Enterococcus avium

An unusual cause of cerebral abscess

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ABSTRACT

Enterococci are responsible for an increasing number of human infections. They are normally part of the flora of the human gastrointestinal tract, buccal cavity, perineal skin, vagina, urethra and gallbladder, but may occur as pathogens in several sites causing urinary tract infections, intra-abdominal infections, fatal bacteremia, meningitis and endocarditis. *Enterococcus avium* is a rare cause of infection in humans. Here, we report a 19-year-old Saudi girl diagnosed as a case of astrocytoma grade II arising from the right thalamus. She underwent treatment with radiotherapy followed by 5 chemotherapy sessions. She subsequently developed a cerebral abscess, and we performed mini craniotomy of the left parietal region with drainage of the brain abscess. The pus obtained from the abscess grew *Enterococcus avium*. We successfully treated her with antibiotics and discharged her home. The rarity of the organism causing cerebral abscess has motivated the documentation of this case and the pathogenesis of *Enterococcus avium*.

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Brain abscesses are localized infections of the brain substance, produced by a variety of pyogenic organisms. Infection originates via extension from adjacent foci or by metastasis through blood stream or thorough septic emboli from other sources of intravascular infection. Although *Enterococcus spp* account for one of the majority causes of brain abscesses, the true incidence of each of *Enterococcus spp* causing brain abscess is not known. Most reports mention only major species of *Enterococci* and go no further in their identification. Enterococcal meningitis tends to occur in patients with history of urinary-tract disease, anatomic defects of the central nervous system, previous neurosurgical procedures, or enterococcal endocarditis.[1-3] *Enterococci*, formerly classified with fecal *streptococci*, have been recognized to be of fecal origin since the beginning of this century, the usual ecological niche for *Enterocccus spp* is the intestines of humans and some animals.[2,3] However, *Enterococci* are ubiquitous and can be found free living in soil, on plants, in dairy products or fecal matter of human and warm blooded animals especially chickens.[2,4] *Enterococcus avium* (*E. avium*) is now becoming increasingly recognized as a human pathogen, producing a variety of lesions including brain abscess.

Case Report. A 19-year-old Saudi female was diagnosed as case of brain tumor originating from and involving the right thalamus, basal ganglia and mid brain with extension upward and mushrooming into the right lateral ventricle with obstructive hydrocephalus. She was operated, and a left ventriculoperitoneal shunt was inserted and through a right frontal craniotomy, the right-sided deeply

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situated thalamic basal ganglia lesion was biopsied. The histology was reported as grade-II astrocytoma. Further surgery to excise the tumor was not attempted in view of the deep location of the tumor. She was therefore referred to our Oncology Department for further management. While she was being treated with radiotherapy, she was receiving dexamethasone and was followed on a 3 monthly basis with brain MRI. One year from the time of initial biopsy and ventriculoperitoneal shunt, while she was still under regular follow up, she was brought to the emergency room (ER) with fever, weakness in the right upper limb, decreased level of consciousness and decrease in speech fluency. Examination of the shunt revealed a compressible and refilling valve. An urgent non-contrast CT scan of the brain was carried out, which showed the deep seated right thalamic tumor with intraventricular extension on the right side and a hypodense area on the left side surrounding the ventricular catheter track in the parietal region (**Figures 1 & 2**). A shunt tap was performed in the ER, which produced a few drops of purulent fluid, which on microscopy and gram stain showed numerous pus cells with Gram-negative bacilli. It was confirmed that the shunt system was infected and nonfunctioning. The same night, the whole shunt system was removed and external ventricular drainage was established from the frontal horn of the left lateral ventricle. She was started on intravenous antibiotics, vancomycin, metronidazole and ceftazidime. The tip of the ventricular catheter and the shunt tap fluid were sent for microbiological examination, which grew *Klebsiella spp* and *Proteus spp*. Since the first CT scan was carried out without contrast as an emergency, a follow up CT scan with contrast was performed 4 days later, which revealed a large 5cm x 3cm x 3cm lesion in the left parietal region with enhancement in the same region of the previous hypodense area, seen along the track of the ventricular catheter (**Figure 3**). A diagnosis of brain abscess was confirmed, the abscess was aspirated, and a partial excision of the abscess was carried out through a mini craniotomy. The pus obtained was sent for microbiological examination and culture. *Enterococcus avium* was isolated as a pure culture from the pus. On further questioning of the parents, it was revealed that the family breeds pigeons in their household as pets and has regular contact with the birds. After 2 weeks of intravenous (IV) antibiotics, the culture of the CSF from the external ventricular drainage showed no growth on 3 consecutive samples and hence, the external drainage was removed and a new ventriculo-peritoneal shunt was carried out using the frontal horn of the left lateral ventricle. A further 6 weeks of IV antibiotic therapy was given, and the patient made a complete recovery. Follow up CT scan

