

Editor's note:

"Palliative Radiotherapy Column" features articles emphasizing the critical role of radiotherapy in palliative care. Chairs to the columns are Dr. Edward L.W. Chow from Odette Cancer Centre, Sunnybrook Health Sciences Centre in Toronto and Dr. Stephen Lutz from Blanchard Valley Regional Cancer Center in Findlay, gathering a group of promising researchers in the field to make it an excellent column. The column includes original research manuscripts and timely review articles and perspectives relating to palliative radiotherapy, editorials and commentaries on recently published trials and studies.

Palliative Radiotherapy Column (Original Article)

Do patients with brain metastases selected for whole brain radiotherapy have worse baseline quality of life as compared to those for radiosurgery or neurosurgery (with or without whole brain radiotherapy)?

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Background: The purpose was to examine the baseline characteristics, symptoms and quality of life (QOL) in patients who receive different treatments for brain metastases.

Methods: Eligible patients were divided and analysed based on their treatment: whole brain radiotherapy (WBRT) alone versus stereotactic radiosurgery (SRS) or neurosurgery with or without WBRT. The Functional Assessment of Cancer Therapy-Brain (FACT-Br) items were grouped according to different domains for summary scores. The domains used for summary scores were physical, social/family, emotional, functional well-being (FWB) and additional concerns.

Results: A total of 120 patients were enrolled, with 37 treated with WBRT alone and 83 with SRS or neurosurgery with or without WBRT. Of the 50 baseline FACT-Br items, only five items (I feel ill; I get support from my friends; I worry about dying; I have difficulty expressing my thoughts, I am able to put my thoughts into action) were statistically worse in patients treated with WBRT alone ($P < 0.05$). Patients who received SRS or surgery with or without WBRT had statistically ($P < 0.05$) higher scores for the FWB domain, additional concerns domain, and FACT-G total scores, indicating better QOL.

Conclusions: Patients selected for WBRT alone reported statistically different baseline QOL as compared to patients who were treated with SRS or neurosurgery (with or without WBRT).

Keywords: Whole brain radiotherapy (WBRT); stereotactic surgery; quality of life (QOL); FACT-Br; brain metastases

Submitted Sep 22, 2015. Accepted for publication Oct 29, 2015.

doi: 10.3978/j.issn.2224-5820.2015.11.01

View this article at: <http://dx.doi.org/10.3978/j.issn.2224-5820.2015.11.01>

Background

Brain metastases patients are selected for treatment based on performance status, age, co-morbidities, whether the metastasis to brain is single or multiple, neurosurgical resectability for single brain metastasis and extracranial disease extent. The goals of brain metastases treatment are to improve brain control (local brain metastases control or whole brain control) and possibly improve survival. Other considerations include neurocognitive outcomes and quality of life (QOL). Guidelines based on these principles have been published (1,2).

Patients with brain metastases often experience psychological, emotional, social and physical difficulties which can all affect QOL (3-5). QOL is most commonly assessed through self-administered questionnaires (6). The Functional Assessment of Cancer Therapy-Brain (FACT-Br) administered in conjunction with the FACT-G is a common questionnaire used to study QOL in brain metastases patients (4). The FACT-Br totals 50 items that covers physical, social/family, emotional, and functional well-being (FWB), as well as disease specific concerns such as concentration, memory, seizures, eyesight, personality, expression of thoughts, weakness, coordination and headaches (4,6,7) (*Appendix 1*). While the tool was originally used and validated for primary brain tumors, it has frequently been used in brain metastases patients (8,9). The purpose of this study was to examine the baseline QOL in patients treated with whole brain radiotherapy (WBRT) alone versus stereotactic radiosurgery (SRS) or surgery with or without WBRT, as assessed by the FACT-Br.

Methods

Newly diagnosed brain metastases patients were approached for the study at the time of their consultation. All consecutive series in patients with brain metastases in Rapid Response Radiotherapy Clinic and CNS clinic who agreed to participate were included. Patients with solitary brain metastasis and good performance status with limited extracranial disease were referred for a neurosurgical opinion. Patients with four or less brain metastases would be assessed for SRS while those with multiple metastases

for WBRT. Informed consent was obtained. Patient demographic information was collected including age, gender, primary cancer site, years from primary cancer to brain metastases, Karnofsky Performance Status (KPS) score, and Eastern Cooperative Oncology Group Performance Status (ECOG PS) score. Baseline FACT-Br results were obtained prior to brain metastases treatment. Eligible patients were analysed based on their treatment: WBRT alone versus SRS or neurosurgery with or without WBRT. Additionally, the FACT-Br items were grouped according to their different domains (physical, social/family, emotional, functional, well-being and additional concerns) for summary domain scores.

