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Is radiofrequency ablation more effective than stereotactic ablative radiotherapy in patients with early stage medically inoperable non-small cell lung cancer?

Haris Bilal[a], Sarah Mahmood[b], Bala Rajashanker[c] and Rajesh Shah[a,*]

[a] Department of Cardiothoracic Surgery, South Manchester University Hospital, Wythenshawe, UK
[b] University of Liverpool, Liverpool, UK
[c] Department of Radiology, Central Manchester University Hospital, Manchester Royal Infirmary, Manchester, UK

* Corresponding author. Tel: +44-1619-987070; fax: +44-1619-987071; e-mail: rajesh.shah@uhsm.nhs.uk (R. Shah).

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Abstract

A best evidence topic in thoracic surgery was written according to a structured protocol. The question addressed was 'is radiofrequency ablation more effective than stereotactic ablative radiotherapy in patients with early stage medically inoperable non-small cell lung cancer?' Altogether, over 219 papers were found, of which 16 represented the best evidence to answer the clinical question. The authors, journal, date and country of publication, patient group studied, study type, relevant outcomes and results of these papers are tabulated. Radiofrequency ablation (RFA) and stereotactic ablative radiotherapy (SABR) offer a clear survival benefit compared with conventional radiotherapy in the treatment of early stage non-small cell lung cancer (NSCLC) in medically inoperable patients. Overall survival at 1 year (68.2–95% vs. 81–85.7%) and 3 years (36–87.5% vs. 42.7–56%) was similar between patients treated with RFA and SABR. However, 5-year survival was higher in SABR (47%) than RFA (20.1–27%). Local progression rates were lower in patients treated with SABR (3.5–14.5% vs. 23.7–43%). Both treatments were associated with complications. Pneumothorax (19.1–63%) was the most common complication following RFA. Fatigue (31–32.6%), pneumonitis (2.1–12.5%) and chest wall pain (3.1–12%) were common following SABR. Although tumours ≤5 cm in size can be effectively treated with RFA, results are better for tumours ≤3 cm. One study documented increased recurrence rates with larger tumours and advanced disease stage following RFA. Another study found increasing age, tumour size, previous systemic chemotherapy, previous external beam radiotherapy and emphysema increased the risk of toxicity following SABR and suggested that risk factors should be used to stratify patients. RFA can be performed in one session, whereas SABR is more effective if larger doses of radiation are given over two to three fractions. RFA is not recommended for centrally based tumours. Patients with small apical tumours, posteriorly positioned tumours, peripheral tumours and tumours close to the scapula where it may be difficult to position an active electrode are more optimally treated with SABR. Treatment for early stage inoperable NSCLC should be tailored to individual patients, and under certain circumstances, a combined approach may be beneficial.

Keywords: Radiofrequency ablation • Stereotactic radiotherapy • Stereotactic ablative radiotherapy • Non-small cell lung cancer • Survival

INTRODUCTION

A best evidence topic was constructed according to a structured protocol. This is fully described in the ICVTS [1].

THREE-PART QUESTION

In [patients with early stage medically inoperable non-small cell lung cancer], is [radio-frequency ablation] superior to [stereotactic ablative radiotherapy] treatment?

CLINICAL SCENARIO

You are at a conference hearing about the effectiveness of radiofrequency ablation (RFA) and stereotactic ablative radiotherapy (SABR) in patients with early stage medically inoperable non-small cell lung cancer (NSCLC). You have an 85-year old patient who has been diagnosed with Stage IA NSCLC and is not fit for surgery due to his extensive comorbidities. You decide to do a literature search.

