**Table 1: Epidemiological and microbiological characteristics**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Case** | **Age**  **(years)** | **Sex**  **F= Female**  **M= Male** | **Clinical presentation** | **Radiographic findings** | **Background medical conditions** | **Clinical form of nocardiosis** | ***Nocardia spp identified*** |
|
|
| 1 | 42 | F | Dry cough | Symmetrical mediastinal lymphadenopathy | None | Pulmonary | *Nocardia asteroides* |
| 2 | 59 | M | Reduced glasgow coma scale, left arm weakness, multiple skin lesions | Empyema  Frontal lobe ring enhancing lesion | Pulmonary fibrosis, granulomatous polymyositis | Disseminated  (cerebral, cutaneous, pulmonary) | *Nocardia farcinica* |
| 3 | 35 | F | Seizures | Multiple cerebral abscesses | Common variable immunodeficiency syndrome, non-hodgkins lymphoma, bronchiectasis, idiopathic thrombocytopenic purpura (ITP), splenectomy | Cerebral | *Nocardia farcinica* |
| 4 | 36 | F | Headaches, night sweats, weight loss | None | Previous pulmonary tuberculosis, Grave’s Disease | Pulmonary | *Nocardia spp*  *(unspeciated)* |
| 5 | 57 | M | Recent dental abscess drainage, headache | Temporal lobe ring enhancing lesion | None | Cerebral | *Nocardia spp*  *(unspeciated)* |
| 6 | 75 | M | Weight loss, cough | New cavitatory lung lesion | Mycobacterium avium intracellulare (MAI) - on treatment at presentation (rifampicin, ethambutol, clarithromycin), previous aspergilloma, childhood polio, ITP, splenectomy | Pulmonary | *Nocardia transvalensis* |
| 7 | 73 | M | Headache, pyrexia | Multiple cerebral abscesses | Prostate cancer, renal transplant, type 2 diabetes mellitus (T2DM) | Cerebral | *Nocardia farcinica* |
| 8 | 70 | F | Headache, nausea, photophobia, dysarthria, vertigo, 3-stone weight loss in previous 12 months | Cerebellar ring enhancing lesion | Bronchiectasis, rheumatoid arthritis | Cerebral | *Nocardia ignorata* |
| 9 | 6 | F | Community-acquired pneumonia | Bronchopneumonia | Asthma | Bacteraemia | *Nocardia spp*  *(unspeciated)* |
| 10 | 47 | M | Surgical site infection (aortic valve replacement) | Sternal osteomyelitis | Inherited connective tissue disorder | Sternal osteomyelitis | *Nocardia farcinica* |
| 11 | 61 | M | Community-acquired pneumonia, upper gastrointestinal bleed | Lobar pneumonia | Meningioma | Disseminated  (pulmonary, bacteraemia) | *Nocardia puris* |
| 12 | 79 | M | Recent blunt injury sole of left foot - stepped on a nail, multiple skin abscesses with enlarged lymph nodes left leg | Pulmonary nodules  Enlarged cervical lymph nodes | Chronic kidney disease, emphysema, giant cell arteritis, chronic inflammatory demyelinating polyneuropathy, T2DM, recurrent non-typhoidal *Salmonella* *spp* bacteraemia | Disseminated  (cutaneous, pulmonary, epicardial) | *Nocardia farcinica* |
| 13 | 83 | M | Dysphasia, dysgraphia, right-sided facial weakness | Temporal lobe ring enhancing lesion | Bladder cancer | Cerebral | *Nocardia spp*  *(unspeciated)* |
| 14 | 57 | M | Headache, dysphagia | Frontal lobe ring enhancing lesion | Metastatic lung cancer | Disseminated  (bacteraemia, cerebral) | *Nocardia farcinica* |
| 15 | 61 | M | Nausea, vomiting, tremor, abnormal gait, headache | Cerebellar ring enhancing lesion | Antisynthetase syndrome (Anti Jo-1), tongue & oropharyngeal cancer, interstitial lung disease | Cerebral | *Nocardia farcinica* |
| 16 | 59 | M | Nasal bridge abscess post outdoor trauma | No imaging | None | Cutaneous | *Nocardia spp*  *(unspeciated)* |
| 17 | 67 | M | Skin abscesses | Multiple cerebral abscesses | Prostate cancer | Disseminated  (cutaneous, cerebral) | *Nocardia farcinica* |
| 18 | 49 | M | Headache, vertigo, slurred speech, ataxia | Cerebellar ring enhancing lesions | Obesity, gastric bypass surgery, renal stones | Cerebral | *Nocardia farcinica* |

