, Zeist, 1983.
22. van de Wiel, Weijmar Schultz WCM, Hallensleben A *et al.* Sexual functioning following treatment of cervical carcinoma. *Eur J Gynaecol Oncol* 1988, **9**, 275–281.
23. Bransfield DD, Horiot JC, Nabid A. Development of a scale for assessing sexual function after treatment for gynaecological cancer. *J Psychosoc Oncol* 1984, **2**, 3–19.
24. Lasry JCM. Women's Sexuality Following Breast Cancer, In: Osoba D, ed. *Effect of Cancer on Quality of Life*. Florida, CRC Press, 1991.
25. Derogatis LR, Lopez MC. *Psychosocial Adjustment to Illness Scale—SR Manual* Baltimore, Clinical Psychometrics Research, 1983.
26. Schag CC, Heinrick RL. *CARES—Cancer Rehabilitation Evaluation System: Manual* California, Cares Consultants, 1988.
27. Bos G. Sexuality of gynaecological cancer patients: quantity and quality. *J Psychosom Obstet Gynecol* 1986, **5**, 217–224.
28. Bergner M Bobbitt RA, Carter WB, Gilson BS. The Sickness Impact Profile: development and final revision of a health status measure. *Med Care* 1981, **19**, 787–805.
29. Hunt SM, McEwen J. The development of a subjective health indicator. *Sociol Hlth Illness* 1980, **2**, 231–246.
30. Priestman TJ, Baum M. Evaluation of quality of life in patients receiving treatment for advanced breast cancer. *Lancet* 1976, **1**, 899–901.
31. de Haes JCJM, Raatgever JW, van der Burg MEL, Hamersma E, Neijt JP. Evaluation of the quality of life of patients with advanced ovarian cancer treated with combination chemotherapy. In: Aaronson NK, Beckmann J, eds. *The Quality of Life of Cancer Patients*. New York, Raven Press, 1987.
32. Campion MJ, Brown JR, McCance DJ, *et al.* Psychosexual trauma of an abnormal cervical smear. *Br J Obstet Gynaecol* 1988, **95**, 175–181.
33. Rieker PP, Edbril SD, Garnick MB. Curative testis cancer therapy: psychosocial sequalae. *J Clin Oncol* 1985, **3**, 1117–1126.
34. Gritz ER, Wellisch DK, Wang HJ, Siau J, Landsverk JA, Cosgrove MD. Long term effects of testicular cancer on sexual functioning in married couples. Cancer 1989, **64**, 1560–1567.

Acknowledgement—I thank Dr Penny Hopwood and Dr John Bancroft for valuable comment on the first draft.

Eur J Cancer, Vol. 28A, No. 10, pp. 1686–1691, 1992.
Printed in Great Britain

0964–1947/92 $5.00 + 0.00

Immunostaining of Cathepsin D in Breast Cancer: Quantification by Computerised Image Analysis and Correlation with Cytosolic Assay

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Cathepsin-D (cath-D) was quantified in 34 breast cancer specimens by immunohistochemical staining of frozen sections with a computer image analysis and the results were compared with the corresponding cytosolic assay. Cath-D concentrations varied from 0 to 420 arbitrary units (AU). Tumour cells were more intensely stained than peritumoral tissue with the D7E3 mouse monoclonal antibody than with rabbit polyclonal antibodies. There was a good correlation ($r = 0.80$) between cath-D values obtained either by immunohistochemistry with D7E3 antibody or by cytosolic immunoenzymatic assay. However, with a cut-off of 50 AU, 3 out of 25 patients had higher immunohistochemical values and 2 had higher cytosolic values. Therefore, quantification of cath-D concentration in tissue section by immunostaining and a computerised image analyser, which is the only technique available for small tumours, should provide similar prognostic information to that obtained by assaying cath-D in the cytosol.
Eur J Cancer, Vol. 28A, No. 10, pp. 1686–1691, 1992.

INTRODUCTION

SEVERAL RETROSPECTIVE studies have shown that high cystosolic cathepsin D (cath-D) concentration in primary breast cancer is correlated with a higher frequency of relapse and metastasis [1, 2, 3, 4]. Moreover, during the progression from normal to malignant mammary cells, cath-D level is markedly increased [4, 5]. However, the pronostic value of cath-D was obtained from immunoassays performed in cytosol [1, 2] or total cell extracts [3] which require a large amount of tissue. Moreover, this assay does not discriminate between antigen produced by cancer cells and that produced by adjacent cells located in the connective tissue or vessels. Due to the increasing progress in early detection of breast cancer, prognostic markers should be quantified in small tumours. Immunohistochemistry in combination with computer-assisted image analysis might be able to fulfil this objective if its validity compared to the cytosol assay can be demonstrated. A good correlation between these two techniques was previously obtained with oestrogen and progesterone receptors [6, 7].

The first immunohistochemical study on cath-D in breast cancer with polyclonal rabbit antibodies to normal cath-D

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Revised 10 Dec. 1991; accepted 17 Mar. 1992.