Statistical analysis

To compare demographics between WBRT alone versus SRS or neurosurgery with or without WBRT patients, Wilcoxon rank-sum nonparametric test or Fisher exact test was applied for continuous or categorical variables. When analyzing the 50 FACT-Br item scores between these two groups, Fisher exact test was also conducted. Summary scores were calculated with respect to physical well-being (PWB; using individual items GP1-GP7), social/family well-being (SWB; using individual items GS1-GS7), emotional well-being (EWB; using individual items GE1-GE6), (FWB; using individual items GF1-GF7), brain cancer (BrC; using individual items Br1-An10) subscale, FACT-Br Trial Outcome Index (TOI), FACT-G (General) total score, FACT-Br (Brain) total score. The higher the scores, the better the QOL.

For items with opposite meaning compared to other items in the section, the inversed values were calculated at the first step to make sure all FACT-Br scales had the same direction. To derive the subscale scores (PWB, SWB, EWB, FWB, and BrC), we used the following method for calculation: (sum individual item scores × number of items)/number of items answered. FACT-Br TOI was defined as the sum of PWB, FWB, and BrC subscale score; FACT-G total score was defined as the sum of PWB, SWB, EWB, and FWB; and FACT-Br total score was defined as the sum of FACT-G total score and BrC subscale score (10).

Table 1 Patient demographics

Characteristics	Results [%]
Age (years) (n=120)	
Median [range]	62 [24–90]
KPS (n=120)	
Median [range]	80 [50–100]
KPS distribution (n=120)	
50	7 [6]
60	7 [6]
70	21 [18]
80	26 [22]
90	32 [27]
100	27 [23]
Patients group (n=120)	
A—WBRT alone	37 [31]
B—SRS or surgery ± WBRT	83 [69]
Months from primary cancer to brain metastases (n=117)	
Median [range]	12 [0–168]
ECOG (n=120)	
0	59 [49]
1	47 [39]
2	14 [11]
Gender (n=120)	
Female	63 [53]
Male	57 [48]
Primary cancer site (n=120)	
Lung	65 [54]
Breast	14 [12]
Renal	11 [9]
Other	30 [25]
Number of brain metastases (n=120)	
1	32 [27]
2–3	30 [26]
>3	55 [47]
Other site of metastases (n=119)	
Bone	30 [25]
Lung	27 [23]
Liver	15 [13]
Lymph	7 [6]
None	64 [54]
Previous chemotherapy (n=120)	
No	67 [56]
Yes	53 [44]

Table 1 (continued)**Table 1** (continued)

Characteristics	Results [%]
Previous hormotherapy (n=119)	
No	110 [92]
Yes	9 [8]

WBRT, whole brain radiotherapy; KPS, Karnofsky Performance Status; SRS, stereotactic radiosurgery.

In the current analysis of the FACT-Br questionnaires (version 4), BrC subscale was calculated either using 46 additional concern items (Br1–Br18) or using 50 additional concern items (Br1–An10). Furthermore, FACT-Br TOI and FACT-Br total score had also two sets of scores. All of the aforementioned scores were analyzed separately. Wilcoxon rank-sum nonparametric test was used to compare the summary scores between the two groups. Two-sided P value <0.05 was considered statistically significant. All analyses were performed using Statistical Analysis Software (SAS version 9.4 for Windows).

Results

Patient demographics

A total of 120 patients were enrolled, with 37 (31%) treated with WBRT alone and 83 (69%) with SRS or surgery with or without WBRT from June 2012 to October 2014. The median age was 62 (range, 24–90) years old and median KPS was 80 (range, 50–100). Fifty-nine (49%), forty-seven (39%) and fourteen (12%) had ECOG PS scores of 0, 1 and 2, respectively. The median time from primary cancer to brain metastases was 1 year (range, 0–14 years). There were 63 females (53%) and 57 males (48%), of which lung (n=65; 54%), breast (n=14; 12%) and renal (n=11; 9%) were the three most common primary cancer sites. With respect to the number of brain metastases, 32 patients (27%) had one, 30 (26%) had 2–3, and 55 (47%) had more than 3. Of 119 patients with available information on extracranial disease, 30 (25%) had bone metastases, 27 (23%) had lung metastases, 15 (13%) had liver metastases, 7 (6%) had lymph metastases, and 64 (54%) had no other metastases (Table 1).

KPS scores between the two groups were significantly different (P=0.002), with WBRT alone patients generally reporting lower KPS scores; median of 80 rather than 90. There were more SRS or surgery with or without WBRT patients with KPS scores of 100 [25 patients (30%) vs.

