

Clinical pain management by a multidisciplinary palliative care team

Experience from a tertiary cancer center in China

Bo Yang, MD^a, Zhi Cui, MS^a, Xiuqin Zhu, BS^b, Muhong Deng, BS^c, Yu Pan, MD^d, Ruixin Li, BS^a, Mei Guo, BS^a, Guijun Lu, BS^e, Xuehua Zhang, BS^f, Liping Guo, BS^g, Yurong Huang, BS^h, Fang Li, BS^{i,*}

Abstract

To investigate the effect of multidisciplinary interventions on pain management in cancer inpatients.

Four hundred thirty eight patients with cancer pain, who performed the multidisciplinary intervention were recruited. Before and after intervention, the Brief Pain Inventory (BPI) and the MD Anderson Symptom Inventory (MDASI) score as the primary endpoints and QOL scores as the secondary endpoint were all evaluated. To investigate the factors that led to different responses to multidisciplinary interventions, patients were classified as non-responders or responders.

Finally, 92 patients (63 male and 29 female) scheduled for cancer pain management by inter-professional team were studied. After individualized multidisciplinary therapy, both pain and symptom severity was improved, as demonstrated by lowered BPI worst and average pain scores, as well as symptom severity score measured by MDASI ($P = .017$, $P = .003$, and $P = .011$, respectively). The proportion of patients with mild pain increased regarding the BPI worst and average pain at baseline and after treatment ($P < .05$). The QOL analyses showed multidisciplinary interventions could significantly improve the function and symptom scores ($P < .001$). More patients in responder group received chemotherapy (58, 70.7%, $P = .003$), while fewer received mini-invasive therapy (6, 7.32%, $P = .011$).

Multidisciplinary interventions had certain beneficial effect on cancer pain management, especially in patients with moderate or severe pain.

Abbreviations: BPI = Brief Pain Inventory, CPR = complete pain response, EORTC = QOL-C30 European Organization for Research and Treatment of Cancer Quality of Life Core 30, MDASI = MD Anderson Symptom Inventory, PHQ-9 = Patient Health Questionnaire, PPR = partial pain response, PpR = progressive pain response, SAS = Self-Rating Anxiety Scale, SPR = stable pain response.

Keywords: cancer pain, inter-professional team, multidisciplinary intervention, pain intensity, pain management, pain response

1. Introduction

Cancer, as a major public health problem, is the leading cause of morbidity and mortality worldwide.^[1] Currently, approximately 25 million people have been reported to live with cancer and 11 million new cases are diagnosed each year.^[2] With the increasing aging of population, it is estimated that the global cancer rate will

increase by 50% to 15 million by 2020.^[3] Advances in cancer therapy may arrest disease progression and prolong the life expectancy of the patients. However, the state of science and research development has lagged in targeting the physical, psychosocial, and existential elements of living with comprehensive cancer care.^[4]

Editor: Bernhard Schaller.

BY and ZC contributed equally to this work and thus shared the co-first authorship.

XZ and FL contributed equally to this work and thus shared the co-correspondence authorship.

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

The authors declare that they have no conflicts of interest.

The datasets generated during and/or analyzed during the current study are not publicly available, but are available from the corresponding author on reasonable request.

^a Department of Oncology, Internal Medicine I, ^b Clinical Division of Internal Medicine, ^c Department of Oncology, Internal Medicine II, Chinese PLA General Hospital, ^d Department of Medical Psychology, Chinese PLA General Hospital & Medical School PLA, ^e Department of Medical psychology, ^f Department of Interventional Ultrasound, ^g Department of interventional radiology, ^h Department of radiotherapy, Chinese PLA General Hospital, Beijing, ⁱ Department of oncology, Chinese PLA General Hospital Hainan Branch, Hainan, China.

* Correspondence: Fang Li, Department of medical oncology, Chinese PLA General Hospital Hainan Branch, Haitang Bay South Area C10, Sanya, 572013, Hainan 572013, China. (e-mail: LiF8988@163.com).

Copyright © 2020 the Author(s). Published by Wolters Kluwer Health, Inc.

This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial License 4.0 (CCBY-NC), where it is permissible to download, share, remix, transform, and buildup the work provided it is properly cited. The work cannot be used commercially without permission from the journal.

How to cite this article: Yang B, Cui Z, Zhu X, Deng M, Pan Y, Li R, Guo M, Lu G, Zhang X, Guo L, Huang Y, Li F. Clinical pain management by a multidisciplinary palliative care team: experience from a tertiary cancer center in China. *Medicine* 2020;99:48(e23312).

