Longterm Pulmonary Parenchymal Change in Preterm Infants via Quantitative CT Assessment

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Introduction

- Advances in perinatal medicine have improved preterm survival, but long-term lung development remains unclear.

- Conditions like **bronchopulmonary dysplasia (BPD)** are common in preterm infants, but prematurity itself is a risk factor for respiratory issues, even without BPD.

- To ascertain long-term **pulmonary parenchymal changes** in children born prematurely and compare these changes with a group of normal children, we analyzed clinical data and CT results of **153 preterm children with respiratory distress syndrome**, comparing them to **29 children with normal lungs.**
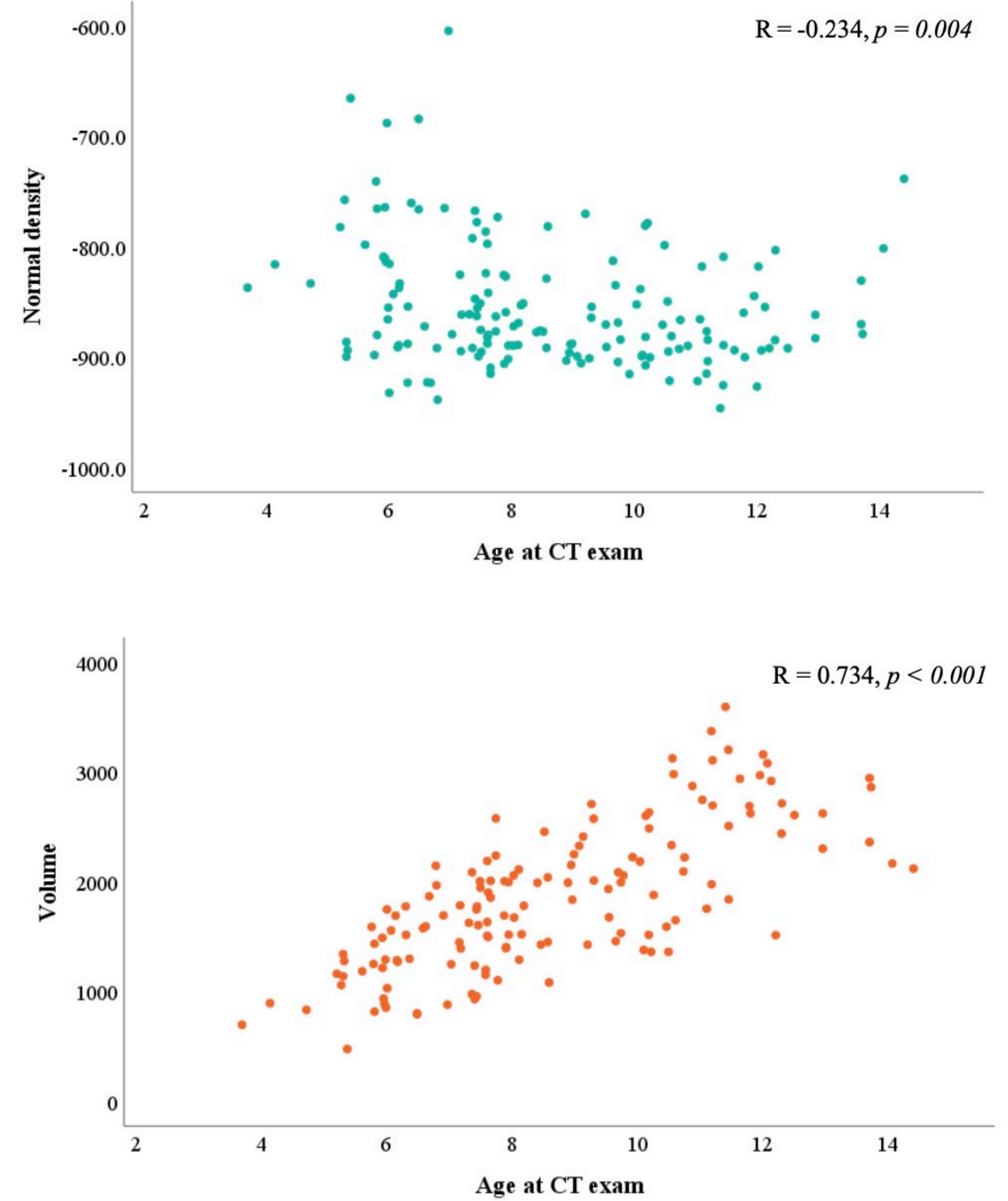
Methods

- **Prematurely born children** diagnosed with **respiratory distress syndrome (total 153)** who were treated at Severance or Gangnam Severance Hospital since 2006 were analyzed, alongside **a control group of 29 children** with normal CT lung scans.

