Journal of Radiation Research, Vol. 64, No. 2, 2023, pp. 457–462
https://doi.org/10.1093/jrr/rrac100
Advance Access Publication: 10 January 2023

Prognostic analysis of radiotherapy for cervical lymph node recurrence after curative resection of thoracic esophageal squamous cell carcinoma

Jinjin Chu and Fan Wang*

Department of Radiation Oncology, The First Affiliated Hospital of Anhui Medical University, Hefei, Anhui 230022, China
*Corresponding author. Fan Wang, Department of Radiation Oncology, The First Affiliated Hospital of Anhui Medical University, No 218 Jixi Road, Hefei, 230022, China. Email: wangfan1965@126.com
(Received 12 August 2022; revised 24 October 2022)

ABSTRACT

To identify efficacy and prognosis of radiotherapy (RT) for cervical lymph node recurrence (CLNR) in thoracic esophageal squamous cell carcinoma (TESCC) after curative resection. The clinical data from 65 patients were retrospectively analyzed. The Kaplan–Meier method was employed to analyze the survival of patients. The Cox proportional hazards model was then exploited for multivariate analysis. The median overall survival (OS) was 20 months; one-year, two-year, three-year and five-year survival rates were 68.3%, 47.3%, 33.4% and 10.6%. The median progression-free survival (PFS) was 14 months. Univariate analysis indicated that time from surgery to recurrence, number of recurrent lymph nodes and dose of RT were significant prognostic factors, whereas multivariate analysis showed that number of recurrent lymph nodes and radiation dose were independent factors. RT was an effective salvage treatment for patients with CLNR after surgery. Those patients who showed single lymph node recurrence and who were exposed to ≥60 Gy of RT experienced a favorable prognosis.
Keywords: Esophageal squamous cell carcinoma; cervical lymph nodes; recurrence; radiotherapy (RT); prognosis

INTRODUCTION

While surgery is the primary therapeutic option for resectable esophageal cancer, over half of patients develop locoregional recurrences or distant metastases within three years after surgery [1, 2]; and of these patients, locoregional recurrences that include regional lymph node recurrence and anastomotic recurrence account for 23.8–58% [3, 4]. With regional lymph node recurrence, prognostic factors such as age, interval to recurrence time, solitary lesion were already reported [5, 6]. Cervical lymph node recurrence (CLNR) comprises one of the most common recurrence patterns in patients with esophageal cancer, and compared with the mediastinum and abdominal cavity, local treatments (including radiotherapy [RT] and surgery) possess the potential to cure patients with affected lymph nodes that are confined to the neck [7]. However, reoperation of the patients is relatively challenging and may create numerous complications. With the continuous improvement in radiotherapeutic technologies, radiation therapy has developed into one of the most effective therapeutic regimens for postoperative CLNR [8]. In this study we retrospectively analyzed the clinicopathologic data from patients with CLNR after surgical resection of thoracic esophageal squamous cell carcinoma (TESCC) to better understand the recurrence characteristics, evaluate the efficacy of RT and identify the relevant prognostic factors.

MATERIALS AND METHODS

Research subjects

This study was a small sample retrospective study. We included patients who underwent RT for CLNR after radical resection of TESCC at the First Affiliated Hospital of Anhui Medical University, from October of 2012 to December of 2020. We reviewed the medical records, diagnostic images and RT treatment plan. The inclusion criteria were patients with TESCC who underwent R0 surgery (i.e. at least a thoracoabdominal two-field lymph node dissection); without preoperative cervical lymph node metastasis; with only cervical lymph node metastasis at the first recurrence after surgery; with no history of other malignant tumors; and possessing complete medical records. The exclusion criteria of our study were postoperative pathologic non-squamous cell carcinoma; mediastinal and/or abdominal lymph node metastasis; cervical lymph node metastasis extending to the mediastinum; a manifestation of distant metastasis; and patients who underwent RT or chemotherapy before or after the surgery.

Our analysis identified 65 cases (49 men and 16 women) that met our inclusion criteria, with patient age ranging from 45 to 79 years old (with a median age of 66 years); we observed 20 cases < 60 years old and 45 cases ≥ 60 years old. There were five cases involving the upper thorax, 37 involving the middle thorax and 23 involving the lower

thorax. We noted 12 cases of well differentiated, 33 cases of moderately differentiated, and 20 cases of poorly differentiated tumors. The tumor designations in 32 of our cases were T1–T2 and 33 cases of T3–T4. There were 38 cases of N0, 15 cases of N1, 9 cases of N2 and 3 cases of N3. Additionally, there were 39 cases of stage I–II and 26 cases of stage III–IVA. The clinical staging of TESCC was in accordance with the *American Joint Committee on Cancer Staging System, 8th Edition,* published in 2016 [9].

