Case Report

A case of cavernous sinus thrombosis caused by *Dialister pneumosintes*, *Slackia exigua* and *Prevotella baroniae*

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Introduction: Cavernous sinus thrombosis (CST) is a rare manifestation of cerebral venous thrombosis. We herein describe the first case of CST associated with the oral microbes (*Dialister pneumosintes*, *Slackia exigua* and *Prevotella baroniae*).

Case presentation: An 82-year-old previously self-supported Japanese woman presented with acute onset of impaired consciousness. Computed tomography revealed intracranial haemorrhage complicated with CST. *D. pneumosintes*, *Slackia exigua* and *P. baroniae* were cultivated from two sets of blood cultures and were identified with 16S rRNA sequencing. The patient was successfully discharged after ampicillin–sulbactam treatment, which was performed soon after admission.

Conclusion: To our knowledge, this is the first description of CST caused by *D. pneumosintes*, *Slackia exigua* and *P. baroniae*. CST should be considered in cases of unusual distribution of cerebral haemorrhage.

Keywords: cavernous sinus thrombosis; *Dialister pneumosintes*; *Prevotella baroniae*; *Slackia exigua*.

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Introduction

Cavernous sinus thrombosis (CST) is a rare manifestation of cerebral venous thrombosis. CST causes several serious complications because the cranial nerves and internal carotid artery run through the lumen (Ebright *et al.*, 2001), and accounts for 1.3 % of all cerebral venous thrombosis (Ferro *et al.*, 2004). Mortality is reportedly 13 % and morbidity 23 % in previous case series (Yarington, 1997).

Unlike other cerebral venous thromboses, for which malignancy, pregnancy, collagen diseases, and trauma are the main aetiologies (Filippidis *et al.*, 2009), most cases of CST have occurred associated with bacterial infections (Desa & Green, 2012). *Staphylococcus aureus* is isolated in

two-thirds of CST cases, and *Streptococcus pneumoniae* is occasionally identified as an unusual presentation of pneumococcal infections (Southwick *et al.*, 1986; Thatai *et al.*, 1992). Anaerobes can also be causative pathogens (Palestro *et al.*, 1986; Chang *et al.*, 2004), but precise identification is rarely successful with conventional methods.

Herein we report a case of CST caused by *Dialister pneumosintes*, *Slackia exigua* and *Prevotella baroniae*, which are oral anaerobes that we determined using 16S rRNA sequencing.

Case report

An 82-year-old previously self-supported Japanese woman was transferred to our hospital with acute onset of impaired consciousness. She had been healthy until the

Abbreviations: CST, cavernous sinus thrombosis; CT, computed tomography.

morning of the day of admission without preceding symptoms, but was drowsy and unable to locate the toilet at home when her son returned in the afternoon. Her consciousness rapidly deteriorated during transportation and she had become unresponsive soon after arriving at our emergency department. She had a history of right upper dental caries before visiting our hospital, but otherwise had no past medical history. At our initial evaluation, the Glasgow Coma Scale value was 6 (E1V1M4) and her body temperature was 37.4 °C. There were no remarkable findings on chest or abdominal examinations. Neurological examination revealed conjugate deviation to the right side, and manual muscle testing was 0/5 on the left upper limb and 2/5 on the left lower limb. Other physical characteristics of significance were swelling of her right cheek and poor hygiene in her mouth, with dental caries in her upper right teeth. Laboratory analysis showed a white blood cell count of $41\,600\ \mu\text{l}^{-1}$ and a C-reactive protein level of $10.5\ \text{mg dl}^{-1}$. Functional indicators of kidney and liver, electrolyte levels, prothrombin time, and activated partial thromboplastin time were unremarkable. Computed tomography (CT) of the brain (Fig. 1a) showed right intracranial haemorrhage ranging from the right external capsule to the temporal lobe, and relatively widespread oedema around the haemorrhage, the distribution of which was inconsistent with the anatomical arterial location. Further investigation was performed with enhanced brain CT, which showed a low-density area ($31 \times 9 \times 7\ \text{mm}$) in the right masticator space (Fig. 1b), poor enhancement of the right cavernous sinus compared with the left cavernous sinus (Fig. 1c), and intermittent defect in the right superior ophthalmic vein (Fig. 1d). Based on the presence of thrombi in the sinus and vein and an abscess in the right masticator space, right CST was

diagnosed. Intravenous ampicillin–sulbactam with anti-coagulant therapy was administered after evaluation.

