

# Ask EuroSafe Imaging Tips & Tricks

## What Patients Should Know CT Working Group

### Risk of radiation induced cancer and exposure to low dose computed tomography for lung cancer screening

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## What is known

- Lung cancer has become the leading cause of cancer death among both men and women in Europe. [1]
- There were an estimated 470,00 new lung cancer cases in Europe in 2018 <sup>[2]</sup>, of which less than 15% are expected to be still alive after five years if diagnosed at a symptomatic stage.
- Three recent European studies (NELSON, MILD and LUSI) have confirmed that screening of high-risk individuals with low dose computed tomography reduces lung cancer mortality by 26 to 39% overall.
- Excess cancer risks related to ionizing radiation from low dose computed tomography are a concern in lung cancer screening.

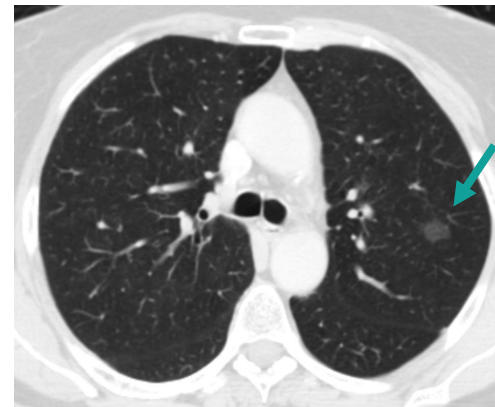


## Screening with Low dose Chest CT

CT Lung Screening has the aim to identify lung cancer in an asymptomatic high risk population

The main advantages of low dose CT are:

- High resolution: early detection of small size tumours
- High detection rate: clear superiority over Chest radiography
- Very small dose: almost 10 times less than a standard Chest CT



## Risk–benefit analysis

- The critical decision for a smoker whether to consent to a screening or not should be supported by a risk-benefit analysis.
- Risk-benefit-analysis of low-dose CT screening is influenced by the risk profile and age of the smoker, by the design of the screening program and by the CT technology used (with particular regard to scanning parameters).
- An Italian Study has evaluated the cumulative radiation exposure and lifetime attributable risk of radiation induced cancer associated with low dose CT from a 10 years lung cancer screening program (COSMOS).



## COSMOS Study

5203 asymptomatic smokers at high risk for lung cancer (3439 men + 1764 women) participated



Age > 50 y



> 20 PY\* and current smoker or  
quit within 10 years



no history of lung cancer

\*PY Pack years = packs per days x number of years smoking

20 PY = 1 pack/day during 20 years or, 2 packs/day during 10 years

## Main Results

Median cumulative effective dose after 10 years of low dose CT screening:

	Total effective dose	Equivalent to 1 conventional CT	Equivalent exposure time to background radiation^
Men	9 mSv	Chest	3 years
Women	13 mSv	Abdomen-pelvis	5.4 years

^mSv is a unit of exposure to radiation. The background natural exposure to radiation in Italy is about 3 mSv per year. The dose in radiology uses the same unit.

10 years of CT screening is equivalent to perform:

- 1 conventional Chest CT for men
- 1 abdomen-pelvis CT for women

In both cases the total exposure is less than 10 years of background exposure to natural radiation.

# Cancer Detection and Cancer Risk



## After 10 years of Low Dose CT Screening in the COSMOS study:

- The number of lung cancers detected after 10 years for both sexes and all ages was **259**.  
That means **5%** of the screened persons.
- The number of estimated radiation induced lung cancers was less than 1.  
That means **0.02%** of the screened persons.
- The number of estimated radiation induced major cancers\* was about 1.  
That means **0,05%** of the screened persons.

\* Cancer of stomach, colon, liver, lung, bladder, thyroid, breast, ovaries, uterus, or leukaemia.

## Technological improvements

- Since the initiation of the COSMOS trial, there have been technological improvements allowing for further reductions in CT radiation exposure, such as iterative reconstructions.
- The radiation dose resulting from the current low dose CT protocols for lung cancer screening can easily be divided by a factor of 2.



## Conclusions

- Having a low-dose chest CT scan reduces the chance of dying from lung cancer in people who are at risk of developing lung cancer with minimal risk of developing a radiation induced cancer.
- Even in low dose CT lung cancer screening, radiation exposure and radiation induced cancer risk are not zero but the benefits of screening for lung cancer outweigh the risks.
- Future technological developments can further reduce radiation exposure in CT.
- Last, but not least, if you smoke, you can cut your risk of dying from lung cancer by quitting.

## References



1. Malvezzi M, Carioli G, Bertuccio P, Boffetta P, Levi F, La Vecchia C, Negri E. European cancer mortality predictions for the year 2017, with focus on lung cancer. *Annals of Oncology*. 2017 May 1;28(5):1117-1123. doi: 10.1093/annonc/mdx033.
2. Ferlay J, Colombet M, Soerjomataram I, Dyba T, Randi G, Bettio M, Gavin A, Visser O, Bray F. Cancer incidence and mortality patterns in Europe: Estimates for 40 countries and 25 major cancers in 2018. *European Journal of Cancer*. 2018 Nov;103:356-387.
3. Rampinelli C, De Marco P, Origgi D, Maisonneuve P, Casiraghi M, Veronesi G, Spaggiari L, Bellomi M. Exposure to low dose computed tomography for lung cancer screening and risk of cancer: secondary analysis of trial data and risk-benefit analysis. *BMJ*. 2017 Feb 8;35
4. National Research Council. *Health risks from exposure to low levels of Ionizing radiation: BEIR VII—phase 2*. National Academies Press, 2006.