



## ANATOMICAL STUDY OF THE GUINEA-PIG (*Cavia porcellus*) HEART AND COMPARISON WITH DIAGNOSTIC RADIOGRAPHIC AND ECHOCARDIOGRAPHIC ASSESSMENTS

**Introduction** - Reported cases of guinea pigs presented with signs indicative of a cardiac disease in clinical practice are increasing, and therefore routine use of diagnostic imaging as a noninvasive tool to evaluate the cardiac patient in order to achieve early diagnoses is starting to acquire great relevance. An anatomical study of the guinea-pig heart was carried out for comparison with echocardiographic and radiographic images and measurements.

### Anatomical study

Four animals, which died from diseases other than those affecting the cardiovascular system, were used. The heart was investigated by dissection, excision, and long- and short-axis measurements were taken using a caliper. It was then transversely cut as in the corresponding right parasternal short axis echocardiographic view at the level of the papillary muscles of the left ventricle (Fig. A,A'). Another specimen was cut longitudinally as in the parasternal apical 4-chamber view (Fig. B,B'), and then subsequently at the level of the aortic root, as in the 5-chamber view (Fig. C,C'). The heart was topographically located between the second intercostal space and the fifth pair of ribs and showed a ventro-caudal inclination, similarly to what could be observed in the thoracic latero-lateral and ventro-dorsal radiographs (Fig. D,D';E,E').

Guinea pigs	Gender	Body weight (g)	Long axis (mm)	Short axis (mm)
1	M	522	19.2	17.9
2	F	463	21.9	17.7
3	M	490	19.6	16.1
4	M	555	21.2	18.5
<b>Mean ± SD</b>		<b>507.5 ± 39.8</b>	<b>20.5 ± 1.3</b>	<b>17.6 ± 1.0</b>



**A-A'**. Right parasternal short-axis view at the level of the papillary muscles and anatomical comparison.



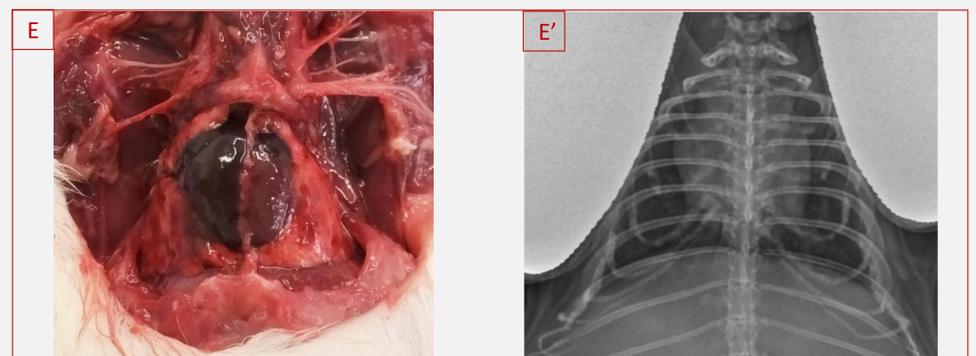
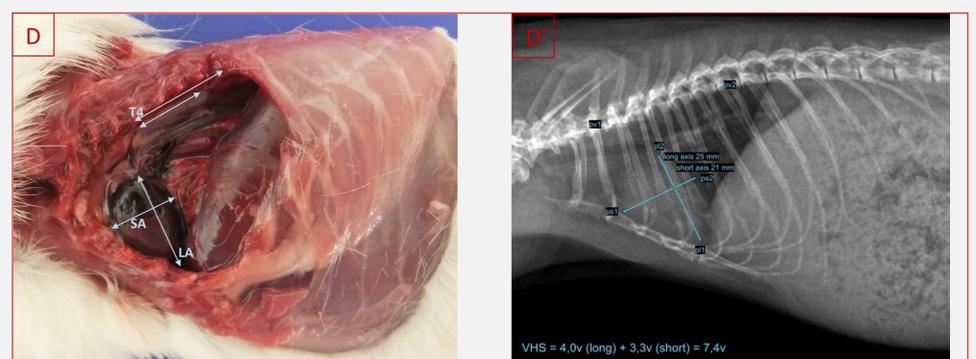
**B-B'**. Parasternal apical 4-chamber view and anatomical comparison.



**C-C'**. Parasternal apical 5-chamber view at the level of the aortic root and anatomical comparison.

Abbreviations: 1 and 1': papillary muscles; Ao: aorta; IVS: interventricular septum; LA: left atrium; LV: left ventricle; MV: mitral valve; RA: right atrium; RV: right ventricle; TV: tricuspid valve.

