Original Article

Functional Outcomes of Cancer Patients in an Inpatient Rehabilitation Setting

San San Tay,[1] *MBBS, MMed (Int Med), MRCP (UK)*, Yee Sien Ng,[1] *MBBS, MRCP (UK)*, Peter AC Lim,[1] *MBBS, ABPMR (Phy Med Rehab), ABPMR (Sci Med)*

Abstract

Introduction: Cancer is the leading cause of death and the second most common cause of hospitalisation in Singapore. Significant functional gains are achievable with cancer rehabilitation yet there are no formal cancer rehabilitation programmes in Singapore. This study aims to describe the demographics, clinical characteristics, complications and functional outcomes of cancer patients undergoing comprehensive inpatient rehabilitation at our unit and compare these with non-cancer patients. It also seeks to compare these data within sub-groups of the cancer cohort. Materials and Methods: This is a prospective cohort study. The Department of Rehabilitation Medicine database was reviewed for the period between 1 July 2002 and 31 December 2006. One thousand seven hundred and fifty patients had complete records, of which 58 are cancer patients. The primary outcome measures were the discharge total Functional Independence Measure (FIM), FIM gain and FIM efficiency. Other outcome measures included the length of rehabilitation stay, discharge destination, complication rates, rate of transfer back to the referring unit, the length of survival of the cancer patients upon discharge and the durability of the functional improvement made. Results: The mean age of the cancer patients was 57.4 ± 16.1 years and 62% were male. The mean admission total FIM was 70.9 ± 18.0 and the total discharge FIM was 86.2 ± 18.3. The average FIM gain was 15.3 ± 11.6 and the mean efficiency was 0.867 ± 0.806. This improvement is highly significant, and there is no statistical difference in FIM gain or efficiency between the cancer and non-cancer cohort, or between the cancer sub-groups. The length of stay was similar in cancer and non-cancer cohorts but cancer patients with spinal metastasis and those who underwent concomitant radiotherapy stayed longer. There were good rates of discharge home, transfer back, survivorship and durability in functional gains. Conclusion: Cancer patients benefit as much as non-cancer patients in undergoing a rehabilitation programme. More patients should be admitted to such programmes and these programmes should be better structured and refined.

Ann Acad Med Singapore 2009;38:197-201

Key words: Complications, Durability, Efficiency, Radiotherapy

Introduction

Cancer is the leading cause of death and the second most common cause of hospitalisation in Singapore.[1] Cancer rehabilitation aims to help the patient achieve maximum physical, social, psychological and vocational function within limits imposed by cancer and its therapy through a multi-disciplinary approach.[2]

There are no formal cancer rehabilitation programmes in Singapore, and there is a shortage of cancer rehabilitation programmes around the world.[2,3] Cancer may result in multiple impairments and disabilities that limit physical performance and activities of daily living.[4] This functional loss can be devastating to the patients, and results in a significant social and economic burden to their families and to society.

Available literature on cancer rehabilitation is scarce but the reported benefits are promising. Preliminary studies indicate that significant functional gains are achievable.[5-7] However, there are many challenges in cancer rehabilitation research. This includes the heterogeneity of the diagnosis and treatment options, intensity of rehabilitation protocols, non-standardised functional outcome measures and varying country-specific healthcare and reimbursement systems. There are also differences in religious and cultural beliefs, attitudes and perception towards cancer and its subsequent management. This includes the willingness of cancer patients to pursue aggressive anti-cancer treatment.[8] Goal setting for patients with advanced cancer is also particularly challenging.[9]

An important trend in cancer treatment is an increasing

[1] Department of Rehabilitation Medicine, Singapore General Hospital, Singapore
Address for Correspondence: Dr Tay San San, Department of Rehabilitation Medicine, Block 6 Level 9, Singapore General Hospital, Outram Road, Singapore 169608.
Email: tay.san.san@sgh.com.sg

emphasis on the overall outcome, including functional status and quality of life.[10]

In this study, we aim to:

1. Describe the demographics, clinical characteristics, complications and functional outcomes in a cohort of cancer patients undergoing comprehensive inpatient rehabilitation at our unit.
2. Compare functional outcomes and determinants of rehabilitation efficiency with non-cancer patients undergoing rehabilitation in our unit.
3. Compare the functional outcomes and other outcome measures within sub-groups of the cancer cohort.
4. Discuss the implications of the results in developing better-defined cancer programmes to improve functional outcomes in local cancer patients.

