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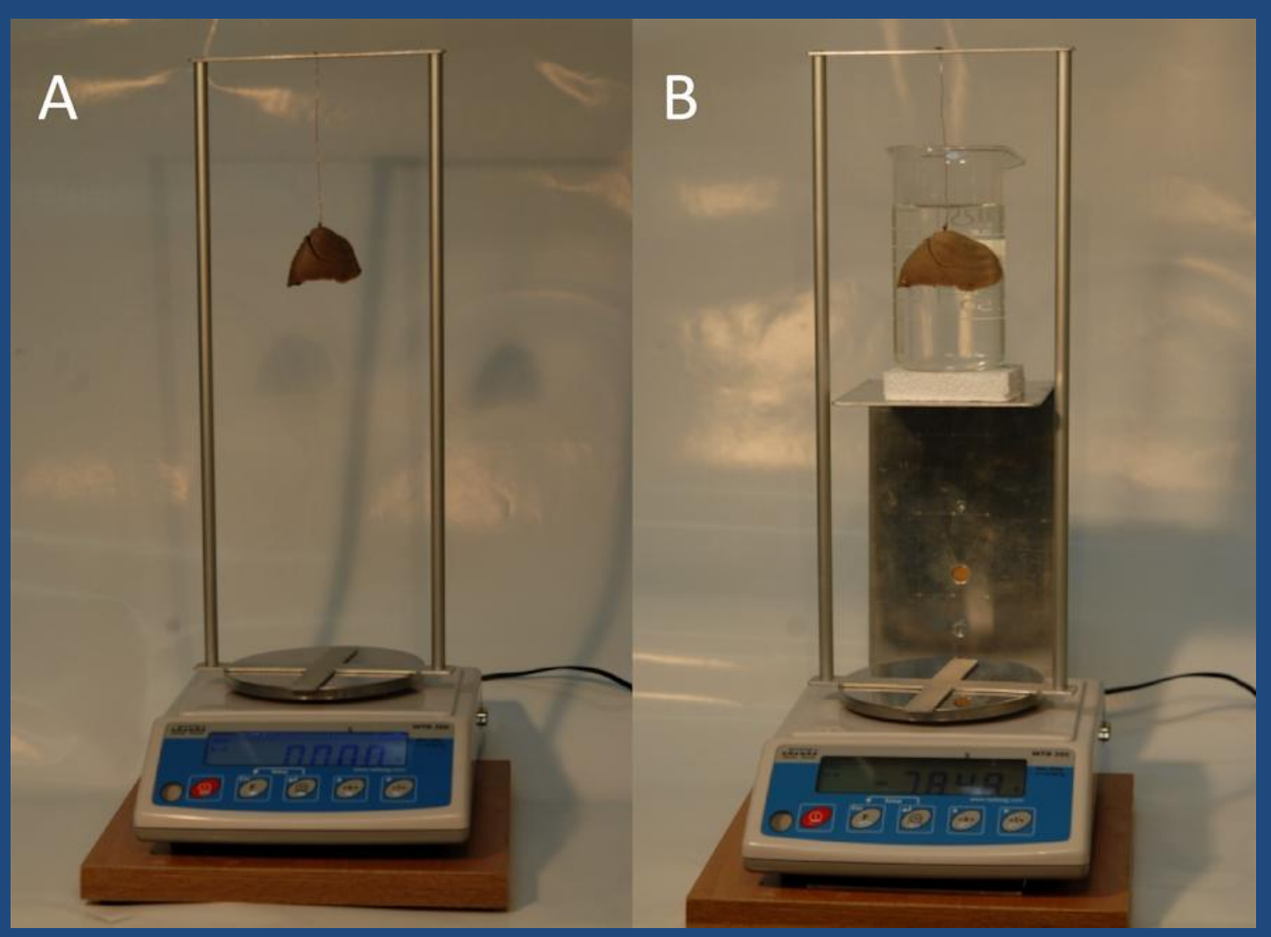
The pulmonary growth in the human fetus – an anatomical, hydrostatic and statistical study

Introduction:

The prenatal assessment of lung volume is becoming increasingly important in determining survival in both preterm infants and newborns affected by pulmonary hypoplasia. This study aimed to examine the lung volumes in fetuses at varying gestational ages.

