# HIGH-RESOLUTION CT IN EX-PREMATURE CHILDREN

## A population based study.

## Radiological findings and reproducibility of the method.

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**ABSTRACT**

**Objectives**: To evaluate radiological findings in young people who were born extremely preterm by using a scoring system in high-resolution CT and to examine the reproducibility of this scoring system.

**Subjects and methods**: High-resolution CT of the lungs was assessed in 72 children, who were born at a gestational age ≤ 28 weeks or with a birthweight ≤ 1000 grams within a defined region in Western Norway in 1982-85 (n = 40) or in 1991-92 (n = 32). All images were analysed by two paediatric radiologists, using a scoring system that assessed a total of fourteen different features.

**Results**: Sixty-three (88%) subjects had pathological findings, the most common being «linear opacities» (n = 52), «triangular opacities» (n = 42), «airtrapping» (n = 19) and «mosaic perfusion» (n = 10). Right and left lungs were equally affected. There were fewer abnormalities in the younger age (born in 1991-92). The intra-and interobserver agreement was moderate (weighted Kappa 0.54 and 0.52, respectively). Fifty-six out of the 72 children had a clinical diagnosis of bronchopulmonary dysplasia and the median total score and the median scores of the four most common findings were higher in the BPD group, however, the differences were not statistically significant.

**Conclusion**: High-resolution CT in young people of preterm birth revealed radiological findings in 81.3 % at age 10 years and 92.5 % at age 18 years, linear, triangular, and subpleural opacities being the most common. The reproducibility of the applied scoring system was acceptable.

**INTRODUCTION**

Over the past decades, an immense development in perinatology and neonatal intensive care medicine has been paralleled by improved survival rates for premature infants (gestational age of 37 weeks or less), particularly the extreme premature (gestational age of 28 weeks or less) (1). Despite improvements in management of the acute neonatal problems, chronic respiratory morbidity has remained a challenge (2). Bronchopulmonary dysplasia (BPD) is now the most common cause of chronic lung disease in infancy (3). There is evidence that even mild pulmonary insults in childhood may be precursors of chronic obstructive pulmonary disease (COPD) in adulthood (4). Extreme premature birth and its sequel may thus be risk factors for COPD in adulthood. Extensive and continued follow-up of full cohorts of preterms is vital to our understanding of these matters.

The radiographic pulmonary findings in extreme preterms have changed (5). Traditionally radiological findings in BPD-survivors in middle childhood included fibrosis, patchy atelectasis and «emphysema». In contrary, we now observe discrete perihilar lung opacification in the neonatal period apparently normalising during childhood. However, the sensitivity of plain x-ray in diagnosing subtle lung pathology is low and the indications for high-resolution computer tomography (HRCT) in children has increased (6). Oppenheim and co-workers (7) performed pulmonary HRCT in 23 selected BPD survivors, born in the late 1980's and described radiological findings in all patients. Results from population-based, unselected cohorts of preterms have not been presented, and our knowledge on long-term effects from changes in perinatal and neonatal care, is scarce. Furthermore, systems for classification of findings on pulmonary HRCT in a population of this kind are not readily available.

The purpose of this study was to examine structural lung sequelae after extremely preterm birth by applying a novel HRCT scoring system in two populations based cohorts, one cohort

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born in the early 1980's and one in the early 1990's. We also assessed intra-and interobserver variability of the scoring system.

## MATERIALS AND METHODS

### Subjects

Two population based cohorts of children and adolescents who were born at a gestational age $\leq 28$ weeks or with birth weight $\leq 1000$ grams during the period 1982-85 (first cohort) or during 1991-92 (second cohort) within a defined region in Western Norway, were examined. Medical care was provided at the only regional neonatal intensive care unit in the region, Haukeland University Hospital, by senior medical staff that was essentially similar in the two inclusion periods. Preterms were considered enrolled when admitted to the neonatal department. Eighty-six (66%) of 130 included preterms were alive at the follow-up examination. Five eligible preterms were inaccessible. Hence, 81 (94%) survivors agreed to enter the study, 46 born in the 1980's and 35 in the 1990's. As part of an extended follow-up, HRCT imaging of the lungs was successfully performed in 74 (91%) subjects between March 2001 and March 2002. One child was medically unable to do the CT scan and six children did not show up. Two patients were examined, but the images were printed on hard copy and accidentally not stored in the PACS system. Thus, images from 40 young adults (mean age 18 years) and 32 children (mean age 10 years) were assessed. Their mean gestational age at birth was 27,2 weeks (SD 1.5) and mean birth weight was 991 grams (SD 191g.)

Fifty-six of the 72 (77.7%) children were given the clinical diagnosis of bronchopulmonary disease (BPD) in the neonatal period. Neonatal data from the nine subjects who were not assessed did not differ significantly compared to those assessed. No subjects were

examined within two weeks of a respiratory tract infection or an asthma event. The examinations were done without sedation.

The Regional Ethics Committee approved the study and informed written consent was obtained from all participating subjects and their caretaker(s).


**HRCT imaging and analysis**

High-resolution computed tomography imaging of the lungs was performed by using a General Electric Hi Speed Advantage Single-slice helical- CT scanner with 1.25 mm slice thickness; 0.5 second scan time, 120 kV, 50-100 mA, lung algorithm and 512-512 matrix. About 10-12 scans in inspiration at 10 mm intervals were followed by 4-5 scans in expiration at 20-mm intervals. Total radiation exposure per examination was not measured directly but dose equivalent was estimated to 0.5–1. 0 mSv.