Materials and Methods

Our acute inpatient rehabilitation unit is located within the premises of a tertiary hospital. Patients admitted to our rehabilitation unit fulfil the following criteria[11]: (i) age 15 or older, (ii) Presence of impairments or disabilities which may benefit from a comprehensive inpatient rehabilitation programme, (iii) Potential to participate in a goal-oriented rehabilitation programme, (iv) Sufficient medical stability to participate in a rehabilitation setting. Cancer patients selected for inpatient rehabilitation in our unit further fulfilled these conditions: (i) Expected prognosis of at least 6 months and (ii) Musculoskeletal stability. Patients were referred from other departments such as Oncology, Orthopaedic Surgery and Neurosurgical Services within the same hospital. A rehabilitation physician consulted will then screen for suitability for inpatient rehabilitation.

Demographic and clinical data of all patients admitted from our unit from 1July 2002 onwards are recorded prospectively in a custom-designed rehabilitation database. Data collection started in early 2006. We reviewed the database for the period between 1 July 2002 and 31 December 2006. One thousand seven hundred and fifty patients had complete records, of which 58 patients formed the cancer cohort. Patients included in the cancer cohort must have impairments directly related to cancer or its treatment. Patients who had a background history of cancer or had stable disease but who were admitted for other unrelated reasons were not included in the cancer cohort. The diagnosis of cancer included both solid tumours as well as haematologic malignancies.

The Functional Independence Measure (FIM) is the primary functional outcome measure in our study. The FIM is the most widely used general measure of disability in North America and Australia, and is increasingly being adopted by Asian countries with developed rehabilitation facilities.[12-14] Huang reports that the Karnofsky scale, which is a measure of functional status in cancer patients, is less sensitive than the FIM in detecting changes in functional status.[15] The FIM consists of 18 items, and scores range from 1 (totally dependent) to 7 (totally independent) for each item. It measures motor function, cognition as well as self-care ability.

Derivatives of the FIM score in our study include FIM gain and FIM efficiency. The FIM gain is the difference between discharge and admission FIM and measures absolute functional gain. The FIM efficiency is the FIM gain divided by the length of stay in rehabilitation and it measures the rate of functional improvement. Other outcome measures included the length of rehabilitation stay, the discharge destination and rate of complications.

Apart from demographic and clinical data, specific data relevant to cancer were collected. These included the presence of metastasis, concomitant anti-cancer treatment, involvement of palliative care team and resulting impairments related to cancer such as paraparesis. In early 2007, the case records were reviewed and telephone interviews were made to find out if the patients were still alive. The length of survival after discharge from rehabilitation and the functional status of the patients at the time of telephone interviews were also recorded.

We classified the functional status of these surviving patients into 3 groups because it was difficult to administer the complete FIM assessment reliably over the phone. These 3 groups were: (i) Independence or modified independence, (ii) partial dependence and (iii) full dependence. This post-discharge classification differs from the FIM classification. In the first group, patients are able to carry out activities of daily living independently, and are able to ambulate independently, within the household or in the community, and did not need a caregiver at any point in time. However, they may require adaptive equipment to carry out these activities. Patients in the second group need some help or supervision, and would need a caregiver during some part of the day. Patients who are fully dependent needed a full-time caregiver. An opinion from the patients and/or caregivers is obtained regarding the patient's functional status, i.e. if the patient has improved, maintained or deteriorated functionally since their discharge from inpatient rehabilitation.

All cancer patients underwent a comprehensive inpatient rehabilitation programme. A multi-disciplinary team led by a rehabilitation physician held weekly multi-disciplinary meetings to discuss rehabilitation goals and coordinate discharge planning. Rehabilitation consisted of 1 hour each of physical therapy and occupational therapy daily for 5 days in a week. An oncologist, speech therapist, dietician, social worker and psychologist may be involved in their care when appropriate.

