Clinical characteristics and prognostic factors of *Acinetobacter nosocomialis* bacteraemia in patients with solid tumours

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Abstract

The clinical characteristics and risk factors for 28-day mortality in 120 patients with solid tumours with *Acinetobacter nosocomialis* bacteraemia were retrospectively analysed. Eighty-one patients (67.5%) had advanced-stage cancer. Most of the bacteraemia (37.5%) did not have an identified source. The bacteraemia episodes developed at a median of 15 days after hospitalization, and most during a non-neutropenic period (97.5%). Although only half of the patients received appropriate antimicrobial therapy, the mortality was relatively low (11.7%). High Pitt bacteraemia score and receipt of chemotherapy within the month before bacteraemia onset were independently associated with 28-day mortality.

Keywords: *Acinetobacter nosocomialis*, bacteraemia, mortality, solid tumour

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Acinetobacter baumannii (genomic species 2), *Acinetobacter pittii* (genomic species 3) and *Acinetobacter nosocomialis* (genomic species 13TU) are the three most clinically relevant *Acinetobacter* species[1–3]. They are not differentiated by the phenotypical tests commonly used in clinical microbiological laboratories and are grouped together as *A. baumannii* complex (ABC) [4].

ABC has increasingly caused bacteraemia in patients with solid tumours [4–6]. It was recently shown that the *Acinetobacter* species belonging to ABC differ in resistance pattern, resistance mechanism and probably pathogenesis [2,7,8]. Therefore, these species should be investigated separately. Previous reports have indicated that *A. nosocomialis* is the most common species that causes *Acinetobacter* bacteraemia in patients with solid tumours [2,4]. Details of patients with *A. nosocomialis* have not been described. In this study, we analysed the records of patients with solid tumours who had *A. nosocomialis* bacteraemia to determine their clinical characteristics and assess risk factors for 28-day mortality.

The study was conducted between 2000 and 2008 at Taipei Veterans General Hospital (TVGH), a 2900-bed tertiary medical centre in Taiwan. This study was approved by the hospital's institutional review board. The patients with solid tumours with *A. nosocomialis* bacteraemia were included if they were older than 18 years of age. The clinical data were collected retrospectively from patient medical records, and were defined as previously described [4]. Bacteria were phenotypically identified to ABC using the API ID 32GN system or Vitek 2 system (both from bioMérieux, Marcy l'Etoile, France). If multiple ABC isolates were obtained from the same patient, only the first isolate was tested. *Acinetobacter nosocomialis* was identified to the species level using 16S–23S ribosomal DNA intergenic spacer sequence analysis, as previously described [9]. Antimicrobial susceptibility testing was performed using an agar dilution test according to the recommendation of the Clinical and Laboratory Standards Institute [10]. The source of infection was identified using the definitions of the Centers for Disease Control and Prevention [11]. Multidrug resistance was defined as resistance to at least one agent in each of three or more classes of antimicrobial agents, including β-lactam/β-lactamase inhibitor combinations, extended-spectrum cephalosporins, carbapenems, aminoglycosides and fluoroquinolones[12]. The statistical package SPSS for Windows (Version 18; SPSS Inc., Chicago, IL) was used for all data analyses. Chi-square tests with Yates' correction or Fisher's exact tests were used to compare categorical differences. Continuous variables were analysed using Mann–Whitney *U* tests or two-sample *t* tests. All

p values were two-tailed and p <0.05 was considered statistically significant. Variables with p <0.10 that were exhibited by at least 10% of the patients in univariate analyses were subsequently subjected to multivariate analyses to assess independent risk factors for acquisition of multidrug-resistant isolates and mortality.

A total of 120 patients were included. Their characteristics are shown in Table 1. Colorectal cancer was the most prevalent underlying tumour type and ten patients had double cancers. About two-thirds of the patients were in an advanced stage of cancer. Most of the patients did not have neutropenia. Among the 22 patients undergoing major oper-

TABLE 1. Clinical characteristics of patients with solid tumours who survived or died within 28 days of *Acinetobacter nosocomialis* bacteraemia onset[a]