All images were displayed at a window width of +1540 and window level of -400 Hounsfield units at a PACS workstation. Based on Bhalla' score (8) we created a scorings system including 14 parameters (Table 1). Based on prior studies of children with bronchopulmonary dysplasia (7) (9), we added the finding of «mosaic perfusion» in inspiration and «airtrapping» in expiration. In addition (7), we scored the occurrence of «linear opacities» and «triangular sub pleural opacities», and evaluated whether the bronchiole artery had a greater diameter then the accompanying bronchus (bronchus and accompanying pulmonary artery within 1mm of each other), and the width of the interlobular septi. The evaluation of disease extent was based on a geographic lung map with lung segment borders, in which all pathological findings were recorded. All parameters, except parameter (11) «number of bullae», had a defined maximum score. The theoretical maximum score for these 13 elements was 152. The occurrence of bullae was low and therefore this maximum score also was the practical maximum score. To our

knowledge no objective method of evaluating «mosaic perfusion» disturbances has been described. In the present study, we defined «mosaic perfusion» as hypoattenuated areas in the lung on inspiratory scan (10), including both hypoattenuated areas with small vessels (mosaic oligemia) and hypoattenuated areas with normal calibre vessels. The evaluation of «mosaic perfusion» was also influenced by the window-and level setting and also disturbed by motion artefacts. In cases showing inspiratory «mosaic perfusion» in one lung segment and hypo-attenuation in the same area at the expiratory scan, we scored the findings separately as «mosaic perfusion» in inspiration and «airtrapping» in expiration.

«Airtrapping» was defined as lucent/hypo attenuated areas on expiratory scans, while the term «emphysema» was defined as an area of destructed lung architecture.

The examinations were read independently by two experienced paediatric radiologists. Observer one (SMA) read the HRCT images during a three-month period in spring 2003, and re-read the images after a period of six months, while observer two (KRF) read the images once during May 2004. Neither of the observers had knowledge of previous results or clinical findings. Prior to the study, in order to standardise the scoring system, both observers analysed and discussed the findings of four different HRCT examinations (three patients with known cystic fibrosis and one ex-premature, later included in our study).

**Statistical analysis.**

Differences in the occurrence of pathological findings between females and males and between the two age groups were tested by using a non-parametric test (Mann-Whitney). Agreement within and between observers (total HRCT-score, subtotal scores for «linear opacities», «triangular opacities», «mosaic perfusion» and «airtrapping») was examined by using Bland-Altman plots and kappa (κ) statistic. Kappa values were interpreted according to Altman (11); i.e.

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κ< 0.20 = poor, κ 0.21-0.4 = fair, κ 0.41-0.60 = moderate, κ 0.61-0.80 = good, κ 0.81-1.00 = very

good. Differences according to grading were tested by using the McNemar's test of symmetry.

All reported p-values are two-tailed, and $p < 0.05$ was considered statistical significant. The

Mann Whitney U test was used to evaluate differences in score between patients with and without

BPD.


**RESULTS**

*Radiological findings.*

The radiological findings of observer 1 and observer 2 are listed in table 2. Results of observer

1's second reading are given in the text below and this is based on the fact that observer 1 has a

greater experience in interpreting HRCT images and the assumption that the second reading is

more accurate due to further experience.

Radiological findings were seen in 63 out of the 72 cases (87.5%), the two most common being

«linear opacities» in 52 children (72.2%) and triangular, subpleural opacities in 42 children

(58.3%) (Figures 1a/b) (Table 2). Other findings (in decreasing order) were «airtrapping» (26.4

%), «mosaic perfusion» (13.1%), «bronchiectasies» (9.7%), «thickening of interlobar septi»

(9.7%), «peribronchial thickening» (5.6%), «collapse/consolidation » (4.2%) and «bullae» (4.2%)

(Figures 1c/d) (Table 2). No cases of pathological «bronchus-to-bronchiole-artery diameter

ratio», «mucus plugging» or «emphysema» were found.


As illustrated in figure 2, the distribution of lung pathology did not differ between right and left

lungs. However, the lower lobes were more often affected then the upper lobes, both for «linear

opacities»and «triangular opacities», «mosaic perfusion» and «airtrapping» (Figure 3).

The mean total HRCT-score was 6.9 (95% CI = 5.3–8.6), while the mean scores for the four most common findings varied between 0.7 and 6.9 (Table 3). There were no differences in the mean total HRCT-score between girls and boys (5.5 vs. 8.8; p = 0.104). Moreover, no differences were found in mean score for «linear opacities», «triangular opacities», «mosaic perfusion» or «airtrapping» between girls and boys. Children aged 10-11 years had a lower total HRCT-score than children aged 17-19 years (5.7 vs. 7.9; p = 0.019). Similar findings were seen for «triangular opacities» (mean HRCT-score 1.1 vs. 2.3   p = 0.018) and for «airtrapping» (mean HRCT-score 0.8 vs. 1.8; p = 0.027). The 56 children who were judged to have BPD in the neonatal period had a higher mean and a higher median total score and a higher score for «linear opacities», «triangular opacities», «mosaic perfusion» and «airtrapping», however the differences were not statistically significant (Table 4).