Table 2 Comparison of patient demographics between the two groups

Characteristics	SRS or surgery ± WBRT (n=83)	WBRT alone (n=37)	P value
Age (years)			0.3182
N	83	37	
Median [range]	67 [24–90]	61 [40–89]	
KPS			0.0022
N	83	37	
Median [range]	90 [50–100]	80 [50–100]	
KPS distribution [%]			0.0001
50	1 [1]	6 [16]	
60	2 [2]	5 [14]	
70	17 [20]	4 [11]	
80	18 [22]	8 [22]	
90	20 [24]	12 [32]	
100	25 [30]	2 [5]	
Months from primary cancer to brain metastases			0.2409
N	80	37	
Median [range]	12 [0–168]	0 [0–132]	
ECOG [%]			0.0005
0	45 [54]	14 [38]	
1	35 [42]	12 [32]	
2	3 [4]	11 [30]	
Gender [%]			0.4289
Female	46 [55]	17 [46]	
Male	37 [45]	20 [54]	
Primary cancer site [%]			0.0913
Lung	42 [51]	23 [62]	
Breast	9 [11]	5 [14]	
Renal	11 [13]	0 [0]	
Others	21 [25]	9 [24]	
Number of brain metastases [%]			<.0001
1	31 [39]	1 [3]	
2–3	25 [31]	5 [14]	
>3	24 [30]	31 [84]	
Other site of metastases (119 available) [%]			
Bone	7 [8]	23 [64]	<0.0001
Lung	17 [20]	10 [28]	0.4753
Liver	5 [6]	10 [28]	0.0021
Lymph	4 [5]	3 [8]	0.4309
None	56 [67]	8 [22]	<0.0001

Table 2 (continued)**Table 2** (continued)

Characteristics	SRS or surgery ± WBRT (n=83)	WBRT alone (n=37)	P value
Previous chemotherapy [%]			0.3237
No	49 [59]	18 [49]	
Yes	34 [41]	19 [51]	
Previous hormotherapy [%]			0.4569
No	77 [94]	33 [89]	
Yes	5 [6]	4 [11]	

WBRT, whole brain radiotherapy; KPS, Karnofsky Performance Status; SRS, stereotactic radiosurgery.

2 patients (5%) for WBRT alone], while more of WBRT alone patients reported KPS scores of 50 [6 patients (16%) vs. 1 patient (1%)], and 60 [5 patients (14%) vs. 2 patients (2%) (P=0.0001)]. WBRT alone patients also more frequently reported poorer ECOG scores (P=0.0005), with only 11 patients (30%), as opposed to 3 (4%) patients, with a score of 2. WBRT alone patients typically had a higher number of brain metastases [>3 metastases; 31 patients (84%) vs. 24 patients (30%)], and a larger proportion had bone [23 patients (64%) vs. 7 patients (8%)] and liver [10 patients (28%) vs. 5 patients (6%)] metastases as well (Table 2).

FACT-Br item scores

The frequency of each FACT-Br item score is shown in Table 3. The most common QOL concerns in the entire cohort (based on at least 80% of patients responding quite a bit or very much) were items in the PWB domain (with the exception of “I am forced to spend time in bed”). A total of 82% of patients responded with quite a bit and very much in terms of accepting their illness. A total of 85% of patients responded with quite a bit or very much with respect to making decisions and taking responsibility. Eighty-nine percent of patients felt that they were able to put their thoughts together, ranked as quite a bit or very much.

FACT-Br item scores of the two groups

The item I feel ill (GP6) was notably different between patients receiving WBRT alone compared to SRS or surgery with or without WBRT (P=0.001). The two groups had similar proportions of patients who did not report illness (“not at all”; 65% for both). However, more WBRT

Table 3 FACT-Br item scores in all patients

FACT-Br items	Not at all, n [%]	A little, n [%]	Somewhat, n [%]	Quite a bit, n [%]	Very much, n [%]	Total
GP1	24 [20]	25 [21]	39 [33]	20 [17]	12 [10]	120
GP2	95 [80]	6 [5]	9 [8]	4 [3]	5 [4]	119
GP3	66 [55]	11 [9]	9 [8]	9 [8]	25 [21]	120
GP4	72 [60]	13 [11]	13 [11]	9 [8]	13 [11]	120
GP5	65 [58]	10 [9]	16 [14]	11 [10]	11 [10]	113
GP6	78 [65]	10 [8]	13 [11]	10 [8]	9 [8]	120
GP7	72 [60]	8 [7]	14 [12]	8 [7]	18 [15]	120
GS1	1 [1]	3 [3]	7 [6]	15 [13]	88 [77]	114
GS2	0 [0]	1 [1]	7 [6]	6 [5]	106 [88]	120
GS3	3 [3]	4 [4]	2 [2]	14 [12]	90 [80]	113
GS4	3 [3]	3 [3]	13 [11]	16 [14]	83 [70]	118
GS5	3 [3]	4 [3]	7 [6]	14 [12]	92 [77]	120
GS6	4 [3]	1 [1]	5 [4]	6 [5]	100 [86]	116
GS7	8 [28]	8 [28]	6 [21]	5 [17]	2 [7]	29
GE1	39 [33]	29 [24]	31 [26]	14 [12]	7 [6]	120
GE2	6 [5]	10 [8]	21 [18]	27 [23]	56 [47]	120
GE3	71 [61]	13 [11]	14 [12]	8 [7]	10 [9]	116
GE4	45 [38]	19 [16]	27 [23]	21 [18]	8 [7]	120
GE5	49 [42]	19 [16]	26 [22]	13 [11]	11 [9]	118
GE6	33 [28]	26 [22]	24 [20]	18 [15]	19 [16]	120
GF1	26 [22]	12 [10]	24 [20]	9 [8]	48 [40]	119
GF2	16 [15]	7 [7]	15 [14]	10 [10]	56 [54]	104
GF3	9 [8]	4 [3]	17 [14]	21 [18]	69 [58]	120
GF4	2 [2]	2 [2]	18 [15]	32 [27]	66 [55]	120
GF5	15 [13]	12 [10]	35 [29]	28 [23]	30 [25]	120
GF6	29 [24]	10 [8]	19 [16]	12 [10]	50 [42]	120
GF7	20 [17]	4 [3]	31 [26]	27 [23]	38 [32]	120
Br1	4 [3]	6 [5]	27 [23]	22 [18]	61 [51]	120
Br2	110 [92]	3 [3]	0 [0]	0 [0]	6 [5]	119
Br3	4 [3]	4 [3]	17 [14]	27 [23]	68 [57]	120
Br4	34 [29]	12 [10]	30 [26]	21 [18]	19 [16]	116
Br5	75 [64]	4 [3]	12 [10]	6 [5]	20 [17]	117
Br6	85 [72]	11 [9]	9 [8]	7 [6]	6 [5]	118
Br7	14 [12]	16 [13]	15 [13]	15 [13]	60 [50]	120
NTX6	85 [71]	12 [10]	16 [13]	2 [2]	5 [4]	120
Br8	6 [5]	3 [3]	22 [18]	25 [21]	64 [53]	120
Br9	68 [57]	15 [13]	26 [22]	6 [5]	5 [4]	120
Br10	68 [60]	22 [19]	15 [13]	4 [4]	5 [4]	114
Br11	6 [5]	3 [3]	8 [7]	11 [9]	91 [76]	119
Br12	47 [44]	9 [8]	21 [20]	13 [12]	17 [16]	107
Br13	0 [0]	1 [1]	12 [10]	25 [21]	80 [68]	118