Received: 19 March 2020 / Received in final form: 3 September 2020 / Accepted: 21 October 2020

<http://dx.doi.org/10.1097/MD.00000000000023312>

Pain is the most prevalent and debilitating symptom in cancer patients. More than 50% of patients have been suffering from cancer-related pain.^[5] However, 1 study has reported the prevalence rate of cancer pain was varied with tumor type, stage, and treatment intention.^[6] Cancer pain might be a major determinant of poor quality of life (QOL) of the patients.^[7] On the basis of opioids, pharmacologic management has been proved potentially effective for cancer pain. However, according to World Health Organization (WHO) estimates, approximately one third of patients who received active cancer treatment experienced pain, as well as over half of people with more advanced disease.^[8,9] The uncontrolled pain significantly limits the QOL and increases the risk of depressive or anxiety disorders.^[10]

Pain is well-established as a multidimensional symptom that consists of physical, psychosocial, emotional, and spiritual elements.^[11] The primary disease-modifying therapy along with the pharmacologic treatment has always been considered for clinical cancer pain management.^[12] Meanwhile, other treatment modalities have also been advocated for pain control. Psychological and behavioral treatments have been reported to be effective in management of various types of cancer pain.^[13] The combination of therapeutic modalities, such as surgery, radiotherapy, chemotherapy, physical, interventional, complementary therapies, hormones, bisphosphonates, with pharmacological and non-pharmacological pain management can optimize pain relief.^[14]

A comprehensive, individually tailored multimodal therapy by a multidisciplinary palliative care team has been suggested to be critical for cancer pain management.^[11] However, clinical response to palliative care varied with different institutions and settings of palliative care.^[15] Therefore, the present prospectively study was to investigate the effect of multidisciplinary interventions from inter-professional team (surgeon, radiotherapist, interventional radiologist, interventional sonographer, pain physicians, psychologists, nutritionist, and nurse specialists) on pain management in cancer inpatients. The Brief Pain Inventory (BPI) and the MD Anderson Symptom Inventory (MDASI) were used for measurement of pain/symptoms and interference.

2. Methods

2.1. Study design and patients

This is a prospective study, primarily aimed to evaluate the effect of multidisciplinary interventions from inter-professional team on pain management in cancer inpatients. This study was approved by the Ethics Committee of our hospital. Patients (≥ 18 years old) scheduled for of cancer pain management by multidisciplinary intervention and multidisciplinary team were recruited from 16 wards of Cancer Center. In this study, the written informed consents were obtained from 1182 patients with malignant tumor, finally, 438 patients with cancer pain were recruited. Patients with mental retardation or unconsciousness that could not provide informed consent or complete questionnaires were excluded. The demographic information and clinical data of all patients, including age, gender, tumor type and stage, current treatments, and others were recorded.

2.2. Interventions

All new inpatients were initially evaluated by palliative care physicians and nurses for entry into the study. The multidisciplinary care team was then allowed to assess the clinical

symptoms and severity, psychological, and nutritional status, and physical function of the patients with cancer pain. The care team was led by physicians. The members of the team included surgeon, radiotherapist, interventional radiologist, interventional sonographer, pain physicians, psychologists, nutritionist, and nurse specialists. The composition of the multidisciplinary team was based on the experience of our previous work. The team members have worked together for almost 2 years and effectively collaborated. All patients with cancer pain were consulted by multidisciplinary care team. The antitumor and/or symptomatic treatments were prescribed according to the clinical conditions of the patients.

The physician, surgeon, radiotherapist, interventional radiologist, and interventional sonographer were responsible for clinical cancer management. The pain physician mainly focused on pain assessment, analgesic prescription, evaluation of responses, and drug adjustment. Nutrition assessment was performed by nutritionist according to the nutritional risk screening tool 2002 (NRS-2002).^[16] Patients with an NRS Score ≥ 3 were considered at risk of malnutrition and were provided with nutrition support. Depression and anxiety of the patients were screened by the Patient Health Questionnaire (PHQ-9) depression scale and Self-Rating Anxiety Scale (SAS).^[17,18] Individuals with moderate to severe depression and/or anxiety (PHQ-9 score ≥ 10 or SAS score ≥ 40) were given psychological support by a professional psychologist. The possible treatment plans were proposed and discussed by the specialists, and the definitive treatment plans were then decided and performed by multidisciplinary team.

2.3. Measurements

The comparison of BPI and MDASI scores before and after intervention were the primary endpoints. The patients were asked to report pain intensity and interference using the BPI, an 11-point scale ranging from 0 (no pain) to 10 (the worst pain you can imagine).^[19] Pain response was calculated on the basis of the changes of pain intensity score. In this study, complete pain response (CPR) was defined as a BPI worst-pain score of 0, partial pain response (PPR) was defined as a reduction in worst-pain score of 2 or more points above baseline, progressive pain response (PpR) was defined as an increase in BPI worst pain score of at least 2 points above baseline, stable pain response (SPR) described all the remaining cases with the change in BPI scores between -2 and 2. The overall pain response was calculated based on the number of patients with CPR, PPR, and SPR. The severity of pain was categorized as mild (1–3 points), moderate (4–6 points), and severe (7–10 points).^[20] To investigate the factors that led to different responses to multidisciplinary treatment, patients were divided into non-responders or responders based on their pain response. MDASI, a validated 19-item questionnaire, was also used to rate the symptoms and functional interference on an 11-point scale (0: no pain or no interference, 10: as bad as you can imagine or complete interference).^[21]