Data analysis was done with SPSS10.0 for windows (SPSS Inc.) The *t*-test was used for continuous variables and the chi-square test was used for categorical ones. This study was approved by the institutional review board.

Results

General Demographics

There were a total of 1750 rehabilitation patients in the study period. One hundred and twenty-three patients had cancer, inclusive of those with active current disease and those with a past history of cancer. Only those who had impairments directly related to cancer or its treatment formed the cancer cohort and there were 58 patients (3.3%) in this group. In the cancer cohort, 62% were male and the average age was 57.4 ± 16.1 years. In the general group, 57% of patients were male, and the average age was 61.9 ± 14.8. This age difference between cancer and non-cancer patients is significant ($P = 0.02$). Of the 58 patients in the cancer cohort, 50 had solid tumours and 8 had haematologic malignancies. Thirty-three of the 50 patients (66%) had metastatic disease. 15 patients (25.9%) had concomitant radiotherapy and 6 of them (10.3%) had concomitant chemotherapy.

Functional Outcomes

The mean admission total FIM score in the cancer cohort is 70.9 ± 18.0 and the mean total discharge FIM score is 86.2 ± 18.3. The average FIM gain is 15.3 ± 11.6 and the mean efficiency is 0.867 ± 0.806. This improvement in the FIM score is highly significant ($P < 0.001$).

Table 1a. Functional Outcomes of Cancer vs Non-cancer Patients

Category	Cancer	General
Absolute Numbers	(n = 58)	(n = 1692)
Admission Total FIM	70.9 ± 18.0	70.2 ± 23.2
Discharge Total FIM	86.2 ± 18.3	86.4 ± 23.2
*P**	<0.001	<0.001
FIM Gain	15.3 ± 11.6	16.2 ± 13.4
$Rehab_{los}$	21.5 ± 13.3	20.6 ± 14.0

FIM: Functional Independence Measure

In the general group, the mean admission total FIM score is 70.2 ± 23.2 and the mean total discharge FIM score is 86.5 ± 23.2. The average FIM gain is 16.2 ± 13.4. The FIM efficiency is 0.896 ± 0.932. There is no significant difference in the admission and discharge total FIM score between the 2 groups ($P = 0.821$ and $P = 0.960$). There is no significant difference in the FIM gain and FIM efficiency between the 2 groups ($P = 0.634$ and $P = 0.813$).

Other Outcome Measures

The average rehabilitation length of stay in the cancer cohort is 21.5 ± 13.3 days and 49 patients (84.5%) were discharged home successfully. There were 2 cancer patients who required a longer period of time for rehabilitation and they were transferred to a sub-acute care facility. There were 5 patients (8.6%) who were transferred back to the referring unit due to the deterioration of medical status.

The general patients stayed an average of 20.6 ± 14.0 days and the rate of discharge home is 88.9%. The rate of transfer back for the general patients is 2.7% (46 out of 1692).

In the cancer cohort, 14 patients (24.1%) had urinary tract infection (UTI), 13 patients (22.4%) had pneumonia while 5 patients (8.6%) had depression, but none had pressure ulcers.

In the general group, the rates of UTI, pneumonia, depression and pressure ulcers were 15.2%, 2.8%, 14.4% and 1.2%, respectively. When compared to the general group, cancer patients had a higher rate for pneumonia ($P = 0.011$) with the other differences being insignificant.

