ORIGINAL ARTICLE

Oral vinorelbine: a better choice for concurrent chemoradiotherapy in stage III non-small cell lung cancer

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Abstract

Background: Lung cancer is the most common cancer in the world, and causes 1.3 million deaths annually. Approximately 45% of patients diagnosed with non-small cell lung cancer (NSCLC) have locally advanced stage III disease. Standard treatment is concurrent chemoradiotherapy (CCRT) with two drugs, but severe toxicities are common. Several single-agent CCRTs have been developed to overcome this problem.

Methods: We reviewed the records of 24 patients with stage III NSCLC who received single-agent vinorelbine CCRT at the National Cheng Kung University Hospital from January 1, 2005 to May 31, 2009. Nine patients received with vinorelbine intravenous infusion (15 mg/m^2/week) and fifteen with oral vinorelbine 40mg/m^2/week. Thoracic radiation was given over 6 weeks in 1.8 Gy/day fractions (total median dose of 59.7 Gy). The primary endpoint was the evaluation of time to progression (TTP) of these patients. The secondary endpoints were analysis of therapy-related toxicities and overall response rate.

Results: Median age was 70 years (range: 58-81 years), and median follow-up time was 430 days (range: 101-1363 days). Eighteen patients were male, six were female and the median ECOG grade was 1. Vinorelbine was given for a median of 5.5 weeks (range: 4-8 weeks). All patients completed all planned cycles of CCRT. Seven patients (29.2%) had radiation pneumonitis. No patient had a complete response, and thirteen patients (54.2%) had a partial response. The median time to progression (TTP) was 6.4 months (95% confidence interval: 4-8.7 months), the median survival time was 24 months (95% CI: 13.8-34.9 months), and the 1- and 2-year survival rates were 68.5% and 41.1%, respectively.

Conclusion: Treatment of stage III NSCLC patients with single-agent vinorelbine CCRT had a better median survival time and 2-year survival rates with fewer toxicities when compared with other therapies. Oral vinorelbine with its convenience in administration is an ideal choice for CCRT.

Key words

Lung cancer, Vinorelbine, Concurrent chemoradiotherapy

1 Introduction

Lung cancer is one of the leading causes of death worldwide. In 2012, there were approximately 226,160 newly diagnosed lung cancer cases and 160,340 deaths due to this illness in the United States [1]. Among patients with lung cancer, 80-85% had non-small cell lung cancer (NSCLC), and 45% were stage III [2].

The 2012 National Comprehensive Cancer Network (NCCN) guidelines suggested that unresectable stage III NSCLC patients should receive definitive concurrent chemoradiotherapy (CCRT). Cisplatin/etoposide or cisplatin/vinblastine plus thoracic radiation are the preferred regimens [3]. CCRT has been proved to yield better responses than sequential chemotherapy and radiotherapy in randomized trials [4-7]. Systemic chemotherapy can reduce the chances of distant metastasis, and some of these chemotherapeutic agents play the role of "radiation sensitizer" in CCRT. But most of the trials used combined agents, and the severe toxicities in platinum-based regimens could not be resolved.

Recently, many doctors have expressed an interest in identifying more active and better tolerated new agents for the treatment of stage III NSCLC. Taxanes, gemcitabine, and vinorelbine all have excellent effects in stage IV NSCLC. New studies of single-agent CCRT have been developed to observe the response rate and survival benefits. In 2003, Hiroshi et al. publish the results of a docetaxel single-agent CCRT study. Thirty-two stage III NSCLC patients were treated with weekly docetaxel 20 mg/m^2 and concurrent two-dimensional radiation for 6-7 weeks. Most patients (79%) had an Eastern Cooperative Oncology Group scale (ECOG) of 1, and the median age was 68 years. Complete response rates reached 28% and the partial response rate was 63%. Grade 3 side effects included pneumonitis (47%) and esophagitis (16%). The median overall survival time was 12 months, and the 2-year overall survival rate was 35% [8].

In 2006, Patrizia et al. reported data on gemcitabine single-agent CCRT. Forty-six stage III NSCLC patients were treated with gemcitabine 350 mg/m^2 for 5 consecutive weeks and with a total dose of 5040 cGy radiation; 76.1% of patients had an ECOG scale of 0, and the median age was 64 years. No complete response was noted, and 82.9% of patients had a partial response. Only one patient had grade 3 thrombocytopenia. By the end of the study, 63% of patients had received surgery, and morbidity was 13.8% [9].

