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Clinical Prediction of Survival is More Accurate Than the Karnofsky Performance Status in Estimating Life Span of Terminally Ill Cancer Patients

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Predicting the survival of terminally ill cancer patients can help in informing patients and their families, in programming therapy and assistance models, and in utilising existing resources correctly. Clinical prediction of survival (CPS) and Karnofsky performance status (KPS) are two factors which have already been described in the literature. The aim of our study was to verify their respective predictive value with regard to actual survival. In our study of 100 consecutive patients, the CPS obtained a higher prediction accuracy than that reported previously (correlation coefficient with actual survival = 0.51) and than that obtained with KPS alone (correlation coefficient = 0.37). The median difference between predicted and expected survival was only 1 week. The resultant predictivity could be further improved by integrating other prognostic factors studied in larger prospective, multicentric studies.

Key words: prognostic factors, terminal cancer patients, palliative care
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INTRODUCTION

Many biological and clinical features have been shown to be useful as predictive factors of survival in cancer patients at initial diagnosis and at the first finding of metastatic disease. Estimation of life span is, however, much more problematic in far advanced and terminally ill cancer patients. An accurate prediction of life expectancy would enable us to carry out an accurate decision-making and planning of terminal care with regard to therapeutic

options, and give adequate information to patients and their families, who could then participate in the decision-making.

Some studies have suggested that clinical estimation of the probable length of survival by experts is inaccurate, more often in an optimistic sense[1–4] or with errors uniformly distributed in over and underestimation of life expectancy [5].

The main objectives of our study were:

(1) to evaluate, in our experience, the degree of precision of clinical prediction of survival (CPS);
(2) to evaluate if a widely used index of performance status, that is, the Karnofsky performance status (KPS) [6] has a positive relationship with the length of life remaining;
(3) to compare the accuracy of CPS and KPS as prognostic indices; and
(4) to evaluate the homogeneity of the predictions of our physicians.

PATIENTS AND METHODS

We studied a sequential sample of 100 patients with cancer in a far advanced stage admitted to the Forli' Home Care Service of the 'Istituto Oncologico Romagnolo' from April 1992 to May 1993. The model of the Home Care Service has already been described [7, 8].

When admitted, all patients underwent a through historical and medical examination by one of the four home care oncologists who care full-time for far advanced cancer patients. At the end of the examination, the physicians filled in a preprinted form which included the KPS value and CPS in weeks. After the assessment was completed, patients progress was followed until death. The real survival was calculated in weeks from day 1 of home care until the day of death.

The relationships between real survival, the predicted survival and KPS score were assessed by the Pearson correlation coefficient (r) [9]. Survival patterns were estimated by the Kaplan–Meier product-limit method, and curves were compared with the log rank test [10]. Statistical analysis was carried out using SAS Software (Cary, NC) [11].

RESULTS

Of the 100 patients entered in the study, 54% were female and 46% male. The median age was 70 years (range 12–93).

Distribution of types of cancer according to primary site was: gastro-intestinal (39%), genito-urinary (17%), lung (15%), breast (11%) and others (18%). 42 patients were evaluated by SD, 24 by MPI, 21 by LF and 13 by NR.

Figure 1 presents the frequency distributions of the KPS score and predicted survival. The two clinical parameters examined are linked to each other because the study of the correlations between KPS value and CPS shows a correlation coefficient of $r=0.61$ ($P<0.001$). If we stratify the analysis for each single medical operator, the correlation coefficient varies from 0.78 ($P<0.01$) for the most experienced physician to 0.45 ($P=0.01$) for the newest arrival to the home care team. If we analyse the actual survival time as a function of the parameters under study, the existence of a correlation between clinical prediction and actual survival emerges. Taking into account the entire case