*Reproducibility of the method.*

The intra-and the interobserver agreement for the total score and for most common radiological findings is shown in figures 4 and 5. For the total score the degree of agreement was higher for low-score cases than for high score cases.

The agreement between two different observers in diagnosing lung pathology varied, with a weighted kappa (κ) of 0.39 for «linear opacities», 0.43 for «triangular opacities», 0.47 for «mosaic perfusion» and 0.61 for «airtrapping». The intraobserver agreement for these four parameters was 0.45 for both «linear opacities», «triangular opacities» and for «mosaic perfusion» and 0.71 for «airtrapping». When categorising into normal and abnormal findings, positive agreement was found in 54 cases (75%) for «linear opacities», in 57 cases (79%) for «triangular opacities», in 67 cases (93%) for «mosaic perfusion» and in 63 cases (88%) for

«airtrapping». Discordant findings for two of the four major findings were found in eight patients. In one patient observer 1 classified the radiological findings as «mosaic perfusion» and «air trapping», while observer 2 classified the findings as «emphysema». In two cases motion artefacts disturbed the interpretation and in five cases the findings were subtle without affecting the total score. In one case agreement between the two observers was met after a second re-examination.

## DISCUSSION

### Study design

Our knowledge of HRCT findings in children who were born extremely preterm is limited, especially in later childhood. In this population based study we found lung pathology of varying degree in 63 patients (87.5%) at age 10 to 19 years, «linear» and «triangular opacities», «air trapping» and «mosaic perfusion» being the more common. Our findings are unlikely to be flawed by selection bias, although HRCT scans were missing in nine out of the 81 children originally included in our study. We assume that the six children who were physically and mentally able to undergo a CT exam, but for various reasons did not show up, are among those suffering minor lung dysfunction.

The use of a semi-quantitative scoring system for assessment of pulmonary disease has proved useful, especially in the follow-up of patients with cystic fibrosis (12). Different systems have been designed (8) (13) (14;15)and when compared, has turned out to be equally reliable and robust (7). At present HRCT is an important additional diagnostic tool in the follow-up of patients with cystic fibrosis, with a great potential to become an outcome surrogate for lung disease in CF (16). After having used the Bhalla score-system for several years, we modified the system for assessment of pulmonary findings in ex-premature, by adding an evaluation of «air

trapping» and subtle lung opacities. Kubota et al (17) reported on an ultrafast CT scoring system for assessing bronchopulmonary dysplasia, however, this system was designed for children with known BPD and did not include all pathological findings of interest in our group of children. The scoring system used in the present study did not weigh different pathological findings according to the degree of severity; thus, the findings of «linear opacities» and «emphysema» had similar impact on the total HRCT-score and as such represent a weakness of our scoring system. However, since the more common findings were those of subtle «linear and triangular opacities», «air trapping» and «mosaic perfusion», only a few cases of collapse/consolidation and no cases of «emphysema», the total HRCT-scores are likely to reflect the degree of lung affection in the present population. The clinical validity of our findings remains unclear, however, and need to be addressed in future studies. Increasing knowledge of the clinical validity will also make it possible to refine the scoring system by weighing the different HRCT findings.

We have not correlated our HRCT findings to pulmonary function tests and this is a weakness of our study.

Although children with a clinical diagnosis of BPD had overall higher CT-scores than those without this diagnosis, the differences were not statistically significant. Several possible explanations have to be considered. First, the number of children without BPD in our cohort was low, thus decreasing the statistical power of the tests applied. Second, the clinical criteria for BPD may be non-specific, resulting in overlap between the groups. Finally the radiological finding noted, may not be associated with BPD in the neonatal period, however this is not supported by others (7;9)

*Linear opacities/triangular opacities*

The differentiation between «linear opacities» and small peripheral vessels was difficult when interpreting the images. Although the examinations were performed using 1.25mm thin sections, partial-volume-effect may partly explain this problem. Moreover, the interlobar septi have a triangular base at the lung surface, which may be misdiagnosed as pathological «triangular opacities» (7). In addition, the linear and «triangular opacities» were often linked together, or were in close proximity (7). In these cases we scored them separately, with a calculated risk of overestimating the number of findings.

The findings of «linear opacities» and «triangular opacities» as the major lung pathology in these children are in accordance with earlier publications (7;9;17). Our study supports the view that these findings are part of a pulmonary damage in patients surviving bronchopulmonary dysplasia. The prevalence of «linear opacities» and «triangular opacities» in our study was 80.6% and 58.5%, respectively; however, the mean scores were low. For children with a history of BPD, the corresponding figures were 80.4% and 58.9%. In comparison, Oppenheim and co-workers found a prevalence of 95.6% and of 100%, respectively, in their study of 23 children with a history of BPD (7). We were not able to explain the marked difference in prevalence in these two studies.