Vinorelbine is a semi-synthetic vinca alkaloid, and binds to tubulin as a potent inhibitor of mitotic microtubule polymerization. It is also a common radiation sensitizer [10-12]. Vinorelbine plus cisplatin/carboplatin CCRT has yielded good responses in stage III NSCLC phase II studies [13-17]. However, only two abstracts have reported preliminary results of using vinorelbine single-agent CCRT in NSCLC [18-19]. In our study, we sought to prove that vinorelbine-based CCRT can maintain good disease control and prolong survival in stage III NSCLC.

2 Methods

2.1 Patient selection

The trial design was a retrospective study. We reviewed the lung cancer charts at National Cheng Kung University Hospital (NCKUH) from 2005.1.1-2009.5.31. Our target population was stage III NSCLC patients who had received vinorelbine-based CCRT. All information was collected by one oncological physician.

Inclusion criteria included age ≥ 18 years; histologically documented stage III NSCLC; and adequate hematological, liver and renal function. Exclusion criteria were non-stage III NSCLC, non-vinorelbine-based single-agent CCRT, severe hepatic or renal dysfunction, and impairment of cognitive function. Neither neoadjuvant chemotherapy nor consolidative chemotherapy was used for these patients. A total of 24 patients were ultimately enrolled. All the adverse effects of CCRT were assessed using the NCI-CTCAE version III, and recorded by our physicians of Thoracic Oncology Team. Because

this study required chart reviews only, the institutional review board (IRB) of NCKUH agreed that we did not need informed consent.

2.2 Definition of smoking status

Current smoker means an adult who has smoked 100 cigarettes in his or her lifetime and who currently smokes cigarettes. Never smoker means an adult who has never smoked, or who has smoked less than 100 cigarettes in his or her lifetime. Our physicians of Thoracic Oncology Team have recorded the smoking status of all NSCLC patients in the charts.

Table 1. Patient characteristics

Characteristic	Number (%)
Number of eligible patients	24 (100%)
Age	
Median (range)	70 (58-81)
Performance status (ECOG)	
0	5 (21%)
1	14 (58%)
2	4 (17%)
3	1 (4%)
Sex	
Male	21 (87.5%)
Female	3 (12.5%)
Stage of disease	
IIIA	8 (33%)
IIIB	16 (67%)
TNM system	
T3N0-1	0 (0%)
T1-3N2	8 (33.3%)
T1-3N3	8 (33.3%)
T4N0-2	6 (25%)
T4N3	2 (8.3%)
Histology	
Non-small cell	5 (21%)
Adenocarcinoma	13 (54%)
Squamous cell	5 (21%)
Large cell	1 (4%)
Smoking history	
Never smoked	5 (21%)
Current smokers	19 (79%)
Underlying disease	
DM	7 (29%)
HTN	5 (21%)

2.3 Treatment schedule

Chemotherapy

Nine patients were given intravenous infusion of vinorelbine (15 mg/m^2/week), until oral vinorelbine became available in December of 2006. A previous study showed 15 mg/m^2 of intravenous vinorelbine was equivalent to 40 mg/m^2 of oral vinorelbine [20]. We gave the dose of 40mg/m^2/week of oral vinorelbine in further fifteen patients.

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Radiation therapy

Computed tomography (CT) simulation–guided 3D plan was used for all patients. Intensity-modulated radiation therapy was used in 7 patients. Thoracic radiation was given over 6 weeks (median dose of 59.7 Gy, and the fraction size was 1.8 Gy per day.

Table 2. Subgroup analysis of TTP

TTP	Number	Mean	95% CI	Median	95% CI	*P*
Stage IIIA	8	204	126-281	191	73-309	.882
Stage IIIB	16	256	134-378	166	85-247	
Never smoked	5	127	74-180	92	86-98	.031
Current smokers	19	303	174-432	208	87-329	
ECOG < 2	19	293	157-428	208	135-281	.423
ECOG ≥ 2	5	181	114-248	150	135-165	
CR+PR+SD	22	279	168-390	191	107-275	<.001
PD	2	74	70-78	72	-	
Non-adenocarcinoma	11	393	177-610	306	126-486	.068
Adenocarcinoma	13	174	121-226	166	128-204	
Female	3	151	70-232	159	26-292	.287
Male	21	280	161-399	191	114-268	