Classification of cervical lymph nodes and diagnostic criteria used for CLNR

The location of cervical lymph nodes and diagnostic criteria for CLNR were in accordance with the *Japanese Classification of Esophageal Cancer, 11th Edition* [10] issued by the Japanese Esophagus Society (JES) as follows: cervical lymph nodes with station number 101 (cervical paraesophageal), station number 102 (deep cervical), station number 103 (peripharyngeal) and station number 104 (supraclavicular). The diagnosis of CLNR was principally based upon cytology, biopsy pathology, enhanced neck computed tomography (CT), magnetic resonance imaging (MRI), or positron-emission tomography (PET)-CT. Diagnostic criteria for CLNR via CT/MRI were $\geq$ 1.0 cm in the smaller diameter, an incomplete lymph node capsule, multiple lymph nodes fused to one another, progressive enlargement compared with previous imaging, central necrosis, extra-nodal extension and heterogeneous enhancement patterns. Lymph nodes with a standard uptake value (SUV) of more than 2.5 on PET-CT images were considered to represent CLNR.

RT

All patients in the present study underwent RT, and were placed in the supine position with head and neck fixed for CT positioning. The Pinnacle treatment planning system (TPS) was used to delineate and plan the target area for treatment, followed by execution of intensity-modulated radiation therapy (IMRT) using 6-MV-X-ray from a linear accelerator. Target delineation that we included involved field irradiation (IFI) and elective nodal irradiation (ENI). The gross tumor volume (GTV) was set as the metastatic cervical lymph node volume, and the clinical target volume (CTV) was defined as the tissue volume with an expansion of 0.5–1.0 cm around the GTV. The ENI comprised the nearby high-risk lymph node drainage area and was appropriately modified according to the inherent anatomical boundaries. The planning target volume (PTV) was a CTV with an expansion of 0.5 cm, the median RT dose was 60 Gy (50–66 Gy) and the fraction dose were 1.8–2 Gy—once daily five days per week.

Chemotherapy

A total of 44 patients received chemotherapeutic regimens, including concurrent chemotherapy and sequential chemotherapy. The chemotherapeutic regimens were primarily platinum-based doublet chemotherapy. Fourteen patients received a chemotherapy regimen consisting of cisplatin plus 5-fluorouracil. Twenty-four patients received a regimen consisting of cisplatin plus docetaxel or paclitaxel. The remaining six patients received oral chemotherapy with S-1 or capecitabine.

Table 1. Clinical characteristics of CLNR in 65 patients with TESCC

Recurrence characteristics	Case (number)
Time from surgery to initial recurrence (month)	
$<$ 12	22
$\geq$ 12	43
Length of cervical lymph node (cm)	
$<$ 2.5	29
$\geq$ 2.5	36
Number of recurrent lymph nodes	
Single	30
Multiple	35
JES station number of lymph nodes	
101	29
102	13
104	40
Number of CLNR sites	
Single	45
Multiple	20
Dose of radiotherapy	
$<$ 60 Gy	20
$\geq$ 60 Gy	45
Chemotherapy	
Without	21
With	44
Irradiation method	
IFI	30
ENI	35

CLNR: cervical lymph node recurrence; TESCC: thoracic esophageal squamous cell carcinoma; JES: Japanese Esophagus Society; IFI: involved field irradiation; ENI: elective nodal irradiation.

Clinical characteristics of CLNR

Table 1 depicts the specific allocation of patients to groups in the present study. There were 18 cases of CLNR in station number 101, seven cases of CLNR in station number 102 and 23 cases of CLNR in station number 104. There were 11 cases of combined CLNR in station numbers 101 and 104, and six cases of combined CLNR in station numbers 102 and 104. We also noted 10 cases of bilateral CLNR.

