

1 Abstract

2 **Background:** Few reports on a biventricular working heart model with *ex vivo*
3 perfusion exist owing to the complexity of establishing a circuit. Hence, we investigated
4 it for donation after circulatory death.

5 **Material and Methods:** The heart in six juvenile pigs (~20 kg) was arrested by
6 asphyxiation. After 30 min of global ischemia, the heart was harvested, reperfused with
7 normoxemic blood cardioplegia for 20 min, and subsequently perfused with hyperxemic
8 blood. After 70 min of controlled reperfusion, the system was switched to the
9 biventricular working mode. Cardiac function was assessed before anoxia and during
10 the biventricular mode.

11 **Results:** Left and right ventricular functions worsened during the biventricular mode, as
12 compared to those before anoxia (dp/dt_{max} , 673 ± 120 vs. 283 ± 95 and 251 ± 35 vs. 141
13 ± 21 mmHg/s, respectively; $P < 0.001$). Systemic (resistance/100 g net heart weight)
14 and pulmonary vascular resistance indexes during the biventricular mode were similar
15 to those before anoxia (829 ± 262 vs. 759 ± 359 , $P = 0.707$, and 167 ± 57 vs. 158 ± 83
16 dynes \cdot sec \cdot cm $^{-5}$ - l-100-g net heart weight, $P = 0.859$, respectively).

17 **Conclusion:** The biventricular working heart model with *ex vivo* perfusion was feasible,
18 exhibiting stable hemodynamics, and has the potential to be a powerful tool for direct
19 cardiac function assessment.