Twenty-five out of 58 patients (43.1%) were alive at the time of the telephone interview. 68.4% of the patients survived at least 6 months after discharge from the inpatient rehabilitation unit (Table 2). At the time of the telephone follow-up, 13 out of 25 survivors (52%) were in post-discharge functional group 1 – either fully independent or had modified independence. Seven (28%) were in post-discharge group 2 – required partial assistance and 5 (20%) were in post-discharge functional group 3 – bedbound or fully dependent. A majority of the patients maintained their

Table 1b. Functional Outcomes in Cancer Sub-groups

Category	Cancer SCI	Cancer non-SCI	Cancer Age >65	Cancer Age <65	Cancer with RT	Cancer with Chemo	Cancer No RT/Chemo
Absolute Numbers	(n=23)	(n = 35)	(n = 22)	(n = 36)	(n = 15)	(n = 6)	(n = 37)
Admission Total FIM	69.4 ± 16.7	71.9 ± 19.0	66.1 ± 17.3	73.8 ± 18.1	73.1 ± 17.1	53.5 ± 17.4	72.8 ± 17.4
Discharge Total FIM	84.4 ± 16.8	87.5 ± 19.4	81.0 ± 19.3	89.5 ± 17.2	86.93 ± 17.0	76.5 ± 17.0	87.5 ± 19.1
*P**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
FIM Gain	14.96 ± 12.3	15.57 ± 11.24	15.6 ± 11.3	14.8 ± 12.2	13.8 ± 11.0	23.0 ± 13.3	14.7 ± 11.4
$Rehab_{los}$	25.0 ± 15.9	19.2 ± 10.9	23.0 ± 15.6	18.9 ± 7.9	25.4 ± 17.5	19.5 ± 11.3	20.2 ± 11.6

Chemo: chemotherapy; FIM: Functional Independence Measure; RT: radiotheraoy; SCI: spinal cord injury

Table 2. Length of Survival Post Inpatient Rehabilitation

Length of survival	Absolute numbers
Up to 1 month	5
1-3 months	14
3-6 months	13
6-9 months	6
9-12 months	7
1-2 years	6
>2 years	7

Table 3. Complications in Cancer vs Non-cancer Patients

Complications	Complication rate in cancer patients	Complication rate in non-cancer patients	*P*
UTI	24.1%	15.2%	>0.05
Pneumonia	22.4%	2.8%	0.011
Depression	8.6%	14.4%	>0.05
Pressure ulcers	0%	1.2%	>0.05

UTI: urinary tract infection

functional status or improved after discharge as per patient and/or caregiver but 2 patients deteriorated. One of them sustained a sub-arachnoid haemorrhage that was not related to cancer and the other had progressive deterioration. Three patients who were interviewed were from the earlier years, that is, 2002 and 2003. Of these patients, 1 of them deteriorated in function due to a progression of disease.

Analysis Within Cancer Sub-groups

Patients who received concomitant chemotherapy or radiotherapy showed no difference in the rehabilitation length of stay when compared to those who did not (P = 0.893 and P = 0.21) (Table 1b). The FIM gain is similar for those who received concomitant cancer treatment when compared to those who did not (P = 0.80 and P = 0.113). However, there is a lower average admission total FIM in the chemotherapy group and this was significant (P = 0.015). There is no statistical significance in the discharge total FIM.

There was a substantial number of cancer patients who had spinal cord injury (SCI) secondary to spinal metastasis (23 out of 58). An analysis was done on this group of patients. The average admission total FIM in the spinal cord injured sub-group is 69.4 ± 16.7 and the average discharge total FIM is 84.4 ± 16.8. The length of stay was 25 ± 15.9 days. 39% of the spinal patients had urinary tract infection (UTI), 13% had pneumonia, 21.7% had depression and 4% had deep vein thrombosis. In the non-spinal cord injured cancer patients, the average admission and discharge total FIM score is 71.9 ± 19.0 and 87.5 ± 19.4, respectively (P = 0.60 and P = 0.529). The average length of stay was shorter at 19.2 ± 10.9 days but this was not significant (P = 0.105). The rate of UTI was 14.3% (P = 0.31), pneumonia was 5.7% (P = 0.33), depression was 22.9% (P = 0.92) and none had deep vein thrombosis (P = 0.968).