*Mosaic perfusion*

The prevalence of hypo-attenuation/»mosaic perfusion» in our study was low, only 13.8%, compared to prevalence between 80% and 90% reported by others (18). Aquino et al (18) found abnormal CT findings in 24 out of 26 (7;9) patients with a clinical history of bronchopulmonary dysplasia; twenty of these had areas of decreased lung attenuation and twenty-four patients had «air trapping». Similar, Howling et al (9) found extensive bilateral areas

of reduced lung attenuation in all their patients when reviewing five adult survivors of bronchopulmonary dysplasia and compared them to ten controls. In Oppenheim's study (7) 20 out of 23 (87%) patients had areas of abnormally low attenuation. In our study, the finding of «mosaic perfusion» changes was consistent between and within observers, and supporting the hypothesis that «mosaic perfusion» may be considered a sequel of BPD. Although the differences between the BPD group and non-BPD group were not statistically significant, near significant p-value (0.07) and a mean score of 0 and 0.95, respectively, strengthen our belief that «mosaic perfusion» may represent permanent lung disease

*Air trapping*

The finding of airtrapping showed a high degree of reproducibility and was seen in 19 out of the 72 patients. 11 of these 19 had hypoattenuated areas at expiratory scans only and normal attenuation at inspiratory scans. Although the additional expiratory scans increased the radiation dose by a factor of 1.5, the total dose was low and in our opinion could be justified by the increased diagnostic yield. Others have found higher rates of «air trapping», up to 92% (18), however, their population differs from ours. Neither Oppenheim (7) nor Howling (9) included expiratory scans in their studies. All children revealing «air trapping» had additional pathological findings, and the mean total score for this group was 11.8, of which «air trapping» alone constituted 41% of the total score. The clinical value of adding expiratory scan remains unclear. Marchac et al (19) did not find any association between «air trapping» on expiratory scans and clinical severity in their study of difficult-to-threat asthma children, while others report expiratory scans to be of value in cystic fibrosis (20) (21) .

*Bronchiectasies*

The evaluation of the severity and the extent of bronchiectasies are flawed by methodological difficulties (19), as illustrated by our low agreement between and within observers for this specific finding. We found mild bronchiectasies in 9.7% of our population, which had median age of 15.7 years.

*Bronchus-to-artery diameter ratio*

Opposite to Howling et al (9), we found no cases of decreased ratio between neighbour bronchus-bronchiole artery. We examined a large group and used an ambitious scoring system, deciding not to use any calibre tools or any systematic magnification in the CT reading. These factors may explain part of the differences.

*Other findings*

The low prevalence of «bullae», «consolidation», «emphysema» and «mucus plugging» corresponds to earlier studies and there seems to be no association between lung damage as part of BPD and these pathological findings on HRCT. «Peribronchial thickening» was found in four patients and always combined with «bronchiectasies». The evaluation of «thickening of the interlobar septi» is, to our knowledge, not previously done and our high prevalence of about 10% suggests that this may be a part of the lung changes in BPD.

*Intraobserver variability.*

We found a moderate reproducibility for all CT-scores, including «linear opacities», «triangular opacities» and «mosaic perfusion» (kappa 0.45). In comparison, De Jong and co-workers (12) found kappa values of 0.67, 0.45, 0.73, respectively. Recoding the score of the findings into one

out of four different categories (Score 0-5 = 1;  6-10 = 2; 11-15 = 3; 16-20 = 4) did not improve the reproducibility rate nor the interobserver agreement. For the four more common findings, we also performed dichotomized analyses with cut-off values of 3, 4 and 5; i.e. HRCT-score lower than the cut-off value was assigned a zero-value and scores equal to or above the cut-off value were given a value of 1. These interim analyses did not improve the reproducibility rate significantly.

*Interobserver variability*

We found a good agreement between observers for the total HRCT-score, however, the degree of agreement varied substantially between different parameters. When categorising into normal and abnormal findings (present or not- present), we found concordance in 54 (75.0%) cases of «linear opacities», 57 (79.2%) cases of «triangular opacities», 67 (93.1%) cases of «mosaic perfusion» and 63 (87.5%) cases of «air trapping». These results are comparable to the results of Kubota et al (17).

**CONCLUSION**

As the population of surviving infants has become more extreme with respect to immaturity, follow up studies including not only BPD survivors but also full preterm cohorts, become more important. Lung imaging with HRCT in childhood and early adulthood will serve as baseline data in the long-term follow-up that will have to take place in these young people. We found no statistically significant correlation between the radiological findings and the clinical diagnosis of BPD in the neonatal period. A substantial number of subjects in this study had abnormal lung HRCT scans, assessed by a CT scoring system with moderate reproducibility. Most of the

pathology was discrete linear or «triangular opacities», together with «mosaic perfusion» and «air trapping». The clinical validity of these findings is unclear and need to be addressed in future studies.

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## Legends to figures

**Figure 1a.** HRCT scan illustrating a typical linear opacity in the right middle lobe, radiating from the periphery toward the hilum.

**Figure 1b.** HRCT scan showing a triangular opacity located in the left upper lobe.

**Figure 1c.** HRCT scan with an area of mosaic perfusion in inspiration; hypo-attenuation and small-calibre vessels.

**Figure 1d.** Air trapping in the right lower lobe. HRCT scan in expiratory phase.

**Figure 2**. Pathological findings on HRCT examination. Number of lung-segments affected in the right and left lung, respectively.

**Figure 3.** Regional distribution of the four most common pathological findings in 72 ex-premature children examined with HRCT at age 10-19 years.( RUL = right upper lobe , RML = right middle lobe, RLL = right lower lobe. LUL = left upper lobe , LLL = left lower lobe)

**Figure 4.** Bland-Altman plot illustrating the variance in intra-observer reproducibility in relation to the four most common findings and the total CT score (Difference in mean score between the first and second observation (vertical axis). Mean score (horizontal axis)).