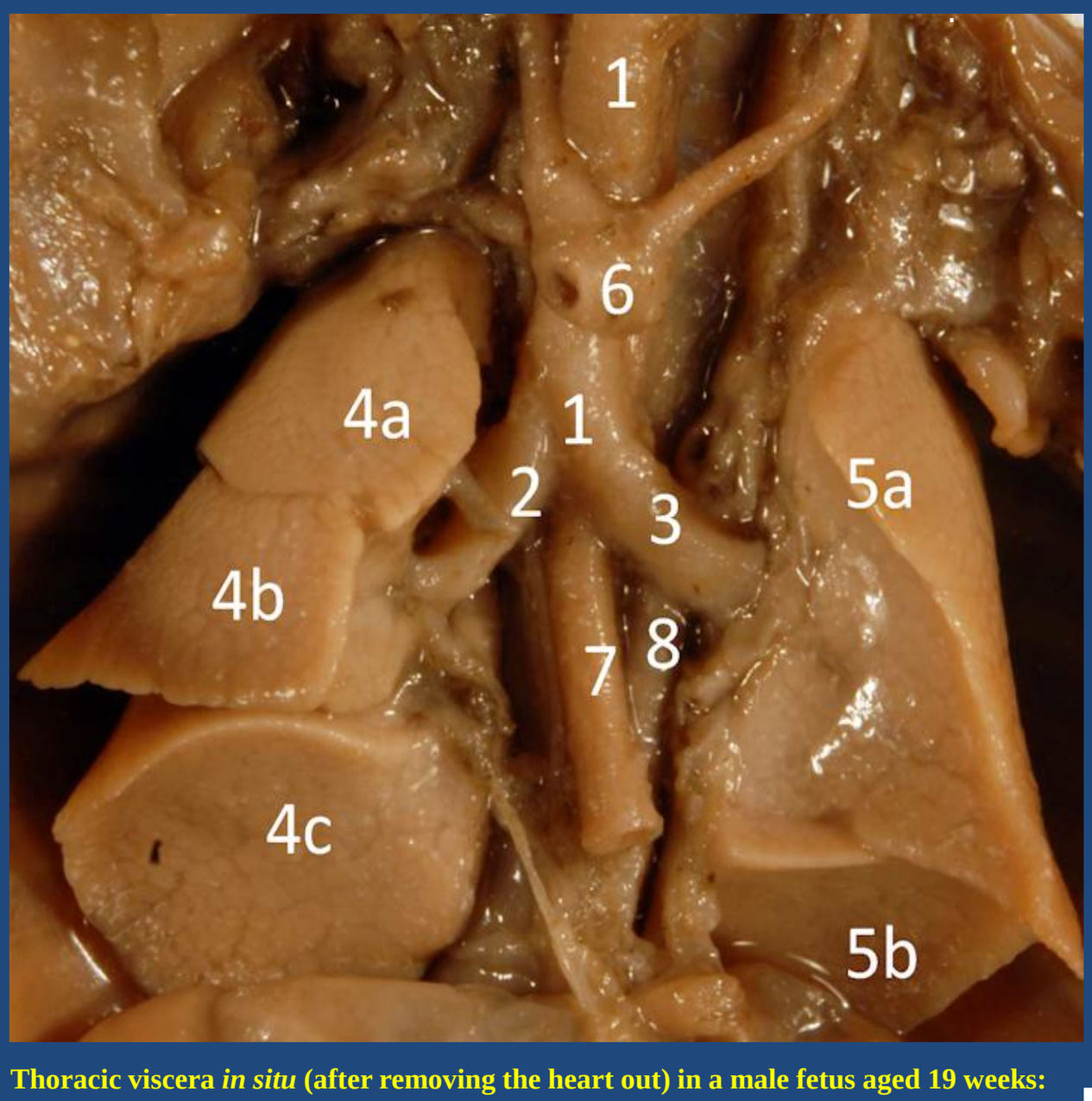
Material and Methods:

Using anatomical, hydrostatic and statistical methods (one-way ANOVA test for paired data and post-hoc Bonferroni test, Kolmogorov-Smirnov test, Levene's test, Student's t-test, regression analysis) volumes of the right and left lungs were measured in 67 human fetuses of both sexes (35 males, 32 females) aged 16–25 weeks, derived from spontaneous abortions and stillbirths.

