

Diseases in neonatal foals. Part 2: Potential risk factors for a higher incidence of infectious diseases during the first 30 days *post partum*

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Appendix: Definitions and frequencies [n] of parameters

Stud management: 1) 'private' [18 stud farms, 481 foals]; 2) 'boarding' i.e. public [18 stud farms, 550 foals].

Number of broodmares on stud: 1) '<10 mares' [3 boarding stud farms with 15 foals, 5 private farms with 39 foals]; 2) '10–40 mares' [7 boarding with 149 foals, 7 private with 112 foals]; 3) '>40 mares' [8 boarding with 386 foals, 6 private with 330 foals]. In the logistic regression model only 2 groups were used: 1) '<40 mares'; 2) '>40 mares'.

Use of prophylactic antimicrobials: 1) prophylactic antimicrobials for every newborn foal [27 stud farms]; 2) prophylactic antimicrobials for high risk foals only [9 stud farms]. Foals were considered as at high risk if they were ill at birth or if they were prone to infection because of insufficient passive transfer of immunity or other circumstances.

Foals' exercise management: 1) 'out on Day 1 in nursery paddock, on artificial surface or indoor' (depending on weather and conformation) [23 stud farms with 595 foals]; 2) 'stay in for Day 1 or longer' [7 farms with 236 foals]. The main reason for foals being kept in the stable for the first few days was to ensure an adequate IgG-level before they were challenged by environmental factors. In most cases this resulted in foals being turned out once the IgG-blood result showed a sufficient transfer of passive immunity or a plasma transfusion has been given.

Age of mare: 1) 4–6 years [246 mares]; 2) 7–9 years [326]; 3) 10–13 years [249]; 4) 14–18 years [135]; 5) 19–25 years [25]. For logistic regression groups 4) and 5) were combined. Range: 4–25 years, median: 9.52, s.e.: 0.12 years

Foaling history: 1) primiparous [125 mares]; 2) multiparous [698 mares]

Mare's time at stud before foaling: 1) resident [464]; 2) seasonal boarders which arrived <1 month before foaling [140]; 3) mares which arrived >1 month before foaling [175]; 4) Mares from a stud organisation (s.o.) that had been moved between stud farms within England; the arrival on the stud farm chosen for foaling was unknown [47].

Country of origin: 1) mares originally resident outside the UK (Ireland, France, Germany, Italy and Spain, in decreasing order) [76]; 2) mares resident in the UK [753].

Mare's health during pregnancy: 1) no problems reported [811 mares]; 2) health affected during pregnancy [20 mares]: colic signs (conservative treatment [3]; leg problems [11] including laminitis [3], Cushing's disease (combined with laminitis) [1], very poor general condition [2], Equine Protozoal Myeloencephalitis [1], haematoma in broad ligament of uterus [1], no details [2].

Mare's rotavirus vaccination status: Two models were used: I: 1) 'vaccinated' (Duvaxyn R³, 7, 9 and 11. month of gestation); 2) 'not vaccinated'; II: 1) 'vaccinated' [476 mares]; 2) 'incomplete vaccination course' (only one or 2 injections) [43]; 3) 'not vaccinated' [489]. Rotavirus-vaccination status unknown in 23 cases. Of 72 foals tested for rotavirus 30 were positive. Only cases with severe diarrhoea or/and a (suspected) endemic problem on the stud farm were tested.

Prepartum lactation: Two models: I: 1) 'no' [593 mares]; 2) 'running milk >1 h' [156]; 3) 'running milk >24 h [24]'; II: 1) 'yes (>1 h)' [180]; 2) 'no' [593]; no information available [258].

Sex: colts [521]; fillies [508]. No gender reported of 2 stillborn foals.

Date of birth: 1) January [118 foals]; 2) February [270]; 3) March [321]; 4) April [222]; 5) May [94]; 6) June [5]. In the logistic regression model foals born in May and June were combined to a single group.

Gestational age: 1) <336 days [113 colts, 156 fillies]; 2) 336–342 days [145, 157]; 3) ≥343 days [226, 164]. Data not normally distributed, median: 340.9 days, s.e.: 0.32, range 301–382.

Prematurity: 1) 'yes' (<320 days) [14]; 2) 'no' (≥320 days) [983]. Four premature foals did not survive the first 30 days.

Birth weight: 1) <50 kg [49 colts, 59 fillies]; 2) 50–54 kg [69, 68]; 3) 55–59 kg [68, 75]; 4) ≥60 kg [61, 40]. Data not normally distributed, median 54.4 kg, s.e. 0.27, range 31–75.