- CT results (**lung density, volume, standard deviation(SD), full width at half maximum(FWHM)**) were analyzed using two programs, with final interpretation by a pediatric radiologist; subgroup analysis followed the new BPD classification criteria.

Results

- The mean gestational age(GA) and birth weight for the preterm group was **29+0 weeks and 1,222 grams.** The mean age at CT exam was **8.6 years**. (the control group, **8.1 years**, p=0.574).

- The study group showed a trend of **decreasing lung density** (r=-0.198 of normal density; r=-0.252 of mean lung density (MLD)) and **increasing lung volume** (r=0.650 of total lung volume (TLV)) with age, similar to normal age-related changes in pulmonary parenchyma.

- In comparing the preterm group to the control group, no differences were found in TLV(p=0.195), SD(p=0.967), and FWHM(p=0.321), but **normal density(-771.17 vs -854.86, p<0.001) and MLD(-688.96 vs -789.55, p<0.001)** showed significant differences.

- Subgroup analysis showed no differences in TLV and density between infants born before and at/after 32 weeks, but **density differences** were observed **(-771.17 vs -854.49, p<0.001 & -771.17 vs -858.31, p=0.001)**, especially in BPD case (p<0.001).

Age-related changes of lung density and volume in the study group

Perinatal/natal/characteristics of the stud2y 2group

Variables	Participants in LONGTERM cohort (n=153)
GA, weeks	29.0 ± 2.2
< 28	49 (32.0)
28-31	90 (58.8)
32-33	10 (6.5)
≥34	4 (2.6)
Birth weight, g	1,222 ± 411
< 1,000	52 (34.0)
1,000-1,499	63 (41.2)
1,500-2,499	37 (24.2)
≥ 2,500	1 (0.7)
Female	69 (45.1)
Oligohydramnios	23 (15.0)
Respiratory support	
Duration of MV, days	24.0 (26.0)
Total duration of respiratory support, days	56.5 (40.2)
BPD	77 (50.3)
Grade 1	37 (24.2)
Grade 2	26 (17.0)
Grade 3	14 (9.2)

Data are mean ± SD or number (%).

Correlation between BPD grades and CT values in the study group

Variables	Group	
	Correlation coefficient	P
Baseline characteristics		
GA	-0.436	<0.001*
Birth weight	-0.469	<0.001*
Respiratory support		
Duration of MV	0.640	<0.001*
Total duration of respiratory support	0.646	<0.001*
CT values		
Total lung volume, ml	-0.018	0.779
Normal density, HU	-0.070	0.262
Mean lung density, HU	-0.022	0.730
SD, HU	0.047	0.461
FWHM, HU	0.085	0.180

Comparison between the study group and the control group

Variables	Group		
	Cohort (n=153)	Control (n=29)	P
Baseline characteristics			
Age, years	8.6 (2.4)	8.1 (4.6)	0.574
Height, cm	130.4 (15.1)	124.7 (30.7)	0.343
Weight, kg	30.9 (11.8)	30.7 (18.5)	0.955
CT values			
Total lung volume, ml	1869.3 (643.0)	1550.4 (971.5)	0.140
Normal density, HU	-854.9 (56.2)	-771.2 (82.1)	<0.001*
Mean lung density, HU	-789.6 (50.9)	-689.0 (109.5)	<0.001*
SD, HU	153.1 (18.8)	153.2 (16.3)	0.967
FWHM, HU	120.4 (56.0)	135.0 (65.6)	0.321

Data are mean (SD).

Conclusion

- When comparing long-term lung growth between preterm infants with a history of RDS and normal infants, **no significant difference in lung volume** was observed, regardless of GA at birth or the presence of BPD. However, **notable differences in lung density were observed**.

- Further research is needed to clarify the clinical significance of these lung density changes. This could enable a more **individualized and precise approach to the treatment** of preterm lung conditions and to prognosis prediction.