



Royal Netherlands Navy

Large lungs in divers risk for pulmonary barotrauma?

Robert van Hulst, MD, PhD
Surgeon captain
Diving Medical Center
Royal Netherlands Navy
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Background

The Navy had 6 cases of divers with PBT
pneumothorax/arterial gas embolism over the last 4
years (2007-2010)

All divers were yearly examined according national
and military regulations



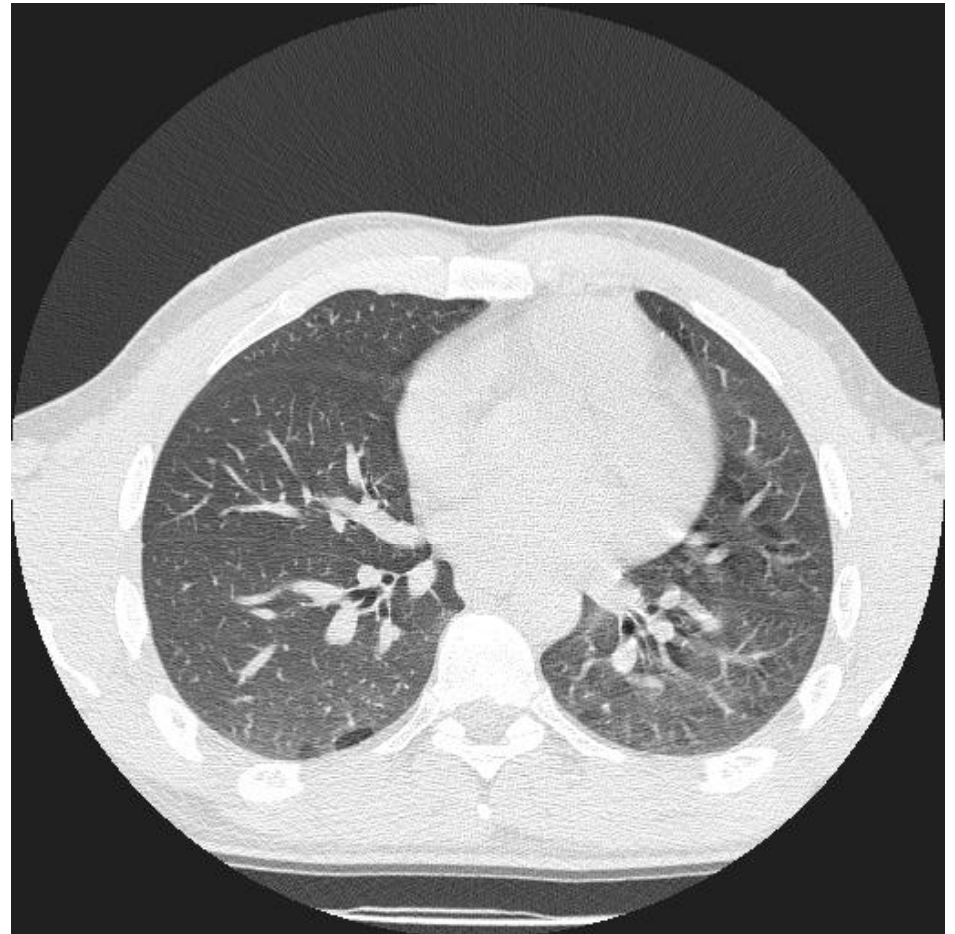
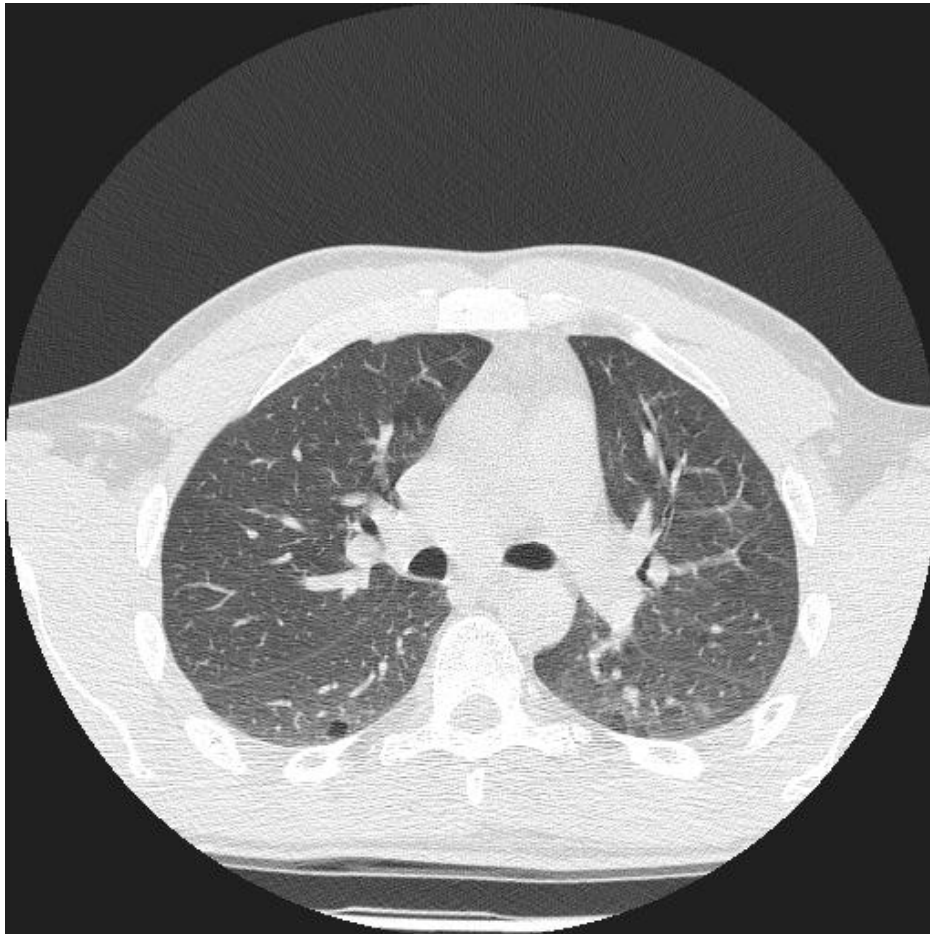