Table 3 (continued)

Table 3 (continued)

FACT-Br items	Not at all, n [%]	A little, n [%]	Somewhat, n [%]	Quite a bit, n [%]	Very much, n [%]	Total
Br14	88 [73]	11 [9]	8 [7]	6 [5]	7 [9]	120
Br15	8 [7]	3 [3]	19 [16]	10 [8]	80 [67]	120
Br16	14 [12]	7 [6]	10 [8]	15 [13]	72 [61]	118
Br17	10 [8]	8 [7]	12 [10]	16 [13]	74 [62]	120
Br18	55 [47]	2 [2]	1 [1]	5 [4]	53 [46]	116
Br19	89 [74]	10 [8]	7 [6]	7 [6]	7 [6]	120
Br20	61 [51]	29 [24]	15 [12]	8 [7]	7 [6]	120
Br21	78 [65]	18 [15]	11 [9]	8 [7]	5 [4]	120
An10	79 [66]	21 [18]	9 [8]	4 [3]	7 [6]	120

FACT-Br, Functional Assessment of Cancer Therapy-Brain.

alone patients reported “a little” illness (16% compared to 5%) and “very much” illness (16% *vs.* 4%), while more patients treated with SRS or surgery with or without WBRT reported “somewhat” (15% compared to 3%) and “quite a bit” (12% *vs.* 0%) of illness (Table 4). All other PWB scores were not significantly different between the two groups.

Patients of the two groups reported different levels of support from their friends (GS3) ($P=0.04$). SRS or surgery with or without WBRT patients reported greater levels of support (“very much”; 84% *vs.* 70%), while more WBRT alone patients reported a lack of support (“not at all”; 8% *vs.* 0%) (Table 4). None of the other SWB questions were statistically significant between the two groups.

The worry of death (GE5) differed between WBRT alone and SRS or surgery with or without WBRT ($P=0.0002$). Less WBRT alone patients had no worry (38% *vs.* 43%), or “a little” fear (0% compared to 24%) of death. Less patients of SRS or surgery with or without WBRT reported moderate (“somewhat”; 16% in comparison to 35%) and significant (“very much”; 5% *vs.* 19%) fear of death (Table 4). All other EWB and FWB scores were not different between the two groups.

SRS or surgery with or without WBRT patients had less difficulty expressing their thoughts (Br9). No difficulty was reported in 64% of SRS or surgery with or without WBRT, while only 41% of WBRT alone patients had no difficulty. A greater proportion of WBRT alone patients reported difficulty expressing thoughts: “somewhat” (24%>21%), “quite a bit” (5.4%>4.8%), and “very much” (11%>1%). There were more SRS or surgery with or without WBRT patients who found it very easy to put their thoughts into

action (“very much”; 72% compared to 54%) ($P=0.005$) (Table 4).

