Locally advanced non surgical NSCL a multidisciplinary approach









LA-NSCLC clinical stage cT2N2, multiple stations, IIIA



Bruni A, et al. PLoS ONE 2019;14(11): e0224027

Italian survey

- 32% radical cCRT
- 27% neoadjuvant CT
- 23% surgery after CT or cCRT





How much can we improve survival of patients with LA-NSCLC?

HR **0.88**

Radiotherapy alone vs Chemoradiation¹



Odds ratio

Contraction of the local distribution of the

Figure 2. Odds ratio (OR) at 2 years (combined treatment: radiotherapy alone) — | — = Trial results and 95% confidence intervals. Solid vertical line represents OR of unity.

Marino et al. Randomized trials of radiotherapy alone versus combined chemotherapy and radiotherapy in stages IIIa and IIIb nonsmall cell lung cancer. A meta-analysis. Cancer 1995;76(4):593-601

¹ De Ruysscher & van Loon. Clin Oncol. 2016 Nov;28(11):708-711



Concomitant versus sequential radiotherapy and chemo.



- Metanalysis of 6 trials (n=1205) showed significant OS benefit of concomitant chemoradiotherapy (HR 0.84)
- Concomitant radiochemotherapy increase acute and late toxicities (esophagitis and pneumonitis)
- Only 40% of LA-NSCLC patients are candidates for this approach



Aupérin et al. Journal of Clinical Oncology 2010;28(13):2181-2190 | Non-small Cell Lung Cancer Collaborative Group. BMJ 1995;311:899–909.



Chemoradiation is the standard of care

RTOG0617 trial

- 60-Gy radiation dose (2-Gy daily over 6 weeks) with concurrent chemotherapy should remain the standard of care
- Cetuximab had no effect on OS, but increased toxicity (grade ≥3 in 85.4% vs 72.4%)
- The 2-year OS rates in the control arm are similar to the PACIFIC trial

Trial	2-year OS rate, % (95%Cl)	2-year PFS rate, % (95%Cl)
RTOG0617	59.6% (52.6-66%)	30.7% (24.6-37.1%)
PACIFIC	66.3% (61.7-70.4%)	49.5% (44.6-54.2%)





Bradley et al. J Clin Oncol 2019; https://doi.org/10.1200/JCO.19.01162



Safety issues regarding Thoracic Radiotherapy



Lung cancer: Side effects of radiotherapy. https://www.cancerresearchuk.org/about-cancer/treatment/radiotherapy/side-effects. Accessed May 27, 2020 | Ming X, et al. Medicine. 2016;96:41(e5051) | Aoki M, et al. Radiat Oncol. 2015;10:99 | Zhao J, et al. Oncotarget. 2017;8:97623-32 | Giridhar P, et al. Asian Pac J Cancer Prev. 2015;16:2613–17 | McDonald S, et al. Int J Radiat Oncol Biol Phys. 1995;31:1187-1203 | Merrill WM, et al. Radiation-induced Lung injury. UpToDate. 2017. www.uptodate.com/contents/radiation-induced-ung-injury. Accessed June 21, 2017. 8. Caffo O. Lung Cancer. 2001;81:590.



Chemoradiotherapy in frail patients

Radiotherapy alone



- 5-year OS 5-20% (all cases)^{1,2}
- ORR 45%, OS 17 months (>70y)³
- Grade 3-4 toxicity: Neutropenia 0%, infection 4%, pneumonitis 3%³

Sequential chemoradiation



- ORR 65%, OS 10 months, 5-year OS 9% (>70 y)⁴
- Grade 3-4 toxicity: hematological 22%, esophageal 7%, and pulmonary 4%⁴

Concurrent chemoradiation



- ORR 51.5%, OS 22 months (low dose daily carboplatin, >70y)³
- Grade 3-4 toxicity: Neutropenia 57.3%, infection 12.5%, pneumonitis 1%³

Overall conclusions:

- Age and comorbidities have impact in OS and may increase the rate of treatment-related adverse events
- OS benefit for different approaches is probably smaller than obtained in younger and fitter patients

¹ De Ruysscher & van Loon. Clin Oncol. 2016 Nov;28(11):708-711 | ² Shuyan et al. Transl Lung Cancer Res. 2020; 9(5):2082–2096 | ³ Atagi et al (JCOG0301) Lancet Oncol 2012;13:671-678 | ⁴ Jeremic et al. Int J Radiat Oncol Biol Phys. 1999 May 1;44(2):343-8



How much can we improve survival of patients with LA-NSCLC?