The comparison of QOL scores before and after intervention were the secondary endpoint. European Organization for Research and Treatment of Cancer Quality of Life Core 30 (EORTC QOL-C30) was used to assess the QOL scores of the patients before and after multidisciplinary interventions. It is a 30-item core questionnaire including 5 function scales, 9 symptomatic scales and 6 single items that reflect the multidimensional construct of the QOL.^[22]

2.4. Statistical analysis

All analyses were performed using SPSS software, version 17.0 (SPSS Inc, Chicago, IL). Normal distribution of data was examined by the Kolmogorov-Smirnov normality test. Values are presented as mean ± SD, medians (interquartile range), or numbers (percentage). Clinical features between non-responders and responders were compared by Student *t* test or Mann-Whitney *U* test for quantitative variables and χ^2 test or Fisher exact test for categorical variables. Univariate and multivariate logistic regression analyses were used to identify predictive factors associated with pain management in cancer patients. All probability values were two-sided, and *P* < .05 is considered significant.

3. Results

3.1. Baseline characteristics of the cancer patients with pain

Among the 438 patients with cancer pain, due to the inadequate training and discharge management for research assistants and patients, many patients did not complete the questionnaires well when they discharged, finally only 92 patients (63 male and 29 female) scheduled for cancer pain management by our inter-professional team were recruited into this study. The mean age of patients was 54.4 ± 10.3 years, the mean pain intensity at baseline was 4.18 ± 2.36 scores. Liver cancer was the most common tumor type, occurring in 29 patients (31.5%), followed by lung cancer in

26 (28.3%). Among them, 73.9% patients had advanced cancers (Stage III and IV) and 21.5% patients (20/92) had received analgesic before. Eighty two (89.1%) patients were regarded as responders, including 9 CPR, 25 PPR, and 48 SPR. The remaining 10 patients (PpR) were regarded as non-responders. Patients in responder groups had advanced tumor stage (*P* = .018), however there was no significant difference in terms of other baseline characteristics between the 2 groups (Table 1)

3.2. Multidisciplinary therapy

The individualized multidisciplinary therapy was administered by inter-professional team. 86 patients (93.5%) received antitumor therapy, in which chemotherapy was the most frequent therapy modality (65.2%, Table 2). Eight five patients (92.4%) were prescribed with supportive symptomatic treatment. Changes in analgesic use were observed in 62 (67.4%) patients. The therapy regimens were comparable between 2 groups, except mini-invasive therapy and chemotherapy. More patients in responder group received chemotherapy (58, 70.7%, *P* = .003), while fewer received mini-invasive therapy (6, 7.32%, *P* = .011).

3.3. Outcome of cancer pain management

After the individualized multidisciplinary therapy, both pain and symptom severity was improved, as demonstrated by lowered BPI worst and average pain scores, as well as symptom severity score

Table 1
Baseline characteristics of the cancer patients with pain.

	Patients (n = 92)	Non-responder (n = 10)	Responder (n = 82)	<i>P</i> value
Age (years)	54.4 ± 10.3	53.4 ± 9.47	54.5 ± 10.4	.759
Gender				.496
Male	63 (68.5)	8 (12.7)	55 (87.3)	
Female	29 (31.5)	2 (6.9)	27 (93.1)	
Marital status, n (%)				1.000
Married	90 (97.8)	10 (100)	80 (97.6)	
Widow	2 (2.2)	0 (0)	2 (2.4)	
Education, n (%)				.532
High school	43 (46.7)	6 (14.0)	37 (86.0)	
College	36 (39.1)	2 (5.6)	34 (94.4)	
Others	13 (14.2)	2 (15.4)	11 (84.6)	
Tumor type, n (%)				.447
Liver cancer	29 (31.5)	5 (17.2)	24 (82.8)	
Lung cancer	28 (30.4)	3 (10.7)	25 (89.3)	
Gastric cancer	8 (8.7)	1 (12.5)	7 (87.5)	
Colorectal cancer	7 (7.6)	1 (14.3)	6 (85.7)	
Pancreatic cancer	6 (6.5)	0	6 (100)	
Others	14 (15.2)	0	14 (100)	
Metastasis, n (%)	49 (53.3)	6 (60.0)	43 (52.4)	.745
Tumor stage, n (%)				.018
I	5 (5.4)	2 (20.0)	3 (3.66)	
II	19 (20.7)	5 (50.0)	14 (17.07)	
III	36 (39.1)	1 (10.0)	35 (42.68)	
IV	32 (34.8)	2 (20.0)	30 (36.59)	
Baseline pain intensity, n (%)	4.18 ± 2.36	1.60 ± 1.43	4.50 ± 2.26	<.001
Baseline pain scale, n (%)				.058
Mild	42 (45.7)	8 (80.0)	34 (41.5)	
Moderate	33 (35.9)	2 (20.0)	31 (37.8)	
Severe	17 (18.5)	0 (0.0)	17 (20.7)	
Prior analgesic use	20 (21.5)	1 (10.0)	19 (23.2)	.678

Categorical variables were presented with numbers and frequencies, and continuous variables were presented as means and ranges.