Follow-up and statistical analysis

After the diagnosis of recurrence and the administration of corresponding treatment, the patients were reexamined every three months within the first two years, and followed up once every six months for the next 3–5 years and once per year after the fifth year. For patients who could not have regular follow-up visits, we performed telephone follow-up instead. Overall survival (OS) was defined as the date of recurrence until the end of follow-up or death, and progression-free survival (PFS) was designated as the date of diagnosis of recurrence until the first tumor progression or death. The follow-up deadline for the patients was August of 2021. The median follow-up duration was 15 months (2–82 months). Two cases were lost to follow-up and defined as censored cases. We employed the SPSS19.0 software package for statistical analysis of our data. The survival analysis was performed using the

Kaplan–Meier method, and the survival was compared by means of the log-rank test. The Cox proportional hazards model was implemented to multivariate survival analysis. $P < 0.05$ was considered to show statistical significance.

RESULTS

Patterns of CLNR

The supraclavicular lymph nodes (JES station number 104) were the most common recurrence site among CLNR. The time from surgery to first CLNR in the 65 patients ranged from two to 85 months, with a median time of 14 months. Twenty-two of 65 patients (34%) exhibited CLNR within one year after the surgery.

Overall survival

After treatment, the median OS of the 65 patients in the total group was 20 months; and the one-, two-, three- and five-year survival rates for all patients were 68.3%, 47.3%, 33.4% and 10.6%, respectively. The causes of death were as following: three cases were local recurrence, five cases were mediastinal and abdominal lymph node recurrence, 27 cases were hematogenous metastasis, five cases were tumor-related complications including myelosuppression, infection and hemorrhage, one case was cardiac failure, one case was cerebral infarction.

Analysis of prognostic factors

Univariate analysis of OS revealed that the time from surgery to recurrence, the number of recurrent lymph nodes and the dose of RT were the significant factors affecting prognosis ($P < 0.05$, Table 2). Multivariate regression analysis of OS exploiting the Cox model confirmed that the number of recurrent lymph nodes and the dose of RT were independent prognostic factors (Table 3).

Disease progression after treatment

There were 32 patients with disease progression, and the median time from CLNR to the initial progression after treatment was eight months (3–62 months); and of these patients, we observed four cases of CLNR, with all manifesting relapse in the elective irradiation field. There were 10 patients with mediastinal and abdominal lymph node recurrence and 18 patients with hematogenous metastasis (e.g. pulmonary, pleural, brain, bone, liver). The median PFS was 14 months; and their one-, two-, three- and five-year PFS rates were 56.1%, 33.9%, 19.8% and 9.9%, respectively.

DISCUSSION

Local-regional recurrence was the primary mode of failure in patients with esophageal squamous cell carcinoma (ESCC) after surgery, and over 11% of the patients developed CLNR [11]. Studies revealed a more favorable prognosis with esophageal cancer in patients with CLNR than with mediastinal and abdominal lymph node recurrence [12, 13]. However, due to the relatively low rate of lymph node recurrence, few investigators have reported on salvage therapy for esophageal cancer patients with CLNR. Salvage cervical lymphadenectomy or salvage chemoradiotherapy (CRT)/RT has been reported to offer benefit to patients with CLNR [7, 14]. No significant difference was uncovered in the prognosis between surgery and RT. However, the probability of failure, especially distant metastasis after salvage surgery was elevated [13]. Our present retrospective study was conducted to examine the prognosis of 65 patients who underwent RT for CLNR after curative surgery and to analyze the prognostic factors that may affect patient survival. Our results indicated that the median OS was 20 months; and that and the 1-, 2-, 3- and 5-year survival rates were 68.3%, 47.3%, 33.4% and 10.6%, respectively. The median PFS was 14 months. Our data were thus similar to those of previous studies and suggested that RT was an effective treatment for postoperative CLNR in patients with TESCC.

According to extant reports, there are many prognostic factors that vary between studies and affect the prognosis of patients with regional lymph node recurrence after surgical treatment for esophageal cancer. Esophageal cancer patients who were < 63 years of age with multiple lymph node recurrence, who possessed a late postoperative pathological stage, reflected a lymph node length ≥ 25 mm, who did not undergo chemotherapy, and who received a < 60-Gy-dose of RT demonstrated a relatively poor prognosis [8, 15–18]. For those patients with only CLNR, our univariate analysis revealed that the time from surgery to initial CLNR was associated with prognosis: the prognosis of patients with a ≥ 12-month recurrence time was more favorable than that for patients with a < 12-month recurrence time, and the median survival times of the patients in these two groups were 30 and 14 months, respectively. Multivariate analysis showed that the number of recurrent lymph nodes was an independent prognostic factor. This result supports that the concept of oligo-recurrence might be applicable to postoperative esophageal cancer. RT may be a recommended minimum treatment for patients with oligo-recurrence in single CLNR.