P: log rank test of Kaplan-Meier curve

2.4 Response evaluation

Response was evaluated with CT scans 4-6 weeks after CCRT was completed. According to the 2009 RECIST criteria [21], complete Response (CR) was defined as the disappearance of all target lesions. Any pathological lymph nodes (whether target or non-target) must have reduction in short axis to <10 mm. Partial Response (PR) was defined as at least a 30% decrease in the sum of diameters of target lesions, taking as reference the baseline sum diameters. Progressive Disease (PD) was defined as at least a 20% increase in the sum of diameters of target lesions; taking as reference the smallest sum on study (this includes the baseline sum if that is the smallest on study). In addition to the relative increase of 20%, the sum must also demonstrate an absolute increase of at least 5 mm. (Note: the appearance of one or more new lesions is also considered progression). Stable Disease (SD) was defined as neither sufficient shrinkage to qualify for PR nor sufficient increase to qualify for PD, taking as reference the smallest sum diameters while on study. Chemoradiotherapy-related side effects were graded according to the ECOG common toxicity criteria.

The primary endpoint was the time to progression (TTP) of these patients. The secondary endpoint was to analysis the therapy-related toxicities and overall response rate.

2.5 Statistical analysis

We used survival analysis to calculate TTP, and plotted the Kaplan-Meier curve. Cox proportional hazard model was performed for univariate and multivariate analysis, identifying the associated factors with TTP. All statistical analysis was performed using the statistical software, SPSS version 18.0.

3 Results

3.1 Patient characteristics

There was an average of 330 patients with newly diagnosed lung cancer at NCKUH per year, and 19% of these patients (64 patients per year) are stage III. 15-20 patients per year are unresectable stage III NSCLC without malignant pleural effusion, and 9 patients per year received CCRT. From January 1, 2005 to May 31, 2009, 27 patients were treated with vinorelbine single-agent CCRT. One patient was excluded from the TTP calculation because he received an operation after CCRT. Two other patients were excluded because they began taxane therapy immediately. We enrolled 27 patients, and only 24 were analyzed in the TTP calculation.

The median age of the 24 patients was 70 years. Twenty-one patients were male, and the median ECOG scale was 1. Nineteen patients were current smokers. There were eight patients with stage IIIA and sixteen with stage IIIB. Ten patients had N3 disease, and adenocarcinoma was documented in thirteen patients. Five patients had only cytology or a small CT-guided specimen. The pathologists could not identify the subgroups of NSCLC, so these histological results were classified as non-small cell carcinoma. Seven patients had diabetes mellitus and five patients had hypertension. (Table 1)

3.2 Chemoradiotherapy

Patients received a median of 5.5 cycles of vinorelbine weekly. Nine patients were treated with an intravenous infusion of vinorelbine (15 mg/m^2/week). Fifteen patients took oral vinorelbine (40mg/m^2/week).

Radiation was given 1.8 Gy per dose. The range for total dose was 32.4-66.6 Gy, and the median total dose was 59.7 Gy. All 24 patients completed all planned cycles of chemotherapy, and vinorelbine was never withheld due to intolerance.

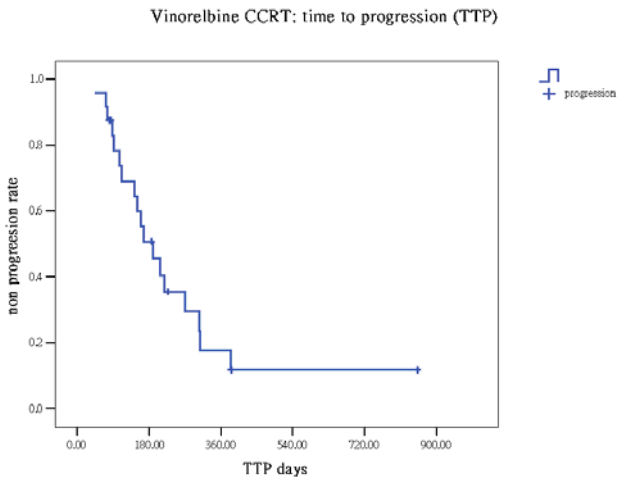
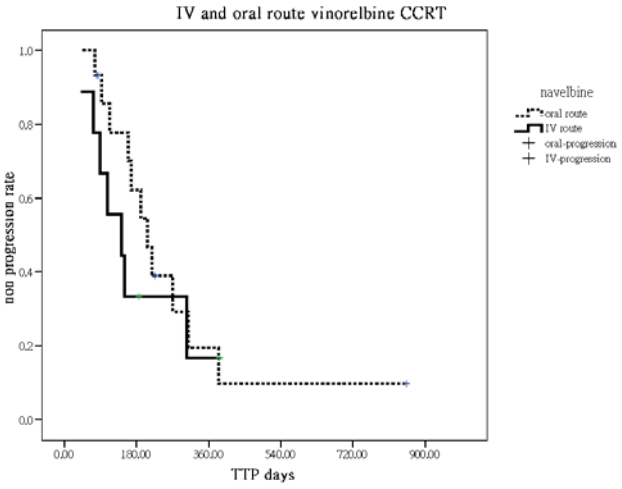