HR $0.88 \times 0.84 = 0.74$

Radiotherapy alone vs Chemoradiation¹ Sequential vs Concurrent Chemoradiation² **±7%** 5-year OS gain



¹ De Ruysscher & van Loon. Clin Oncol. 2016 Nov;28(11):708-711 | ² Aupérin et al. Journal of Clinical Oncology 2010;28(13):2181-2190



Which are the best concurrent chemo(radiation) regimens?

Cis+Etoposide slightly better than Carbo+Paclitaxel¹



3-year OS rate 41% (EP) vs 26% (PC); P=0.024

- Increased grade 2 radiation pneumonitis in the PC arm (33.3% versus 18.9%, P=0.036)
- Increased grade 3 esophagitis in the EP arm (20.0% versus 6.3%, P=0.009)

Cis+Etoposide and Carbo+Paclitaxel are equal²



EP was associated with increased morbidity:

 more hospitalizations (2.4 vs 1.7), infectious complications (47.3% vs 39.4%), acute kidney disease/dehydration (30.5% vs 21.2%) and mucositis/esophagitis (18.6% vs 14.4%)

¹Liang et al. Ann Oncol. 2017; 28(4):777-783 (RCT) | ²Santana-Davila et al. J Clin Oncol. 2015; 33(6):567-74 (retrospective study)



Concurrent chemo(radiation) regimens



Nonsquamous NSCLC			
Regimen	Outcome	Toxicity	Notes
Carboplatin AUC 5 + Pemetrexed 500 mg/m ² every 21 days for 4 cycles ⁽¹⁾	ORR 77% PFS 12.6 months OS 21.2 months	Grade ≥3 neutropenia 8% Grade ≥3 esophagitis 16% Grade ≥3 pneumonitis 12%	RT 70 Gy Included squamous hitology
Cisplatin 75 mg/m ² + Pemetrexed 500 mg/m ² every 21 days for 3 cycles + concurrent thoracic RT \rightarrow Pemetrexed consolidation for 4 cycles (PROCLAIM, 2)	ORR 36% PFS 11.4 months OS 26.8 months	Grade ≥3 neutropenia 24% Grade ≥3 esophagitis 16% Grade ≥3 pneumonitis 2%	RT 60 to 66 Gy Similar efficacy, with less hematological toxicity than Cis/Etop
Nonsquamous or Squamous NSCLC			
Carboplatin AUC 2 + Paclitaxel 45–50 mg/m ² weekly with concurrent thoracic RT \pm additional 2 cycles every 21 days of Carboplatin AUC 6 + Paclitaxel 200 mg/m ^{2 (3)}	ORR not reported PFS 11.8 months OS 28.7 months	Grade ≥3 neutropenia 24% Grade ≥3 esophagitis 7% Grade ≥3 pneumonitis 6% Grade 1-2 neuropathy 30%	Comparing groups received either 60 Gy or 74 Gy ± cetuximab
Cisplatin 50 mg/m ² on days 1, 8, 29, and 36; Etoposide 50 mg/m ² days 1–5 and 29–33	ORR not reported PFS not reported OS 15 months	Grade 4 neutropenia 32% Grade ≥3 Anemia 28% Grade ≥3 Esophagitis 20%	

¹Govindan et al. J Clin Oncol 2011;29:3120-3125 | ² Senan et al. (PROCLAIM trial) J Clin Oncol 2016;34:953-962 | ³ Bradley et al. Lancet Oncol 2015;16:187-199 | ⁴ Albain et al. (SWOG 9019). J Clin Oncol 2002;20:3454-3460