**Figure 5**. Bland-Altman plot illustrating the variance in interobserver agreement for the four most common findings and the total score (Difference in mean score between the two observers (vertical axis). Mean score (horizontal axis)).
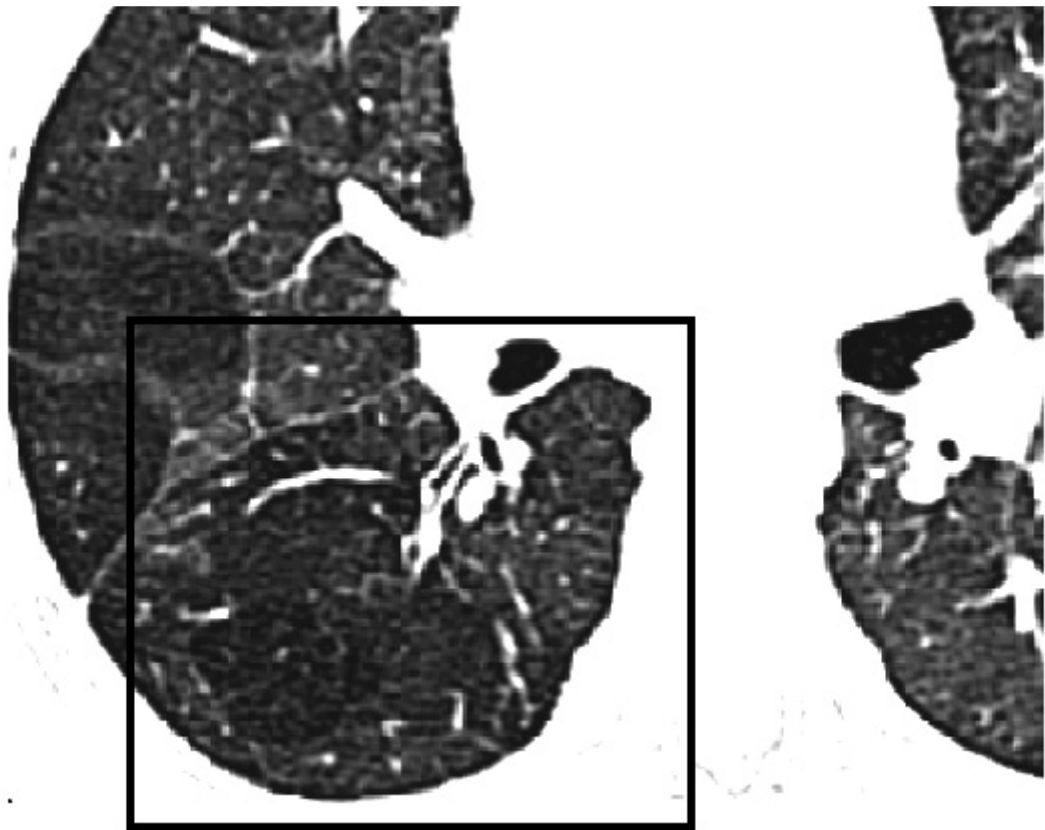
Figure 1a