FACT-Br summary scores of the two groups

Using the scales with 46 items, FWB, FACT-G total score, BrC subscale score, FACT-Br total score and FACT-Br TOI (when using 46 items) were found to be statistically significant between the two groups ($P=0.04$, 0.04, 0.02, 0.02, and 0.02, respectively). SRS or surgery with or without WBRT had higher scores, or better QOL, than WBRT alone patients with respect to FWB (19.6>16.9), FACT-G total score (82.3>76.2), BrC subscale score (60.3>55.4), FACT-Br total score (142.7>131.7), and FACT-Br TOI (100.9>91.7). The higher PWB (21.0>19.3), SWB (25.2>24.4) and EWB (16.6>15.6) scores for SRS and WBRT were numerically higher but not significant ($P=0.40$, 0.84, and 0.23, respectively) (Table 5).

Similar findings were expressed in the scale with 50 items: WBRT alone had significantly lower QOL across all scores, however, PWB, SWB and EWB did not show the significant difference between two groups ($P=0.40$, 0.84, and 0.23, respectively). FWB (19.6>16.9), FACT-G total score (82.3>76.2), BrC subscale score (73.5>68.5), FACT-Br total score (155.8>144.8) and FACT-Br TOI (114.1>104.8) were all reported higher for SRS or surgery with or without WBRT patients ($P=0.04$, 0.04, 0.02, 0.02, and 0.02, respectively) (Table 5).

Discussion

Several studies (11-15) have investigated the choice between

Table 4 FACT-Br item scores between the two groups

FACT-Br items	WBRT alone (n=37)					SRS or surgery ± WBRT (n=83)					P value
	Not at all, n [%]	A little, n [%]	Somewhat, n [%]	Quite a bit, n [%]	Very much, n [%]	Not at all, n [%]	A little, n [%]	Somewhat, n [%]	Quite a bit, n [%]	Very much, n [%]	
GP1	5 [14]	10 [27]	12 [32]	4 [11]	6 [16]	19 [23]	15 [18]	27 [33]	16 [19]	6 [7]	0.2703
GP2	26 [72]	4 [11]	1 [3]	2 [6]	3 [8]	69 [83]	2 [2]	8 [10]	2 [2]	2 [2]	0.0546
GP3	16 [43]	4 [11]	3 [8]	3 [8]	11 [30]	50 [60]	7 [8]	6 [7]	6 [7]	14 [17]	0.4185
GP4	22 [59]	4 [11]	4 [11]	1 [3]	6 [16]	50 [60]	9 [11]	9 [11]	8 [10]	7 [8]	0.5588
GP5	19 [53]	4 [11]	5 [14]	6 [17]	2 [6]	46 [60]	6 [8]	11 [14]	5 [6]	9 [12]	0.4047
GP6	24 [65]	6 [16]	1 [3]	0 [0]	6 [16]	54 [65]	4 [5]	12 [14]	10 [12]	3 [4]	0.0011
GP7	19 [51]	2 [5]	6 [16]	5 [14]	5 [14]	53 [64]	6 [7]	8 [10]	3 [4]	13 [16]	0.2465
GS1	0 [0]	2 [5]	3 [8]	4 [11]	28 [76]	1 [1]	1 [1]	4 [5]	11 [14]	60 [78]	0.6497
GS2	0 [0]	0 [0]	3 [8]	2 [5]	32 [86]	0 [0]	1 [1]	4 [5]	4 [5]	74 [89]	0.8596
GS3	3 [8]	1 [3]	0 [0]	7 [19]	26 [70]	0 [0]	3 [4]	2 [3]	7 [9]	64 [84]	0.0408
GS4	0 [0]	2 [6]	1 [3]	3 [9]	29 [83]	3 [4]	1 [1]	12 [14]	13 [16]	54 [65]	0.0820
GS5	2 [5]	3 [8]	1 [3]	4 [11]	27 [73]	1 [1]	1 [1]	6 [7]	10 [12]	65 [78]	0.1683
GS6	2 [6]	0 [0]	0 [0]	1 [3]	32 [91]	2 [2]	1 [1]	5 [6]	5 [6]	68 [84]	0.4732
GS7	3 [23]	3 [23]	4 [31]	3 [23]	0 [0]	5 [31]	5 [31]	2 [13]	2 [13]	2 [13]	0.5741
GE1	8 [22]	10 [27]	12 [32]	5 [14]	2 [5]	31 [37]	19 [23]	19 [23]	9 [11]	5 [6]	0.5011
GE2	2 [5]	2 [5]	7 [19]	7 [19]	19 [51]	4 [5]	8 [10]	14 [17]	20 [24]	37 [45]	0.8998
GE3	25 [68]	4 [11]	5 [14]	2 [5]	1 [3]	46 [58]	9 [11]	9 [11]	6 [8]	9 [11]	0.6124
GE4	12 [32]	7 [19]	9 [24]	7 [19]	2 [5]	33 [40]	12 [15]	18 [22]	14 [17]	6 [7]	0.9150
GE5	14 [38]	0 [0]	13 [35]	3 [8]	7 [19]	35 [43]	19 [23]	13 [16]	10 [12]	4 [5]	0.0002
GE6	6 [16]	6 [16]	10 [27]	8 [22]	7 [19]	27 [33]	20 [24]	14 [17]	10 [12]	12 [15]	0.1602
GF1	12 [32]	6 [16]	7 [19]	1 [3]	11 [30]	14 [17]	6 [7]	17 [21]	8 [10]	37 [45]	0.0996
GF2	5 [17]	4 [14]	5 [17]	4 [14]	11 [38]	11 [15]	3 [4]	10 [13]	6 [8]	45 [60]	0.1743
GF3	3 [8]	3 [8]	8 [22]	5 [14]	18 [49]	6 [7]	1 [1]	9 [11]	16 [19]	51 [61]	0.1366
GF4	0 [0]	0 [0]	5 [14]	10 [27]	22 [59]	2 [2]	2 [2]	13 [16]	22 [27]	44 [53]	0.9913
GF5	6 [16]	4 [11]	9 [24]	11 [30]	7 [19]	9 [11]	8 [10]	26 [31]	17 [20]	23 [28]	0.5838
GF6	10 [27]	3 [8]	10 [27]	1 [3]	13 [35]	19 [23]	7 [8]	9 [11]	11 [13]	37 [45]	0.1049
GF7	10 [27]	0 [0]	12 [32]	6 [16]	9 [24]	10 [12]	4 [5]	19 [23]	21 [25]	29 [35]	0.1101
Br1	0 [0]	2 [5]	8 [22]	12 [32]	15 [41]	4 [5]	4 [5]	19 [23]	10 [12]	46 [55]	0.0749
Br2	35 [95]	0 [0]	0 [0]	0 [0]	2 [5]	75 [91]	3 [4]	0 [0]	0 [0]	4 [5]	0.7184
Br3	0 [0]	1 [3]	7 [19]	8 [22]	21 [57]	4 [5]	3 [4]	10 [12]	19 [23]	47 [57]	0.6867
Br4	6 [16]	5 [14]	12 [32]	6 [16]	8 [22]	28 [35]	7 [9]	18 [23]	15 [19]	11 [14]	0.2022
Br5	20 [54]	1 [3]	4 [11]	4 [11]	8 [22]	55 [69]	3 [4]	8 [10]	2 [3]	12 [15]	0.2652
Br6	25 [68]	2 [5]	4 [11]	4 [11]	2 [5]	60 [74]	9 [11]	5 [6]	3 [4]	4 [5]	0.4155
Br7	6 [16]	7 [19]	5 [14]	3 [8]	16 [43]	8 [10]	9 [11]	10 [12]	12 [14]	44 [53]	0.4602
NTX6	24 [65]	3 [8]	6 [16]	2 [5]	2 [5]	61 [73]	9 [11]	10 [12]	0 [0]	3 [4]	0.2606
Br8	2 [5]	1 [3]	8 [22]	10 [27]	16 [43]	4 [5]	2 [2]	14 [17]	15 [18]	48 [58]	0.6041
Br9	15 [41]	7 [19]	9 [24]	2 [5]	4 [11]	53 [64]	8 [10]	17 [20]	4 [5]	1 [1]	0.0343
Br10	28 [76]	3 [8]	5 [14]	0 [0]	1 [3]	40 [52]	19 [25]	10 [13]	4 [5]	4 [5]	0.0822