Consolidation or Maintenance Chemotherapy has failed

Trial (reference)	Design/treatment arm	Median OS, mo	HR (95% CI)	P value
CALGB 39801 [13]	cCRT vs.	12	N/R	0.3
	Induction Chemo→cCRT	14		
LUN 01-24 [14]	cCRT vs.	23.2	N/R	0.883
	cCRT→docetaxel	21.2		
SWOG S0023 [15]	cCRT→docetaxel→placebo vs.	35	0.63	0.013
	cCRT→docetaxel→gefitinib	23	(0.44-0.91)	
KCSG-LU05-04 [16]	cCRT vs.	20.6	0.91	0.44
	cCRT→docetaxel + cisplatin	21.8	(0.73 - 1.12)	
RTOG 0617 [17]	cCRT→Chemo vs.	24	1.07	0.29
	cCRT + cetuximab→Chemo + cetuximab	25	(0.84–1.35)	
START [18]	Sequential or cCRT→placebo	22.3	0.88	0.123
	Sequential or cCRT→tecemotide	25.6	(0.75 - 1.03)	
CALGB 30605 [19]	Chemo→RT + erlotinib	17	N/A	N/A -

cCRT, concurrent chemo radiation; *Chemo*, chemotherapy; *N/A*, not applicable; *N/R*, not reported; *NSCLC*, non-small cell lung cancer; *RT*, radiation therapy



Puri et al. Current Oncology Reports (2020) 22:31



Clues for the success of immunotherapy in lung cancer



Alexandrov LB, et al. Nature 2013;500:415-421

SPP



Hurdles for immunotherapy in lung cancer





Debilitating conditions, frequently needing of high dose of corticosteroids (example, SVCS, atelectasis)







Lazzari et al. Ther Adv Med Oncol. 2018; 10: 1758835918762094



Synergistic drug administration







Synergistic drug administration





PACIFIC trial: Durvalumab after Chemoradiotherapy in Stage III NSCLC



Antonia et al. N Engl J Med. 2017;377(20):1919–1929 | Antonia et al. N Engl J Med. 2018;379:2342–2350 | Gray et al. J Thorac Oncol 2020;15:288–293 | Faivre-Finn et al. Annals of Oncology (2020) 31 (suppl_4): \$1142-\$1215. 10.1016/annonc/annonc325

SPP



How much can we improve survival of patients with LA-NSCLC?

HR $0.88 \times 0.84 \times 0.68 = 0.50$

Radiotherapy alone vs Chemoradiation¹ Sequential vs Concurrent Chemoradiation² Concurrent Chemoradiation with/without consolidation Immunotherapy³

¹ De Ruysscher & van Loon. Clin Oncol. 2016 Nov;28(11):708-711 | ² Aupérin et al. Journal of Clinical Oncology 2010;28(13):2181-2190 | ³ Faivre-Finn et al. Annals of Oncology (2020) 31 (suppl_4): S1142-S1215. 10.1016/annonc/annonc325





Concurrent chemoradiation followed by durvalumab consolidation therapy

Male 67 years-old COPD (FEV1 37.4%) OSAS Chronic respiratory failure with hypercapnia (NIV + O2) HIV+

Squamous cell carcinoma, cT2bN1 (suspected N2 in EBUS-TBNA), PD-L1 ≥50%





PACIFIC trial



Median PFS (mo)

(95% CI)

10.7 (7.3-NR)

5.6 (3.7-10.6)

The sector of the

Durvalumab. <1%

HR (95% CI): 0.73 (0.48-1.11)

Placebo, <1%

D PD-L1 TC <1%

1.0

0.9

0.8

Antonia et al. N Engl J Med. 2017;377(20):1919–1929 | Paz-Ares et al. Ann Oncol. 2020 Jun;31(6):798-806



REFRACT: one retrospective clinical study investigating the treatment patterns in EGFR-mutant LA-NSCLC





		Median OS (months)	95% CI		Median PFS (months)	95% CI	
_	CRT	51.0	36.4–60.7	CRT	12.4	11.4–15.5	
	RT+TKI	67.4	50.1–NR	RT+TKI	26.2	19.8–36.4	
	ткі	49.3	39.3–NR	ткі	16.2	14.1–19.5	_

Nan Bi et al. Presented at WCLC Annual Meeting 2020; 29th January 2021; Virtual Meeting



Pembrolizumab and Nivolumab as <u>consolidation</u> <u>therapy</u> in LA-NSCLC: results from phase 2 trials

LUN 14-179: Consolidation treatment with Pembrolizumab after cCRT



BTCRC-LUN16-081: Consolidation treatment with Nivo- or Nivo-/Ipilimumab after cCRT



