Comparison of four mouse models for abdominal aortic aneurysm by 3D ultrasound

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Mouse models of abdominal aortic aneurysm (AAA)



Monitoring of aorta size by 3D ultrasound











Aim: Compare 3D volume vs aortic diameter

- monitoring aorta expansion in 4 mouse models of AAA ٠
- robustness, interobserver variability and sensitivity •

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3D ultrasound analysis yields highly reproducible AAA measurements for all mouse models

| Model Parameter | % Interobserver coefficient of variation: mean±SD | 95% Limits of agreement: lower, upper | Lin's concordance correlation coefficient (95% CI) | |
|---------------------------|--|---|--|--|
| Angll (n=84/77) | | | | |
| Volume [mm ³] | 4.46±3.61 | -3.04, 3.43 | 0.985 (0.977-0.990) | |
| Diameter [mm] | 4.49±5.20 | -0.33, 0.26 | 0.944 (0.915-0.964) | |
| ePPE (n=60/58) | | | | |
| Volume [mm ³] | 1.65 ± 1.49 | -0.52, 0.50 | 0.998 (0.997-0.999) | |
| Diameter [mm] | 3.30±2.67 | -0.12, 0.11 | 0.980 (0.968-0.988) | |
| ePPE+BAPN (n=32) | | | | |
| Volume [mm ³] | 8.46±5.40 | -7.74, 3.79 | 0.952 (0.923-0.970) | |
| Diameter [mm] | 4.19±3.38 | -0.28, 0.21 | 0.979 (0.957-0.990) | |
| PPE (n=37) | | | | |
| Volume [mm ³] | 5.42±3.06 | -0.85, 0.86 | 0.932 0.873-0.964) | |
| Diameter [mm] | 3.42 ± 2.57 | -0.11, 0.10 | 0.952 (0.909-0.975) | |





Differences between AAA models are reflected in volume and diameter measurements

Angll and ePPE ± BAPN models:

 higher volume than diameter increase



PPE model:

- lowest aorta expansion
- best detected by diameter increase









All models show a high correlation between 3D volume and maximum aortic diameter and good agreement with *ex vivo* aortic diameter





3D ultrasound based AAA monitoring is more effective in detecting early aneurysm growth than by conventional 2D B-mode analysis

| Cohen´s d standardized effect size | Angll | ePPE | ePPE +BAPN | PPE |
|---------------------------------------|-------|------|---------------|------|
| Absolute volume [mm ³] | 1.28 | 3.98 | 3.07 | 1.30 |
| Relative volume [%] | 1.32 | 3.17 | 3.03 | 1.16 |
| Absolute diameter [mm] | 1.30 | 3.70 | 3.27 | 1.61 |
| Relative diameter [%] | 1.33 | 3.19 | 2.85 | 1.52 |
| Absolute 2D diameter [mm] | 1.33 | 3.51 | 2.97 | 1.24 |
| Relative 2D diameter [%] | 1.31 | 3.13 | 2.66 | 1.25 |







3D ultrasound measurements are highly sensitive to monitor formation and progression of abdominal aortic aneurysms in mouse models

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