Although no unified standard or relevant research exists as to the dose of RT and target area required for CLNR after TESCC surgery, some studies on postoperative regional lymph node recurrence can still be used as references. A study by Zhang *et al.* showed that ≥ 60-Gy RT resulted in a significantly improved prognosis relative to < 60-Gy RT in TESCC patients with CLNR ($P = 0.041$), and that the former did not generate any serious adverse reactions [19]. In addition, clinical studies on concurrent CRT for esophageal cancer in China all recommend 60 Gy as the dose of RT, indicating that 60 Gy is a safe minimal dose for radical cure. In the present study, 45 patients received a dose of $\geq$60-Gy RT (but not more than 66 Gy), and their median survival was 28 months—significantly longer than the case for patients receiving $<$ 60-Gy RT, who experienced a median survival time of only 15 months. Our multivariate analysis also indicated that the dose of RT was an independent prognostic factor. Moreover, we noted that 4 patients who received < 60-Gy RT were observed local recurrence in elective irradiation field. Thus, we believe that a salvage dose of at least 60 Gy might be more reasonable and effective for patients with CLNR. However, we should be cautious about increasing the intensity of treatment. A prospective trial may be needed to confirm these findings. We exploited two approaches of target delineation, that of IFI and ENI. Kawamoto *et al.* retrospectively analyzed 21 patients with regional lymph node recurrence who underwent IFI, and demonstrated that after treatment, four patients showed in-field recurrence with no lymph node recurrence in the field drainage area observed—indicating that IFI was safe and feasible [17]. A study by Bao *et al.* encompassed 83 esophageal cancer patients with postoperative regional recurrence who underwent

Table 2. Univariate analysis of the prognosis of patients with postoperative CLNR

Factor	Case number	Case of death	Survival rate (%)			Median OS (months)	χ^2-value	*P*-value
			1 year	3 year	5 year			
Age (years)								
< 60	20	12	64.5	48.4	16.1	35	1.946	1.163
≥ 60	45	30	63.7	26.4	7.9	19		
Gender								
Male	49	34	68.6	33.8	7.5	24	0.276	0.599
Female	16	8	67.3	31.4	31.4	20		
Performance status								
0/1	54	36	71.3	35.9	11.4	24	1.831	0.176
2	11	6	53	0	0	28		
Degree of differentiation								
High	12	8	83.3	31.7	21.2	28	0.871	0.647
Moderate	33	21	68.4	34.6	6.9	19		
Poor	20	13	58.7	36.5	0	20		
Depth of invasion								
T1–2	32	21	71.9	40.3	17.3	26	1.617	0.204
T3–4	33	21	65	25.4	0	18		
Lymph node metastasis								
N0	38	21	75.3	40.3	15.3	35	3.334	0.068
N+	27	21	58.5	23.4	5.8	15		
pTNM Stage								
I–II	39	21	73.2	37.3	18.7	28	2.306	0.129
III–IVA	26	21	60.9	25.4	5.1	17		
Time from surgery to initial recurrence (months)								
< 12	22	16	54.5	22.7	0	14	4.631	0.031
≥ 12	43	26	75.8	38.9	15.6	30		
Length of cervical lymph node (cm)								
< 2.5	29	20	65.2	34.2	14.3	19	0.070	0.791
≥ 2.5	36	22	70.7	31.9	6.4	20		
Number of recurrent lymph nodes								
Single	30	16	79.5	48.7	17.4	30	5.991	0.014
Multiple	35	26	58.5	18.8	4.7	17		
Number of CLNR sites								
Single	45	29	68.4	31.9	11.4	26	0.129	0.719
Multiple	20	13	68.3	34.7	8.7	20		
Dose of radiotherapy								
< 60 Gy	20	15	52.5	26.3	0	15	4.159	0.041
≥ 60 Gy	45	27	74.9	36.2	13.6	28		
Chemotherapy								
Without	21	18	61.9	20.6	6.9	19	1.764	0.184
With	44	24	71.4	43.1	13.5	26		
Irradiation method								
IFI	30	19	72.7	33.0	13.2	24	0.161	0.688
ENI	35	23	64.2	34.0	7.6	19		

CLNR: cervical lymph node recurrence; OS: overall survival; IFI: involved field irradiation; ENI: elective nodal irradiation.

concurrent CRT and prophylactic extended-field irradiation, and these authors showed an overall effective rate of 75.9%, a median survival time of 43 months, and a favorable prognosis [20]. Therefore, the RT plan in clinical practice should be performed according to performance status of patients, the physician's experience, the extension of lymph node invasion and the tumor's relationship with adjacent normal tissues of the patients, to reduce the local recurrence as much as possible while ensuring therapeutic safety.