Overview 6 divers

Nr	DCI	Age	Dive	Years dive	VC (ml)	VC %ref	FEV1 (ml)	FEV1 %ref	FEV1/VC
EW	Pneu	29	SF	7	8250	131	5870	118	71
B	AGE	47	Offs	20	5820	120	4170	100	72
L	Pneu	40	Police	8	6450	121	5130	119	80
D	A+P	21	SF	2	6590	120	5300	118	80
D	AGE	32	Army	8	6960	121	5140	110	74
S	Pneu	29	Navy	2	7100	124	5280	112	74

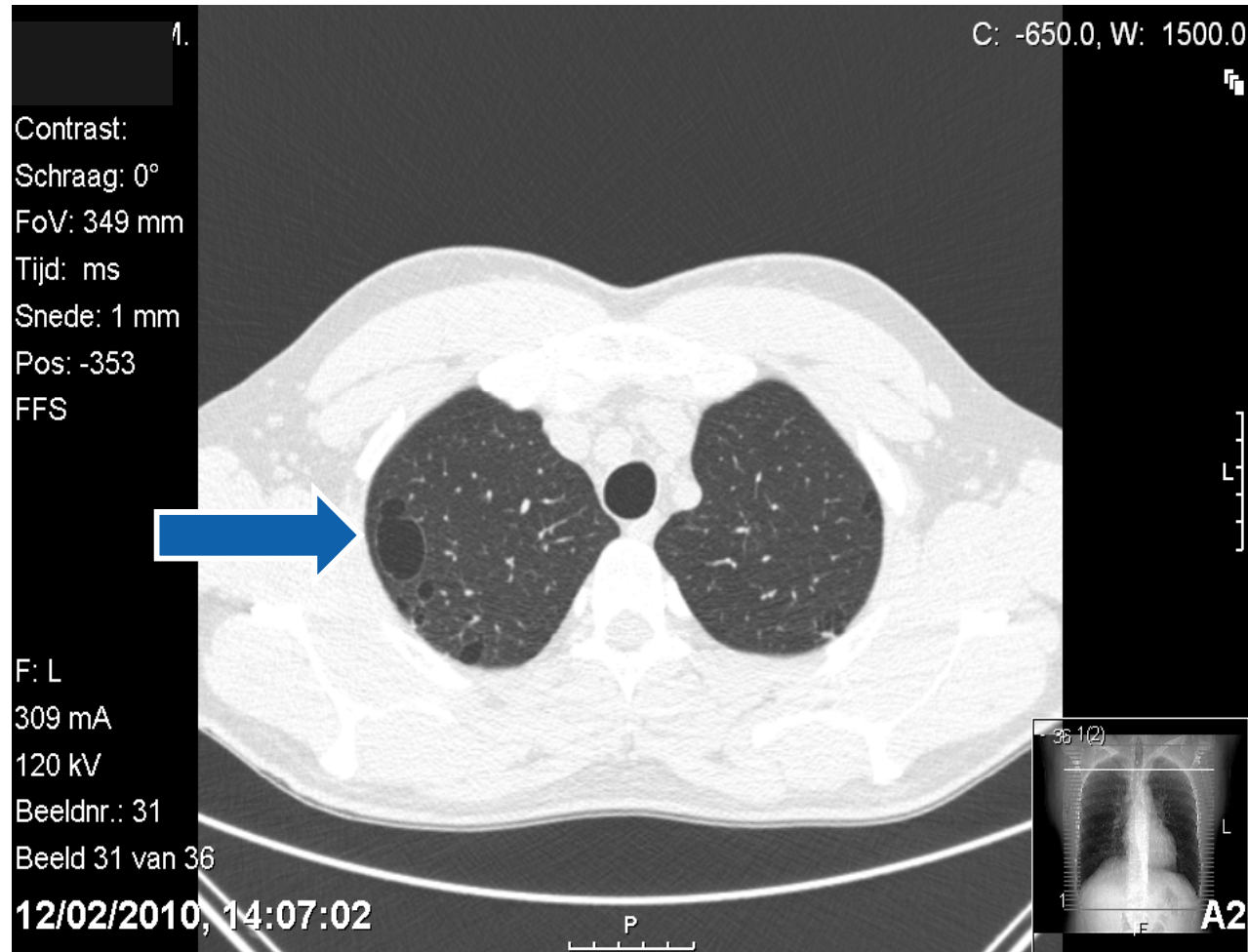


Diver 2





Diver 3





Diver 4





- Relationship “Large lungs” and risk for PBT ?
- Database Diving Medical Center/Royal Neth Navy:
77 persons (divers and submariners) applies to the
criteria of “Large Lungs”
- Subjects were called up for pulmonary function
(spirometry, bodybox) and HR-CT scan (insp/exp) of the
lungs
(approval of SG Min. of Defence)



Results 1

N = 77 divers/submariners

N = 3; substantial airtrapping, bullae or blebs
> unfit for diving or free-escape

N = 3; miscellaneous extra pulmonary findings;
hemangioma, nefrosclerosis and thymus residuals



Results 2

Population	Mean	SD
Age (yr)	36	9
Length (mt)	183	7
Weigth (kg)	88	9
Smoker	N = 25	
Pack years	1.7	2.9
Non smoker	N = 52	



Results 3

	Mean	SD
VC (ml)	7800	710
VC pred (%)	128	9
FEV1 (ml)	5400	555
FEV1 pred (%)	124	8
FEV1/VC (%)	76	5
MEF50 (L/s)	5.8	1.2
MEF50 pred (%)	105	20
RV (ml)	1930	470
TLC (ml)	8980	960



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RV (ml)	1930	470
RV pred (%)	98	21
TLC (ml)	8980	960
TLC pred (%)	118	9.5
Raw (kPa/L/sec)	0.22	0.06



Results 4 Statistics

Generalized Linear model:

Abn. HR-CT and TLC ($p=0.038$)

Abn. HR-CT and TLC%, RV% and Raw ($p=0.036$)



Discussion 1