Figure 1. Kaplan-Meier curve of time to progression for 24 patients.
Median: 191 days (6.4 months), 95% CI: 121-260 days (4-8.7 months)
Mean: 262 days (8.7 months), 95% CI: 158-367 days (5.3-12.2 months)

3.3 TTP and response rate

The median TTP was calculated with 6.4 months (95% confidence interval CI: 4-8.7 months), and the mean TTP was 8.7 months (95% CI: 5.3-12.2 months). In the vinorelbine infusion group, median TTP was 4.8 months (95% CI: 1.3-8.3

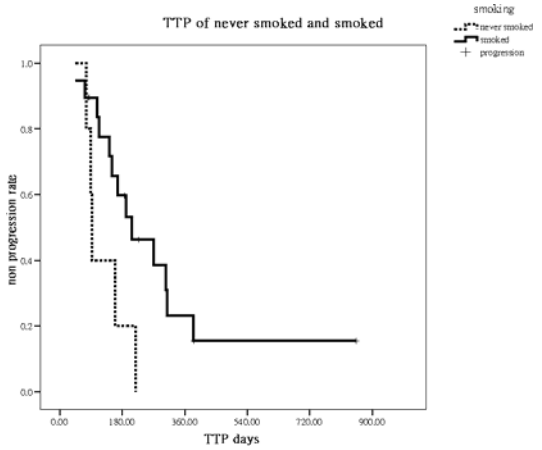
months), and in the oral group, median TTP was 7 months (95% CI: 4.9-9 months). No patient had complete response, and 13 patients had partial responses. The objective response rate reached 54.2% in the 24 patients. The response rate would increase to 59.2% (16/27) if we added the 3 patients who were excluded previously. (Figures 1 and 2)



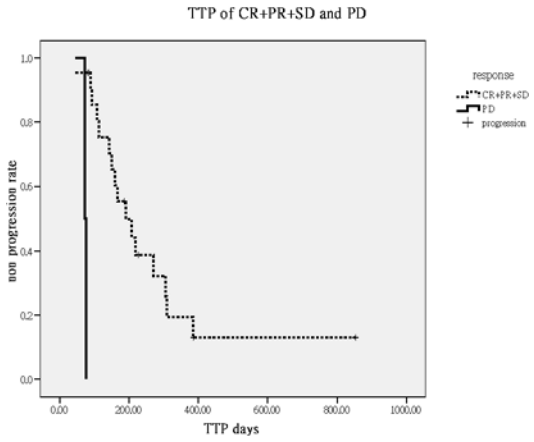
TTP (days)	number	Mean	95% CI	Median	95% CI
IV route	9	183	102-263	143	38-248
Oral route	15	271	150-392	208	148-269

P=0.438

A. Time to progression of intravenous and oral route vinorelbine CCRT



B. Time to progression of never smoked and smoked



C. Time to progression of disease controlled and progressive disease

Figure 2. Figures of time to progression in different subgroups

3.4 Subgroup analysis of TTP

We noted increased TTP in six parameters: diagnosis of stage IIIA, current smokers, good performance (ECOG scale <2), disease controlled (CR+PR+SD), absence of adenocarcinoma, and male sex. The only significant subgroups were for current smokers (*P*=.031) and disease controlled (*P*<.001). Patients without adenocarcinoma had the longest median TTP. (10.2 months, Table 2)