SEARCH STRATEGY

An English language literature review was performed on MEDLINE 1948 to July 2011 using the Ovid interface: [catheter ablation/OR radiofrequency ablation.mp.OR radiosurgery/OR stereotactic radiotherapy.mp. OR stereotactic ablative radiotherapy.mp. OR stereotactic body radiation therapy.mp. OR stereotactic Irradiation.mp. OR radiation therapy.mp] AND [non small cell lung carcinoma.mp. OR Carcinoma, Non-Small-Cell Lung]

Table 1: Best-evidence papers

Author, date, journal and country, study type (level of evidence)	Patient group	Outcomes	Key results	Comments, study weaknesses
Huang *et al.*, (2011), Eur J Cardiothorac Surg, China [2] Retrospective study	Three hundred and twenty-nine patients with 436 lung tumours treated with RFA from 1999 to 2006 Primary (*n* = 237) Metastatic (*n* = 92) Inclusion criteria: (1) Aged 18–80 (2) Poor pulmonary function with FEV1 < 1 l, FEV1% <50%; MVV <50% and/or high cardiac risk (3) Refusal of surgery	Median progression-free period Local progression 30-day mortality Overall survival: 1, 2 and 5 years Complications: Pneumothorax Haemoptysis Haemothorax Pneumonia Pericardial tamponade	21.6 months 78/329 (23.7%) 0.6% 68.2, 35.5, 20.1% 63/329 (19.1%) 14/329 (4.2%) 10/329 (3.0%) 15/329 (4.5%) 3/329 (0.9%)	RFA is a safe and well-tolerated procedure with confirmed efficacy in the treatment of malignant lung tumours Tumours >4 cm have a significantly increased risk of local progression Treatment-related complications were counted if within 30 days after RFA treatment
Beland *et al.*, (2010), Radiology, USA [3] Retrospective study	Seventy-nine patients with 79 tumours underwent RFA for primary NSCLC from 1998 to 2008 Stage IA *n* = 35 (78%) Stage IB *n* = 7 (16%) Stage IIIB *n* = 3 (7%) Adjuvant external beam radiation *n* = 19 (24%) Concomitant brachytherapy *n* = 9 (11%) Mean follow-up 17 months	Residual tumour or recurrence Recurrence pattern: Local Intrapulmonary Nodal Mixed Distant metastases	34/79 (43%) 38% 18% 18% 6% 21% 23 months	RFA is a promising treatment option for primary lung cancer in non-surgical patients, however disease recurrence is common, occurring in 43% of patients At 2 years, local recurrence was the most common at 28%, suggesting that more aggressive initial RF ablation and adjuvant radiation may offer improvement in outcomes Potential for understaging of disease as patients did not undergo mediastinoscopy No standardized post-treatment follow-up imaging protocol
de Baère *et al.*, (2006), Radiology, France [4] Prospective study	Sixty patients with 97 treatable lung tumours underwent 74 RFA using CT guidance Patients who received systematic chemotherapy during follow-up period *n* = 22 Primary *n* = 9 (15%) Metastatic *n* = 51 (85%)	Rate of incomplete local treatment per tumour at 18 months: Tumours <2 cm Tumours >2 cm Survival at 18 months: Overall Lung disease free Complications: Pneumothorax Alveolar haemorrhage Pleural effusion: Immediately after treatment 24–48 h after treatment FEV_1 (L): Before treatment After treatment	7% 5% 13% (*P* = 0.66) 71% 34% 40/74 (54%) 8/74 (11%) 7/74 (9%) 45/74 (60%) 0.62–3.65 0.72–3.65 (*P* = 0.65)	RFA has high local success rates of complete ablation and curative treatment in inoperable primary and metastatic lung tumours and is well tolerated Ideal follow-up imaging to determine early treatment failure remains to be improved, probably including functional imaging and CT Small population Twenty-two patients received systemic chemotherapy for distant metastases during follow-up, hence difficult to evaluate the effect of such therapy on the rate of incomplete local treatment

Continued

Table 1: (*Continued*)