Table 2
Multidisciplinary therapy used in our cancer in patients with pain.

	Total (n=92)	Non-responder (n=10)	Responder (n=82)	P value
Antitumor therapy, n (%)	86 (93.5)	9 (90.0)	77 (93.9)	>.05
Surgery, n (%)	20 (21.7)	3 (30.0)	17 (20.7)	.685
Radiotherapy, n (%)	5 (5.4)	0 (0.0)	5 (6.1)	.644
Evacuation of serous effusion, n (%)	7 (7.6)	0 (0.0)	7 (8.54)	.600
Mini-invasive therapy, n (%)	10 (10.9)	4 (40.0)	6 (7.32)	.011
Chemotherapy n, (%)	60 (65.2)	2 (20.0)	58 (70.7)	.003
Targeted therapy, n (%)	10 (10.9)	0 (0.0)	10 (12.2)	.638
Traditional chinese medicine, n (%)	11 (12.0)	1 (10.0)	10 (12.2)	>.05
Symptomatic treatments, n (%)	85 (92.4)	9 (90.0)	76 (92.7)	.556
Enteral nutrition, n (%)	2 (2.2)	0 (0.0)	2 (2.4)	>.05
Parenteral nutrition	38 (41.3)	7 (70.0)	31 (37.8)	.086
Electrolyte disturbance correction, n (%)	41 (44.6)	5 (50.0)	36 (43.9)	.747
Protein supplement, n (%)	19 (20.7)	4 (40.0)	15 (28.8)	.206
Anti-infective drug, n (%)	37 (40.2)	5 (50.0)	32 (39.0)	.734
Liver and kidney protection, n (%)	85 (92.4)	10 (100.0)	75 (91.5)	.600
Psychological support, n (%)	45 (48.9)	4 (40.0)	41 (50.0)	.740
Changes in analgesic use, n (%)	62 (67.4)	6 (60.0)	56 (68.3)	.720

measured by MDASI ($P=.017$, $P=.003$, and $P=.011$, respectively, Table 3). The pain and symptom interference scores were also found to be lower after treatment with our multidisciplinary team, however, the data did not reach the statistical significance (Fig. 1A-B). The proportion of patients with mild pain increased for both the worst and average pain after multidisciplinary treatment (Fig. 1C-D, $P=.028$ and $P=.017$, respectively).

The baseline pain/symptom and their interference scores of patients in responder group were higher than those of non-responder group (Table 3), although there was no significant difference in terms of BPI least pain and symptom severity. The pain/symptom severity and their interference in responder group was markedly reduced by multidisciplinary treatment, by contrast, the data in non-responder group were increased to some extent (Table 3). The proportion of patients with mild pain increased in responder group after multidisciplinary treatment, by contrast, the data decreased in non-responder group (Fig. 1).

These results suggested that cancer patients with higher pain score were more positively affected by multidisciplinary intervention and were better managed than these with lower pain scores.

3.4. Quality of life of the patients

QOL analyses showed the function and symptom scores in the individual scales were significantly improved by the interventions of our multidisciplinary team ($P<.001$), although there was no obvious improvement in the global QOL scores of the cancer patients during study (Table 4).

3.5. Predictive factors for cancer pain management

In univariate logistic regression analysis, BPI worst, average and current pain scores, pain interference, and mini-invasive therapy

Table 3
Effect of multidisciplinary treatment on pain/symptom and interference scores in cancer patients with pain.

	Before multidisciplinary therapy			After multidisciplinary therapy		
	Total	Non-responder group	Responder group	Total	Non-responder group	Responder group
BPI pain score						
Worst pain in last 24 h	4.18±2.36	1.60±1.43	4.46±2.27 ^{###}	3.53±2.44 [*]	5.50±2.92 ^{***}	3.29±2.28 ^{***##}
Least pain in last 24 h	1.58±1.54	1.00±1.05	1.64±1.56	1.64±1.46	2.80±2.53 [*]	1.50±1.22
Average pain in last 24 h	3.09±1.89	1.40±0.97	3.28±1.90 ^{##}	2.46±1.71 ^{**}	3.50±2.72 [*]	2.33±1.52 ^{***}
Current pain	2.43±1.96	0.90±1.29	2.62±1.94 ^{##}	2.12±1.81	2.70±2.67	2.04±1.69 ^{**}
Pain interference score	2.88±2.66	1.14±0.95	3.09±2.72 [#]	2.48±2.33	1.79±1.05	2.57±2.43 [*]
General activity	3.23±2.81	1.78±1.39	3.38±2.90	2.75±2.51	3.44±2.40	2.97±2.42
Mood	3.22±3.04	1.67±1.12	3.39±3.15	2.56±2.64	2.56±1.33	2.80±2.65 [*]
Walking ability	2.63±2.84	1.00±0.87	2.88±2.98	2.91±2.99	1.22±1.20	2.74±2.74
Normal work	3.24±3.38	1.00±1.07	3.49±3.52	2.11±2.36	1.75±1.04	3.09±3.11
Relations with others	2.60±2.94	1.00±1.00	2.72±3.02	2.69±2.78	1.22±0.83	2.23±2.47
Sleep	2.86±2.91	1.67±2.45	3.00±3.01	2.76±2.85	1.33±0.87	2.87±2.89
Enjoyment of life	2.79±2.98	0.89±0.93	3.00±3.10	2.48±2.33	1.33±1.50	2.87±2.87
MDASI score						
Symptom severity	2.95±1.98	1.86±2.02	3.08±1.95	2.49±1.68 [*]	2.50±1.77	2.49±1.68 ^{**}
Symptom interference	2.76±2.34	1.55±1.25	2.91±2.40 [#]	2.58±2.38	1.62±1.00	2.70±2.47 [#]