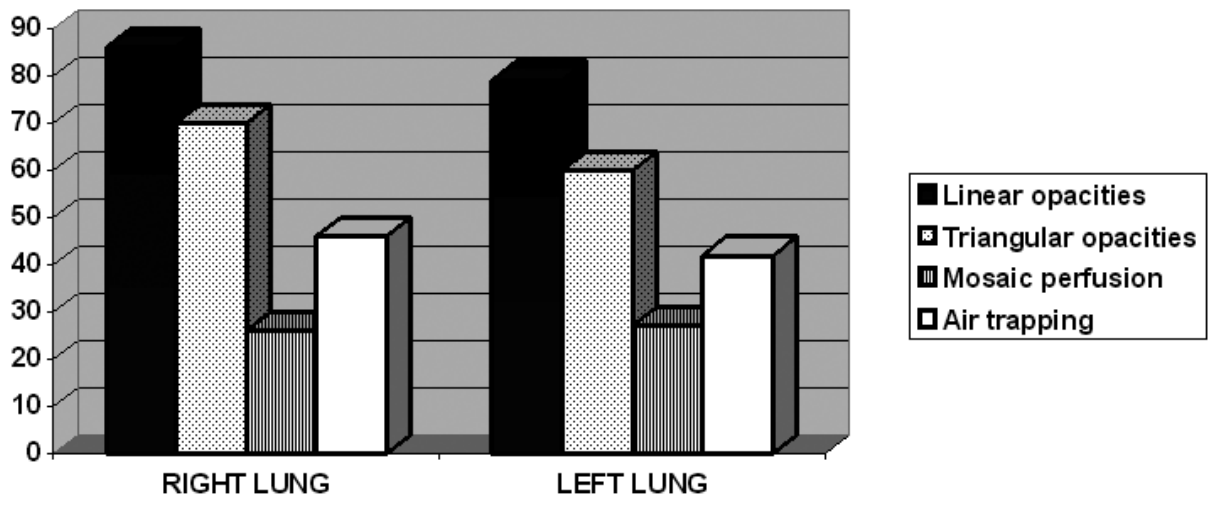Figure 1b
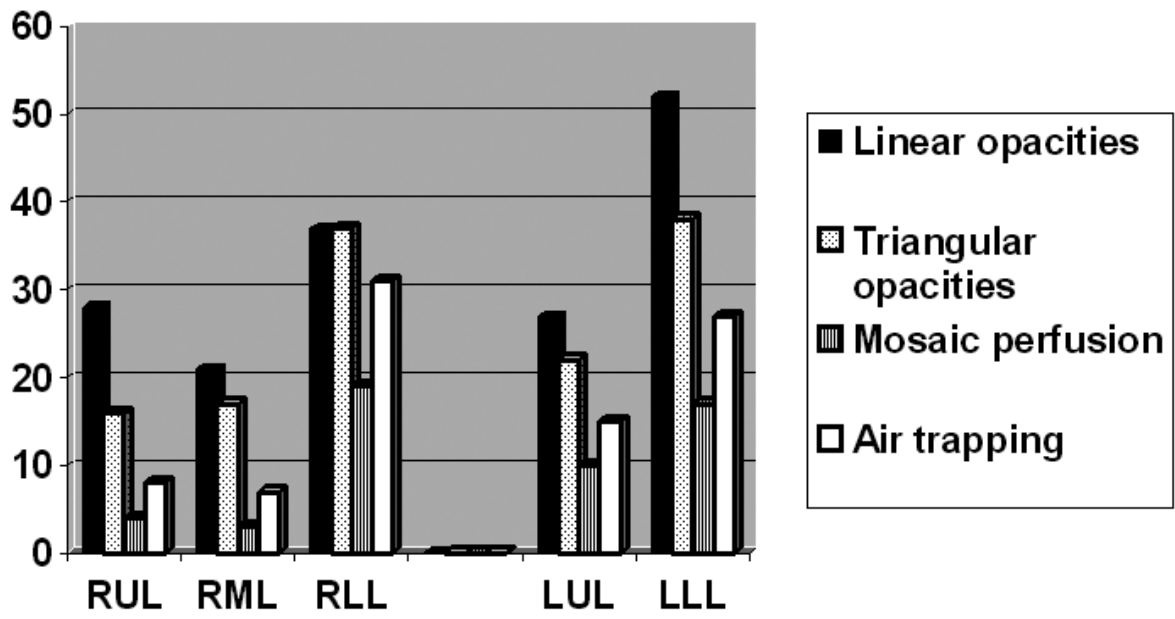
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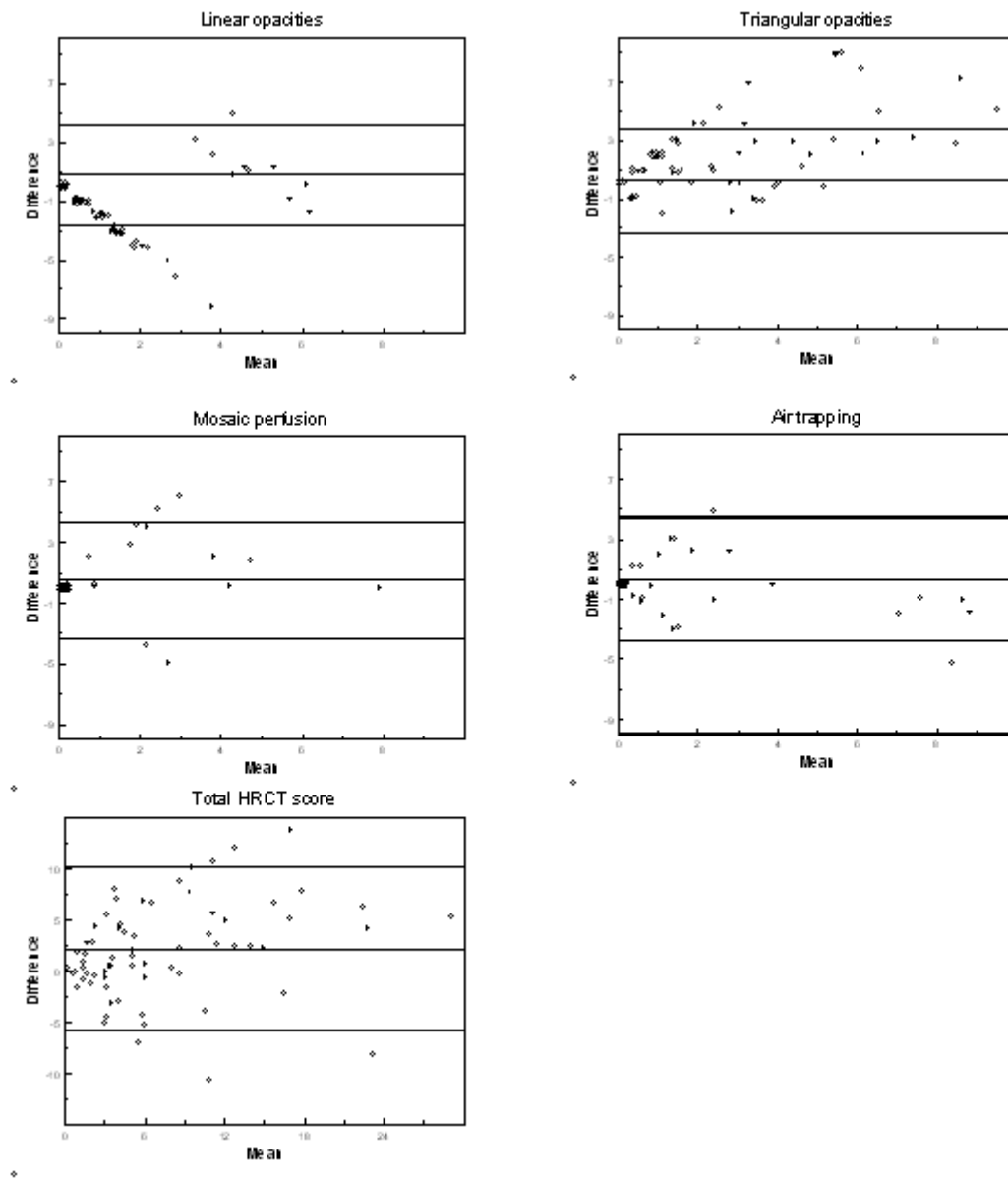
Figure 1d

