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Retrospective evaluation of bacteriological results of blood cultures in dogs, horses and cats from 2022 to 2023

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Introduction:

- Bacteraemia (presence of bacteria in bloodstream) occurs during a variety of infections, but is not necessarily accompanied with a systemic antiinflammatory response
- Sepsis is defined as a life-threatening organ dysfunction caused by a dysregulated host response to infection
- Associated clinical signs include (a.o.) altered body temperature, tachycardia, tachypnea or neutrophilia/ neutropenia
- Blood culture is essential for adequate and immediate treatment, but though remaining the gold standard, turnaround times over several days show a negative impact on patient survival
- This study retrospectively evaluates the results of bacteriological examination from blood culture samples from dogs, horses and cats over a two-year period between 2022 and 2023

Materials and Methods:

- Blood samples were submitted mainly from German veterinary practices, but also from other European countries
- Sample cultivation depended on the type of submitted blood culture bottle:
  - BD BACTEC ™ bottles (Becton Dickinson GmbH, Heidelberg, Germany) were incubated in BD BACTEC ™ FX40 instrument (Becton Dickinson GmbH, Heidelberg, Germany) at 34.5°C for maximum five days
  - Bottles incompatible with BD BACTEC ™ system were streaked out twice: straight after sample arrival and after an incubation period of maximum seven days. Bottles were checked daily for bacterial growth via an integral growth indicator device
- After detection of bacterial growth one drop was transferred onto Columbia sheep blood agar and Endo agar for aerobic culture or Schaedler agar with and without additional kanamycin/ vancomycin for anaerobic culture (all agar types obtained by Becton Dickinson GmbH, Heidelberg, Germany) in a three-phase streaking pattern
- Incubation period was 24 hours (aerobic culture) or 96 hours (anaerobic culture)
- Bacterial isolates were classified semiquantitatively and identified via growth characteristics, biochemical reactions and time-of-flight mass spectrometry (MALDI Biotyper® sirius one IVD System, Bruker Daltonics GmbH & Co. KG, Bremen, Germany)
- Collected data were evaluated by descriptive statistics

Results:

- Total amount of 387 samples were analyzed: divided into 202 (dogs), 165 (horses) and 20 (cats) samples
- Median age for dogs and cats: seven years (range: five weeks to 22 years/ 19 weeks to 22 years); median age for horses: five years (range: newborn to 28 years)
- In aerobic culture bacterial growth was detected in 30.2% (dogs), 43.6% (horses) and 50% (cats) of the samples
- Most of the positive samples were monomicrobial: 87.5% (dogs), 72.9% (horses), 77.8% (cats)
- Most prevalent Gram-positive bacteria were staphylococci (dogs: 30.2%, horses: 25.3%, cats: 9.1%), thereof mainly coagulase-negative ones, but also coagulase-positive species such as *S. pseudintermedius* and *S. aureus* (see Table 1)
- Most prevalent Gram-negative bacteria were Enterobacterales (dogs: 17.5%, horses: 21.1%, cats: 72.7%), headed by *Escherichia coli*
- Anaerobic cultures were mainly negative: in only 4% (dogs), 2.4% (horses) and 5% (cats) of the samples obligate anaerobic bacteria were detected, predominantly *Cutibacterium* species or *Bacteroides* species
- The time to positivity (TTP), defined as the time period between start of sample incubation and detection of bacterial growth, took an average of three to four days

Figure 1. Percentage of positive and negative blood culture samples under aerobic (AE) and anaerobic (AN) conditions from 2022-2023 in dogs, horses and cats