Two sets of blood cultures were incubated with the BacT/ALERT system (bioMérieux), and positive signals were obtained in both of the anaerobic bottles after 78 and 86 h. No positive signals were obtained from the aerobic bottles. Direct Gram staining showed Gram-positive and Gram-negative rods. Three different colony types (Gram-positive rods and two kinds of Gram-negative rods) were obtained on 5 % sheep blood agar plates from two sets of blood culture bottles after 96 h of anaerobic incubation at 35 °C in an anaerobic chamber. One of the two Gram-negative rods was initially classified as *Bacteroides uniformis* by BBL Crystal ANR (Becton Dickinson) and API 20A (bioMérieux). However, we could not microbiologically identify the other two bacteria with conventional phenotypic methods. Partial 16S rRNA gene sequencing using the ABI PRISM Big Dye Terminator Cycle Sequencing kit v3.1 (Applied Biosystems) was therefore performed, and the consensus sequence had the highest similarity to *D. pneumosintes* (100 % match; 847/847 bp; GenBank accession number HM 596297) and *S. exigua* ATCC 700122 (99.7 % match; 770/772 bp; GenBank accession number AF101240). We also performed sequence analysis for the Gram-negative rod initially considered as *B. uniformis*, and this was genetically classified as *P. baroniae* based on GenBank database searches (99.8 % match; 822/824 bp compared with *P. baroniae* strain E9.33, GenBank accession number AY840553). *D. pneumosintes*, *S. exigua* and *P. baroniae* bacteraemia was ultimately diagnosed. The MIC of ampicillin–sulbactam against *P. baroniae* was measured as $\leq 4\ \mu\text{g ml}^{-1}$ with Dry Plate (Eiken Chemical Company), but we could not measure antimicrobial

Fig. 1. CT on admission showed intracranial haemorrhage ranging from the right external capsule to the temporal lobe, with relatively widespread oedema around the haemorrhage (a). Initial enhanced CT showed an abscess in the right masticator space (b), poor enhancement of the right cavernous sinus (c), and intermittent defect in the right superior ophthalmic vein, representing thrombosis (d).

susceptibilities of *D. pneumosintes* and *S. exigua* because of their slow rate of growth.

Anticoagulant therapy was discontinued on day 34 because of rectal bleeding, and ampicillin–sulbactam was continued for 61 days with clinical improvement. The patient was discharged on day 108 after hospitalization. Owing to the sequelae of cerebral haemorrhage, she needed physical assistance, and her physical status at discharge was recorded as Grade 4 based on the modified Rankin Scale.

Discussion

We report a life-threatening CST with a mixed anaerobic infection. In this case we identified three anaerobes (*D. pneumosintes*, *S. exigua* and *P. baroniae*), all of are oral microbes whose molecular features were established recently (Doan *et al.*, 2000; Downes *et al.*, 2005; Moore & Moore, 1994; Wade *et al.*, 1999). They have been associated with periodontal infections (Booth *et al.*, 2004; Contreras *et al.*, 2000; Downes *et al.*, 2001; Rocas *et al.*, 2010; Sakamoto *et al.*, 2006; Siqueira & Rocas, 2009), but are rarely isolated from extra-oral infections. There has been one case of pneumonia (Bahrani-Mougeot *et al.*, 2007), one of sinusitis (Drago *et al.*, 2013), and cases of brain abscess (Rousee *et al.*, 2002) with *D. pneumosintes*; and a case of meningitis (Bukki *et al.*, 2011), cases of wound infections (Kim *et al.*, 2010), and a case of infective endocarditis (Woo *et al.*, 2004) with *S. exigua*. To our knowledge, none of these anaerobes has been reported as a causative pathogen of CST. We therefore describe the first case of CST associated with *D. pneumosintes*, *S. exigua* and *P. baroniae*, as confirmed by two sets of blood cultures. These organisms could be easily missed when standard protocols are used because of their fastidious and slow growth, and 16S rRNA sequence analysis is required for precise identification. Thus, these and other oral anaerobes might be more frequent causes of medically important infections than is currently recognized.