Table 3. Chemoradiation-related toxicities

Common toxicity criteria (CTC version 3)	Grade 1	Grade 2	Grade 3	Grade 4
Radiation pneumonitis	0 (0%)	5 (20.8%)	2 (8.3%)	0 (0%)
Esophagitis	5 (20.8%)	9 (37.5%)	1 (4.2%)	0 (0%)
Vomiting	1 (4.2%)	0 (0%)	0 (0%)	0 (0%)
Dermatitis	7 (29.2%)	3 (12.5%)	0 (0%)	0 (0%)
Fever	0 (0%)	2 (8.3%)	0 (0%)	0 (0%)
Infection	1 (4.2%)	0 (0%)	0 (0%)	0 (0%)
Anemia	1 (4.2%)	4 (16.7%)	0 (0%)	0 (0%)
Leukopenia	1 (4.2%)	7 (29.2%)	1 (4.2%)	0 (0%)
Thrombocytopenia	0 (0%)	1 (4.2%)	0 (0%)	0 (0%)

3.5 Toxicities

Most of the patients had grade 1-2 treatment-related toxicities. Those with more than grade 3 toxicities included one patient with grade 3 radiation esophagitis, two with grade 3 radiation pneumonitis and one with grade 3 leukopenia. The common toxicities included radiation esophagitis (62.5%), dermatitis (41.7%), pneumonitis (29.2%), and vomiting (4.2%). Vinorelbine-related hematological toxicities included anemia (20.8%), leucopenia (37.5%), fever (8.3%), thrombocytopenia (4.2%), and infection (4.2%). (Table 3)

3.6 Survival and follow-up

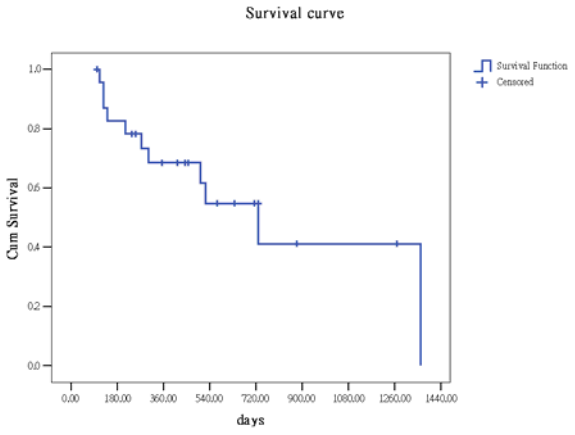


Figure 3. Kaplan-Meier curve of survival time for 24 patients.

Survival period (days)
Median: 730 days (24 months), 95% CI: 413-1047 days (13.8-34.9 months)
Mean: 790 days (26.3 months), 95% CI: 523-1056 days (17.4-35.2 months)

Median follow-up was 430 days (range, 101-1363 days). Eleven patients died, and thirteen were still alive. The organs of metastasis included the lung (7 patients, 29.2%), bone (3 patients, 12.5%), brain (1 patient, 4.2%), and adrenal gland (1 patient, 4.2%). Eighteen patients had tumor progression, and six have been without progression until now. Only one patient expired due to pneumonia during follow-up. (Figure 3)

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3.7 Univariate analysis by Cox regression

Table 4. Univariate analysis by Cox regression

Parameter	Hazard ratio	95% CI	*P* value
Stage IIIA vs. stage IIIB	1.078	0.403-2.883	.882
Never smoked vs. current smokers	3.191	1.053-9.673	.040
ECOG < 2 vs. ECOG ≥ 2	0.651	0.227-1.872	.426
PD vs. CR+PR+SD	27.290	2.405-309.638	.008
Non-adenocarcinoma vs. adenocarcinoma	0.403	0.147-1.102	.077
Female vs. male	1.978	0.550-7.111	.296

We performed univariate analysis to check the hazard ratios between different parameters. (Table 4) Cox regression analysis showed that progressive disease had the highest hazard ratio (HR = 27.290, *P*=.008) and that ECOG scale < 2 (HR = 0.651, *P*=.426) and non-adenocarcinoma (HR = 0.403, *P*=.077) had lowest hazard ratios. Two other factors, never smoked and female, had higher hazard ratios of 3.191 and 1.978 (*P*=.040, 0.296), respectively. We chose two factors, smoking habit and gender, into multivariate analysis, and hazard ratios of never smoked and female were 8.67 and 3.673 (*P*=.021, 0.212), respectively. The result showed that never smoked was an independent parameter.

