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Protocol Article

Refinement of a colostrum-deprived pig model for infectious disease research



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A B S T R A C T

Well-defined pig models are useful to study the pathogenicity of newly recognized pathogens or strains in pigs and serve as animal models for some human diseases. The conventional pig model, where research pigs are sourced from commercial high-health production systems, is commonly used due to the easiness of getting pigs in a timely manner. However, freedom of the pig for the pathogen of interest is important at study start and serological assays to screen pigs for antibodies against newly identified pathogens or molecular assays detecting all possible circulating pathogen variants may not yet exist. Using colostrum-deprived (CD) pigs is a good alternative strategy to circumvent passively-acquired immunity against the pathogen of interest or exposure to pathogens shortly after birth. However, CD pigs are difficult to rear as they are highly susceptible to infections, and mortality rates in the first few days of life are often very high. Herein we report on refinement of a CD pig model with consistent survival rates of 90–100% of the piglets.

- Step-by-step protocol to derive and rear CD piglets with higher expected survival rates.
- Pig housing improvement minimizes the risk of disease transmission.
- Infectious virus disease research pig model purpose.

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A R T I C L E I N F O

Method name: Colostrum-deprived pig model

Keywords: Pig model, Infectious pathogens, Colostrum-deprived pigs, Naturally-farrowed, Artificially-reared

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Specifications table

Subject area	Veterinary science and veterinary medicine
More specific subject area	Laboratory animals
Method name	Colostrum-deprived pig model
Name and reference of original method	B. Ratcliffe, J.P. Fordham, A technique for rearing germfree piglets obtained without surgery. <i>Lab. Anim.</i> 21 (1987) 53–59. G.M. Allan, F. McNeilly, J.P. Cassidy, G.A.C. Reilly, B. Adair, W.A. Ellis, M.S. McNulty, Pathogenesis of porcine circovirus; experimental infections of colostrum deprived piglets and examination of pig foetal material. <i>Vet. Microbiol.</i> 44 (1995) 49–64. P.C. Gauger, K.M. Lager, A.L. Vincent, T. Opriessnig, M.E. Jr. Kehrli, A.K. Cheung, Postweaning multisystemic wasting syndrome produced in gnotobiotic pigs following exposure to various amounts of porcine circovirus type 2a or type 2b. <i>Vet. Microbiol.</i> 153 (2011) 229–239.
Resource availability	All consumables used are listed in Tables 2–4 . Specifications of the structures are described in the manuscript.

Method details

Pig infectious disease researchers can choose to use conventional pigs, colostrum-deprived (CD) pigs [1–3], caesarian-derived colostrum deprived (CDCD pigs) or gnotobiotic/germfree pigs, each with their own advantages and disadvantages ([Table 1](#); [Fig. 1](#)). Moderate to high mortality at an early age as the direct result of colostrum deprivation requires refinement of procedures [4] in sourcing and rearing pigs for research. The customized model for CD pigs described herein uses elevated pens split into quarters which can house 1–2 pigs per quarter ([Fig. 2](#)). This prevents direct contact between piglets and reduces movement of feces and waste between pens minimizing risk of transmission of diseases. The initial set-up of the research facility, on-farm derivation of piglets, preventive medical treatment protocols and a simplified feeding schedule, compared to previous protocols [1,5], are described in here. This refined model has been used at Iowa State University several times over the last few years resulting in survival rates of over 90% of the CD pigs derived for various research trials lasting from a few days to several weeks.

Initial room set-up at the research facility

Cleaning procedure

The rooms and equipment are washed and disinfected ahead of time using a degreaser followed by a disinfectant [6]. Rooms, walls and equipment are thoroughly cleaned with 70 °C water using a high-pressure (180 psi) nozzle and then sprayed with a degreaser (PRL-Grease Free; Pharmacal Research Laboratory Inc, Naugatuck, Connecticut), which is allowed at least 10–15 min contact with surfaces. Rooms and equipment are then fumigated with Virkon S (Dupont, Pharmacal Research Laboratories, Inc, Naugatuck, Connecticut) at the manufacturer's recommended concentration and the room is allowed to completely dry (1–2 days).

Room stocking

After the rooms are dry, it is stocked with personal protective equipment, supplies, and broad spectrum antibiotics, as described in [Tables 2 and 3](#). Animal rooms are set up so that personnel enters through anterooms, where room specific boots, disposable N95 respirators, and disposable coveralls are stored.

Pig housing tubs

In each animal room there is one tub made from heavy-duty, UV-stabilized polyethylene ([Fig. 2](#)) which is supported by a heavy-duty stand manufactured with a 22.2 mm solid rod steel, raising the unit 30.5 cm

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