Regarding the diagnosis of CST, radiological signs of cerebral haemorrhage caused by cerebral venous thrombosis are not recognized in daily practice, so CST also tends to be under-diagnosed among patients with cerebral haemorrhage (Giroi *et al.*, 2007). In this case the haemorrhage in our patient was patchy, and peripheral oedematous change was apparent in comparison with typical acute intracranial haemorrhage. In addition, the haemorrhage overlapped several territories of intra-cerebral arteries (precentral artery, insular branches of middle cerebral artery, and posterior temporal artery). These are key features of cerebral haemorrhage caused by cerebral venous thrombosis (Bakac & Wardlaw, 1997), leading us to suspect the possibility of cerebral venous thrombosis in our patient. CST has been known to be frequently missed by non-enhanced CT with traditional section thickness (Chen *et al.*, 2006), so thin-section enhanced CT should be performed.

A limitation of this report concerns the fact that we did not perform an invasive procedure or dental intervention to treat the abscess and dental caries during hospitalization. We considered aspiration therapy; however, as most of the abscess was located near or within the venous system, we chose antimicrobial therapy along with blood pressure and seizure control for CST and cerebral haemorrhage. A favorable response allowed us to continue these conservative therapies. However, it is possible that part of the abscess (Fig. 1b; size 31 × 9 × 7 mm) could be aspirated percutaneously, which might shorten the duration of antimicrobial therapy, while dental intervention might provide the diagnosis for the route of infection.

We have reported a case of CST caused by *D. pneumosintes*, *S. exigua* and *P. baroniae*. CST should be considered in cases of unusual distribution of cerebral haemorrhage, especially with systemic inflammatory response syndrome.

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References

- Bahrani-Mougeot, F. K., Paster, B. J., Coleman, S., Barbuto, S., Brennan, M. T., Noll, J., Kennedy, T., Fox, P. C. & Lockhart, P. B. (2007). Molecular analysis of oral and respiratory bacterial species associated with ventilator-associated pneumonia. *J Clin Microbiol* **45**, 1588–1593.
- Bakac, G. & Wardlaw, J. M. (1997). Problems in the diagnosis of intracranial venous infarction. *Neuroradiol* **39**, 566–570.
- Booth, V., Downes, J., Van den Berg, J. & Wade, W. G. (2004). Gram-positive anaerobic bacilli in human periodontal disease. *J Periodontol Res* **39**, 213–220.
- Bukki, J., Huttner, H. B., Lee, D. H., Jantsch, J., Janka, R. & Ostgathe, C. (2011). Polymicrobial feculent meningitis with detection of *Slackia exigua* in the cerebrospinal fluid of a patient with advanced rectal carcinoma. *J Clin Oncol* **29**, e852–e854.
- Chang, C. S., Liou, C. W., Huang, C. C., Lui, C. C. & Chang, K. C. (2004). Cavernous sinus thrombosis and cerebral infarction caused by *Fusobacterium nucleatum* infection. *Chang Gung Med J* **27**, 459–463.
- Chen, H. W., Su, C. P., Su, D. H., Chen, H. W. & Chen, Y. C. (2006). Septic cavernous sinus thrombosis: an unusual and fatal disease. *J Formos Med Assoc* **105**, 203–209.
- Contreras, A., Doan, N., Chen, C., Rusitanonta, T., Flynn, M. J. & Slots, J. (2000). Importance of *Dialister pneumosintes* in human periodontitis. *Oral Microbiol Immunol* **15**, 269–272.
- Desa, V. & Green, R. (2012). Cavernous sinus thrombosis: current therapy. *J Oral Maxillofac Surg* **70**, 2085–2091.
- Doan, N., Contreras, A., Flynn, J., Slots, J. & Chen, C. (2000). Molecular identification of *Dialister pneumosintes* in subgingival plaque of humans. *J Clin Microbiol* **38**, 3043–3047.
- Downes, J., Munson, M. A., Spratt, D. A., Kononen, E., Tarkka, E., Jousimies-Somer, H. & Wade, W. G. (2001). Characterisation of