4 Discussion

We compared our results using vinorelbine with cisplatin/etoposide [22] (2012 NCCN preferred regimen), and docetaxel [8] and gemcitabine [9] single-agent CCRT. Our group had 5 patients (21%) with an ECOG ≥ 2, and the oldest median age (70 years). Stage III NSCLC patients were able to complete the docetaxel and our CCRT schedules. The longest median survival was 24 months in our group. The highest 2-year survival rate was 66.1% in the gemcitabine group (pre-operative CCRT). We had limited grade ≥ 3 toxicities (4.2% for leucopenia and esophagitis). (Table 5)

We searched keywords: vinorelbine, concurrent chemoradiotherapy, stage III lung cancer, publication dates (2001-2011), english language in Pubmed, and listed seven previous studies of vinorelbine-based CCRT [13-19]: five studies with vinorelbine, cisplation (or carboplatin) plus thoracic radiation and two studies with single-agent vinorelbine CCRT. Progression-free survival (PFS) was from 34 weeks-12 months, and the response rate ranged from 56% to 93.2%. Median survival time was 14-21 months, and the 2-year survival rate was 10-34.2%. Our CCRT regimen had the longest median survival (24 months) and highest 2-year survival rate (41.1%). Grade ≥ 3 leukopenia, thrombocytopenia, and esophagitis were 0-68%, 0-27%, and 4-18%, respectively. Our toxicities were lower than that of most of these studies. (Tables 6 and 7)

In the subgroup analysis of the TTP of our 24 patients, the only two significant parameters were smoking habit and disease controlled. Current smokers benefited significantly more from CCRT than non-smokers. The reasons for no differences in the other parameters may be due to our small sample size. The TTP of patients with stage IIIB disease was longer than that of patients with stage IIIA disease, and patients with better performance or disease controlled (CR+PR+SD) also had longer TTPs. Surprisingly, we also found better TTPs for patients with non-adenocarcinomas and for males. (Table 2)

Table 5. Comparing different regimens of CCRT

Regimen author	Vinorelbine Chiu WH	Cisplatin/ Etoposide Kathy SA[22]	Gemcitabine Domenico G[9]	Docetaxol Hiroshi O[8]
Median age (range)	70 years old (58-81)	58 years old (36-78)	64 years old (47-75)	68 years old (30-86)
ECOG scale ≥ 2	5/24 (21%)	0	0	0
Number Stage IIIA/IIIB	24 8 (33%)/ 16 (67%)	50 0 (0%)/ 50 (100%)	46 41 (89%)/ 5 (11%)	32 13 (41%)/ 19 (59%)
Median radiation dose	59.7 Gy	61 Gy	50.4 Gy☆	60 Gy
Radiation pneumonitis	7 (29.2%)	NA	2 (4.3%)	30 (93.7%)*
Completed the schedule	100%	66%	82.6%	100%
Response rate (CR+PR)	54.2% (24) 59.2% (27)	NA	82.9%	91%
Median survival	24 months	15 months	13 months	12 months
2-year survival	41.1%	33%	66.1%	35%
≥ Gr 3 leucopenia	4.2%	32%	☆☆	6.3%**
≥ Gr 3 esophagitis	4.2%	20%	0	16%

☆: pre-operative CCRT, not for definite CCRT

☆☆: 3 patients required hospitalization due to febrile neutropenia

*: radiotherapy two-dimensional technique

**: 6 patients (19%) received G-CSF

NA: not available

Our study is the first complete report that describes vinorelbine single-agent CCRT for treatment of stage III NSCLC. Platinum-based chemotherapy is associated with numerous adverse effects, including nausea, vomiting, and bone marrow suppression, so patients who cannot tolerate these toxicities may fail to complete chemotherapy. All of our patients successfully completed CCRT and experienced few toxicities. Our median TTP was 6.4 months; there is no previous TTP data for vinorelbine single-agent CCRT. Compared with previous vinorelbine-based CCRT studies, our patients had the longest median survival (24 months) and the highest 2-year survival rates (41.1%).

Our study was small and retrospective, but the results provide some initial information about the treatment of stage III NSCLC. First, patients treated with vinorelbine single-agent CCRT were not inferior to those treated with cisplatin/etoposide [22], docetaxel [8] single-agent CCRT or gemcitabine [9] single-agent CCRT. Second, oral vinorelbine is more convenient and might be more readily accepted than other agents which are conventionally used to treat NSCLC. Third, our patients were older and had higher ECOG scores than previous studies, indicating that vinorelbine single-agent CCRT is suitable for treatment of elderly NSCLC patients with poor performance status. Take together; our results suggest that platinum-based agents might not be the only choice for treatment of stage III NSCLC. Clearly, large prospective phase III trials are necessary to verify our findings.