Author, date, journal and country, study type (level of evidence)	Patient group	Outcomes	Key results	Comments, study weaknesses
		VC (L):		
		Before treatment	0.80–8.0	
		After treatment	0.83–7.98 ($P = 0.93$)	
		Post-procedure haemoptysis	7/74 (10%)	
Lencioni *et al*., (2008), The Lancet, Italy [5]	One hundred and six patients with 183 biopsy-confirmed lung tumours <3.5 cm underwent RFA	Technical success	99%	Percutaneous CT-guided RFA yields high proportions of sustained complete ablation in patients with primary or secondary lung tumours, and is associated with acceptable morbidity
Multicentre prospective trial		Major complications:		
		Pneumothorax	$n = 27$	
	NSCLC ($n = 33$)	Pleural effusion	$n = 4$	
		Complete tumour response lasting at least 1 year	88%	Heterogeneous patient population
	Median follow-up 24 months			Mean follow-up not long enough to detect late tumour recurrences
		Overall survival (NSCLC):		
		1 year	70%	
		2 years	48%	PET scans not routinely used for the assessment of response
		Cancer-specific survival (NSCLC):		
		1 year	92%	
		2 years	73%	
		Stage I NSCLC:		
		2-year overall survival	75%	
		2-year cancer specific survival	92%	
Hiraki *et al*., (2007), J Thorac Cardiovasc Surg, Japan [6]	Twenty patients with Stage I NSCLC underwent RFA	Local progression	7/20 (35%)	Treatment of Stage I NSCLC with one or more sessions of RFA offers promising outcomes in relation to survival. However, local progression rates are relatively high
Retrospective study	Median follow-up 21.8 months	Local control rate:		
		1 year	72%	
		2 years	63%	
		3 years	63%	Short follow-up period
		Mean survival	42 months	
		Overall survival:		Small study population
		1 year	90%	
		2 years	84%	
		3 years	74%	
		Cancer-specific survival:		
		1 year	100%	
		2 years	93%	
		3 years	83%	
		Complications:		
		Pneumothorax	13/20 (57%)	
		Pleural effusion	4/20 (17%)	
Pennathur *et al*., (2007), J Thorac Cardiovasc Surg, USA [7]	Nineteen patients with Stage I NSCLC underwent RFA under CT-guidance	Local progression	8/19 (42%)	RFA appears to be safe in high-risk patients with stage I NSCLC, with reasonable results in terms of survival in high-risk patients who are not fit for surgical intervention
		Initial complete response	2/19 (10.5%)	
Retrospective study	Stage IA ($n = 11$)	Partial response	10/19 (53%)	

Continued

Table 1: (*Continued*)

Author, date, journal and country, study type (level of evidence)	Patient group	Outcomes	Key results	Comments, study weaknesses
		Overall survival:		
	Stage IB	1 year	95%	Small sample size
	(*n* = 8)	2 years	68%	
		Complications:		
	Mean follow-up 29 months	Pneumothorax	63%	
Simon *et al*., (2007), Radiology, USA [8]	One hundred and fifty-three patients with 189 tumours underwent 183 RFA sessions	(≤3 cm) Local tumour progression–free rates:		Lung RFA appears to be a safe treatment for Stage I NSCLC and is linked with promising long-term survival and local tumour progression outcomes
		1 year	83%	
Retrospective study		2 years	64%	
	Primary	3 years	57%	
	(*n* = 116)	4 years	47%	
		5 years	47%	
	Metastatic			Biopsies were not routinely performed during follow-up
	(*n* = 73)	(>3 cm) Local tumour progression–free rates:		
	Stage I NSCLC	1 year	45%	A proportion of patients treated concomitantly with systemic chemotherapy and/or external beam radiation therapy
	(*n* = 75)	2 years	25%	
		3 years	25%	
	Median follow-up 20.5 months	4 years	25%	
		5 years	25%	
		Difference between the survival rates: (≤3 cm) and (>3 cm)	(*P* < 0.002)	
		Overall survival rates: (NSCLC)		
		1 year	78%	
		2 years	57%	
		3 years	36%	
		4 years	27%	
		5 years	27%	
		Complications:		
		Pneumothorax	28.4%	
		Chest tube insertion	9.8%	
Kashima *et al*., (2011), Am J Roentgenol, Japan [9]	Four hundred and twenty patients with 1403 lung tumours underwent 1000 RFA sessions	Complications:		Lung RFA is a relatively safe procedure, but it can be fatal in few cases. Known risk factors such as age, tumour size, platelet count, previous systemic chemotherapy, previous external beam radiotherapy, emphysema should be used to stratify patients
		Death	0.4%	
Retrospective study		Aseptic pleuritis	2.3%	
		Pneumonia	1.8%	
		Lung abscess	1.6%	
		Bleeding requiring transfusion	1.6%	
		Pneumothorax requiring pleural sclerosis	1.6%	
		Bronchopleural fistula	0.4%	
		Brachial nerve injury	0.3%	
		Tumour seeding	0.1%	
		Diaphragm injury	0.1%	
Zemlyak *et al*., (2010), J Am Coll Surg, USA [10]	Sixty-four patients with Stage I NSCLC	Overall 3-year survival:		SLR, RFA and PCT are reasonable alternatives to lobectomy for patients who are poor candidates for major surgery. Survival at 3 years is comparable after sublobar resections and ablative therapies. Ablative therapies appear to be a reasonable alternative in high-risk patients not fit for surgery
		SLR	87.1%	
Retrospective study		RFA	87.5%	
	SLR (*n* = 25)	PCT	77%	
			(*P* > 0.05)	
	RFA (*n* = 12)			
		3-year cancer-specific survival:		
	PCT (*n* = 27)	SLR	90.6%	
		RFA	87.5%	
		PCT	90.2%	Small sample
			(*P* > 0.05)	