^{*} $P<.05$, ^{*} $P<.01$, ^{***} $P<.001$ vs that data before multidisciplinary treatment; [#] $P<.05$, ^{##} $P<.01$, ^{###} $P<.001$ vs the data of Non-response group.

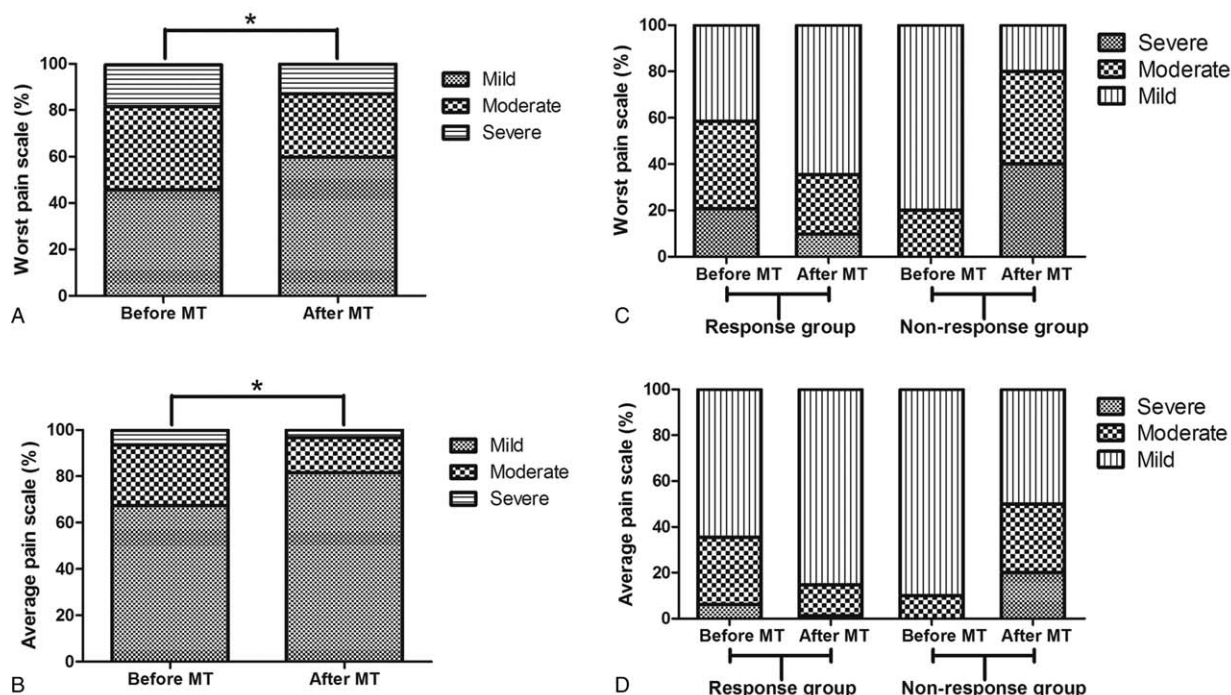


Figure 1. Changes in pain intensity following multidisciplinary interventions by our inter-professional team. MT = multidisciplinary treatment.

were positively associated with pain response, while tumor stage and chemotherapy were negatively associated with pain response of the patients (Table 5). In the multivariate analysis, only the BPI worst pain score was significantly associated with pain response after adjustment for other factors (OR 7.301, 95% CI 1.695–31.451, $P = .008$). Patients with higher baseline worst pain score showed better response to pain management ($P < .001$, Fig. 2).

4. Discussion

For cancer patients, the management of pain is still problematic worldwide, almost half of them were still undertreated.^[23] Considering the multidimensional nature of pain, the palliative/supportive care from an interdisciplinary working group has been suggested and demonstrated to be effective in cancer pain

Table 4
Quality of life of the patients with cancer pain following multidisciplinary treatment.