Figure 2

Figure 3

Figure 4

Figure 5



Linear opacities
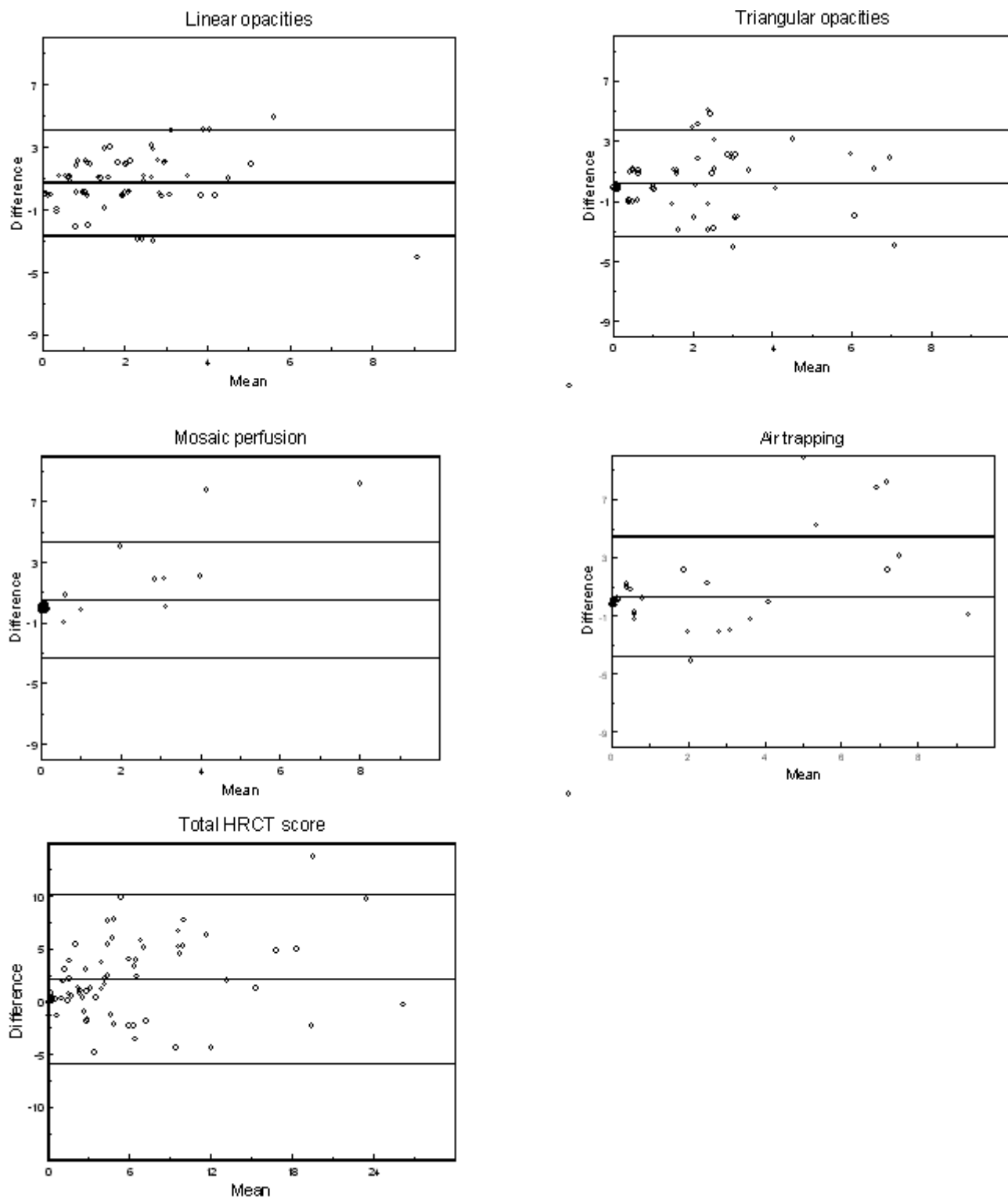
Triangular opacities

Mosaic perfusion

Air trapping

Total HRCT score

**TABLES 1**

| 1 | Well defined linear opacities, radiating from the periphery toward the hilum | 0=absent, 1=one segment…..max.20 |
|---|---|---|
| 2 | Triangular subpleural opacities, defined as small triangles with a pleural base and an internal apex | 0=absent, 1=one segment......max. 20 |
| 3 | Bronchus/bronchiole: artery diameter ratio | 0=absent, 1=one segment......max. 20 |
| 4 | Severity of mosaic perfusion in inspiration | 0=absent, 1=one segment......max. 20 |
| 5 | Severity of air trapping in expiration | 0=absent, 1=one segment......max. 20 |
| 6 | Severity of bronchiectasies | 0=absent, 1=mild (luminal diameter slightly greater than diameter of adjacent blood vessel), 2=moderate (lumen 2-3 times the diameter of the vessel), 3=severe (lumen >3 times diameter of vessel) |
| 7 | Extent of bronchiectasies (No. BP segments) | 0=absent, 1=one segment....max.20 |
| 8 | Severity of peribronchial thickening | 0=absent, 1=present, all degrees |
| 9 | Extent of mucus plugging (No. BP segments) | 0=absent, 1=one segment....max.20 |
| 10 | Generations of bronchial divisions involved (bronchiectasies/plugging) | 0=absent, 1=up to $4^{th}$ gen., 2=up to $5^{th}$ gen., 3=up to $6^{th}$ gen. and distal |
| 11 | Bullae | 0=absent, 1=one bullae, etc Number of bullae R: ........(No) L:.........(No) |
| 12 | Severity of emphysema (No. BP segments) | 0=absent, 1=one segment....max.20 |
| 13 | Collapse/consolidation | 0=absent, 1=subsegmental, 2=segmental, lobar |
| 14 | Thickening of interlobar septi | 0 =absent, 1= unilateral, 2= bilateral) |

**Table 1.** HRCT scoring system with 14 different parameters and a final total score.

**TABLES 2**

| HRCT findings | Observer 1 1.reading | Observer 1 2.reading | Observer 2 |
|---|---|---|---|
| 1. Well-defined linear opacities | 44 (61.1) | 52 (72,2) | 47 (65,3) |
| 2. Triangular subpleural opacities | 58 (80.6) | 42 (58,3%) | 39 (54,2) |
