JR Greig, Department of Microbiology, Plymouth Hospitals NHS Trust, Plymouth, PL6 8DH, UK

eP032 Bloodstream infection within 48 hours of admission: The effect of healthcare-associated risk factors on antibiotic resistance - a cross-sectional study

Introduction and Purpose

Blood stream infections (BSI) presenting outside of the hospital can be classified as either community or healthcare (HC) associated. HC risk factors have been defined and debated[1-3]. A retrospective review of BSIs was undertaken to identify simple risk factors easily available to the Clinical Microbiologist that discriminated between community and HC associated BSIs

Methods

Between 2009 and 2012 BSIs were randomly selected from diagnostic laboratory samples. Hospital associated BSI was defined as any clinically significant BSI identified >48 hours after admission. The remaining BSIs were defined as HC associated by the presence of pre-defined risk factors, loosely based on 2005 American Thoracic Society criteria[1], identifiable from the hospital patient management system or computerized clinical notes kept by the Clinical Microbiologists.

- Hospitalisation for >24 hours in the preceding three months
- Admission from residential care eg Nursing or Residential home
- Intensive medical care, receipt of a medical device, medical procedure causing the BSI

Multi drug resistance (MDR) coliforms and pseudomonads were defined as resistance to levofloxacin, gentamicin and piperacillin/tazobactam or the presence of an ESBL or Amp-C enzyme regardless of in vitro beta lactam susceptibilities.

The three main local empirical antibiotics for undifferentiated community or healthcare associated sepsis, co-amoxiclav, piperacillin/tazobactam and levofloxacin were selected to assess the effect of HC risk factors of rates of resistance.

Susceptibility to antibiotics was measured using disc testing and/or breakpoint testing. Clinical and microbial aetiologies were assessed using the Fisher exact test. The effect of HC risk factors on antibiotic resistance rates was assessed using a relative risk.

Results

747 BSIs were identified of which 219 were HC and 255 community associated (239 and 265 individual isolates respectively). On the few occasions where information was missing the BSI was excluded from that element of the analysis. Figures 1a/1b show antibiotic susceptibilities.

The microbial epidemiologies of community and HC associated BSIs were distinct, the clinical syndromes similar (table 1). The correlation between intravascular lines and healthcare infections was expected as the presence of an indwelling intra vascular line was part of the definition of HC infection.

Admission from residential care was a risk factor for presence of resistance for all bacteria and yeasts isolated (all isolates) (tables 2 and 3). The effect on coliforms and pseudomonas was modest. Presence of clinical risk factors was not associated with resistance. This may be a true finding but the methodology used is likely to have missed many of these risk factors.

Recent hospitalisation was a risk factor for resistance in all isolates, for coliforms and pseudomonas the difference was again modest. A similar pattern was noted for hospitalisation in the previous 12 months. The differences between three and 12 months were minimal. If one used hospitalisation in the preceding 12 months (along with residential care and clinical risk factors) as the definition of HC association instead of three months, resistance rates did not significantly change (absolute differences for co-amoxiclav, pip/tazo and levofloxacin <4.8% p>0.2 for all comparisons).

Table 1 Comparison of the microbial and clinical sources of BSI, community and HC BSIs (as defined in methods section) are microbiologically though not clinically distinct from one another

Microbiological/Clinical parameter	Proportion of community BSI(%)	Proportion of healthcare BSI (%)	P value
EnterobacteriacaeΩ	47.2	58.7	0.01
Staphylococcus aureus Ω	15.1	8.3	0.02
Streptococcus pneumoniaΩ	9.1	2.9	0.005
Other streptococciΩ	12.8	5.4	0.005
Pseudomonas aeruginosaΩ	1.9	5.8	0.03
All gram negative isolatesΩ	53.2	70.7	<0.0001
Mixed bacteraemiaΩ	3.1	8.0	0.02
Urogenital	30.5	32.6	0.7
Lower respiratory tract	9.3	5.8	0.3
Soft tissue	10.2	4.7	0.06
Intra-abdominal (including biliary)	19.9	20.3	1.0
Intravascular line	0	13.4	<0.0001
Endocarditis	8.8	4.7	0.1
Unidentified focus	2.2	5.2	0.2

Ω Statistically significant p<0.05 Enterococci, anaerobes and candida each represented 9-10.7% of isolates and were not significantly over represented in either community or HC groups
17.7%-18.3% of isolates could not be ascribed to a clinical group due inadequate available information, these were removed from the clinical syndrome analysis.