	Multidisciplinary interventions		P value
	Before	After	
Global health status	50.0 (41.67–75.5)	58.3 (41.67–66.7)	.749
Function scale			
Physical function	72.28 ± 20.94	80.60 ± 15.62	<.001
Role function	65.73 ± 24.79	82.40 ± 17.29	<.001
Emotional function	70.51 ± 22.62	85.02 ± 16.49	<.001
Cognitive function	77.15 ± 21.38	85.02 ± 16.49	<.001
Social function	61.24 ± 29.06	80.71 ± 19.12	<.001
Symptom scales			
Fatigue scale	37.70 ± 22.88	25.59 ± 15.75	<.001
Nausea/vomiting	22.47 ± 25.39	15.73 ± 19.84	<.001
Pain	35.96 ± 22.03	22.85 ± 17.11	<.001

Table 5
Univariate logistic regression analysis of factors that associated with clinical pain management in cancer patients.

Univariate analysis	OR (95% CI)	P value
Age	1.01 (0.947–1.007)	>.05
Gender	0.509 (0.101–2.564)	>.05
Education level		>.05
High school	1.121 (0.198–6.363)	
College	3.091 (0.388–24.606)	
Metastasis	0.735 (0.193–2.8)	>.05
Tumor stage		.031
I	0.100 (0.010–0.989)	.049
II	0.187 (0.032–1.083)	>.05
III	2.333 (0.201–27.026)	>.05
Prior analgesic used	2.413 (0.284–20.531)	>.05
Antitumor therapy	1.711 (0.179–16.321)	>.05
Surgery	1.639 (0.383–7.014)	>.05
Mini-invasive therapy	8.444 (1.859–38.369)	.006
Chemotherapy	0.103 (0.02–0.523)	.006
Traditional Chinese Medicine	0.8 (0.091–7.002)	>.05
Symptomatic treatment	1.407 (0.152–13.408)	>.05
Parenteral nutrition	3.839 (0.924–15.949)	>.05
Electrolyte disturbance correction	1.278 (0.434–4.755)	>.05
Protein supplement	2.978 (0.747–11.878)	>.05
Anti-infective drug	1.562 (0.419–5.829)	>.05
Psychological support	0.667 (0.175–2.539)	>.05
Changes in analgesic use	0.67 (0.174–2.583)	>.05
Worst pain in last 24 h	2.96 (1.508–5.814)	.002
Least pain in last 24 h	1.45 (0.812–2.588)	>.05
Average pain in last 24 h	2.854 (1.413–5.764)	.003
Current pain	2.116 (1.154–3.882)	.015
Pain interference	1.621 (1.01–2.6)	.045
Symptom severity	1.485 (0.958–2.304)	>.05
Symptom interference	1.441 (0.938–2.214)	>.05

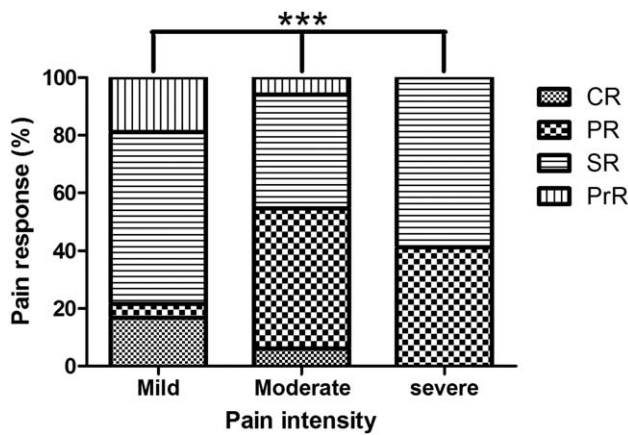


Figure 2. Clinical responses of cancer patients with different pain intensity to multidisciplinary interventions. CPR = complete pain response, PPR = partial pain response, SPR = stable pain response, PpR = progressive pain response.

management.^[24] The therapeutic effect of multidisciplinary interventions on cancer pain was retrospectively investigated from the inpatients of Chinese PLA General Hospital, one of the largest comprehensive medical and teaching hospital in China. The findings showed that pain/symptom severity and interference of cancer pain patients were significantly improved after individualized multidisciplinary therapy by the inter-professional team. However, most patients still had pain, which was consistent with the report of Bostrom et al, they indicated the significant improvement of pain intensity in cancer patient after palliative care but still had poor pain control.^[25] The multidisciplinary intervention by inter-professional team were more effective and better for management of cancer patients with moderate or severe pain. The logistical analysis showed that BPI worst pain score was an independent factors that associated with cancer pain management.