Table 6. Vinorelbine-based chemoradiotherapy

CCRT regimen	No	TTP	RR (%)	Median survival	2-yr survival	Ref
Vinorelbine 15 mg/m^2 intravenous infusion or 40 mg/m^2 oral use weekly	24	6.4 months	54.2 (24) 59.2 (27)	24 months	41.1%	
Vinorelbine 20 mg/m^2 D1,8 and cisplatin 80 mg/m^2 D1 per 4 weeks	73	12 months (PFS)	93.2	21 months	33% (3 years)	13
Vinorelbine 15 mg/m^2 weekly and cisplatin 6 mg/m^2 daily	17	34 weeks (PFS)	65	64 weeks	25%	14
Vinorelbine 15 mg/m^2 D1,8,15, 29,36,43 and carboplatin 70 mg/m^2 or cisplatin 20 mg/m^2 D1-5, 29-33	66	10 months (PFS)	74	14 months	24%	15*
Vinorelbine 25 mg/m^2 (cycle 1 and 4), 12.5 mg/m^2 (cycle 2 and 3) D1,8,15 and cisplatin 80 mg/m^2 D1 per 4 weeks	52	11.9 months	80	16.6 months	34.2%	16*
Vinorelbine 25 mg/m^2 and cisplatin 40 mg/m^2 D1,8,22,29,57,64,78,85	24	10 months (PFS)	58.3	15 months	10%	17
Multidose vinorelbine 5 mg/m^2 on M/W/F	36	NA	56	20.7 months	35%	18
Oral vinorelbine 20 mg/m^2 twice weekly	10	NA	70	NA	NA	19

* including patients with stage I-II NSCLC

PFS: progression-free survival

NA: not available

M/W/F: Monday/Wednesday/Friday

Table 7. Comparing toxicities of vinorelbine-based CCRT

CCRT regimen toxicity ≥ Gr 3	Leukopenia	Thrombocytopenia	Esophagitis
Vinorelbine 15 mg/m^2 intravenous infusion or 40 mg/m^2 oral use weekly	4.2%	0%	4.2% (59.7 Gy)
Vinorelbine 20 mg/m^2 D1,8 and cisplatin 80 mg/m^2 D1 per 4 weeks	68%	1%	4% (60 Gy)
Vinorelbine 15 mg/m^2 weekly and cisplatin 6 mg/m^2 daily	59% neutropenia	5.9%	18% (54.9 Gy)
Vinorelbine 15 mg/m^2 D1,8,15, 29,36,43 and carboplatin 70 mg/m^2 or cisplatin 20 mg/m^2 D1-5, 29-33	42%	27%	5% (63 Gy)
Vinorelbine 25 mg/m^2 (cycle 1 and 4), 12.5 mg/m^2 (cycle 2 and 3) D1,8,15 and cisplatin 80 mg/m^2 D1 per 4 weeks	53%	6%	18% (59.4 Gy)
vinorelbine 25 mg/m^2 and cisplatin 40 mg/m^2 D1,8,22,29,57,64,78,85	-	-	12.5%* (60 Gy)
Multidose vinorelbine 5 mg/m^2 on M/W/F	0% neutropenia	0%	19% (66 Gy)
Oral vinorelbine 20mg/m^2 twice weekly	0%	0%	- (60 Gy)

*Radiation (2 courses of 30 Gy separated by a 2-week break) was delivered

-:13% of patients experienced WHO grade 3-4 hematologic toxicity

The limitations of our study include the enrollment of a small number of patients, the retrospective design, using two kinds of vinorelbine, lower TTP and response rate than other studies. We used an intravenous infusion of vinorelbine initially, and then shifted to the oral vinorelbine when it became available since December 2006. Patients more readily accepted the oral form than the intravenous form, because the oral form is not associated with phlebitis. Nonetheless, vomiting is a common adverse effect of oral vinorelbine. Interestingly, we found that the TTP was longer for oral vinorelbine than intravenous vinorelbine. We will propose a prospective study of oral vinorelbine single-agent CCRT for unresectable stage III NSCLC in the future.

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Conflicting interests

The authors declare that they have no conflicting interests.

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