Table 4 (continued)

Table 4 (continued)

FACT-Br items	WBRT alone (n=37)					SRS or surgery ± WBRT (n=83)					P value
	Not at all, n [%]	A little, n [%]	Somewhat, n [%]	Quite a bit, n [%]	Very much, n [%]	Not at all, n [%]	A little, n [%]	Somewhat, n [%]	Quite a bit, n [%]	Very much, n [%]	
Br11	2 [5]	0 [0]	4 [11]	6 [16]	25 [68]	4 [5]	3 [4]	4 [5]	5 [6]	66 [80]	0.1936
Br12	10 [30]	4 [12]	8 [24]	4 [12]	7 [21]	37 [50]	5 [7]	13 [18]	9 [12]	10 [14]	0.3429
Br13	0 [0]	0 [0]	2 [6]	11 [31]	22 [63]	0 [0]	1 [1]	10 [12]	14 [17]	58 [70]	0.2463
Br14	24 [65]	3 [8]	3 [8]	4 [11]	3 [8]	64 [77]	8 [10]	5 [6]	2 [2]	4 [5]	0.2834
Br15	2 [5]	3 [8]	5 [14]	7 [19]	20 [54]	6 [7]	0 [0]	14 [17]	3 [4]	60 [72]	0.0045
Br16	6 [17]	5 [14]	3 [8]	3 [8]	19 [53]	8 [10]	2 [2]	7 [9]	12 [15]	53 [65]	0.1065
Br17	5 [14]	3 [8]	4 [11]	5 [14]	20 [54]	5 [6]	5 [6]	8 [10]	11 [13]	54 [65]	0.6159
Br18	19 [56]	0 [0]	0 [0]	1 [3]	14 [41]	36 [44]	2 [2]	1 [1]	4 [5]	39 [48]	0.7624
Br19	24 [65]	7 [19]	2 [5]	1 [3]	3 [8]	65 [78]	3 [4]	5 [6]	6 [7]	4 [5]	0.0537
Br20	21 [57]	7 [19]	4 [11]	1 [3]	4 [11]	40 [48]	22 [27]	11 [13]	7 [8]	3 [4]	0.3743
Br21	25 [68]	5 [14]	3 [8]	3 [8]	1 [3]	53 [64]	13 [16]	8 [10]	5 [6]	4 [5]	0.9719
An10	24 [65]	8 [22]	1 [3]	2 [5]	2 [5]	55 [66]	13 [16]	8 [10]	2 [2]	5 [6]	0.5689