Numerous studies have shown that CRT is more effective than RT alone for patients with locoregional lymph node recurrence [21, 22].

Table 3. Multivariate analysis of the prognosis of patients with CLNR

Factor	B	SE	Wald	*P*-value	Exp (B)	95%CI
Time from surgery to initial recurrence (< 12 months/≥ 12 months)	0.356	0.365	0.951	0.329	1.428	0.698-2.921
Number of recurrent lymph nodes (single/multiple)	−0.795	0.342	5.396	0.020	0.452	0.231-0.883
Dose of radiotherapy (< 60 Gy/≥ 60 Gy)	0.725	0.369	3.871	0.049	2.065	1.003-4.252
Lymph node metastasis (N0/N+)	-0.179	0.346	0.269	0.604	0.836	0.424-1.647
Chemotherapy (without/with)	0.470	0.316	2.216	0.137	1.600	0.862-2.972

CLNR: cervical lymph node recurrence; CI: confidence interval.

Although our study did not reveal a statistical effect of chemotherapy on the prognosis of postoperative CLNR using univariate analysis, the median survival time of the 44 patients who received RT and chemotherapy was 26 months—which was higher than that for the 21 patients who received RT alone (19 months). The one-, three- and five-year survival rates for the CRT group were also higher than in those who experienced RT alone. In the further analysis of posttreatment failure patterns, 32 patients showed disease progression, with a median time from CLNR to initial disease progression of less than one year after treatment. In addition to regional lymph node recurrence, 18 patients initially developed hematogenous metastasis, and 11 of these did not undergo chemotherapy. This indicated that patients who received local RT alone were prone to distant metastasis. However, the optimal chemotherapeutic regimen remains unknown, and sample size needs to be increased to allow further stratified analysis.

The retrospective nature of the present study is a limitation. It is difficult to make a randomized, controlled study, as the number of patients with only CLNR is small—only 65 patients treated with RT were observed. Secondly, we could not demonstrate a survival benefit of treatment with RT compared with other treatment such as surgery, chemotherapy alone. The optimal treatment cannot be established. Moreover, there were some selection biases: small sample size, the primary therapy was different among surgeons, as well as the heterogeneity of the combined chemotherapy regimen, RT dose, target delineation.

In summary, RT, with or without chemotherapy, reflected an effective therapeutic modality for patients with CLNR after surgery for TESCC. Patients with single lymph node recurrence and ≥ 60 Gy of RT achieved a favorable prognosis. Further prospective clinical studies are needed to determine the best therapeutic strategy for postoperative CLNR in TESCC.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ETHICS STATEMENT

This study was approved by the Ethics Committee of the First Affiliated Hospital of Anhui Medical University (Reference number: Quick-PJ 2022-06-32).

DATA AVAILABILITY

All data generated or analyzed during this study are included in this published article.