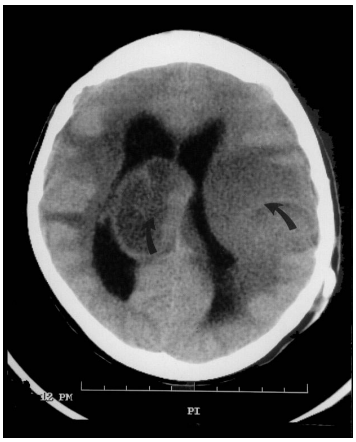

Figure 1 - Computerized tomography scan of the brain without contrast enhancement showing tumor in the right thalamic region with intraventricular extension and brain abscess in the left parietal lobe with compression of the lateral ventricle.

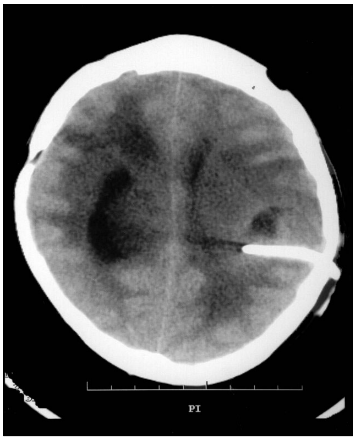

Figure 2 - Computerized tomography of the brain without contrast pretreatment, showing a localized abscess in the left parietal area in relation to the ventricular catheter.

Figure 3 - Computerized tomography scan of the brain with contrast enhancement showing abscess in the left parietal lobe and the tumor in the right thalamic region with tip of the ventricular catheter of the external ventricular drainage in the left frontal horn of the lateral ventricle, taken 3 days after removal of the ventriculoperitoneal shunt.

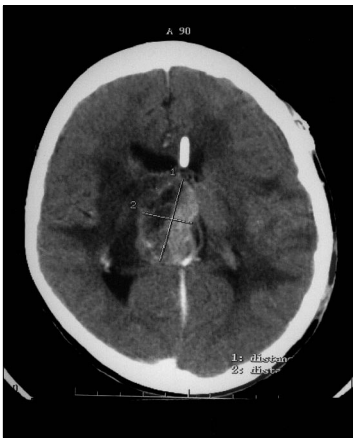

Figure 4 - Computerized tomography scan of the brain with contrast enhancement (post treatment) showing the tumor in the right thalamic region and the complete disappearance of the left parietal lobe brain abscess.

examination showed a satisfactorily resolved abscess in the left parietal region (**Figure 4**).

Microbiological investigations. The CSF obtained by shunt tapping at the ER was slightly turbid. The results of microbiological investigations were as follows. White blood cell count 38/cmm; red blood cell count 3,360/ cmm; differential count 80% polymorphs and 20% mononuclear cells. Bacterial antigen detection in the CSF was negative. The Gram's stain on the CSF showed Gram-negative bacilli, while *Klebsiella spp* and *Proteus spp* were isolated on culture. The pus collected from the brain abscess at surgery, showed numerous pus cells and a moderate number of Gram-positive cocci. Culture on blood agar showed moderate growth of small alpha–hemolytic colonies. The isolate was catalase negative, grows on 6.5% sodium chloride (NaCl), hydrolyze esculin in the presence of 40% bile salts (bile-esculin medium) and 0.1% methylene blue milk and at pH 9.6. It was non-motile. Identification using the API Strep system (Biomerieux sa, au capital de 11879045 E, 673620399 RCS LYON, France) was used to identify the isolate as an *Enterococcus*. Further confirmation of the isolate was carried out using the Microscan (Microscan Walkaway 40 SI. Dade Behring Inc. 1584 Enterprise Blvd., West Sacramento, CA 95691, USA), which showed the isolate to be *Enterococcus avium*, with a probability of 98.1%. The organism was susceptible to penicillin (10 ug); erythromycin (15 ug), ampicillin (10 ug); and vancomycin (30 ug) by the Kirby Bauer disc diffusion method.