WBRT, whole brain radiotherapy; FACT-Br, Functional Assessment of Cancer Therapy-Brain.

Table 5 Comparison of FACT-Br summary scores between the two groups

FACT-Br summary scores	Total (n=120)	SRS or surgery ± WBRT (n=83)	WBRT alone (n=37)	P value
Scales using 46 items				
PWB				0.3974
N	120.00	83.00	37.00	
Mean	20.50	21.00	19.30	
SD	7.27	6.85	8.11	
Median	23.50	24.00	22.00	
Q1	15.00	15.00	14.00	
Q3	26.00	26.00	26.00	
Min	1.00	1.00	1.00	
Max	28.00	28.00	28.00	
SWB				0.8445
N	120.00	83.00	37.00	
Mean	24.90	25.20	24.40	
SD	4.01	3.60	4.81	
Median	26.80	26.80	26.00	
Q1	23.33	23.33	23.00	
Q3	28.00	28.00	28.00	
Min	7.00	7.00	10.00	
Max	28.00	28.00	28.00	

Table 5 (continued)

Table 5 (continued)

FACT-Br summary scores	Total (n=120)	SRS or surgery ± WBRT (n=83)	WBRT alone (n=37)	P value
EWB				
N	120.00	83.00	37.00	0.2327
Mean	16.30	16.60	15.60	
SD	5.29	5.49	4.80	
Median	17.00	18.00	16.00	
Q1	12.00	12.00	13.00	
Q3	21.00	21.00	20.00	
Min	6.00	6.00	6.00	
Max	24.00	24.00	24.00	
FWB				
N	120.00	83.00	37.00	0.0397
Mean	18.70	19.60	16.90	
SD	6.05	5.65	6.57	
Median	20.00	20.00	17.00	
Q1	14.50	16.00	12.83	
Q3	23.33	24.00	22.17	
Min	3.50	6.00	3.50	
Max	28.00	28.00	27.00	
FACT-G total score				
N	120.00	83.00	37.00	0.0345

Table 5 (continued)

Table 5 (continued)

FACT-Br summary scores	Total (n=120)	SRS or surgery ± WBRT (n=83)	WBRT alone (n=37)	P value
Mean	80.50	82.30	76.20	
SD	16.22	16.13	15.84	
Median	84.80	85.30	79.00	
Q1	70.00	73.00	58.43	
Q3	92.00	93.83	90.00	
Min	45.00	45.00	46.00	
Max	105.00	105.00	101.80	
BrC subscale score				0.0142
N	120.00	83.00	37.00	
Mean	58.80	60.30	55.40	
SD	11.29	11.74	9.50	
Median	59.10	61.20	55.00	
Q1	51.86	53.00	48.00	
Q3	69.00	71.00	62.28	
Min	30.00	32.00	30.00	
Max	76.00	76.00	70.00	
FACT-Br total score				0.0186
N	120.00	83.00	37.00	
Mean	139.30	142.70	131.70	
SD	25.68	25.89	23.82	
Median	142.30	149.20	138.00	
Q1	122.83	123.00	113.00	
Q3	160.83	162.00	145.00	
Min	77.50	83.80	77.50	
Max	179.30	179.30	171.80	
FACT-Br TOI				0.0147
N	120.00	83.00	37.00	
Mean	98.10	100.90	91.70	
SD	21.71	21.52	21.03	
Median	101.70	103.00	97.00	
Q1	85.50	89.00	82.00	
Q3	115.50	117.82	104.00	
Min	34.50	48.00	34.50	
Max	129.00	129.00	125.00	
Scales using 50 items				
PWB				0.3974
N	120.00	83.00	37.00	
Mean	20.50	21.00	19.30	
SD	7.27	6.85	8.11	

Table 5 (continued)

Table 5 (continued)