- Eubacterium*-like strains isolated from oral infections. *J Med Microbiol* **50**, 947–951.
- Downes, J., Sutcliffe, I., Tanner, A. C. & Wade, W. G. (2005). *Prevotella marshii* sp. nov. and *Prevotella baroniae* sp. nov., isolated from the human oral cavity. *Int J Syst Evol Microbiol* **55**, 1551–1555.
- Drago, L., Vassena, C., Saibene, A. M., Del Fabbro, M. & Felisati, G. (2013). A case of coinfection in a chronic maxillary sinusitis of odontogenic origin: identification of *Dialister pneumosintes*. *J Endodont* **39**, 1084–1087.
- Ebright, J. R., Pace, M. T. & Niazi, A. F. (2001). Septic thrombosis of the cavernous sinuses. *Arch Intern Med* **161**, 2671–2676.
- Ferro, J. M., Canhao, P., Stam, J., Bousser, M. G. & Barinagarrementeria, F. (2004). Prognosis of cerebral vein and dural sinus thrombosis: results of the International Study on Cerebral Vein and Dural Sinus Thrombosis (ISCVT). *Stroke* **35**, 664–670.
- Filippidis, A., Kapsalaki, E., Patramani, G. & Fountas, K. N. (2009). Cerebral venous sinus thrombosis: review of the demographics, pathophysiology, current diagnosis, and treatment. *Neurosurg Focus* **27**, E3.
- Giro, M., Ferro, J. M., Canhao, P., Stam, J., Bousser, M. G. & Barinagarrementeria, F. (2007). Predictors of outcome in patients with cerebral venous thrombosis and intracerebral hemorrhage. *Stroke* **38**, 337–342.
- Kim, K. S., Rowlinson, M. C., Bennion, R., Liu, C., Talan, D., Summanen, P. & Finegold, S. M. (2010). Characterization of *Slackia exigua* isolated from human wound infections, including abscesses of intestinal origin. *J Clin Microbiol* **48**, 1070–1075.
- Moore, L. V. & Moore, W. E. (1994). *Oribaculum catoniae* gen. nov., sp. nov.; *Catonella morbi* gen. nov., sp. nov.; *Hallella seregens* gen. nov., sp. nov.; *Johnsonella ignava* gen. nov., sp. nov.; and *Dialister pneumosintes* gen. nov., comb. nov., nom. rev., anaerobic Gram-negative bacilli from the human gingival crevice. *Int J Syst Bacteriol* **44**, 187–192.
- Palestro, C. J., Malat, J., Gladstone, A. G. & Richman, A. H. (1986). Gallium scintigraphy in a case of septic cavernous sinus thrombosis. *Clin Nucl Med* **11**, 636–639.
- Rocas, I. N., Alves, F. R., Santos, A. L., Rosado, A. S. & Siqueira, J. F. Jr. (2010). Apical root canal microbiota as determined by reverse-capture checkerboard analysis of cryogenically ground root samples from teeth with apical periodontitis. *J Endodont* **36**, 1617–1621.
- Rousee, J. M., Bermond, D., Piemont, Y., Tournoud, C., Heller, R., Kehrli, P., Harlay, M. L., Monteil, H. & Jaulhac, B. (2002). *Dialister pneumosintes* associated with human brain abscesses. *J Clin Microbiol* **40**, 3871–3873.
- Sakamoto, M., Rocas, I. N., Siqueira, J. F. Jr. & Benno, Y. (2006). Molecular analysis of bacteria in asymptomatic and symptomatic endodontic infections. *Oral Microbiol Immunol* **21**, 112–122.
- Siqueira, J. F. Jr. & Rocas, I. N. (2009). The microbiota of acute apical abscesses. *J Dent Res* **88**, 61–65.
- Southwick, F. S., Richardson, E. P. & Swartz, M. N. (1986). Septic thrombosis of the dural venous sinuses. *Medicine* **65**, 82–106.
- Thatai, D., Chandy, L. & Dhar, K. L. (1992). Septic cavernous sinus thrombophlebitis: a review of 35 cases. *J Indian Med Assoc* **90**, 290–292.
- Wade, W. G., Downes, J., Dymock, D., Hiom, S. J., Weightman, A. J., Dewhurst, F. E., Paster, B. J., Tzellas, N. & Coleman, B. (1999). The family Coriobacteriaceae: reclassification of *Eubacterium exiguum* (Poco et al. 1996) and *Peptostreptococcus heliotrinireducens* (Lanigan 1976) as *Slackia exigua* gen. nov., comb. nov. and *Slackia heliotrinireducens* gen. nov., comb. nov., and *Eubacterium lentum* (Prevot 1938) as *Eggerthella lenta* gen. nov., comb. nov. *Int J Syst Bacteriol* **49**, 595–600.
- Woo, P. C., Tse, H., Chan, K. M., Lau, S. K., Fung, A. M., Yip, K. T., Tam, D. M., Ng, K. H., Que, T. L. & Yuen, K. Y. (2004). “*Streptococcus milleri*” endocarditis caused by *Streptococcus anginosus*. *Diagn Microbiol Infect* **48**, 81–88.
- Yarrington, C. T. Jr. (1977). Cavernous sinus thrombosis revisited. *Proc R Soc Med* **70**, 456–459.