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Short communication

IMPLANTATION OF TISSUE CHAMBERS IN TURKEYS: A PILOT STUDY

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Tissue chambers are used as a model to study the composition of the interstitial fluid since 1963 (Guyton, 1963). Under experimental conditions, tissue chambers have been placed in the peritoneal cavity or in the subcutaneous space, where they remain accessible for transcutaneous punctures allowing to obtain in parallel serum/plasma samples and tissue fluid. A revival of this technique occurred in 1987, when Lees and co-workers re-established the model as non-invasive tool to study the local inflammatory response and drug concentrations of anti-inflammatory drugs as the site of action (Higgins *et al*., 1987; Lees *et al*., 1987). Compounds such as carrageenan and lypopolysaccharide (LPS) were used to provoke a local inflammatory reaction. Parameters studied in the tissue cage fluid included inflammatory mediators (cytokines, eicosanoids), leukocyte influx and skin temperature over the tissue chamber by serial measurements (Higgins *et al*., 1984; Higgins *et al*., 1987). Moreover, drug penetration into inflamed (exudate) and non-inflamed (transudate) chamber fluid was measured as a surrogate for the distribution of the drug over the interstitial tissue space (Onderdonk *et al*., 1989; Vogel *et al*., 1996; Erlendsdottir *et al*., 2001; Liu *et al*., 2002, Sidhu *et al*., 2003).

More recently, essentially the same technique was applied to study pharmacokinetic/pharmacodynamic (PK-PD) interactions of antimicrobials measuring not only drug concentrations in the tissue chamber, but also the therapeutic efficacy of animicrobials against local infections with diverse pathogens (Greko *et al*., 2003; Aliabadi & Lees, 2001; 2002; 2003; Aliabadi *et al*., 2003).

Whereas the tissue cage model has been validated in various mammalian species, experiments in poultry are lacking. Therefore, the possibility to implant tissue cage in poultry was evaluated for first time.

A one-year-old healthy female turkey, BUT 9 breed, 5.15 kg body weight, was selected. It was given free access to commercial food for turkeys (without antibacterials and coccidiostatics) and the animal was kept with other turkeys in a box stand.

A round custom-made tissue chamber was used for implantation (Fig. 1). It had an inner diameter of 2.2 cm and a depth of 1 cm and contained 9 holes in the bottom and 12 holes on the side surface. The total volume of the empty chamber was 2.2 mL.

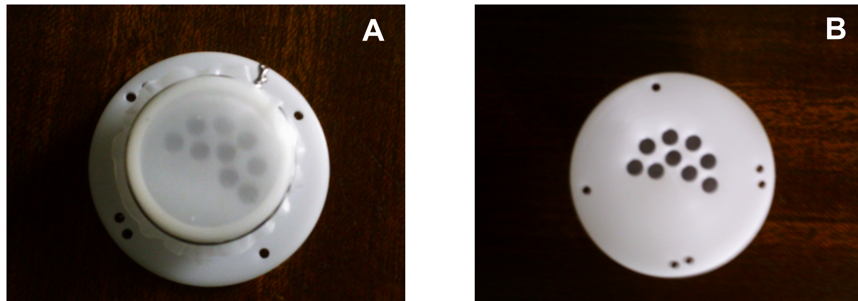

Fig. 1. Tissue chamber. A – upper side with membrane; B – bottom side.

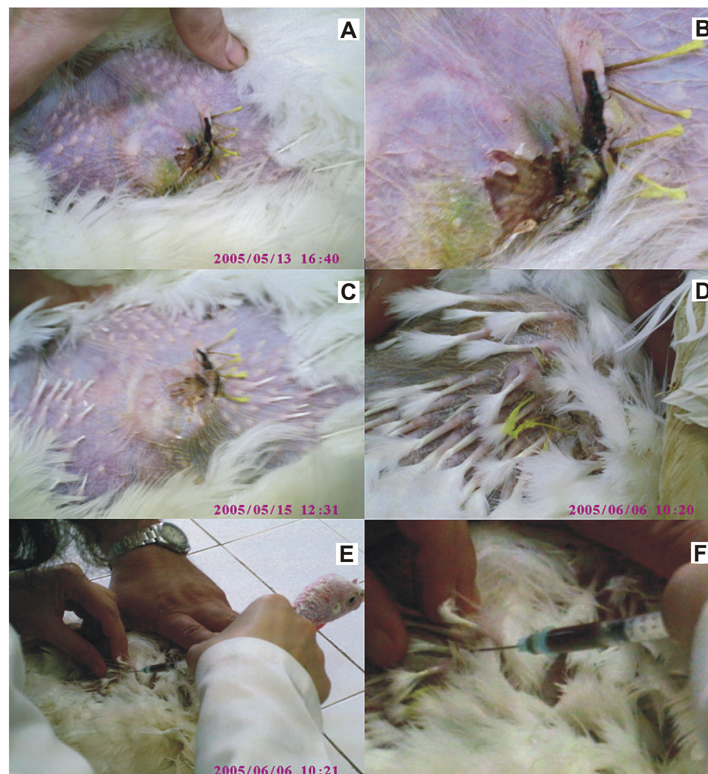

Fig. 2. Implanted tissue cage. A (view of the whole tissue cage) and B (view of the operation wound) show the implanted tissue cage on 4th day after surgery; C and D – 10 and 29 days after implantation, respectively; E – puncture of the cage on the 29th day; F – the obtained transudate contaminated with blood.

The cage was aseptically implanted subcutaneously under the right wing, above the *M. pectoralis thoracicus.* After implantation, the animal was allowed to recover for a period of 4 weeks.

Figures 2A (view of the implanted tissue cage) and 2B (view of the operation wound) show the implanted tissue cage on 4th day after surgery. Picture 2C and 2D were taken 10 days and 29 days after implantation, respectively, demonstrating that the tissue chamber was implanted successfully without visual signs of inflammation. Feathers reappeared on the skin-surface at the end of the sampling period, 29 days post implantation (p.i.) (Picture 2D). On day 29 p.i. attempts to aspirate tissue cage fluid were made at times zero (Picture 2E and 2F), one and three hours, and at each time point 0.5 ml fluid could be withdrawn. When after 24 hrs the 4th sampling was conducted only 0.2 ml fluid could be aspirated. It should be mentioned that the withdrawn tissue fluid was contaminated with blood, which might be a problem in experiments in which drug concentrations should be measured in the tissue chamber fluid in parallel with blood serum/plasma samples.

The obtained results from this pilot experiment also indicate the limitations in the amount of tissue fluid that can be obtained from the chamber in serial experiments. After removal of the cage on day 40 after implantation approximately 60% of the internal volume was filled with connective tissue, which explains the limited fluid volume. Previous experiments in mammals had already indicated that the size and shape of tissue chambers and the number and size of holes influence the composition and rate of formation of tissue cage fluid (Bergan, 1981). Moreover, the age of the tissue chamber influences the amount of tissue fluid produced upon a challenge (Aliabadi & Lees, 2001).

In conclusion, this first pilot experiment suggests the possibility to use tissue chambers also in turkeys or other avian species. Special small and tailor-made chambers are necessary according the size of the animals. Further experiments need to be conducted to assess the most optimal time points at which tissue chamber fluid can be withdrawn at regular intervals and to identify agents that result in a reproducible local inflammatory response (Roacha & Sufka, 2003). These experiments will provide valuable details regarding the inflammatory response in terms of cellular infiltration and the production of inflammatory mediators in avian species, and allow the assessment of the efficacy of anti-inflammatory agents as well as antimicrobials in the interstitial space.

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