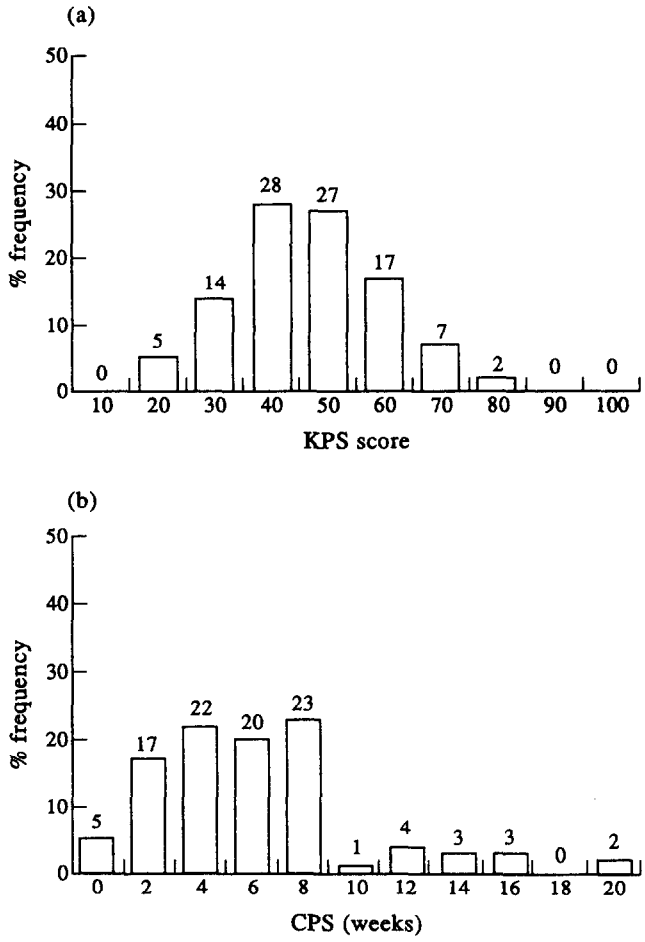

Figure 1. (a) Frequency distribution of Karnofsky performance status (KPS) score in 100 far advanced cancer patients. (b) Frequency distribution of clinical prediction of survival (CPS) in 100 far advanced cancer patients.

study, r equals 0.51 ($P<0.01$), while the correlations for individual physicians were 0.63, 0.60, 0.58 ($P<0.01$) and 0.03 (P non-significant), corresponding to the most experienced to the least experienced physician.

In Figure 2, the chart shows the real length of survival plotted

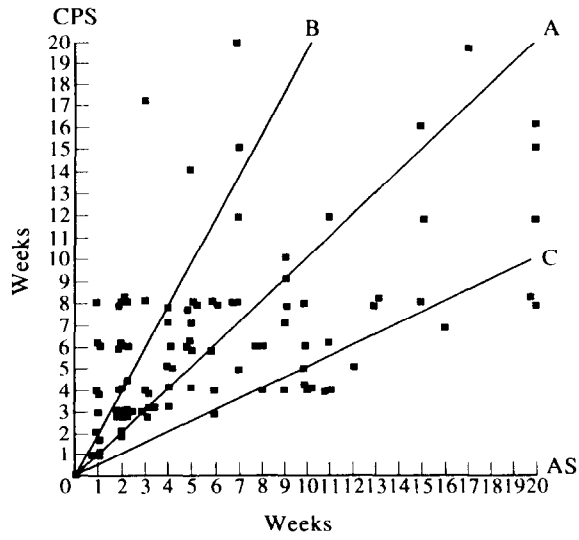

Figure 2. Scatter plot of clinical prediction of survival (CPS) by doctors on day of admission and actual survival (AS).

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on a scattergram against the length of survival predicted by one of the four physicians. Similarly to Parkes' method [1], completely accurate predictions ($n=15$) appear on line O–A. Optimistic predictions ($n=53$) appear above that line, while pessimistic predictions ($n=32$) appear below the line. Lines O–B and O–C represent 100% error in optimistic and pessimistic directions. The survival of any patient who appears on line O–B was thus predicted to be twice as long as it turned out to be, and any patient on line O–C survived twice as long as originally predicted.