Courtesy of Dr. Baron Toaldo



**D-D'**. Thoracic radiograph, right lateral (RL) view and Vertebral Heart Scale (VHS) measurements. **E-E'**. Ventro-dorsal (VD) thoracic radiograph (Courtesy of Dr. Bo). On the left, corresponding anatomical specimens. LA: cardiac long axis; SA: cardiac short axis.

The aim of the present study was to report normal echocardiographic variables from a population of clinically healthy guinea pigs, in order to provide predictive values for comparison with clinical cases. 21 privately-owned pet guinea pigs underwent conscious two dimensional, M-mode and Doppler echocardiography. 14 selected echocardiographic parameters were measured and statistically analyzed and correlation with age, body weight, sex and heart rate was investigated.

### Echocardiography

Descriptive and echocardiographic data obtained from 21 healthy pet guinea pigs					
Variable	Median (min-max)	Average ± SD	Lower 95% Confidence Interval	Upper 95% Confidence Interval	p Value
Age (years)	2 (0.4 - 7)	2.3 ± 1.9	1.4	3.2	.262
Weight (grams)	830 (500 - 1230)	830 ± 205	736	924	.886
HRA (bpm)	273 (194 - 316)	270 ± 33	255	285	.656
RVDd (mm)	3.5 (2.6 - 5.5)	3.7 ± 0.8	3.3	4.0	.443
IVSd (mm)	1.9 (1.5 - 2.4)	1.9 ± 0.3	1.8	2.1	.406
LVIDd (mm)	10.1 (8.2 - 12.7)	9.9 ± 1.1	9.4	10.5	.317
LVPWD (mm)	2 (1.6 - 2.4)	1.9 ± 0.2	1.8	2.1	.704
IVSs (mm)	2.6 (1.9 - 4.1)	2.6 ± 0.5	2.4	2.9	.056
LVIDs (mm)	6.8 (4.5 - 10.7)	6.8 ± 1.2	6.3	7.4	.0003
LVPWs (mm)	2.9 (1.9 - 3.6)	2.9 ± 0.4	2.7	3.1	.875
FS %	31 (16 - 50)	31 ± 8	27	35	.825
LA (mm)	6.6 (5.1 - 7.8)	6.6 ± 0.8	6.2	6.9	.488
Ao (mm)	5.5 (4.0 - 7.3)	5.5 ± 0.7	5.2	5.8	.318
LA/Ao*	1.2 (0.7-1.4)	1.2 ± 0.2	1.1	1.3	.047
Vmax MV E (cm/sec)	71 (39 - 113)	74 ± 20	65	83	.763
Vmax PV (cm/sec)	90 (40 - 145)	91 ± 21	81	101	.184
Vmax Ao (cm/sec)	89 (57 - 132)	91 ± 15	81	98	.084

Courtesy of Dr. Baron Toaldo

### Radiography

The aim of the present study was to establish a species-specific set of reference values regarding standard cardiac dimensions in guinea pigs using Vertebral Heart Score (VHS) from thoracic radiographs<sup>1</sup>. Six adult privately-owned healthy pet guinea pigs underwent conscious right lateral and ventro-dorsal thoracic radiography. Cardiac short- and long-axis measurements were transposed over thoracic vertebrae (from T4) and summated to yield the VHS, expressed as total units of vertebral length to the nearest 0.1 vertebra.

Radiographic measurements of cardiac size obtained from right lateral projections of thoracic digital radiographs in six healthy pet guinea pigs

Parameter	Mean ± SD	Minimum	Maximum	95% Confidence Interval
Age (yrs)	2.4 ± 0.7	1.8	3.2	1.8 - 2.9
Weight (g)	1,120.8 ± 312.9	820	1,500	870.4 - 1,371.3
Long axis (v)	4.4 ± 0.2	4.1	4.6	4.1 - 4.6
Short axis (v)	2.9 ± 0.3	2.6	3.5	2.7 - 3.2
Long axis (mm)	27.8 ± 2.9	26	33	25.4 - 30.2
Short axis (mm)	18.7 ± 1.9	17	21	17.2 - 20.2
VHS (v)	7.3 ± 0.5	6.8	7.8	7.0 - 7.6

1: Buchanan JW, Bucheler J: Vertebral scale system to measure canine heart size in radiographs. J Am Vet Med Assoc 206:194-199, 1995.