| 3. Bronchus/ artery diameter ratio | 0 (0) | 0 (0) | 0 (0) |
| 4. Severity of mosaic perfusion | 14 (19.4) | 10 (13,8) | 7 (9,7) |
| 5. Severity of air trapping in expiration | 19 (26.4) | 19 (26,4) | 20 (27,8) |
| 6. Severity of bronchiectasies | 4 (5.6) | 7 (9,7) | 1 (1,4) |
| 7. Extent of bronchiectasies | 4 (5.6) | 7 (9,7) | 1 (1,4) |
| 8. Severity of peribronchial thickening | 3 (4.2) | 4 (5,6) | 1 (1,4) |
| 9. Extent of mucus plugging | 0 (0) | 0 (0) | 0 (0) |
| 10. Generations of bronchial divisions | 4 (5.6) | 7 (9,7) | 1 (1,4) |
| 11. Bullae | 2 (2.8) | 3 (4,2) | 1 (1,4) |
| 12. Severity of emphysema | 0 (0) | 0 (0) | 1 ( 1,4) |
| 13. Collapse/consolidation | 4 (5.6) | 3 (4,2) | 7 (9,7 ) |
| 14. Thickening of interlobar septi | 16 (22.2) | 7 (9,7) | 10 (13,8) |

**Table 2.** HRCT findings in 72 ex-premature children aged 10-19 years. Number of patients (per cent in parenthesis).

**TABLES 3**

| HRCT-findings | Mean score | 95% CI | Median score |
|---|---|---|---|
| Linear opacities | 2.29 | 1,78 – 2,81 | 2.0 |
| Triangular opacities | 1.75 | 1,26 – 2,24 | 1.0 |
| Mosaic perfusion | 0.74 | 0,20 – 1,28 | 0 |
| Air trapping | 1.36 | 0,65 – 2,07 | 0 |
| Total score | 6.93 | 5,29 – 8,57 | 4.5 |

**Table 3.** HRCT findings in 72 ex-premature children aged 10-19 years. Mean HRCT-scores with 95%CI, and median scores.

**TABLES 4**

| HRCT-findings | CT score (median) | | CT-score (mean) | | Mean rank M-W | | p-value |
|---|---|---|---|---|---|---|---|
| | BPD- | BPD+ | BPD- | BPD+ | BPD- | BPD+ | |
| Linear op. | 1.5 | 2.0 | 2.00 | 2.38 | 35.2 | 36.9 | 0.77 |
| Triangular op. | 1.0 | 1.0 | 1.19 | 1.91 | 32.0 | 37.8 | 0.31 |
| Airtrapping | 0.0 | 0.0 | 0.31 | 1.66 | 32.9 | 37.5 | 0.31 |
| Mosaic perf. | 0.0 | 0.0 | 0.00 | 0.95 | 31.5 | 37.9 | 0.07 |
| Total | 3.0 | 5.0 | 4.19 | 7.71 | 29.2 | 38.6 | 0.11 |

**Table 4.** Median and mean HRCT-scores in 56 children with a history of BPD (BPD+) and in 16 children with no history of BPD (BPD-). Mean rank and p-values (Mann-Whitney U test).