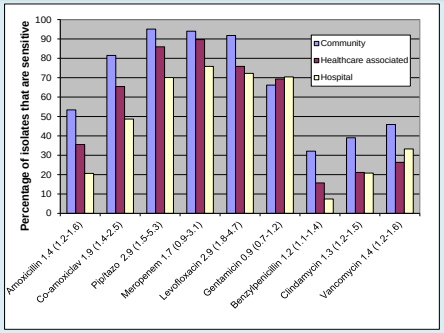

Figure 1a Susceptibility rates to commonly used antibiotics, 804 isolates all types
The relative risk noted on the x axis applies to healthcare and community associated isolates.
Healthcare defined as per methods section

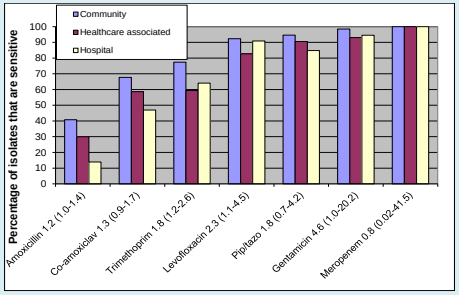

Figure 1b Susceptibility rates to commonly used antibiotics, 451 individual isolates
Enterobacteriaceae and *Pseudomonas aeruginosa*

The relative risk noted on the x axis applies to healthcare and community associated isolates.
Healthcare defined as per methods section

	Co-amoxiclav all isolates	Co-amoxiclav coliforms and pseudomonas	Pip/tazo all isolates	Pip/tazo coliforms and pseudomonas	Levofloxacin all isolates	Levofloxacin coliforms and pseudomonas	MDR coliforms and pseudomonas
Admitted from residential care	61.1	55.2	77.8	89.7	69.4	69.0	13.3
Admitted from the community	74.8	64.0	91	93.0	85.3	89.1	4.1
Difference (%)	13.7	8.8	13.2	3.3	15.9	20.1	9.2
Relative risk	1.6 (1.0-2.4)Ω	1.2 (0.8-1.9)	2.5 (1.3-4.9)Ω	1.5 (0.5-4.7)	2.1 (1.2-3.6)Ω	2.8 (1.5-5.4)Ω	3.3 (1.1-9.6)Ω

Ω Statistically significant p<0.05

Table 2a Risk factors for Healthcare associated infections

	Co-amoxiclav all isolates	Co-amoxiclav coliforms and pseudomonas	Pip/tazo all isolates	Pip/tazo coliforms and pseudomonas	Levofloxacin all isolates	Levofloxacin coliforms and pseudomonas	MDR coliforms and pseudomonas
Hospitalisation within preceding 3 months	66.9	61.7	85.1	89.2	77.8	84.2	6.7
Not hospitalised in preceding 3 months	78.9	62.9	95.2	93.0	89.1	89.6	4.2
Difference (%)	12.0	1.2	10.1	3.8	11.3	5.4	2.5
Relative risk	1.5 (1.2-2.1)Ω	1.0 (0.8-1.4)	3.1 (1.7-6.0)Ω	1.5 (0.8-3.1)	2.0 (1.3-3.1)Ω	1.5 (0.9-2.7)	1.6 (0.6-4.2)
Hospitalisation within preceding 12 months	70.0	61.8	88.8	91.2	79.8	84	6.5
Not hospitalised in preceding 12 months	80.1	66.1	95.1	95.5	90.8	92.9	3.6
Difference (%)	10.1	4.3	6.3	4.3	11.0	8.9	2.9
Relative risk	1.5 (1.1-2.1)Ω	1.1 (0.8-1.6)	2.3 (1.2-4.5)Ω	2.0 (0.7-5.3)	2.2 (1.4-3.6)Ω	2.2 (1.1-4.7)Ω	1.8 (0.6-5.5)

Ω Statistically significant p<0.05

Table 2b risk factors for Healthcare associated BSI

Discussion

HC risk factors have been used to identify a sub set of patients at an increased risk of antibiotic resistance. These risks represent recent exposure to the healthcare environments and antibiotics. Definitions of HC risk factors are controversial. The use of risk factors for respiratory tract infections has led to claims that current risk factors lack specificity[2].

This observational study aimed at identifying patients at an increased risk of resistance based only on information available on patient information systems or routinely gathered at the time of Clinical Microbiology consultations. The concept (if not the detail) of HC associated BSIs is valid. The microbes associated with HC BSI are reminiscent of nosocomial infections with nearly three quarters of BSIs due to gram negative bacteria, a paucity of gram positives and a tendency to greater resistance.

Of the three examined risk factors, admission from residential care and recent hospitalisation were associated with greater resistance, a finding of greater magnitude and statistical significance with relation to gram positive as opposed to gram negative microbes. The effect of hospitalisation persisted to at least a year.

Conclusions

- A group of patients admitted from the community with BSI can be identified who are more likely to have infection with antibiotic resistant pathogens
- Resistance risk factors include admission from residential care and recent hospitalisation
- The effect on antibiotic resistance is greatest for gram positive BSI
- Simple risk factors may allow more rapid identification of patients at greatest risk of antibiotic resistant BSI and allow targeted broad spectrum empirical antibiotic treatment

References

1. ATS, IDSA Guidelines for the management of adults with hospital-acquired, ventilator-associated, and healthcare-associated pneumonia. Am J Respir Crit Care Med 2005; 171: 388-416

2. Chalmers JD et al. Healthcare associated pneumonia does not accurately identify potentially resistant pathogens: A systematic review and meta-analysis. Clin Infect Dis 2014; 58: 330-9.

3. Friedman ND et al. Health care associated blood stream infections in adults. Ann Intern Med 2002; 137: 791-7.