IDCases 22 (2020) e00974

Contents lists available at ScienceDirect

IDCases

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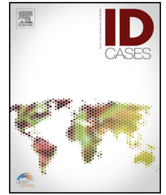

Case report

Pott's puffy tumor caused by *Actinomyces naeslundii*

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ARTICLE INFO

Article history:
Received 1 July 2020
Received in revised form 24 September 2020
Accepted 24 September 2020

Keywords:
Pott's puffy tumor
Actinomycosis

ABSTRACT

Pott's puffy tumor is characterized by forehead swelling from subperiosteal abscess and frontal bone osteomyelitis. It is encountered mainly in children; rarely in adults. When it does occur in the latter population, the most common risk factors include head trauma, sinusitis, or cocaine abuse. Generally, the organisms thought to be involved include streptococci, staphylococci and oral anaerobic flora. We present a case of a 53 year old female who presented with forehead swelling of 3 month duration after a dental procedure, found to be secondary to *Actinomyces naeslundii*. Actinomyces is a very rare etiology of this disease and has been reported only twice earlier in the literature. We present an uncommon infectious disease along with summary of clinical characteristics of this entity in the adult population.
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Introduction

Pott's Puffy Tumor (PPT) is a clinical diagnosis of a subperiosteal abscess and osteomyelitis of the frontal bone [1]. It is encountered mainly in children, and rarely seen in adults [1]. When it does occur in the latter population, the most common risk factors include head trauma, sinusitis, or cocaine abuse [1]. Complications from PPT include meningitis, epidural empyema, frontal lobe abscess, and cavernous sinus thrombosis; hence the need for prompt diagnosis and aggressive treatment [1].

Case report

A 53 year-old Caucasian female with history of sleep apnea and acid reflux presented with gradual swelling of her forehead for 3 months. She denied having any history of chronic sinusitis or illicit drug use. She did smoke tobacco, 1 pack per day for 30 years. About 6 months prior to presentation, the patient had undergone a tooth extraction; shortly thereafter that she developed symptoms of sinus pressure and congestion. She was initially treated with multiple courses of antimicrobials and steroids for presumed sinusitis without improvement. About three weeks prior to presenting, the patient underwent sinus surgery and was placed on oral levofloxacin for five days. No cultures were obtained at that time.

About a week after surgery, the patient started to develop fevers, chills and worsening headache. She reported that while she did have forehead swelling prior to surgery on her sinuses, it became much more pronounced post-operatively. Three weeks after surgery the patient had a CT head that revealed a peripherally enhancing fluid collection measuring 3.1 cm $\times$ 5.9 cm along the right frontal scalp in close proximity to the frontal sinuses and enhancement of the frontal subdural space. MRI head confirmed the findings (Fig. 1). The patient underwent surgical debridement of the abscess with frontal sinus trephination. Cultures were obtained, which grew *Actinomyces naeslundi.* Due to history of being allergic to penicillin the patient was treated with intravenous (IV) ceftriaxone for 9 weeks and then transitioned to oral doxycycline for a total of 6 months of therapy. At 6 month follow up, her symptoms and radiological abnormalities had resolved.

Discussion

Subperiosteal abscess and frontal bone osteomyelitis, also known as Pott's Puffy Tumor (PPT) was first described by Sir Percival Pott in 1768 in association with head trauma and sinusitis [2]. It occurs as the result of infection traversing through the venous drainage of the frontal sinus or due to direct inoculation to the frontal bone [3]. In order to better understand the clinical characteristics of this disease in the adult population, we reviewed case reports (a total of 47 cases, Table 1) of PPT in adults to determine common risk factors, microbial involvement, management, and outcome of this relatively rare condition. The details are tabulated, and some salient features are described here. With regards to precipitating or underlying risk factors, chronic sinusitis, penetrating defects (either through trauma or

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https://doi.org/10.1016/j.idcr.2020.e00974
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Table 1
Clinical characteristics of adult patients with Pott's puffy tumor.