The patients were divided into 2 age groups: the first being those aged 65 and below and the other, aged 66 and above. There were 36 patients (62.1%) in the younger group and 22 patients (37.9%) in the older group. The total admission FIM and discharge FIM in the younger age group is 73.8 ± 18.1 and 89.5 ± 17.2, respectively. The total admission and discharge FIM for the older age group is 66.1 ± 17.3 and 81.0 ± 19.3, respectively. There are no significant differences in these scores (P = 0.12 and P = 0.09). There is no difference in the FIM gain (P = 0.796), the older group being 15.6 ± 11.3 and the younger group being 14.8 ± 12.2. The average rehabilitation length of stay for the older age group is 23.0 ± 15.6 days and 18.9 ± 7.9 days for the younger group (P = 0.26).

Discussion

There have been limited studies on the efficacy of inpatient cancer rehabilitation. This study explores the efficacy of cancer rehabilitation in Singapore and explores if concomitant anti-cancer treatment affects rehabilitation progress.

Our patients often need concomitant radiotherapy because they are unable to travel for outpatient radiotherapy on a daily basis due to immobility. This problem is unique in our society due to high-rise housing and the lack of availability of the elevator on each floor in certain types of housing. Thus, they are often transferred to us for continual medical therapy and for the improvement of functions.

We had more male than female cancer patients, and this is in concordance with the higher incidence of cancer among males in our country.[16] The average age of patients in cancer rehabilitation is significantly younger than the average age of other patients admitted to rehabilitation. Whilst stroke and other chronic diseases that make up our cohort tend to affect the elderly, cancer can occur in patients of any age.[16] Younger patients are often financial breadwinners or main caregivers for their families and require more independence and thus were referred to the inpatient rehabilitation unit in the hope of optimising their function.

The cancer and non-cancer patients had similar levels of disability on admission and they made similar improvements on discharge. The improvement in the FIM score for the cancer patients was significant, implying that the time and effort spent in the hospital undergoing rehabilitation was worthwhile. Despite the conception that cancer patients are more frail and require a longer period of rehabilitation, the length of stay of both groups was found to be similar. There was also a good rate of discharge home, and only 2 patients were discharged to a step-down facility. There is a higher rate of transfer back of the cancer patients to the referring

unit due to a deterioration of the medical condition. This is likely due to the progression of disease, rather than the occurrence of common complications that are pertinent to the rehabilitating patients, such as nocosomial infections. Our rehabilitation unit did well, as we had shorter length of stays (21.5 ± 13.3) and lower rates of transfer backs (8.6%) compared to other available studies.[6,7] Marciniak reported an average length of stay of 28 days, and a transfer back rate of 13%.[7]

Interestingly, patients who underwent concomitant chemotherapy or radiotherapy did not have significantly longer rehabilitation length of stay compared with those who did not, and these treatments did not appear to make them less able to participate or make them achieve less functional gains. Patients who had concomitant chemotherapy, however, appeared to be more disabled, as reflected by significantly lower admission and discharge FIM scores.

Patients with spinal metastasis stayed longer, although this was not statistically significant, and were at higher risk of urinary tract infection. Compared to studies available for rehabilitation of the sub-group of cancer patients with spinal metastasis, our spinal cord injured patients required a shorter length of stay and had a lower incidence of medical complications requiring transfer back to the referring unit.[6] Our average length of stay was 25 days compared to 104 days in Eriks' study, with 17.4% requiring transfer back compared to 27%.[6] This may be explained by our differing practice and reimbursement systems in Singapore, where a majority of rehabilitation physicians are also trained in internal medicine and may choose to treat medical complications in the rehabilitation unit. Although the elderly cancer patients had lower admission and discharge FIM scores, they had similar good FIM gains as the younger ones, and this finding is similar to that of other studies.[15,17] However, they required a slightly longer stay for their course of rehabilitation.

The durability of the functional improvement was studied, and we found that the majority of surviving patients improved or maintained their functional status, as per patient and/or caregiver. This was comforting, as it also meant that undergoing rehabilitation translates into a lower burden of care, even if there is a subjective component involved in this classification. The majority of the patients survived at least 6 months or more after discharge from the rehabilitation unit, suggesting that the selection process was appropriate.