Continued

Table 1: (*Continued*)

Author, date, journal and country, study type (level of evidence)	Patient group	Outcomes	Key results	Comments, study weaknesses
		3-year cancer-free survival:		Selection bias
		SLR	60.8%	SBRT not included in comparison
		RFA	50%	
		PCT	45.6%	
			($P > 0.05$)	
Lagerwaard *et al.*, (2008), Int J Radiat Oncol Biol Phys, The Netherlands [11]	Two hundred and six patients with Stage I NSCLC underwent SRT	Median overall survival:	34 months	SRT is well tolerated in patients with extensive comorbidity presenting with inoperable Stage I NSCLC with high local control rates and minimal toxicity
		1-year survival rate	81%	
		2-year survival rate	64%	
	Medically inoperable	Local recurrence:	3.5%	
Retrospective study	($n = 167$)	T1	2 /129 (1.6%)	Median follow-up was only 12 months. Most recurrences occur within 2 years following treatment
		T2	5/90 (5.6%)	
	Refused surgery ($n = 39$)		($P = 0.13$)	
	Inclusion criteria:	Overall recurrence	21% (43 patients)	Only 88 patients attended for follow-up at 1 year
	(1) Tumour <6 cm			
	(2) Confirmed malignancy	DFS:		
	(cytohistologic or CT)	1 year	83%	Only a minority of the patients had pathologic confirmation of malignancy
	(3) Absence of metastases on PET scan	2 years	68%	
		Toxicity:		
	Prescription dose 60 Gy in three, five or eight fractions	Fatigue	31%	
		Chest wall pain	12%	
		Nausea	9%	
		Dyspnoea	6%	
		Cough	6%	
		Pneumonitis	3%	
		Rib fractures	2%	
		Chronic thoracic pain	1%	
Haasbeek *et al.*, (2010), Cancer, The Netherlands [12]	One hundred and ninety-three patients ≥75 years with 203 tumours treated using SRT	Survival rate:		SRT achieved high local control rates with minimal toxicity in patients aged ≥75 years, suggesting it should be considered as a curative alternative in the treatment of NSCLC
		1 year	85.7%	
		3 years	45.1%	
		Median overall	32.5 months	
Retrospective study	T1 ($n = 118$)			
		DFS:		
	T2 ($n = 85$)	1 year		Median follow-up of 12.6 months not long enough
		3 years	89.2%	
	80% medically inoperable		72.6%	
		Complications:		
	20% declined surgery	Fatigue	32.6%	
		Nausea	4.1%	
	Median follow-up 12.6 months	Cough	5.7%	
		Dyspnoea	5.2%	
		Chest wall pain	3.1%	
		Rib fracture	1.6%	
		Grade ≥3 radiation pneumonitis	2.1%	
		Chronic chest wall pain	2.6%	
		Acute toxicity	1.6%	
Le *et al.*, (2006), J Thorac Oncol, USA [13]	Thirty-two patients with inoperable lung tumours treated with single-fraction SRT	Local progression: (NSCLC)		Single-fraction SRT is feasible for selected patients with lung tumours and higher doses (>20 Gy) are associated with improved local control. For those who have had prior thoracic radiotherapy, doses ≥25 Gy may be too toxic
		>20 Gy	9%	
Retrospective study		<20 Gy	54%	
	NSCLC		($P = 0.03$)	
	($n = 20$)			
		CR rate:		
	Metastases	>20 Gy	57%	
	($n = 12$)	<20 Gy	10%	Short follow-up period
			($P = 0.21$)	
	Tumour diameter 20–62 mm			Variation in treatment techniques (breath-holding vs. tracking)
		1-year overall survival:		
	15–30 Gy in one fraction	(NSCLC)	85%	