**Table 2**

Diagnostic methodologies for *Nocardia* diagnosis and results.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Case Year | | Local microscopy/culture results |  |  |  | Reference laboratory result | Reference laboratory method |
| Clinical sample(s) | AAFBa microscopy | AAFB cultureb | Routine bacterial 48 h culture |
| 1 | 2000 | Mediastinal lymph node | Negative | Positive | Negative | Positive | Unknown |
| 2 | 2001 | Cerebral pus | Negative | Negative | Positive | Positive | Unknown |
|  |  | *Skin swabs also culture positive at referring hospital* |  |  |  |  |  |
| 3 | 2001 | Cerebral pus | NDd | ND | Positive | Positive | Unknown |
| 4 | 2014 | Sputum | Negative | Positive | Negative | Positive | Unknown |
| 5 | 2005 | Cerebral pus | ND | ND | Positive | Positive | Unknown |
| 6 | 2005 | Fine needle aspirate of lung abscess | Negative | Positive | Positive | Not sent | NAc |
| 7 | 2006 | Cerebral pus | ND | ND | Positive | Not sent | NA |
|  |  | Cerebrospinal fluid | ND | ND | Positive | Not sent | NA |
| 8 | 2006 | Cerebral pus | ND | ND | Positive | Positive | Partial sequencing of 16S  rDNA |
| 9 | 2006 | Blood culture | ND | ND | Positive | Positive | Partial sequencing of 16S  rDNA |
| 10 | 2007 | Tissue sternum | ND | ND | Positive | Positive | Partial sequencing of 16S  rDNA |
| 11 | 2009 | Sputum | ND | ND | Positive | Positive | Partial sequencing of 16S  rDNA |
|  |  | Blood culture | ND | ND | Positive | Positive | Partial sequencing of 16S  rDNA |
|  |  | Wound swab chest | ND | ND | Positive | Positive | Partial sequencing of 16S  rDNA |
| 12 | 2011 | Neck lymph node | Negative | Negative | Positive | Positive | Partial sequencing of 16S  rDNA |
| 13 | 2015 | Cerebral pus | Negative | Negative | Negative | Positive | Partial sequencing of 16S  rDNA |
| 14 | 2015 | Blood culture | ND | ND | Positive | Not sent | NA |
| 15 | 2017 | Cerebral pus | Negative | Negative | Positive | Positive | Partial sequencing of 16S  rDNA |
| 16 | 2017 | Wound swab nose | ND | ND | Positive | Not sent | NA |
| 17 | 2018 | Wound swab skin | ND | ND | Positive | Positive | Partial sequencing of 16S  rDNA |
| 18 | 2018 | Cerebral pus | Negative | Positive | Positive | Positive | Partial sequencing of 16S  rDNA |

a Alcohol and acid fast bacilli.

b AAFB culture positive for *Nocardia* spp only.

c Not applicable.

d Not done.

**Table 3: Nocardia antimicrobial susceptibility testing results**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Case | Year | *Nocardia spp* | Amikacin | Doxycycline | Co-amoxiclav | Ciprofloxacin | Co-trimoxazole | Cefotaxime | Ceftriaxone | Gentamicin | Linezolid | Imipenem | Meropenem | Moxifloxacin |
| 1 | 2000 | *Nocardia asteroides* | Data missing | | | | | | | | | | | |
| 2 | 2001 | *Nocardia farcinica* | Data missing | | | | | | | | | | | |
| 3 | 2001 | *Nocardia farcinica* | NT\* | NT | NT | NT | S^ | S | NT | NT | NT | NT | NT | NT |
| 4 | 2004 | *Nocardia spp* | Data missing | | | | | | | | | | | |
| 5 | 2005 | *Nocardia spp* | S | R$ | S | S | R | S | S | R | NT | S | S | S |
| 6 | 2005 | *Nocardia transvalensis* | R | R | S | R | S | S | S | R | S | S | S | NT |
| 7 | 2006 | *Nocardia farcinica* | S | R | S | S | S | S | S | R | S | S | S | NT |
| 8 | 2006 | *Nocardia ignorata* | NT | R | S | R | S | S | S | S | S | S | S | S |
| 9 | 2006 | *Nocardia spp* | Data missing | | | | | | | | | | | |
| 10 | 2007 | *Nocardia farcinica* | S | R | S | S | S | S | S | S | NT | S | S | NT |
| 11 | 2009 | *Nocardia puris* | S | R | S | R | S | S | S | S | S | S | S | S |
| 12 | 2011 | *Nocardia farcinica* | S | I | S | S | S | S | S | R | S | S | S | S |
| 13 | 2015 | *Nocardia spp* | Data missing | | | | | | | | | | | |
| 14 | 2015 | *Nocardia farcinica* | S | NT | S | S | S | S | NT | R | S | NT | NT | S |
| 15 | 2017 | *Nocardia farcinica* | S | I | S | S | S | S | S | R | S | S | S | S |
| 16 | 2017 | *Nocardia spp* | Data missing | | | | | | | | | | | |
| 17 | 2018 | *Nocardia farcinica* | S | R | S | S | S | S | S | R | S | S | S | S |
| 18 | 2018 | *Nocardia farcinica* | NT | NT | S | R | S | I£ | R | NT | S | S | S | R |

