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**Morphological effects of pulsed Doppler diagnostic
ultrasound on rat adult lung and fetal tissues**

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REFERENCES

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ABSTRACT

This study investigated morphological effects of diagnostic pulsed Doppler ultrasound on adult and fetal rat lungs from 16 to 22 days gestation. A clinical ultrasound machine with two types of focused transducers (3.5 MHz, 5MHz) was used with an adjustment for an experimental animal as small as a rat. Three levels of exposure were represented by a mechanical index (MI) of 0.5, 0.6 and 1.0. Subpleural multifocal intra-alveolar haemorrhage was found to a significant degree in exposed adult rat lung and less significantly in fetal lung. The threshold for adult lung haemorrhage was considered to be between MI 0.5 and 0.6.

Fetal lungs were microscopically investigated by sectioning through the whole fetal body, which facilitated the discovery of haemorrhage at other sites. The percentage of exposed fetuses with haemorrhage is significant.

A threshold for fetal haemorrhage could not be determined because a significant variation due to age within each exposure group affected the results. The oldest 21 and 22 day old fetuses had no lung haemorrhage or significant non-lung haemorrhage. The risk for haemorrhage at all three exposure levels is more than double that of non exposed fetuses. Fetuses with lung in the canalicular stage of development (18-19 day) showed the greatest degree of lung haemorrhage.

Following laparotomy of the dam to achieve a precise and uniform exposure, a small number of fetuses within each exposure group was exposed directly. There was no higher degree of haemorrhage in these fetuses than in others indirectly exposed through the dam's abdominal wall.

The fetal age dependency of fetal lung haemorrhage found in this study adds complexity to the issue of adult and fetal lung sensitivity to ultrasound and to the question of the pathophysiological role of cavitation in the presence of air. In addition, our result in 21-22 day fetuses does not support the hypothesis that fetal haemorrhage is associated with developing bone.

The results in this study were achieved using conditions commonly used in echocardiography and obstetrical ultrasound examinations. Therefore, caution is suggested in the medical use of ultrasound.

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