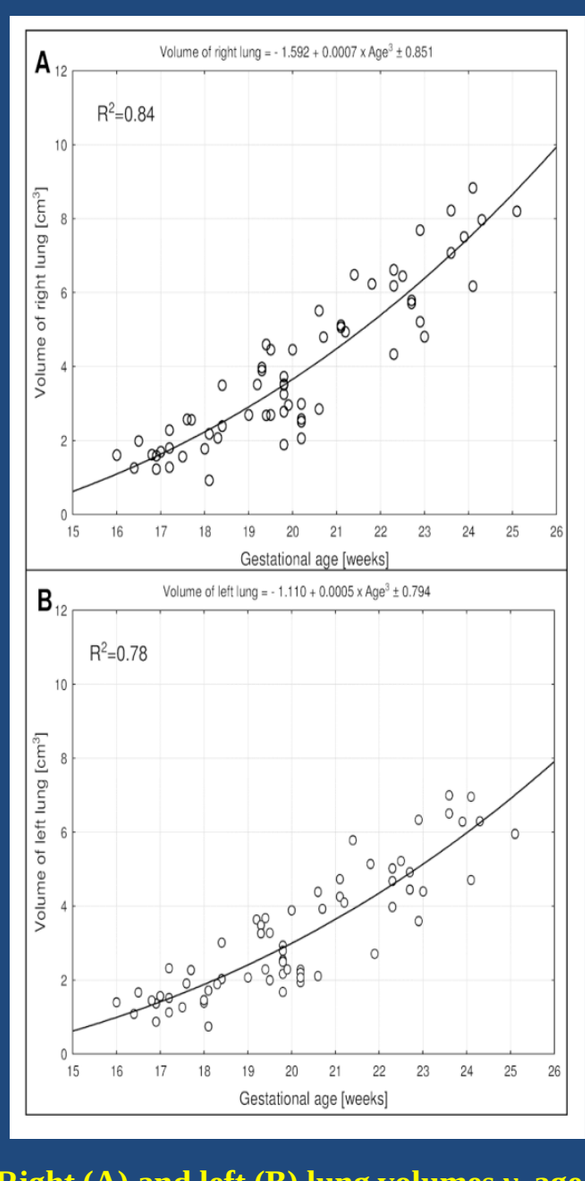


A double weighing procedure to obtain the weight of the lung in air (A) and distillate water (B)

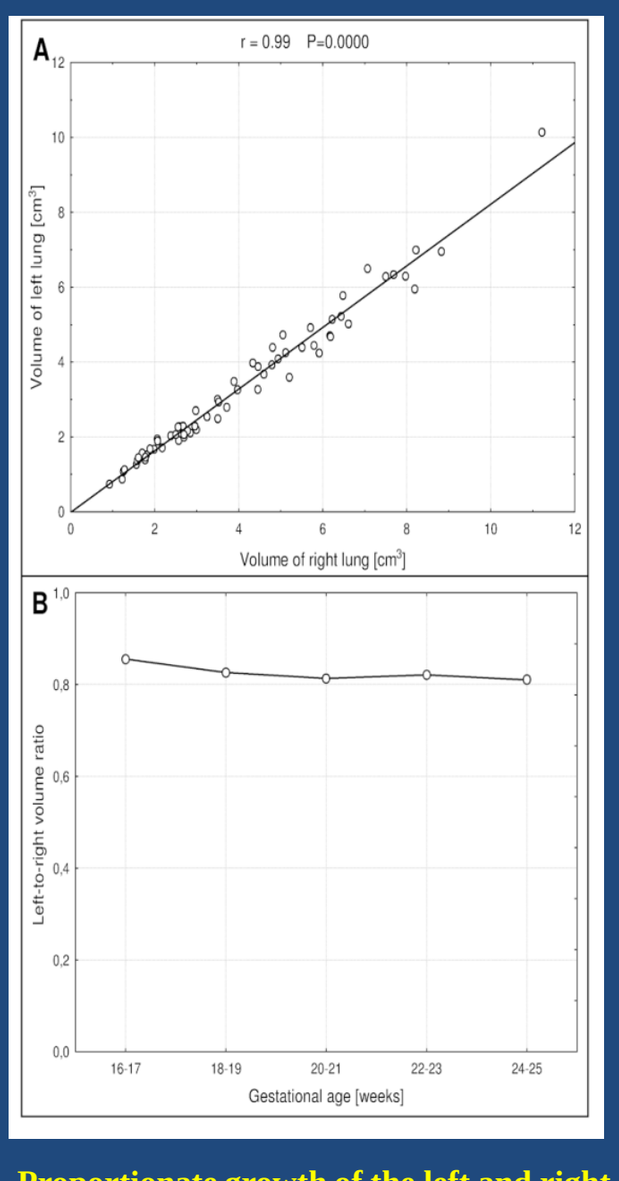
Results:



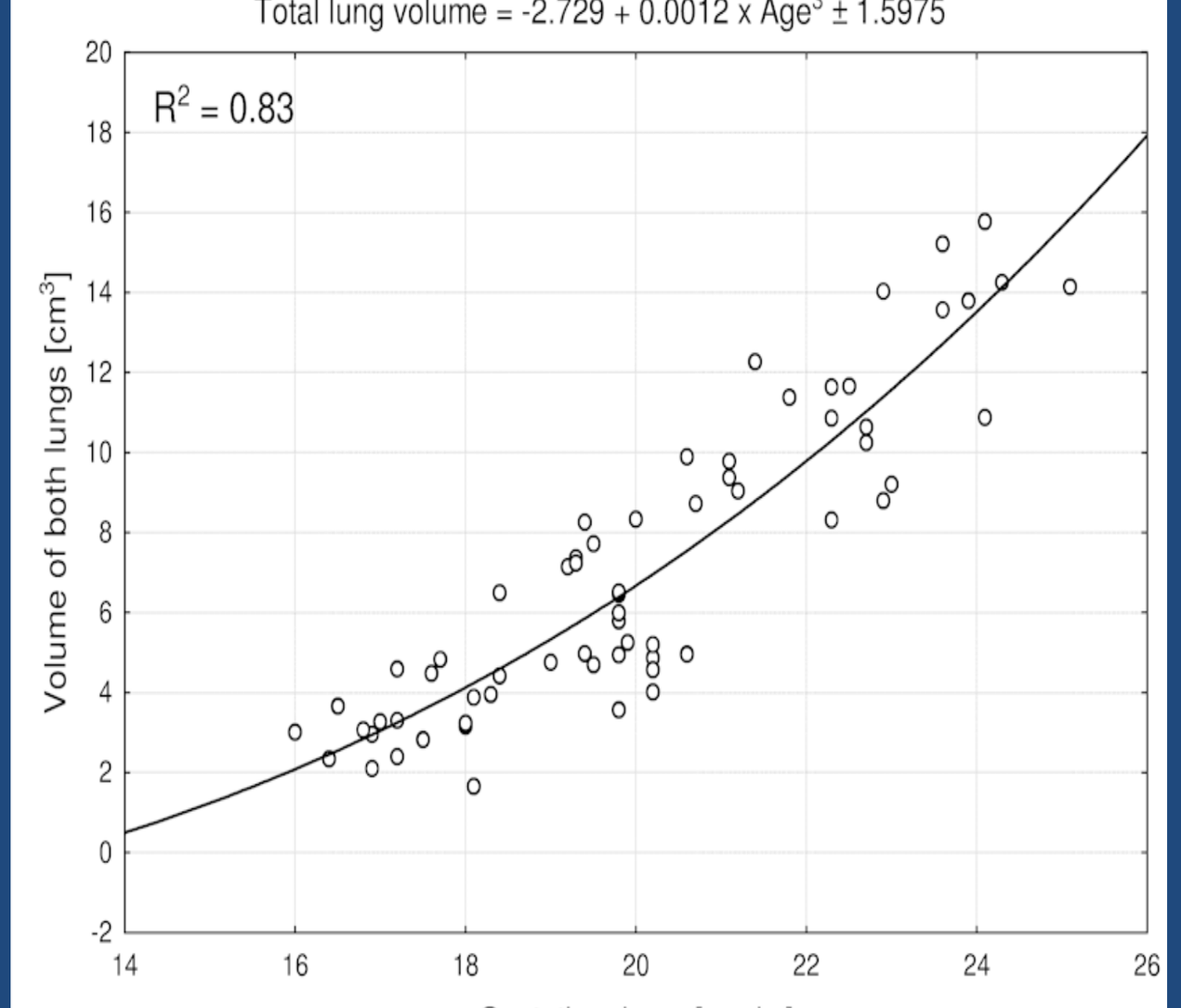
Thoracic viscera *in situ* (after removing the heart out) in a male fetus aged 19 weeks: 1–trachea, 2–right main bronchus, 3–left main bronchus, 4a–superior lobe of right lung, 4b–middle lobe of right lung, 4c–inferior lobe of right lung, 5a–superior lobe of left lung, 5b–inferior lobe of left lung, 6–aortic arch, 7–oesophagus, 8–thoracic aorta.



Right (A) and left (B) lung volumes *v.* age



Proportionate growth of the left and right lungs



Total lung volume *versus* fetal age

Conclusions:

1. The fetal pulmonary volumes do not reveal sex differences.
2. The values of fetal pulmonary volume are greater on the right than on the left.
3. The volumetric growths of the fetal lungs follow three-degree polynomial functions with age.
4. The growth rate of the left and right lungs is alike.
5. The fetal lung volumes are of great relevance in the evaluation of the normal pulmonary growth and the diagnosis of pulmonary hypoplasia.