Continued

Table 1: (*Continued*)

Author, date, journal and country, study type (level of evidence)	Patient group	Outcomes	Key results	Comments, study weaknesses
	15 Gy ($n = 9$) 20 Gy ($n = 1$) 25 Gy ($n = 20$) 30 Gy ($n = 2$) Median follow-up 18 months	Toxicity: Fatigue Pneumothorax Grade 2–3 pneumonitis Pleural effusion	 10/32 6/32 (19%) 4/32 (12.5%) 1/32	
Onishi H *et al.*, (2004), Cancer, Japan [14] Retrospective study	Two hundred and forty-five underwent hypofractionated high-dose STI between 1995 and 2003 BED ≥100 Gy ($n = 173$) BED 100 Gy ($n = 72$) Stage IA $n = 155$ Stage IB $n = 9$ Tumour diameter 7–58 mm (median, 28 mm) CT chest usually obtained 3-monthly for first year and repeated every 4–6 months thereafter Tumour response evaluated using previously published National Cancer Institute (NCI) criteria	Local progression overall: BED ≥100 Gy BED 100 Gy Local disease recurrence: BED ≥100 Gy BED 100 Gy 3-year survival rate: BED ≥100 Gy BED 100 Gy Overall survival rates: 3 years 5 years Local tumour response: CR (completely disappeared/ replaced by fibrotic tissue) PR (≥30% reduction in the maximum cross-sectional diameter) Overall response rate BED ≥100 Gy BED 100 Gy Toxicity: Radiation-induced pulmonary complications	14.5% 8.1% 26.4% ($P < 0.05$) 13.5% 8.1% 26.4% ($P < 0.01$) 88.4% 69.4% (P 0.05) 56% 47% 57/245 (23.3%) 151/245 (61.6%) 84.8% 84.5% 83.3% 17/245 (6.9%)	Hypofractionated high-dose STI is a feasible and effective curative treatment of patients with Stage I NSCLC Local control and survival rates better in patients treated with BED ≥100 Gy than for BED 100 Gy Treatment parameters heterogeneous
Timmerman *et al.*, (2010) JAMA, USA [15] Multicentre prospective study	Fifty-five patients with biopsy-proven peripheral T1-T2N0M0 NSCLC (measuring 5 cm in diameter) underwent SBRT T1 ($n = 44$) T2 ($n = 11$) Prescription dose 18 Gy per fraction ×3 fractions (54 Gy total) Median follow-up 34.4 months	Median overall survival Overall 3-year survival Disseminated recurrence at 3 years 3-year primary tumour control rate Local-regional control rate DFS Adverse events: Grade 3 Grade 4	48.1 months 55.8% 22.1% 97.6% 87.2% 48.3% 7/55 (12.7%) 2/55 (3.6%)	SBRT is an effective treatment in patients with inoperable NSCLC, with high rates of local tumour control and moderate treatment-related morbidity Rarely used invasive pathological staging and histological confirmation of recurrence, lowering accuracy
Fakiris *et al.*, (2009), Radiat Oncol Biol Phys, USA [16]	Seventy patients with biopsy confirmed NSCLC underwent SBRT	Local control at 3 years Local recurrence Nodal recurrence Distant recurrence	88.1% 4/70 (5.7%) 6/70 (8.6%) 9/70 (12.9%)	Treatment with SBRT results in high rates of local control in medically inoperable patients with Stage I NSCLC