\*NT= not tested, ^S=sensitive, $R= resistant, £I = intermediate

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Case** | **Clinical form of nocardiosis** | ***Nocardia spp identified*** | **Nocardiosis management** | | | |
| **Surgery** | **Antimicrobial therapy**  **[duration - days]** | | **Outcome**  **[days between nocardiosis diagnosis and death]** |
| **Intravenous therapy** | **Oral therapy** |
| 1 | Pulmonary | *Nocardia asteroides* | N/A | None | None | Discharged |
| 2 | Disseminated | *Nocardia farcinica* | Yes | co-trimoxazole [68 days], cefotaxime [68 days], metronidazole [68 days] | None | Died  [66 days] |
| 3 | Cerebral | *Nocardia farcinica* | Yes | co-trimoxazole [25 days], ceftriaxone [25 days], clindamycin [25 days] | co-trimoxazole [497 days] | Died  [522 days] |
| 4 | Pulmonary | *Nocardia spp* | No | None | None | Discharged |
| 5 | Cerebral | *Nocardia spp* | Yes | meropenem [21 days], co-trimoxazole [21 days] | moxifloxacin [365 days] | Discharged |
| 6 | Pulmonary | *Nocardia transvalensis* | No | None | co-trimoxazole [356 days] | Died  [356 days] |
| 7 | Cerebral | *Nocardia farcinica* | Yes | co-trimoxazole [58 days], metronidazole [61 days], amoxicillin [61 days], cefotaxime [61 days] | None | Died  [58 days] |
| 8 | Cerebral | *Nocardia ignorata* | Yes | cefotaxime [17 days], metronidazole [17 days] | moxifloxacin [2 days] | Died  [16 days] |
| 9 | Bacteraemia | *Nocardia spp* | No | None | None | Discharged |
| 10 | Sternal osteomyelitis | *Nocardia farcinica* | Yes | None | co-trimoxazole [14 days], co-amoxiclav [63 days], ciprofloxacin [185 days] | Discharged |
| 11 | Disseminated | *Nocardia puris* | Yes | co-amoxiclav [8 days], clarithromycin [8 days], piperacillin-tazobactam [9 days], gentamicin [9 days]  \*treatment withdrawn | None | Died  [30 days] |
| 12 | Disseminated | *Nocardia farcinica* | No | meropenem [228 days], co-trimoxazole [228 days] | co-amoxiclav [2,026 days] | Died  [2,646 days] |
| 13 | Cerebral | *Nocardia spp* | Yes | meropenem [12 days while in St George’s] | None | Discharged, interhospital transfer – lost to follow up |
| 14 | Disseminated | *Nocardia farcinica* | No | None  \*palliative at diagnosis | None | Died  [5 days] |
| 15 | Cerebral | *Nocardia farcinica* | Yes | meropenem [4 days], imipenem [68 days],  co-trimoxazole [7 days] | moxifloxacin [73 days], co-trimoxazole [145 days] | Died  [226 days] |
| 16 | Cutaneous | *Nocardia spp* | No | None | None | Discharged |
| 17 | Disseminated | *Nocardia farcinica* | No | imipenem [6 days], amikacin [22 days], meropenem [42 days], co-trimoxazole [42 days] | moxifloxacin [48 days], co-trimoxazole [48 days] | Died  [90 days] |
| 18 | Cerebral | *Nocardia farcinica* | Yes | imipenem [28 days], co-trimoxazole [5 days], meropenem [day 33 to date; on-going] | moxifloxacin [day 43 to date; on-going], linezolid [day 58 to date; on-going] | Discharged on outpatient antimicrobial therapy (OPAT) January 2019 |

**Table 4: Clinical management and outcome**