Discussion. The genus *Enterococcus* was proposed in 1984. The species that carry the genus name *Enterococcus* are *E. avium, E. casseliflavus, E. cecorum, E. columbae, E. dispar, E. durans, E. faecium, E. faecalis, E. gallinarum, E. hirae, E. malodoratus, E. mundtii, E. pseudovium, E. raffinosus, E. saccharolyticus,* and *E. sulfurous*. Phenotypic characteristics of this genus are: gram-positive cocci, occurring singly, in pairs, or in short chains, facultative anaerobic growth between 10-45ºC (most strains), optimum at 35ºC, growth in broth containing 6.5% NaCl, hydrolyze esculin in the presence of 40% bile salts (bile-esculin medium), motility observed in some species, hydrolysis of leucine-ß-naphthylamide, hydrolysis of pyrrolidonyl-ß-naphthylamide, with the exception of *E. cecorum, E. columbae,* and *E. saccharolyticus*; catalase negative, although catalase test can appear positive occasionally.[2,4] Our isolate fulfilled these criteria. The group Q Streptococci, in which *E. avium* has been grouped, possess unique serological and physiological characteristics which differentiate them from established *Enterococci*.[2,4,5] Isolation of *Enterococci* can be performed by using trypticase soy broth or brain heart infusion containing 5% animal blood, bile-esculin azide, Pfizer selective enterococcus medium, Columbia colistin-nalidixic acid agar, phenylethyl alcohol agar, or other media containing azide can be used to separate *Enterococci* from gram-negative bacteria in the sample.[4,5] In the routine clinical laboratory, the isolation of a *Streptococci* is not difficult, however, differentiation of *Enterococci* requires special media or the automated identification systems such as the Microscan (used in this study) or Vitek and other automated identification systems. The cell and colonial morphology are similar to *E. faecalis* and *E. faecium*. Slow growth may be observed in 6.5% NaCl broth, and they can produce α-hemolytic reaction on blood agar. The species has a marked broad fermentation pattern, including sorbose fermentation but inability to hydrolyse arginine.[2] The main reservoir of *E.avium* is the feces of chickens, birds and occasionally from man, dogs and pigs.[2,5]

Significant correlations between *E.avium* and many clinical manifestations have been reported such as: endocarditis, acute cholecystitis, bacteremia, splenic abscess, pancreatic abscess, meningoencephalitis, cerebral abscess, and osteomyelitis.[4-6] However, it is to be noted that plasmid borne high-level resistance to gentamicin has been described among some strains of *E. avium*, which could be of therapeutic concern.[5,6] The common complications of the ventriculo-peritoneal shunt, apart from malfunction are shunt infection, meningitis, ventriculitis and cerebral abscess. Brain abscess most commonly is the result of hematogenous spread of organisms from a distance focus, contiguous spread, operative procedures and penetrating cranial trauma. Whatever the cause of the shunt infection or the causative organism, the best treatment option is immediate shunt removal,

external ventricular drainage and use of intravenous antibiotics.[7,8] The standard management of brain abscess utilizes a combination of surgical aspiration and removal of the abscess through a burr hole or craniotomy, followed by 6-8 weeks of intravenous antibiotics,[7-10] as carried out in this case. In the case reported here, the organisms encountered in shunt infection were different from the organisms grown from the abscess pus. As shunt infection and obstruction were the initial diagnosis, our patient had shunt removal, external ventricular drainage and intravenous antibiotics. While the shunt infection treatment was under way, a diagnosis of cerebral abscess was confirmed by contrast-enhanced CT scan (**Figure 3**). Surgical aspiration and partial excision of the abscess was performed. The growth of *E. avium* from the pus cultures was, however, more surprising given the rarity of the pathogen in humans.

Ventriculo-peritoneal shunt related brain abscess is a relatively rare complication of shunt infection. Nevertheless, several cases have been reported as independent case reports or as a part of large clinical studies.[11] In the cases reported in the literature, shunt-related brain abscesses have usually shown the primary source of infection to be bowel perforation resulting in ascending shunt infection or shunt exposure due to wound dehiscence or multiple ventricle punctures or reservoir puncture for aspiration of the ventricles or infection introduced at the initial shunt insertion. The mechanisms usually postulated are ascending shunt infections or infections that are introduced at the initial insertion of the shunt system.[7-11] Hence, meticulous aseptic technique during shunt surgery is of utmost importance. The most common organisms have been *Staphylococcus aureus*, *Staphylococcus epidermidis* and enteric organisms. In our case, the non-functioning infected shunt system was removed which grew *Klebsiella spp* and *Proteus spp*, whereas the pus from the abscess grew *Enterococcus avium*. This complication, most probably developed while the patient was receiving radiotherapy for the brain tumor and was on steroids. The most probable mechanism of infection in this case was because of close domestic association with pigeons, from where the patient acquired the organism, colonizing the gastro-intestinal tract and through the peritoneal shunt system or hematogenously into the brain, followed by abscess formation. *Enterococcus avium* is now increasingly being recognized as a human pathogen.

It is important that the microbiology laboratory must carry out complete identification of the *Streptococci* and the *Enterococci*, if infections due to *E. avium* are not to be missed. The attention of clinicians and microbiologists is called to this organism, especially when there is a history of bird contact.

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