Ref No.	Sex	Age	Past medical history	Precipitating cause	Duration of onset	Organism	Antibiotic	Outcome
[6]	M	49	No prior history	Insect bite	1 wk	Staph aureus	Flucloxacillin, fusidic acid, metronidazole for 6 weeks	Resolved at 6 weeks
[7]	F	55	No prior history	Prior surgical history along the frontal bone 8 yr ago	2 mo	Staph aureus	Antibiotic NR, treated for 8 weeks	NR
[8]	M	55	Alcoholism, cirrhosis, epilepsy, tobacco abuse, HTN	Prior history of sinus surgery	1 mo	Viridans group strep	Vancomycin and clindamycin, unknown duration	Patient lost to follow up
[9]	F	54	Cocaine/heroin, tobacco abuse, hepatitis C	Trauma to forehead	1 mo	Coagulase negative Staphylococci and beta-hemolytic Streptococci	2.4 million units of benzathine penicillin; 2 IM injections	Resolution by day 5
[10]	M	25	Allergic rhinitis and asthma	No known cause	3 wk	Staph aureus	Ceftriaxone 2 g IV daily and then switched to PO antibiotics for 8 weeks (did not specify antibiotic)	Resolved at 6 month follow up
[11]	M	33	No prior medical history	No known cause	5 mo	Staph aureus, Peptostreptococcus, S. pneumoniae, H. influenzae	Ceftriaxone 2 g Q 12 h and metronidazole for 2 weeks, followed by oral metronidazole and amoxicillin-clavulanate for 4 weeks	No recurrence for 7 yrs
[12]	M	NR	Hx of headaches and recurrent abscesses along the frontal soft tissue	No known cause	Not known	Strep anginosus	Moxifloxacin and metronidazole for 3 months	NR
[13]	M	41	Chronic sinusitis, tobacco use, cocaine use	No known cause	26 days	Strep intermedius	Ceftriaxone and metronidazole, unknown duration	NR
[14]	M	37	Chronic exophthalmia	No known cause	2 yr	Mycoplasma	Doxycycline, unknown duration	Symptoms resolved at 2 months
[15]	M	46	No prior medical history	No known cause	6 mo	No organism identified by culture	NR	Recurred twice and required second I&D
[16]	M	26	No prior medical history	No known cause	2 mo	H. influenzae	antibiotic NR - for 5 weeks	resolved
[16]	M	34	No prior medical history	Cocaine use	6 wk	B. melaninogenicus, Fusobacterium, Propionibacterium, group A Strep	IV ampicillin/sulbactam 2 wks then oral amoxicillin/clavulaunate for 4 wks	NR
[16]	F	54	No prior medical history	No known cause	Not known	No organism isolated	PO amox/clav and cloxacillin for 1 mo, PO penicillin for 1 mo	resolved
[16]	M	83	Unknown	Head trauma	4 yr	H. influenzae	Ceftriaxone for 2 weeks followed by cefprozil for 4 week	No recurrence for 1 yr f/u
[17]	M	74	Unknown	Scalp injections for hair loss	2 mo	Staph aureus	IV nafcillin 1 mo, Po dicloxacillin 4 weeks	resolved
[18]	M	21	No prior medical history	Dental sepsis	3 wk	Streptococcus intermedius, Bacteroides melaninogenicus	4 weeks of IV ampicillin	resolved
[19]	M	53	None	Head trauma	3 wk	Streptococcus milleri	Unknown	Died 5 days after admission
[20]	M	39	None	No known cause	3 mo	Streptococcus milleri	IV benzyl penicillin for 3 weeks followed by amoxicillin for 3 weeks	resolved
[21]	F	67	None	No known cause	Not known	Pseudomonas aeruginosa	Unknown	NR
[22]	M	58	Diabetes mellitus	Head trauma	2 mo	No organism isolated	Cefuroxime, unknown duration	No recurrence
[23]	M	27	Diabetes mellitus	Head trauma 13 yrs prior	3 wk	Staph aureus	NR	Unknown
[24]	M	35	No prior medical problems	No known cause	9 mo	Aspergillus flavus	NR	No recurrence at 3 mo f/u
[25]	F	62	Diabetes, CKD, HTN	No known cause	1 wk	mucormycosis	Amphotericin B for 3 weeks	No recurrence
[26]	M	54	Hx of frontal bone reconstruction 30 yrs prior	URI- cold virus	15 days	No organism isolated	Ampicillin/sulbactam for 10 days followed by amoxicillin/clavulanate for 15 days	Did well at 24 month follow up
[1]	M	37	No prior medical history	No known cause	1 mo	unknown	Unknown	No recurrence