One of our limitations is the small number of cancer patients in the study. There is also the presence of selection bias whereby only those patients who are deemed able to participate and benefit were admitted to our unit. Another limitation was recall bias during the telephone interview.

Conclusion

Cancer patients benefit as much as non-cancer patients when undergoing a rehabilitation programme, even if they were undergoing concomitant chemoradiotherapy. The rate of medical complications is comparable with non-cancer patients undergoing rehabilitation and the rate of transfer back to referring units is within reasonable limits. It is gratifying that the majority of patients were discharged home, and were able to maintain their functional status, thus reducing the burden of care. More patients should be referred and admitted into an inpatient comprehensive cancer rehabilitation programme. Cancer rehabilitation programmes should be better structured and refined, especially for specific cancer groups, such as the spinal cord injured or the elderly cancer patient.

No commercial party having a direct financial interest in the results of the research supporting this article has or will confer a benefit upon the author(s) or upon any organization with which the author(s) is/are associated.

REFERENCES

1. Ministry of Health, Singapore website on statistics of top cause of death as well as hospitalized conditions. Available at: http://www.moh.gov.sg. Accessed January 2007.
2. Cheville AL. Cancer rehabilitation. Semin Oncol 2005;32:219-24.
3. Beck LA. Cancer rehabilitation: Does it make a difference? Rehabil Nurs 2003;28:42-7.
4. Ness KK, Wall MM, Oakes JM, Robison LL, Gurney JG. Physical performance limitation and participation restrictions among cancer survivors: a population-based study. Ann Epidemiol 2006;16:197-205.
5. Cole RP, Scialla SJ, Bednarz L. Functional recovery in cancer rehabilitation. Arch Phys Med Rehabil 2000;81:623-7.
6. Eriks IE, Angenor EL, Lankhorst GJ. Epidural metastatic spinal cord compression: functional outcome and survival after inpatient rehabilitation. Spinal Cord 2004;42:235-9.
7. Marciniak CM, Sliwa JA, Spill G, Heinemann AW, Semik PE. Functional outcome following rehabilitation of the cancer patient. Arch of Phys Med Rehabil 1996;77:54-7.
8. Chartterjee AK, Ganquly S, Pal SK, Chatterjee A, Mukhopadhyay G, Bhakta R. Attitudes of patients to alternative medicine for cancer treatment. Asian Pac J Cancer Prev 2005;6:125-9.
9. Cheville A. Rehabilitation of patients with advanced cancer. Cancer 2001:92(4 Suppl):1039-48.
10. Mellette SJ. Cancer rehabilitation. J Natl Cancer Inst 1993;85:781-4.
11. Ng YS, Jung H, Tay SS, Bok CW, Chiong Y, Lim PA. Results from a prospective acute inpatient rehabilitation database: clinical characteristics and functional outcomes using the functional independence measure. Ann Acad Med Singapore 2007;36:3-10.
12. Ottenbacher KJ, Smith PM, Illig SB, Linn RT, Ostir GV, Granger CV. Trends in length of stay, living setting , functional outcome and mortality following medical rehabilitation. JAMA 2004;292:1687-95.
13. Granger CV, Hamilton BB, Linacre JM, Heinemann AW, Wright BD. Performance profiles of the functional independence measure. Am J Phys Med Rehabil 1993;72:84-9.
14. Murakami M, Inouye M. Stroke rehabilitation outcome study: a comparison of Japan with the United States. Am J Phys Med Rehabil 2002;82:279-82.
15. Huang ME, Wartella JE, Krentzer JS. Functional outcomes and quality of life in patients with brain tumours: a preliminary report. Arch Phys Med Rehabil 2001;82:1540-6.
16. Seow A, Koh WP, KS Chia, et al. Trends in Cancer Incidence in Singapore 1968-2002. Singapore Cancer Registry Report No. 6. Available at: http://www.nccs.com.sg/pat/file/Report_1968_2002.pdf. Accessed August 2008.
17. Black-Schaffer RM, Winston C. Age and functional outcomes after stroke. Top Stroke Rehabil 2004;11:23-32.