There is no information in literature on the incidence of blebs and bullae in a healthy population

There is no consensus on the amount of airtrapping on the HR-CT scan which could be a reason for unfitness for divers because of the risk on PBT ¹

¹ Reuter et al. Scand J Work Environ Health 1999

Functional and high resolution computed tomographic studies of divers lungs



Discussion 2

Large lungs in diver?

- Natural selection or a training effect¹
- Prolonged diving experience may result in the development of hyperinflation^{1,2}
- Development of new reference values for selected populations (military, divers)

¹ Adir et al. Chest 2005. Large lungs in divers

² Skogstad et al. Occup Environ Med 2000. Lungfunction over the first 3 yrs of a professional diving career.



Discussion 3

In our Navy population 83 divers/submariners comply with the criteria of large lungs

9/83 (10.8%) had abnormal HR-CT scans of the lungs

6 divers had abnormal HR-CT scans after PBT (fit for duty, unfit for diving)



Conclusions 1

- X-ray lungs for initial examination ?
- HR-CT lungs scan new standard¹ ?
- Definition of radiological criteria fit/unfit for diving

¹ Toklu et al. Should computed chest tomography be recommended in the medical certification of professional divers? Occup Environ Med 2003



Conclusions 2

- RNLN policy divers/submariners

Initial examination: HR-CT scan for Large lungs

- HR-CT scan for Large Lungs (and FEV1/VC <70%)

- Research on new references values for military population

To be continued..



QUESTIONS?



*"Of course they're chewy —
you're supposed to take the peel off."*