[1]	M	36	No prior medical history	No known cause	1 mo	unknown	Unknown	No recurrence
[1]	M	76	Aplastic anemia, Diabetes	No known cause	2 wk	Streptococcus anginosus, Micromonas micros	Unknown	No Recurrence
[1]	M	38	History of cranioplasty for pituitary tumor	No known cause	2 days	Prevotella oralis, Fusobacterium, Micromonas micros	Unknown	Had recurrence requiring further surgical intervention
[1]	M	28	No prior medical history	No known cause	2 yr	unknown	Unknown	No recurrence
[27]	F	21	Pregnancy	No known cause	not knwon	Strep milleri	IV ceftriaxone for 3 weeks, oral amoxicillin/clavulanate for 4 weeks	Unknown
[28]	M	37	No prior medical history	Traumatic head injury	1 mo	No growth	Ciprofloxacin 3 weeks	Resolved at 6 mo follow up
[29]	M	60	HTN, DM	No known cause	8 wks	Strep anginosus	Ceftriaxone and metronidazole for 6 wks	2 wk f/u swelling resolved
[30]	F	41	rhinosinusitis	No known cause	not known	Peptostreptococcus prevotii, Streptococcus constellatus	Amp/sulbactam, vancomycin, meropenem, netilmycin For 4–8 weeks	Deceased
[30]	M	60	rhinosinusitis	No known cause		Proteus	Amp/sulbactam 4–8 weeks	Resolved at 6 mo
[30]	+	27	rhinosinusitis	No known cause		unknown	Amp/sulbactam 4–8 weeks	Resolved
[30]	M	24	Rhinosinusitis,	No known cause		E. coli and staph aureus	Amp/sulbactam, meropenem, netilmycin 6 weeks	Resolved at 3 months
[31]	M	56	sinusitis	Traumatic injury	1 month	No growth	IV antibiotics for 1 month, type NR	Drain removed and had full recovery at 3 months follow up
[32]	F	72	NR	No known cause	4 yr	MSSA and Coagulase negative Staphylococci	A third generation cephalosporin, duration NR	No recurrence at one year follow up
[33]	F	62	No prior medical problems	No known cause	6 mo	Prevotella	Clindamycin for 2 weeks, ertapenem + metronidazole for 6 weeks and then clindamycin for another 6 weeks	Resolved at 12 month follow up
[34]	M	21	sinusitis	Teeth extractions	3 wk	Eikenella corrodens, Prevotella bivia, streptococcus intermedius	IV vancomycin and metronidazole for 4 weeks, then PO moxifloxacin for unknown duration	Resolved at 6 month follow u[p
[35]	M	29	none	trauma	5 yr after surgery	Staph aureus	Levofloxacin, duration NR	Refused surgery, recurred after 2 months
[36]	M	27	none	Poor dentition	unknown	unknown	Broad spectrum abx for 6 weeks	Resolved without surgical intervention
[37]	M	61	none	Prior hx of Pott's puffy tumor 5 mo prior	5 day	Unknown	Unknown	Unknown
[38]	M	63	Chronic rhinosinusitis	No known cause	2 wk	Strep milleri	Co-amoxiclav, unknown duration	Unknown
[2]	F	58	Recurrent sinusitis	No known cause	3 wk	Pasteurella multocida	IV cefotaxime and PO clindamycin for four weeks followed by PO penicillin for 5 mo	Required further debridement 5 months later
[4]	M	79	HTN, prostate cancer, CKD	No known cause	unknown	Actinomyces	Antibiotics for 6 months; po course with amoxicillin-clavulanate	unknown
[5]	M	52	none	Trauma	1 mo	Actinomyces, Fusobacterium, Propionibacterium	4 weeks IV antibiotic vancomycin, ceftazidime, metronidazole; then 4 weeks oral amoxicillin	Resolved at 6 mo follow up

