Double-Decker Rodent Telemetry: A Stretch Objective

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Introduction: Telemeterised rats are usually housed in single-storey individually ventilated cages (IVCs) as the animal must be in close proximity to the telemetry receiver, positioned directly beneath the cage. Double-decker (D-D) rodent IVCs offer an enriched environment, allowing animals to exhibit more natural behaviours including upright posture and stretching, shown recently to be an important component of a rat's welfare (Makowska and Weary 2017). We assessed whether telemetry recordings could be made from rats socially-housed in D-D cages and whether use of D-D cages would affect the ability to detect drug-induced changes in cardiovascular parameters.

Methods: Male Sprague-Dawley rats (n=7) were instrumented with telemetry transmitters (DSI C50-PXT) to record arterial blood pressure (ABP), heart rate (HR) temperature and activity.

Methods (cont): ***Phase 1*** - Rats were housed initially in standard IVCs (internal height 20cm, Fig. 1) with a non-instrumented companion. One receiver was placed beneath each cage to detect the telemetry signals. Rats received either vehicle or verapamil (10 and 30 mg/kg p.o.) on each dosing day in a modified William's square design and recordings were made for 22h post-dose.

Fig. 1: Standard IVC

Phase 2 - Animals were transferred to larger D-D IVCs (internal height 38cm, Fig. 2) along with their companion. Four receivers were multiplexed together to allow telemetry recordings from each D-D cage. The animals were dosed using the same design as in Phase 1 following a period of acclimatisation. A blood sample was taken by tail vein microsampling at 3h post-dose in both phases.

Fig. 2: Double-decker IVC

Fig. 3

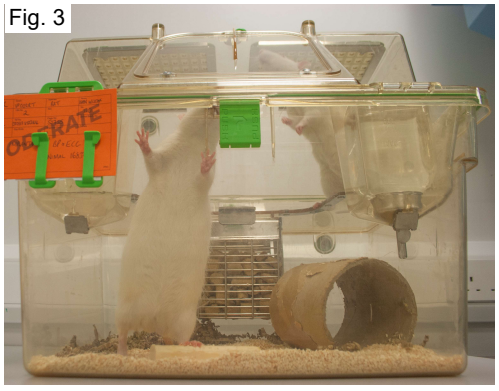

Fig. 4

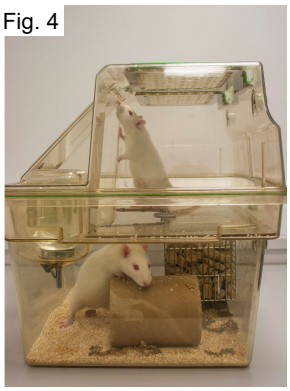

Fig. 3 and 4: Rats housed in double-decker IVCs allowing upright standing

Fig. 5

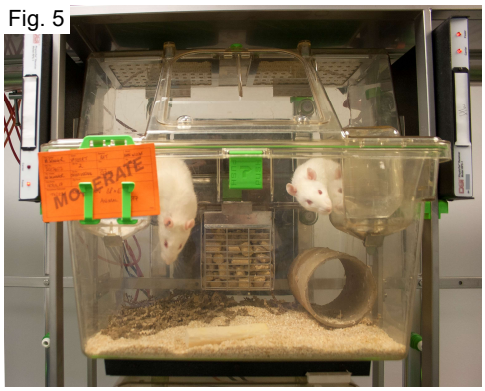

Fig. 5: Telemetry receivers positioned around the double-decker IVC

Results: Verapamil caused a dose-related decrease in ABP and a tachycardia at 30 mg/kg when assessed in rats housed either in standard or D-D cages (Fig. 6 shows D-D results). The changes induced by verapamil were compared between the two study phases using a linear mixed effect model and no significant differences in drug-induced responses were observed (Fig. 7). Plasma drug concentrations (3h post-dose) were consistent between both phases: 38 ± 25 and 279 ± 91 ng/mL in Phase 1 and 43 ± 50 and 224 ± 133 ng/mL in Phase 2 after 10 and 30 mg/kg, respectively.

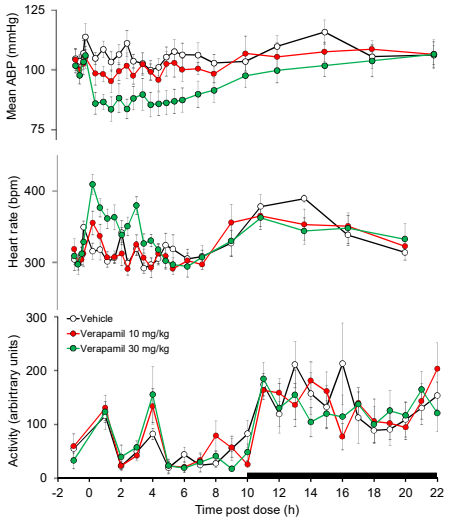

Fig. 6: Effects of verapamil in telemetered rats housed in D-D cages (mean ±SE mean). Bar shows night phase.

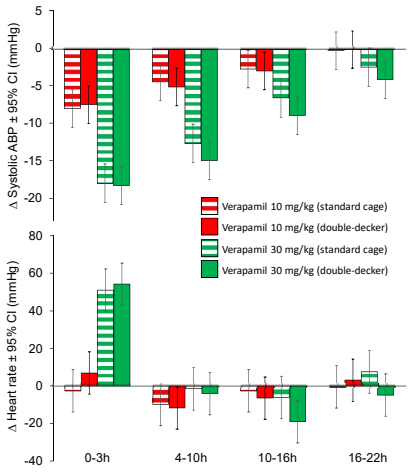

Fig. 7: Comparison of effects of verapamil on systolic ABP and HR in standard and D-D cages.

Conclusion: These results show that recording from telemetered rats socially-housed in double-decker cages is technically possible and does not adversely affect the detection of drug-induced cardiovascular changes. Use of double-decker housing allows the rats to exhibit more natural behaviours.

Reference: Makowska and Weary 2017 *R. Soc. open sci.* **3**: 160136.