Interim analysis of first 50 patients PACIFIC consolidation **Nivolumab** Nivolumab plus 17 m Median PFS, months 19 m Grade 3-4 AE, n (%) ipilimumab (n = 25) (n = 25)12-mo PFS rate 61% 56% TRAE leading to 2 (8%) 7 (28%) Median OS, months 47.5 m 36 m discontinuation 83% 12-mo OS rate 81% Pneumonitis 1 (4%) 4 (16%) Grade ≥3 pneumonitis 7% 3.4% SPP

Durm G et al. Cancer. 2020;10.1002/cncr.33083 [E-pub ahead of print] | Yan M et al. Presented at ASCO 2020. Abstract 9010. 2. Clinicaltrials.gov. NCT03285321. Accessed June 6, 2020



Pembrolizumab and Nivolumab as <u>concurrently with</u> <u>chemoradiation therapy</u> in LA-NSCLC: results from phase 2 trials

KN-799: Concurrent treatment with Pembrolizumab with CRT, followed by consolidation



NICOLAS: Nivolumab Plus Chemotherapy and Radiotherapy



Reck et al. Presented at WCLC Annual Meeting 2020; 29th January 2021; Virtual Meeting | Peters S et al. Poster presented at ESMO 2019. Abstract 2782



Treatment of LA-NSCLC during Covid-19 pandemic

Торіс	Recommendation
Chemoradiation	 Consider sequential chemoradiation (either systemic therapy or radiation first) Consider durvalumab after concurrent or sequential chemoradiation If using durvalumab after chemoradiation, consider 4-weekly dosing or delaying initiation of durvalumab (within 42 days)
Radiation techniques	 Use IMRT with a hypofractionated schedule (4 Gy*15 fractions; 3 Gy*20 fractions; 2.75 Gy*20 fractions) Elective nodal coverage is not needed and may increase toxicity In the absence of pathologic hilar or mediastinal staging, treat all hypermetabolic lymph nodes as if they are positive for the disease. If CT with contrast was used alone, consider treatment of all lymph nodes >1 cm in the short axis
Treating patients with COVID-19	 The focus of care should shift to supportive and anti-infectious methods so that the patient can resume optimal oncologic therapy as soon as possible Hold treatment in patients who are symptomatic from the infection and whose malignancy would most likely not progress during the delay or interruption Consider brief radiotherapy in patients who have tumor obstructions, hemoptysis, or are symptomatic from LA-NSCLC In these patients, oncologic care can be possibly resumed when symptoms have resolved and the patient tests negative

Kumar et al. J Thorac Oncol. 2020 Jul;15(7):1137-1146

SPP



Bronchoscopic treatment of inoperable NSCLC

Radiofrequency ablation

Cryotherapy

Photodynamic therapy



Kniese & Musani. European Respiratory Review 2020 29: 200035 | Steinfort & Herth. Respirology 2020;25(9):944-952 | Guibert et al. J Thorac Disease 2016;8(11) | Marchioni et al. (EVERMORE). Lung Cancer 2020;148:40-47



Bronchoscopic treatment of inoperable NSCLC

Laser/ electrocautery/ argon plasma coagulation

Airway senting

Brachytherapy



Kniese & Musani. European Respiratory Review 2020 29: 200035 | Steinfort & Herth. Respirology 2020;25(9):944-952 | Guibert et al. J Thorac Disease 2016;8(11) | Marchioni et al. (EVERMORE). Lung Cancer 2020;148:40-47





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Conclusions and future perspectives

Key messages

- Concurrent chemoradiation followed by consolidation therapy with durvalumab is the standard of care therapy for unresectable disease
- 60-Gy radiation dose, with a protocol of 2-Gy daily over 6 weeks, is recommended
- Insufficient evidence (at least regarding efficacy) to prefer any particular chemotherapy regimen

Future perspectives

- A new trimodality therapy in unresectable tumors concurrent chemo + immuno + radiation therapy, followed by consolidative immunotherapy
- Exploring the role of targeted-therapies
 - Preclinical studies have suggested that gefitinib may have a radiosensitizing effect, but lacks efficacy data -
 - LAURA trial (Osimertinib maintenance after definitive chemoratiation in unresectable stage III EGFR+ NSCLC)