Palliative care across multiple areas has been advocated to improve pain, physical symptoms, and any other existential suffering in cancer patients.^[26] The introduction of palliative care services has been reported to brought about meaningful improvement with an emphasis on symptom management and QOL.^[4] A cancer patient with complex and refractory pain, who responded poorly to analgesia, experienced significant improvement in symptoms after management by an interdisciplinary palliative care team.^[27] Palliative care services in Spain have demonstrated to be effective to symptom control of advanced cancer patients, significantly improving pain severity and number of breakthrough pain crises.^[28] Yennurajalingam et al also have reported that the palliative consultation could achieve significant symptom improvement in advanced cancer patients.^[29] Furthermore, the clinical pharmacist-led guidance teams have been established in China, showing efficiency and efficacy for cancer pain management.^[30] However, a randomized controlled trial failed to demonstrate the beneficial effect of hospital-based palliative care on the improvement of physical symptoms and QOL in cancer patients, when compared with limited telephone advice.^[31] A hospital-based palliative care has been identified to have several benefits but without effective pain management.^[32] Moreover, 1 study also has indicated that cancer patients with moderate or severe pain were partially responded to palliative

care interventions, however, the symptom in patients with no/mild pain was exacerbated after interventions.^[33]

The findings of this study showed that the multidisciplinary therapy from inter-professional team could better control the pain of cancer patients, especially those with moderate or severe pain. Pain intensity was worse in 6.1% of patients with moderate pain and 19% of patients with mild pain, suggesting the pain worsening during a short period. Furthermore, the baseline BPI pain score was found to positively associate with pain response, consistent with the results reported by Yennurajalingam et al, which indicated that the initial pain intensity was the only significant predictive factor for pain response.^[34] However, Fainsinger et al found a negative association between pain intensity and response, with severe cancer pain predicting poor response.^[35] These conflicting results may be partially explained by different patient population and palliative care settings. The QOL scores of the patients were found to be improved to some extent after interventions by multidisciplinary team. Take all these together, these results suggested that cancer patients with moderate or severe pain responded better to the multidisciplinary therapy. Future studies are needed to optimize strategies for cancer pain management. More attention should be focused on initial pain intensity of cancer patients when multidisciplinary intervention is considered.

This study also has some limitations. The number of patients recruited in this study was comparatively small. It might bring a selection bias and lack of generalization of this study. Besides, the care setting in this study is unique, while no comparable patients in another setting are available. In addition, the application of the results of the present study was not clear in clinicians. Therefore, a randomized controlled clinical trial using a larger sample size by extending the recruitment period would be required to fully compare the efficiency of pain management by our multidisciplinary palliative care team in the future study.

5. Conclusions

The findings showed the beneficial effect of the multidisciplinary intervention team on cancer pain management, especially in patients with moderate or severe pain.

Acknowledgments

The authors thank Mundipharma (China) Pharmaceutical Co., Ltd. for medical writing assistance.

Author contributions

- Conceptualization:** Xiuqin Zhu, Fang Li.
- Data curation:** Bo Yang, Zhi Cui, Yurong Huang.
- Formal analysis:** Bo Yang, Zhi Cui.
- Investigation:** Xiuqin Zhu, Liping Guo, Fang Li.
- Methodology:** Bo Yang, Zhi Cui, Xiuqin Zhu, Fang Li.
- Project administration:** Xiuqin Zhu, Fang Li.
- Resources:** Xiuqin Zhu, Muhong Deng, Guijun Lu, Yurong Huang.
- Software:** Muhong Deng, Yu Pan, Ruixin Li, Mei Guo.
- Supervision:** Yu Pan.
- Validation:** Ruixin Li, Xuehua Zhang.
- Writing – original draft:** Mei Guo, Guijun Lu, Xuehua Zhang, Liping Guo, Fang Li.
- Writing – review & editing:** Xiuqin Zhu.