Continued

Table 1: (*Continued*)

Author, date, journal and country, study type (level of evidence)	Patient group	Outcomes	Key results	Comments, study weaknesses
Retrospective study	T1 ($n = 34$) T2 ($n = 36$) Prescription dose: 60–66 Gy in three fractions Median follow-up 50.2 months	Median survival 3-year overall survival Median survival: T1 tumours T2 tumours	32.4 months 42.7 months 38.7 months 24.5 months ($P = 0.194$)	
Timmerman *et al.*, (2006), J Clin Oncol [17] Prospective study	Seventy patients underwent SBRT for NSCLC Treatment dose: 60 to 66 Gy total in three fractions during 1–2 weeks Median follow-up 17.5 months	2-year overall survival 3-month major response rate Local control 2 years: Deaths due to: Cancer Treatment Comorbid illness Median overall survival Toxicity: Grade 1–2 Grade 3–4 Grade 5 (death)	54.7% 60% 95% $n = 5$ $n = 6$ $n = 17$ 32.6 months $n = 58$ $n = 8$ $n = 6$	Local recurrence and toxicity occur late after this treatment; however, this regimen should not be used for patients with tumours near the central airways due to excessive toxicity Short follow-up period This trial did not define a limit on the period of observation of toxicity related to therapy-hospitalizations/deaths occurring more than a year after therapy might not have been attributed to SABR

NSCLC: non-small-cell lung cancer; RFA: radiofrequency ablation; FEV_1: forced expiratory volume in 1 s; VC: vital capacity; DFS: disease-free survival; MVV: maximum voluntary ventilation; SLR: sublobar resection; PCT: percutaneous cryoablation therapy; SRT: stereotactic radiotherapy; SBRT: stereotactic body radiation therapy; STI: stereotactic irradiation; BED: biologic effective dose; CR: complete resolution; PR: partial resolution; MTD: maximum tolerated dose.

AND [disease-free survival/ OR survival/ OR survival.mp. OR toxicity.mp. OR control rate.mp].

SEARCH OUTCOME

The search returned 219 papers. In addition, the references of relevant papers were searched. Sixteen papers provided the best evidence to answer the question. These are tabulated in Table 1.

RESULTS

The effectiveness of RFA and SABR in the treatment of inoperable NSCLC is well documented. Huang *et al.* [2] reported a median progression-free-interval of 21.6 months following RFA. Overall survival at 1, 2 and 5 years was 68.2, 35.3 and 20.1%, respectively, and 23.7% patients developed local progression during follow-up. There was no significant difference in outcome for tumours <3 cm, while there was a significant difference in the risk of local progression in tumours >4 cm ($P = 0.01$). In another study [3], 57% of primary lung tumours treated with RFA had no recurrence. The local recurrence rate was 38%, with increasing tumour size ($P = 0.02$) and disease stage ($P = 0.007$) significantly increasing its likelihood.

de Baère *et al.* [4] documented an 18-month survival rate of 71%, and a trend towards better efficacy for tumours <2 cm in diameter ($P = 0.066$). The respiratory function was not adversely affected when measured within 2 months of RFA treatment ($P = 0.51$); however, the long-term effects are unknown and the FDA have received reports of patient deaths associated with lung tumour ablation using RFA.