The selection of 100% error in under and overestimation of survival, although arbitrary, is that reported in the literature and enables 'historic' comparisons.

19 cases were considered errors because they appeared above line O–B and 11 were judged incorrect because they were below line O–C. Expected median survival was 6 weeks (range 1–20), while actual median survival was 5 (range 1–48), with a difference in the optimistic direction of only 1 week.

The other parameter whose correlation with actual survival we wanted to evaluate was that of performance status. When stratified into three levels, i.e. 20–30, 40–50, >50, it clearly differentiates the survival time of patients with terminal cancer.

Median survival for the three groups was 2, 5 and 6.5 weeks respectively. The survival curves by Kaplan and Meier according to the KPS can be seen in Figure 3, log rank = 13.04 ($P=0.001$). The correlation analysis, considering the KPS as continuous, also shows a weak correlation with actual survival, $r=0.37$ ($P<0.001$).

DISCUSSION

It is already known from the literature that, although KPS is reasonably reliable in predicting imminent death if low (≤40), a high KPS does not automatically mean a long survival [12, 13]. Our weak correlation between KPS predictivity of survival and actual survival is consistent with literature data. Multicentric retrospective studies and prospective studies in single centres have attempted to integrate KPS with numerous other factors, among which the following have proved important: physical symptoms, nutritional criteria, site of metastasis, cognitive features, quality of life indices, psychological factors and activities of daily living. Recently, many reviews have tried to summarise and integrate the data reported in the literature [14–16]. These findings would seem to suggest the existence of a 'terminal cancer syndrome' or 'terminal cancer pathway' which extends across histological tumour types [17].

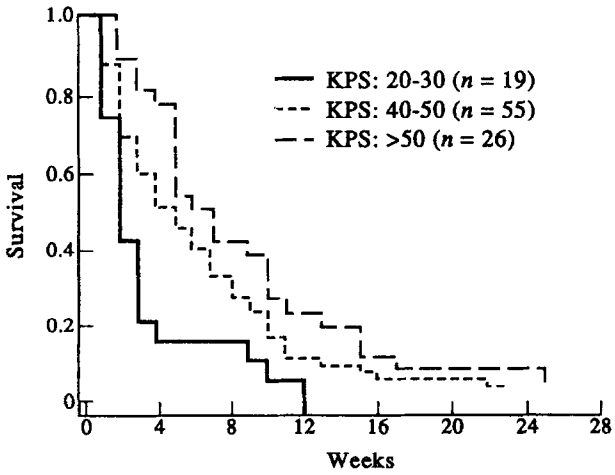

Figure 3. Survival curves of 100 far advanced cancer patients according to Karnofsky performance status.

Our data are not totally consistent with those published in the literature, which would attribute CPS with a low predictive power [1–4]. In our hands, the correlation coefficient between expected survival and actual survival was sufficiently high (0.51) with a median difference of 1 week.

A comparison of our results with the historic data of Parkes, reveals the following: in Parkes' work, the errors (that is, the difference between CPS and actual survival >100%) accounted for 51% of total predictions. Out of his errors, 81% were in an optimistic direction. In our study, the percentage of errors was lower, accounting for 30% of total predictions. Furthermore, the errors were distributed more widely between optimistic and pessimistic predictions (63 and 37%, respectively).

Towards the end of 1992, our team began an Italian multicentric prospective study on the factors of predictivity of short-term survival in terminal cancer patients, in co-operation with the Medical Oncology Department of S. Carlo Borromeo in Milan. This study, currently in its recruitment phase, will investigate a series of potentially useful factors in an attempt to create an integrated score of predictivity of survival.

We hope that the results which emerge from this multicentric study will be able to help the physician to predict the life expectancy of far advanced and terminal cancer patients with much greater accuracy.

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