NR: not reported.

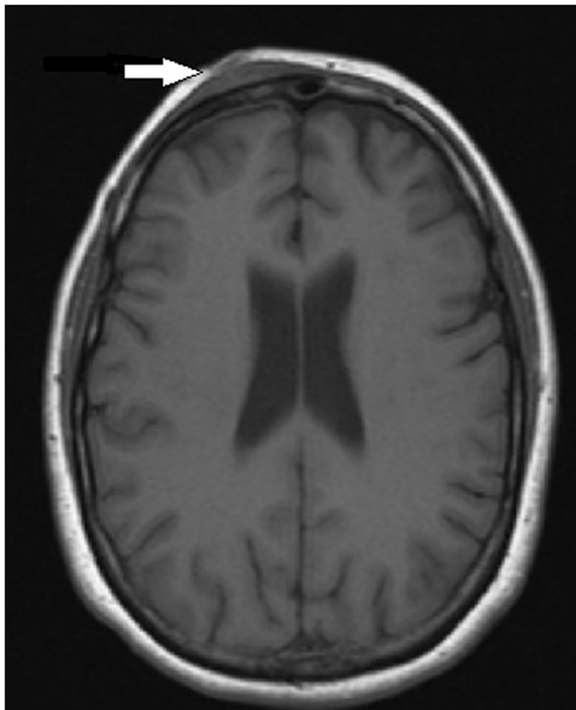

Fig. 1. MRI head revealing right frontal subgaleal abscess along with involvement of the right frontal bone.

surgical interventions), dental issues, and cocaine abuse appeared to be present in majority of the patients. It is felt that the presence of cocaine or tobacco use results in disruption of the mucosal barrier of the nasal passage ways, predisposing to infection [1]. In our patient, we suspect that the preceding dental procedure was the inciting event leading to the development of PPT.

Symptom onset ranged from weeks to years, depending on the risk factors and type of organism implicated. Microbes like *Actinomyces* and anaerobes are more indolent compared to others like *Staphylococcus aureus* or agents of mucormycosis which tend to be more aggressive and onset of clinical symptoms tends to be relatively faster. Of these 47 cases reviewed, *Actinomyces* was reported in two previous cases [4,5].

Treatment most often involves surgical debridement followed by antimicrobial therapy for 4–8 weeks targeted towards the isolated pathogens [1]. In the cases with unknown bacterial involvement, antimicrobials were targeted towards α-hemolytic streptococci and anaerobes. The majority of cases had good outcomes, with near complete resolution of symptoms. Our patient was treated for 9 weeks with IV ceftriaxone, followed by 6 months of PO doxycycline due to the presence of *Actinomyces naeslundi* which generally requires a longer course of treatment.

Pott's puffy tumor should be considered as a potential diagnosis in people who present with a forehead swelling, particularly in the presence of known risk factors such as sinusitis, head trauma, dental procedures, and cocaine abuse. While staphylococci and streptococci have been commonly implicated, rarely *Actinomyces* may be encountered, especially in indolent cases.

Credit author statement

All the authors have contributed to the writing of the manuscript of the case report.

Sources of funding

No funding applicable to this article

Consent

Not applicable. We have ensured to not report any potential identifying information in the manuscript.

Declaration of Competing Interest

The authors report no declarations of interest.

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