References

- [1] Heaney A, Buggy D. Can anaesthetic and analgesic techniques affect cancer recurrence or metastasis? *Br J Anaesth* 2012;109:i17–28.
- [2] Kennedy GC, Anderson BH, Chudova DI, et al. Methods and compositions for diagnosis of thyroid conditions. World Intellectual Property Organization Publ.of the Int.Appl. without Int.search REP. 2010;WO2010US34140.
- [3] Rassool GH. Global Cancer Rates Could Increase by 50% to 15 Million by 2020. *J Adv Nurs* 2003;44:7–8.
- [4] Greer JA, Jackson VA, Meier DE, et al. Early integration of palliative care services with standard oncology care for patients with advanced cancer. *CA Cancer J Clin* 2013;63:349–63.
- [5] Burton AW, Fanciullo GJ, Beasley RD, et al. Chronic pain in the cancer survivor: a new frontier. *Pain Med* 2007;8:189–98.
- [6] Van den Beuken-van Everdingen M, De Rijke J, Kessels A, et al. Prevalence of pain in patients with cancer: a systematic review of the past 40 years. *Ann Oncol* 2007;18:1437–49.
- [7] Selvaraj D, Gangadharan V, Michalski CW, et al. A functional role for VEGFR1 expressed in peripheral sensory neurons in cancer pain. *Cancer Cell* 2015;27:780–96.
- [8] Greco MT, Roberto A, Corli O, et al. Quality of cancer pain management: an update of a systematic review of undertreatment of patients with cancer. *J Clin Oncol* 2014;32:4149–54.
- [9] Webb JA, LeBlanc TW. Evidence-based management of cancer pain. *Semin Oncol Nurs* 2018;34:215–26.
- [10] Katz N. The impact of pain management on quality of life. *J Pain Symptom Manage* 2002;24:S38–47.
- [11] Kwon JH. Overcoming barriers in cancer pain management. *J Clin Oncol* 2014;32:1727–33.
- [12] Portenoy RK. Treatment of cancer pain. *Lancet* 2011;377:2236–47.
- [13] Syrjala KL, Jensen MP, Mendoza ME, et al. Psychological and behavioral approaches to cancer pain management. *J Clin Oncol* 2014;32:1703–11.
- [14] Raphael J, Hester J, Ahmedzai S, et al. Cancer pain: part 2: physical, interventional and complimentary therapies; management in the community; acute, treatment-related and complex cancer pain: a perspective from the British pain society endorsed by the UK Association of Palliative Medicine and the Royal College of General Practitioners. *Pain Med* 2010;11:872–96.
- [15] Dumitrescu L, van den Heuvel-Olaroiu M, van den Heuvel WJ. Changes in symptoms and pain intensity of cancer patients after enrollment in palliative care at home. *J Pain Symptom Manage* 2007;34:488–96.
- [16] Kondrup J, Rasmussen HH, Hamberg O, et al. Group AahEW. Nutritional risk screening (NRS 2002): a new method based on an analysis of controlled clinical trials. *Clin Nutr* 2003;22:321–36.
- [17] Kroencke K, Spitzer R, Williams J. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med* 2001;16:606–13.
- [18] Zung WW. A self-rating depression scale. *Arch Gen Psychiatry* 1965;12:63–70.
- [19] Cleeland C, Ryan K. Pain assessment: global use of the Brief Pain Inventory. *Ann Acad Med Singapore* 1994;23:129–38.
- [20] Swam R, Abernethy AP, Angheliescu DL, et al. Adult cancer pain. *J Natl Compr Canc Netw* 2010;8:1046–86.
- [21] Cleeland CS, Mendoza TR, Wang XS, et al. Assessing symptom distress in cancer patients. *Cancer* 2000;89:1634–46.
- [22] Aaronson NK, Ahmedzai S, Bergman B, et al. The European Organization for Research and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use in international clinical trials in oncology. *J Natl Cancer Inst* 1993;85:365–76.
- [23] Ripamonti C, Santini D, Maranzano E, et al. Group EGW. Management of cancer pain: ESMO clinical practice guidelines. *Ann Oncol* 2012;23:vii139–54.
- [24] Bandieri E, Sichetti D, Romero M, et al. Impact of early access to a palliative/supportive care intervention on pain management in patients with cancer. *Ann Oncol* 2012;mds103.
- [25] Boström B, Sandh M, Lundberg D, et al. Cancer patients' experiences of care related to pain management before and after palliative care referral. *Eur J Cancer Care (Engl)* 2004;13:238–45.
- [26] Yamagishi A, Morita T, Miyashita M, et al. Pain intensity, quality of life, quality of palliative care, and satisfaction in outpatients with metastatic or recurrent cancer: a Japanese, nationwide, region-based, multicenter survey. *J Pain Symptom Manage* 2012;43:503–14.
- [27] Reddy A, Hui D, Bruera E. A successful palliative care intervention for cancer pain refractory to intrathecal analgesia. *J Pain Symptom Manage* 2012;44:124–30.
- [28] Gómez-Batiste J, Porta-Sales J, Espinosa-Rojas J, et al. Effectiveness of palliative care services in symptom control of patients with advanced terminal cancer: a spanish, multicenter, prospective, quasi-experimental, pre-post study. *J Pain Symptom Manage* 2010;40:652–60.
- [29] Yennurajalingam S, Urbauer DL, Casper KL, et al. Impact of a palliative care consultation team on cancer-related symptoms in advanced cancer patients referred to an outpatient supportive care clinic. *J Pain Symptom Manage* 2011;41:49–56.
- [30] Chen J, Lu X-y, Wang W-j, et al. Impact of a clinical pharmacist-led guidance team on cancer pain therapy in China: a prospective multicenter cohort study. *J Pain Symptom Manage* 2014;48:500–9.
- [31] Hanks G, Robbins M, Sharp D, et al. The imPaCT study: a randomised controlled trial to evaluate a hospital palliative care team. *Br J Cancer* 2002;87:733–9.
- [32] Higginson IJ, Finlay I, Goodwin DM, et al. Do hospital-based palliative teams improve care for patients or families at the end of life? *J Pain Symptom Manage* 2002;23:96–106.
- [33] Kang JH, Kwon JH, Hui D, et al. Changes in symptom intensity among cancer patients receiving outpatient palliative care. *J Pain Symptom Manage* 2013;46:652–60.
- [34] Yennurajalingam S, Kang JH, Hui D, et al. Clinical response to an outpatient palliative care consultation in patients with advanced cancer and cancer pain. *J Pain Symptom Manage* 2012;44:340–50.
- [35] Fainsinger RL, Fairchild A, Nekolaichuk C, et al. Is pain intensity a predictor of the complexity of cancer pain management? *J Clin Oncol* 2009;27:585–90.