TEN YEAR TRENDS AND RESISTANCE PATTERNS OF BLOOD AND CSF CULTURES IN CHILDREN UNDER 3 YEARS OLD

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Background

- Bacterial infections are a major cause of childhood hospitalisation in the UK, especially in young infants.
- Resistance patterns to common antibiotics can have significant regional variation, but data on resistance among children is scarce.

Aims

- To describe the 10-year temporal trends of blood cultures (BC) and CSF cultures (CSFC) in children under 3 years of age in Oxford between 2005-2014.
- To assess antimicrobial resistance patterns to Gram-negative bacteria grown blood cultures.

Methods

Site	Oxford University Hospitals NHS Foundation Trust
Study period	January 2005 – December 2014
Data sources	Microbiology lab (culture results) / electronic patient records (antimicrobial sensitivities)
Inclusion criteria	Blood and CSF cultures taken from all children <3 years old
Exclusion criteria	<ul style="list-style-type: none">Unprocessed / unknown locations (n=2,265)Pathology/post-mortem samples (n=486)Samples from blood products (n=35)Duplicates: same organism grown ≤7 days of previous sample without alternative in between (n=850)Mixed growth (n=92)

Current first-line empirical antibiotics for sepsis

- Neonatal wards (NICU, maternity units)
 - ≤48hrs: benzylpenicillin + gentamicin
 - >48hrs: flucloxacillin + gentamicin
- Paediatric wards (PICU, medical & surgical wards, A&E)
 - <3 months: cefotaxime/ceftriaxone + amoxicillin
 - ≥3 months: cefotaxime/ceftriaxone

Results

Overall trends and common organisms

- 35,187 samples were taken in 2005-14. 2,147 (6.1%) were positive (Table 1).
- 1/3 sampled from neonates ≤48hrs but positive rates lowest (2.1% BC, 1.6% CSFC) (Figure 1).
- Cases of vaccine-preventable organisms negligible in neonatal units (*N. meningitidis* n=0, *S.pneumoniae* n=2) and higher in paediatric units (n=20, n=45 respectively); no cases of *Listeria monocytogenes*.

Blood cultures (n=1974)		CSF cultures (n=173)	
Neonatal (n=598)	Paediatric (n=1376)	Neonatal (n=42)	Paediatric (n=131)
CONS (n=391)	CONS (n=756)	CONS (n=18)	CONS (n=54)
GBS (n=33)	<i>S.aureus</i> (n=64)	viridans Strep (n=5)	viridans Strep (n=8)
<i>E.coli</i> (n=23)	<i>E.coli</i> (n=60)	<i>P.aeruginosa</i> (n=2)	<i>E.coli</i> (n=7)

Table 1. Top 3 common organisms by location. CONS = coagulase-negative staphylococcus. GBS = Group B Streptococcus.

Temporal trends over ten years

- Number of cultures taken **increased** 1.5-fold, mainly in neonatal units (2.9-fold).
- Culture-positive rates **decreased** from 10.2% (BC) and 5.0% (CSFC) in 2005, to 4.2% (BC) and 1.9% (CSFC) in 2014, especially in neonatal units (Figure 2).
- Greatest decline was in CONS (43.4% decline in neonatal units; 62.4% in paediatric).

Antibiotic resistance in Gram negatives

- In 277 Gram-negative isolates:
 - Resistance rates were generally higher in neonatal units (Table 2).
 - In ceftriaxone-resistant isolates, co-resistance rates were co-amoxiclav (83%), piperacillin-tazobactam (63%), ciprofloxacin (23%), gentamicin (27%). In neonatal units, this rose to 50% for ciprofloxacin and gentamicin.
- In 83 *E.coli* isolates:
 - Ceftriaxone resistance was 11.1% (21.1% in neonatal / 7.5% paediatric) and declined with age (33.3% in neonates ≤2 days, 0% in 6 months and above).
 - Gentamicin resistance was 12.0% (20.8% in neonatal / 8.5% paediatric).
 - In ceftriaxone-resistant isolates, co-resistance rates were co-amoxiclav 100%, piperacillin-tazobactam (50%), ciprofloxacin (75%), gentamicin (75%).

	Neonatal (n=80)	Paediatric (n=197)	Total (n=277)
Co-amoxiclav	45.9%	34.7%	38.4%
Ceftriaxone	19.4%	13.1%	15.1%
Piperacillin-tazobactam	16.0%	17.1%	16.7%
Ciprofloxacin	7.9%	4.2%	5.4%
Gentamicin	10.5%	7.3%	8.3%
Meropenem	0.0%	0.0%	0.0%

Table 2. % resistance of those tested (NB. Not every organism was tested to each antibiotic).

Figure 1 (top). Bar graph of culture results by age group. Figure 2 (bottom). Bar graph of culture results by year stratified by location.

Conclusions

- Increasing tendency to investigate in forms of cultures, but a decline in culture-confirmed infections over time.
- No resistance to meropenem but significant resistance to ceftriaxone, with high levels of co-resistance to gentamicin and ciprofloxacin.
- This study provides valuable evidence to inform locally-tailored antimicrobial prescribing guidelines.