TABLE 4: Laboratory results observed in foals in a survey on 36 stud farms in Newmarket, UK 12–48 h after birth (January–June 2005)

Parameter	<Normal (%)	Normal (%)	>Normal (%)
WBC	1 (0.14)	624 (86.55)	96 (13.31)
RBC	38 (5.27)	677 (93.90)	6 (0.83)
Fib	0	295 (50.26)	292 (49.74)
SAA	0	606 (84.17)	114 (15.83)
TP	90 (12.48)	564 (78.22)	67 (9.29)
Glob	75 (10.40)	611 (84.74)	35 (4.85)

Birth complications: Problems reported in 120 out of 1031 births. 1) Dystocia [99 foals]; 2) premature placental separation ('red bag' deliveries) [24]; 'Dystocia' divided into 3 sub-categories: a) assistance by stud groom needed [75]; b) assistance by veterinarian needed [21]; c) caesarean section [3].

Daily vet check for first three days: 1) 'yes' [668 foals]; 2) 'no' [363]. Every foal received 3000 iu of tetanus antitoxin (Tetanus Antitoxin Behring)⁴ i.m. once within the first 3 days *post partum*.

Antimicrobial schedules: *Group A* [650 foals] with prophylactic antimicrobials, *Group B* [342 foals] without prophylactic antimicrobials; *Group A* divided into 4 categories: 1) '3 days of 3 ml Tribriksen 48%'⁵ (trimethoprim-sulphadiazine) i.m.' (31 foals received 5 ml Tribriksen/dose instead of 3 ml) [523 foals]; 2) '>3 days of Tribriksen 48% i.m. (4 up to 7 days)' [33 foals]; 3) 'others', i.e. mainly Excenel⁶ (Ceftiofur) i.m. 0.25 g twice a day for 3–6 days [66 foals] or Engemycin (oxytetracycline)⁴ (in 3 cases on Day 1 only, in one case on Days 1 and 2) because of a very upright leg conformation (carpal and metacarpal-phalangeal hyperflexion) [4 foals]; 4) 'mixed protocols', i.e. mainly Tribriksen 48% on the first 1–3 days, which was then changed to Excenel for medical reasons [23 foals]. For the logistic regression model additional groupings were tested: 'no' vs. '1 + 2 combined' vs. '3 + 4 combined' or 'no + 1 combined' vs. '2 + 3 + 4 + 5 combined'. Information about the antimicrobial schedule was not available for one foal.

Blood parameters (excluding IgG): RBC, WBC, TP, GLOB, IgG, FIB, SAA as continuous variables and in 3 subgroups: 1) 'normal'; 2) 'above normal'; 3) 'below normal'. For logistic

regression different categories were used for WBC (below normal and normal value = 0, >normal = 1) and RBC (<normal = 1, normal and above normal = 0). Table 4 shows the distribution of the 6 analysed blood parameters.

Serum IgG-levels: 1a) 0–2 g/l [20]; 1b) 2–4 g/l [60]; 2) 4–8 g/l [200]; 3) >8 g/l [728].

Colostrum intake and quality: Every foal received colostrum within 4 h from birth: 1) by sucking dam [607 foals]; 2) by bottle [303 foals]; 3) by stomach tube [68 foals]. Colostrum quality was divided into: 1) 'good' [541 mares]; 2) 'bad' [110 mares]. 'Good' means a refractometer BRIX reading $\geq 20\%$ (Cash 1999), a colostrometer reading ≥ 6 or colostrum visually judged as good. 'Bad' means a refractometer reading $< 20\%$, a colostrometer reading < 6 (Le Blanc *et al.* 1986) or colostrum judged as bad quality by eye.

Hyperimmune plasma: Plasma was transfused (into jugular vein) in 158/1015 foals (Hyperimmune Equine plasma)⁷. Reasons for plasma transfusion: 1) IgG-value < 4 g/l [71 foals]; 2) IgG-level > 4 g/l but potentially high economic value [26 foals]; 3) mare from Ireland with *Rhodococcus equi* problem at home stud farm (hyperimmune plasma containing *Rhodococcus equi* antibodies used) [52 foals]; 4) IgG < 4 g/l and *Rhodococcus* plasma given [7 foals]; 5) haemolytic foal (plasma and full blood transfusion) [2]. In addition hyperimmune plasma was given orally to 49 foals.

Manufacturers' addresses

³Fort Dodge Animal Health, Hedge End, Southampton, UK.

⁴Intervet UK Ltd., Milton Keynes, Buckinghamshire, UK.

⁵Schering-Plough Animal Health, Middlesex, Uxbridge, UK.

⁶Pfizer Limited, Sandwich, Kent, UK.

⁷Veterinary Immunogenetics Ltd., Penrith, Cumbria, UK.

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