Variables	All (*n* = 120)	Survivor (*n* = 106)	Non-survivor (*n* = 14)	p[b]
Demographic data				
Age (years), mean ± SD	65.66 ± 14.09	65.92 ± 14.43	63.64 ± 11.35	0.571
Sex (male)	81 (67.5)	74 (69.8)	7 (50.0)	0.223
ICU admission[c]	45 (37.5)	42 (39.6)	3 (21.4)	0.186
Pitt bacteraemia score	2.00 (1.00–4.75)	2.00 (1.00–4.00)	3.50 (2.00–6.25)	0.049
Length of stay (days)	38.00 (21.00–63.50)	43.50 (26.00–71.00)	21.50 (12.25–25.00)	<0.01
Time between admission and culture-positive date (days)	15.00 (7.00–25.00)	15.00 (7.00–28.00)	15.00 (5.00–18.25)	0.177
Underlying diseases				
Chemotherapy within 1 month before bacteraemia	37 (30.8)	28 (26.4)	9 (64.3)	0.010
Neutropenia[d]	3 (2.5)	3 (2.7)	0 (0)	>0.99
Hypertension	29 (24.2)	26 (24.5)	3 (21.4)	>0.99
Coronary arterial disease	12 (10.0)	11 (10.4)	1 (7.1)	>0.99
Congestive heart failure	5 (4.2)	5 (4.7)	0 (0)	>0.99
Cerebrovascular disease	16 (13.3)	12 (11.3)	4 (28.6)	0.092
Diabetes mellitus	23 (19.2)	20 (18.9)	3 (21.4)	>0.99
Smoking	21 (17.5)	19 (17.9)	2 (14.3)	>0.99
Chronic lung disease	14 (11.7)	14 (13.2)	0 (0)	0.368
Connective tissue disease	3 (2.5)	3 (2.8)	0 (0)	>0.99
Steroid use[e]	13 (10.8)	13 (12.3)	0 (0)	0.359
Use of immunosuppressive agents	5 (4.2)	5 (4.7)	0 (0)	>0.99
Liver cirrhosis	12 (10.0)	11 (10.4)	1 (7.1)	>0.99
Alcoholism	11 (9.2)	9 (8.5)	2 (14.3)	0.616
Chronic renal disease	11 (9.2)	10 (9.4)	1 (7.1)	>0.99
End-stage renal disease	4 (3.3)	4 (3.8)	0 (0)	>0.99
Invasive procedures				
Endotracheal intubation/tracheostomy	43 (35.8)	38 (35.8)	5 (35.7)	0.992
Central vascular device	57 (47.5)	49 (46.2)	8 (57.1)	0.442
Port-A implant	10 (8.3)	8 (7.5)	2 (14.3)	0.391
Major operation within 1 month	22 (18.3)	22 (20.8)	0 (0)	0.070
TPN	7 (5.8)	6 (5.7)	1 (7.1)	0.590
Underlying cancer type				
Colon and rectal cancer	18 (15)	16 (15.1)	2 (14.3)	>0.99
Oesophago-gastrointestinal cancer	17 (14.2)	16 (15.1)	1 (7.1)	0.689
Lung cancer	16 (13.3)	14 (13.2)	2 (14.3)	>0.99
Head and neck cancer	15 (12.5)	13 (12.3)	2 (14.3)	0.687
Hepato-biliary cancer	10 (8.3)	9 (8.5)	1 (7.1)	>0.99
Breast cancer	10 (8.3)	8 (7.5)	2 (14.3)	0.329
Brain tumour	10 (8.3)	9 (8.5)	1 (7.1)	>0.99
Renal/bladder/prostate cancer	9 (7.5)	9 (8.5)	0 (0)	0.596
Gynaecological cancer	9 (7.5)	8 (7.5)	1 (7.1)	>0.99
Pancreatic cancer	5 (4.2)	3 (2.8)	2 (14.3)	0.103
Miscellaneous	7 (5.8)	6 (5.7)	1 (7.1)	0.590
Advanced cancer status	81 (67.5)	69 (65.1)	12 (85.7)	0.143
Cancer with metastasis	54 (45.0)	46 (43.4)	8 (57.1)	0.331
Source of bacteraemia				
Primary	45 (37.5)	41 (38.7)	4 (28.6)	0.463
Respiratory	36 (30.0)	30 (28.3)	6 (42.9)	0.264
Catheter-related	21 (17.5)	21 (19.8)	0 (0)	0.126
Intra-abdominal	8 (6.7)	5 (4.7)	3 (21.4)	0.050
Skin and soft tissue	6 (5.0)	6 (5.7)	0 (0)	>0.99
Others	4 (3.3)	3 (2.8)	1 (7.1)	0.395
Polymicrobial bacteraemia	26 (21.7)	20 (18.9)	6 (42.9)	0.077
Multidrug resistant isolates	37 (30.8)	32 (30.2)	5 (35.7)	0.760
Appropriate antimicrobial therapy	60 (50.0)	55 (51.9)	5 (35.7)	0.255

SD, standard deviation; ICU, intensive care unit; TPN, total parenteral nutrition.
[a]Data are median value (interquartile range) for continuous variables and number of cases (%) for categorical variables.
[b]p <0.05 is considered significant.
[c]A stay in the ICU within the 2 weeks before the first positive blood culture.
[d]An absolute neutrophil count of <500 cells/mm^3.
[e]Use of >10 mg prednisolone per day for >5 days in the 2 weeks before a bacteraemic episode.