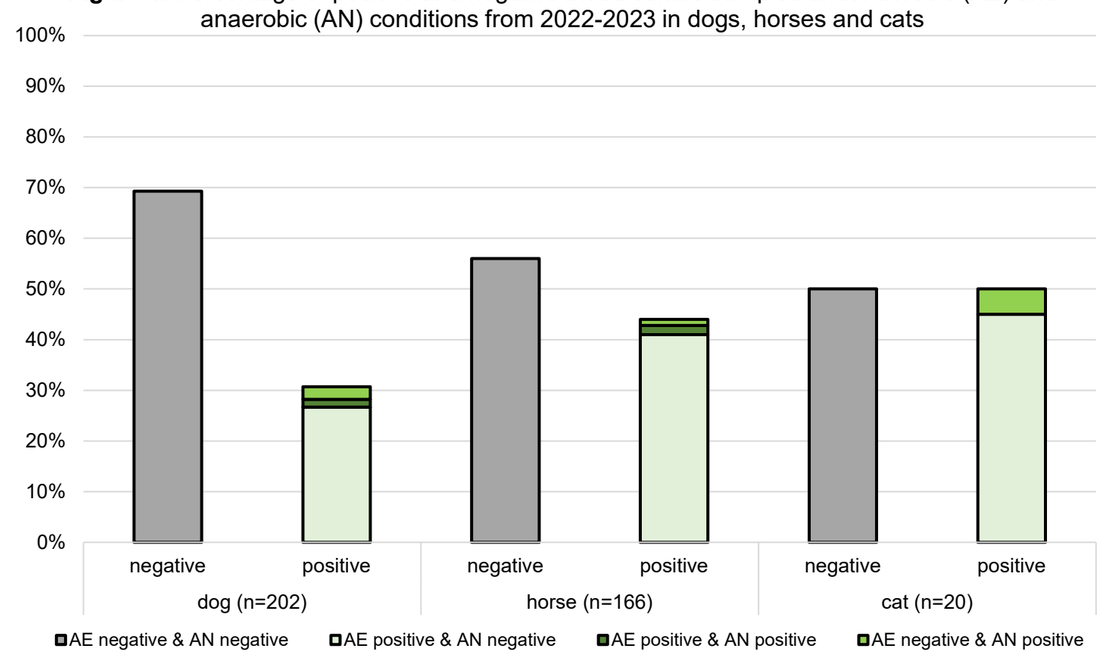

Table 1. Species of bacteria isolated from blood culture samples from dogs, horses and cats from 2022-2023

Aerobic culture	**dogs**		**horses**		**cats**	
Bacterial isolates	Number of isolates	(%)	Number of isolates	(%)	Number of isolates	(%)
Staphylococcus sp.	19	30.2	24	25.3	1	9.1
Staphylococcus aureus	1	1.6	4	4.2	0	0.0
Staphylococcus pseudintermedius	8	12.7	0	0.0	0	0.0
coagulase-negative *Staphylococci*	10	15.9	20	21.1	1	9.1
Streptococcus sp.	5	7.9	8	8.4	0	0.0
α-hemolytic *Streptococci*	3	4.8	4	4.2	0	0.0
β-hemolytic *Streptococci*	2	3.2	3	3.2	0	0.0
anhemolytic *Streptococci*	0	0.0	1	1.1	0	0.0
Enterococcus sp.	4	6.3	8	8.4	1	9.1
Micrococcaceae	4	6.3	3	3.2	1	9.1
Paeni-/ Bacillaceae	4	6.3	8	8.4	0	0.0
Rhodococcus sp.	0	0.0	1	1.1	0	0.0
Corynebacterium sp.	0	0.0	1	1.1	0	0.0
Other Gram-positive bacteria (unclassified)	5	7.9	5	5.3	0	0.0
Enterobacterales	11	17.5	20	21.1	8	72.7
Escherichia coli	4	6.3	11	11.6	2	18.2
Klebsiella sp.	0	0.0	1	1.1	3	27.3
Proteus sp.	1	1.6	0	0.0	1	9.1
Serratia sp.	6	9.5	0	0.0	2	18.2
Providencia sp.	0	0.0	2	2.1	0	0.0
Pantoea sp.	0	0.0	3	3.2	0	0.0
Citrobacter sp.	0	0.0	2	2.1	0	0.0
Enterobacter sp.	0	0.0	1	1.1	0	0.0
Neisseria sp.	1	1.6	0	0.0	0	0.0
Pasteurella sp.	1	1.6	0	0.0	0	0.0
Actinobacillus sp.	0	0.0	4	4.2	0	0.0
Pseudomonas sp.	4	6.3	4	4.2	0	0.0
Acinetobacter sp.	1	1.6	6	6.3	0	0.0
Other Gram-negative bacteria (unclassified)	4	6,3	3	3.2	0	0.0
Total	**63**	**100**	**95**	**100**	**11**	**100**
Anaerobic culture	**dogs**		**horses**		**cats**	
Bacterial isolates	Number of isolates	(%)	Number of isolates	(%)	Number of isolates	(%)
Cutibacterium sp.	6	75	1	25	0	0
Bacteroides sp.	0	0	1	25	0	0
Unclassified	2	25	2	50	1	100
Total	**8**	**100**	**4**	**100**	**1**	**100**

Discussion and Conclusions:

- Most frequently isolated bacteria were Staphylococci and Enterobacterales, mainly Escherichia coli, which is consistent to previous studies
- Study design shows limitations: diagnosis of sepsis is based on clinical signs, case history and various blood biomarkers [1]
- As a diagnostic laboratory detailed sample information regarding further parameters were lacking, impairing a classification of isolated species as relevant or rather contaminant
- Due to submission of only one sample per patient, consecutive samples could not be compared
- Previous data had shown intermittent shedding of bacteria into the blood stream during sepsis, a possible explanation for the high proportion of negative samples in this study [2]
- In most samples a single bacterial species was isolated, corresponding to previous data [3,4] but polymicrobial bacteraemia can occur due to impaired ability of removing bacteria from circulation in critically ill patients [5]
- These data present blood culture as a useful diagnostic method, which could be improved via additional patient data and sequential samplings

References:

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