REFERENCES

1. Liu Q, Cai XW, Wu B *et al.* Patterns of failure after radical surgery among patients with thoracic esophageal squamous cell carcinoma: implications for the clinical target volume design of postoperative radiotherapy. *PLoS One* 2014;9:e97225.
2. Ninomiya I, Okamoto K, Tsukada T *et al.* Recurrence patterns and risk factors following thoracoscopic esophagectomy with radical lymph node dissection for thoracic esophageal squamous cell carcinoma. *Mol Clin Oncol* 2016;4:278–84.
3. Guo XF, Mao T, Gu ZT *et al.* Clinical study on postoperative recurrence in patients with pN0 esophageal squamous cell carcinoma. *J Cardiothorac Surg* 2014;9:150.
4. Oppedijk V, van der Gaast A, van Lanschot JJB *et al.* Patterns of recurrence after surgery alone versus preoperative chemoradiotherapy and surgery in the CROSS trials. *J Clin Oncol* 2014;32:385–91.
5. Jingu K, Umezawa R, Yamamoto T *et al.* Elective nodal irradiation is not necessary in chemoradiotherapy for postoperative loco-regional recurrent esophageal cancer. *Jpn J Clin Oncol* 2017;47:200–5.
6. Kimoto T, Yamazaki H, Suzuki G *et al.* Local field radiotherapy without elective nodal irradiation for postoperative loco-regional recurrence of esophageal cancer. *Jpn J Clin Oncol* 2017;47:809–14.
7. Ma X, Zhao KL, Guo W *et al.* Salvage lymphadenectomy versus salvage radiotherapy/chemoradiotherapy for recurrence in cervical lymph node after curative resection of esophageal squamous cell carcinoma. *Ann Surg Oncol* 2015;22:624–9.
8. Fakhrian K, Gamisch N, Schuster T *et al.* Salvage radiotherapy in patients with recurrent esophageal carcinoma. *Strahlenther Onkol* 2012;188:136–42.
9. Rice TW, Ishwaran H, Ferguson MK *et al.* Cancer of the esophagus and esophagogastric junction: an eighth edition staging primer. *J Thorac Oncol* 2017;12:36–42.
10. Japan Esophageal Society. Japanese classification of esophageal cancer, 11th edition: part I. *Esophagus* 2017;14:1–36.
11. Wang Z, Lin SF, Wang F, Liu S. Salvage lymphadenectomy for isolated cervical lymph node recurrence after curative resection of thoracic esophageal squamous cell carcinoma. *Ann Transl Med* 2019;7:238.

12. Motoyama S, Kitamura M, Saito R *et al.* Outcome and treatment strategy for mid- and lower-thoracic esophageal cancer recurring locally in the lymph nodes of the neck. *World J Surg* 2006;30:191–8.
13. Watanabe M, Mine S, Yamada K *et al.* Outcomes of lymphadenectomy for lymph node recurrence after esophagectomy or definitive chemoradiotherapy for squamous cell carcinoma of the esophagus. *Gen Thorac Cardiovasc Surg* 2014;62:685–92.
14. Yano M, Takachi K, Doki Y *et al.* Prognosis of patients who develop cervical lymph node recurrence following curative resection for thoracic esophageal cancer. *Dis Esophagus* 2006;19:73–7.
15. Chen J, Yin WM, Yao H, Gu W. Salvage treatment for lymph node recurrence after radical resection of esophageal squamous cell carcinoma. *Radiat Oncol* 2019;14:169.
16. Kawamoto T, Nihei K, Sasai K, Karasawa K. Clinical outcomes and prognostic factors of chemoradiotherapy for postoperative lymph node recurrence of esophageal cancer. *Jpn J Clin Oncol* 2018;48:259–64.
17. Kawamoto T, Nihei K, Sasai K, Karasawa K. Involved-field chemoradiotherapy for postoperative solitary lymph node recurrence of esophageal cancer. *Esophagus* 2018;15:256–62.
18. Ni WJ, Yang JS, Deng W *et al.* Patterns of recurrence after surgery and efficacy of salvage therapy after recurrence in patients with thoracic esophageal squamous cell carcinoma. *BMC Cancer* 2020;20:144.
19. Zhang J, Peng F, Li N *et al.* Salvage concurrent radiochemotherapy for post-operative local recurrence of squamous-cell esophageal cancer. *Radiat Oncol* 2012;7:93.
20. Bao Y, Liu SL, Zhou QC *et al.* Three-dimensional conformal radiotherapy with concurrent chemotherapy for postoperative recurrence of esophageal squamous cell carcinoma: clinical efficacy and failure pattern. *Radiat Oncol* 2013;8:241.
21. Zhang WW, Zhu YJ, Yang H *et al.* Concurrent radiotherapy and weekly chemotherapy of 5-fluorouracil and platinum agents for postoperative locoregional recurrence of oesophageal squamous cell carcinoma. *Sci Rep* 2015;5:8071.
22. Ma DY, Tan BX, Liu M *et al.* Concurrent three-dimensional conformal radiotherapy and chemotherapy for postoperative recurrence of mediastinal lymph node metastases in patients with esophageal squamous cell carcinoma: a phase 2 single-institution study. *Radiat Oncol* 2014;9:28.