FACT-Br summary scores	Total (n=120)	SRS or surgery ± WBRT (n=83)	WBRT alone (n=37)	P value
Median	23.50	24.00	22.00	
Q1	15.00	15.00	14.00	
Q3	26.00	26.00	26.00	
Min	1.00	1.00	1.00	
Max	28.00	28.00	28.00	
SWB				0.8445
N	120.00	83.00	37.00	
Mean	24.90	25.20	24.40	
SD	4.01	3.60	4.81	
Median	26.80	26.80	26.00	
Q1	23.33	23.33	23.00	
Q3	28.00	28.00	28.00	
Min	7.00	7.00	10.00	
Max	28.00	28.00	28.00	
EWB				0.2327
N	120.00	83.00	37.00	
Mean	16.30	16.60	15.60	
SD	5.29	5.49	4.80	
Median	17.00	18.00	16.00	
Q1	12.00	12.00	13.00	
Q3	21.00	21.00	20.00	
Min	6.00	6.00	6.00	
Max	24.00	24.00	24.00	
FWB				0.0397
N	120.00	83.00	37.00	
Mean	18.70	19.60	16.90	
SD	6.05	5.65	6.57	
Median	20.00	20.00	17.00	
Q1	14.50	16.00	12.83	
Q3	23.33	24.00	22.17	
Min	3.50	6.00	3.50	
Max	28.00	28.00	27.00	
FACT-G total score				0.0345
N	120.00	83.00	37.00	
Mean	80.50	82.30	76.20	
SD	16.22	16.13	15.84	
Median	84.80	85.30	79.00	
Q1	70.00	73.00	58.43	
Q3	92.00	93.83	90.00	

Table 5 (continued)

Table 5 (continued)

FACT-Br summary scores	Total (n=120)	SRS or surgery ± WBRT (n=83)	WBRT alone (n=37)	P value
Min	45.00	45.00	46.00	
Max	105.00	105.00	101.80	
BrC subscale score				0.0237
N	120.00	83.00	37.00	
Mean	71.90	73.50	68.50	
SD	13.39	13.96	11.48	
Median	73.10	76.30	68.00	
Q1	64.00	66.00	60.64	
Q3	82.50	84.00	78.41	
Min	36.00	36.00	45.00	
Max	92.00	92.00	86.00	
FACT-Br total score				0.0186
N	120.00	83.00	37.00	
Mean	152.40	155.80	144.80	
SD	27.69	28.03	25.65	
Median	157.10	160.70	151.00	
Q1	135.83	137.00	125.00	
Q3	175.83	177.00	158.00	
Min	83.80	83.80	91.00	
Max	195.30	195.30	187.80	
FACT-Br TOI				0.0204
N	120.00	83.00	37.00	
Mean	111.20	114.10	104.80	
SD	23.77	23.74	22.85	
Median	114.40	117.80	110.00	
Q1	97.00	101.00	96.00	
Q3	129.50	131.86	119.00	
Min	50.50	51.00	50.50	
Max	145.00	145.00	141.00	

WBRT, whole brain radiotherapy; FACT-Br, Functional Assessment of Cancer Therapy-Brain; PWB, physical well-being; SWB, social/family well-being; EWB, emotional well-being; FWB, functional well-being; BrC, brain cancer; TOI, Trial Outcome Index.

WBRT or SRS alone, or a combination of the two treatments. All have included good prognosis patients and up to four small brain metastases for the use of radiosurgery alone, with documented benefit in terms of neurocognitive

sparing and QOL as compared to WBRT (16,17). Patients with good prognosis and resectable single brain metastasis who underwent neurosurgery had better survival as compared to patients who did not have neurosurgery but rather only WBRT (18,19).

This study evaluated baseline QOL between WBRT alone versus SRS or surgery with or without WBRT. A higher proportion of WBRT alone patients had lower KPS and ECOG PS scores. Additionally, a higher percentage of WBRT alone patients had greater than three brain metastases. Both of these findings illustrate common practices as documented in the literature. Physicians are less likely to treat patients with poor performance status and multiple brain metastases using SRS or neurosurgery (20-24). The lower QOL as observed in WBRT alone patients may be related to more brain metastases, and active extracranial disease. Li *et al.* documented that a correlation exists between lower neurocognitive function and an associated lower QOL (25). We also found that WBRT alone patients had worse FWB in particular.

Limitations

Our study was limited by English speaking patients. Patients who declined study or with very poor performance status as they were too ill would not be captured in this study. We only compared the baseline differences.

Conclusions

WBRT alone patients reported statistically different baseline QOL as compared to patients who went on to have SRS or neurosurgery (with or without WBRT); five of fifty individual items and five of eight summary items had lower QOL.

Acknowledgements

We thank the generous support of Bratty Family Fund, Michael and Karyn Goldstein Cancer Research Fund, Joey and Mary Furfari Cancer Research Fund, Pulenzas Cancer Research Fund, Joseph and Silvana Melara Cancer Research Fund, and Ofelia Cancer Research Fund.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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Cite this article as: Chow R, Tsao M, Pulenzas N, Zhang L, Sahgal A, Cella D, Soliman H, Danjoux C, DeAngelis C, Vuong S, Chow E. Do patients with brain metastases selected for whole brain radiotherapy have worse baseline quality of life as compared to those for radiosurgery or neurosurgery (with or without whole brain radiotherapy)? *Ann Palliat Med* 2016;5(1):1-12. doi: 10.3978/j.issn.2224-5820.2015.11.01