Lencioni *et al.* [5] achieved a technical success rate of 99% in performing RFA. 12.5% of patients with NSCLC showed incomplete response or progression of disease. The overall 2-year survival of patients with NSCLC was 48%. Hiraki *et al.* [6] observed a high local progression rate (35%) within a median of 9.0 months after the first session.

Pennathur *et al.* [7] documented a local progression in 42%, and the median time to progression was 27 months. The overall 2-year survival rate was 49% for primary lung cancers. Simon *et al.* [8] documented a significant difference in survival between patients with large (>3 cm) and small (≤3 cm) tumours ($P < 0.002$). Local recurrence was most common, suggesting that more aggressive RFA and adjuvant radiation may improve outcomes [9, 10]. Kashima *et al.* [9] concluded that puncture number ($P < 0.02$) and previous systemic chemotherapy ($P < 0.05$) were significant risk factors for aseptic pleuritis. Increasing age ($P < 0.02$) and previous external beam radiotherapy ($P < 0.001$) were significant risk factors for pneumonia, as were emphysema ($P < 0.02$) for lung

abscess and pneumothorax requiring pleural sclerosis ($P < 0.02$), and serum platelet count ($P < 0.002$) and tumour size ($P < 0.02$) for bleeding. Zemlyak *et al.* [10] reported comparable survival rates following sublobar resections (87.1%) and ablative therapies (87.5%).

SABR, a non-invasive technique, precisely delivers very high radiation doses in a short period of time. It is well tolerated in patients with extensive comorbidity with high local control rates and minimal toxicity, and results have been so promising that there are ongoing trials comparing SABR with surgery in operable patients. Lagerwaard *et al.* [11] observed local recurrences in only 3.5% of patients, which is much less than previously reported when using conventional radiotherapy in Stage I NSCLC. Haasbeek *et al.* [12] found no significant difference in overall survival between the older and younger patient cohorts ($P = 0.18$) following SABR; however, disease-free survival was slightly better in older patients ($P = 0.04$). Le *et al.* [13] reported an association between prior thoracic radiotherapy or chemotherapy and treatment-related toxicity.

On comparing outcomes between patients treated with biologic effective doses (BED) of ≥100 Gy and <100 Gy, Onishi *et al.* [14] found improved local control and survival rates with BED ≥100 Gy. They reported the most benefit in those with medically operable tumours, treated with BED ≥100 Gy.

Timmerman *et al.* [15] reported a 3-year local control rate of 97.6%, and an overall 3-year survival rate of 55.8%. Fakiris *et al.* [16] reported lower rates of toxicity after SABR in patients with peripheral tumours. However, there was no significant difference in survival between patients with peripheral and central tumours ($P = 0.69$). The 3-year local control (88.1%) was comparable to that following lobectomy. Another study [17] reported mainly grade 1–2 toxicities (83%), consisting of fatigue, musculoskeletal discomfort and radiation pneumonitis. Most cases resolved within 3–4 months of SABR. The authors concluded that patients with perihilar/central tumours had an 11-fold increased risk of experiencing severe toxicity compared with more peripheral locations. Tumours close to the left hemidiaphragm may also be very dangerous to treat with SABR due to their proximity to the stomach.

CLINICAL BOTTOM LINE

SABR is associated with higher 5-year survival rates compared with RFA and conventional radical radiotherapy (40–47% vs. 20.1–27 vs. 19%) [18] and local control rates up to 80–90% [19] are two to three times greater than conventional fractionated radiotherapy. This modality has a favourable toxicity profile in peripheral tumours measuring ≤5 cm. RFA can be performed in one session, whereas SABR is more effective if larger doses of radiation are split over two to three fractions. RFA is more difficult in central tumours but is being increasingly performed with increased operator experience and confidence. Both treatment modalities are associated with side-effects, and risk factors should be used to stratify patients. Overlapping ablations in the same sitting also improve the outcomes for larger tumours. In certain circumstances, a combined approach may be beneficial.

Conflict of interest: none declared.

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