CASE REPORT

Not quite Pott's puffy tumour

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SUMMARY

Pott's puffy tumour (PPT) is characterised by a subperiosteal abscess associated with osteomyelitis of the frontal bone—a rare complication of frontal sinusitis, more common in the paediatric population. We describe a case mimicking PPT, where abscess extension was facilitated by previous surgery. Usually patients with PPT would be systemically unwell, but our patient, a 63-year-old Caucasian man, was systemically well with a large swelling of his forehead. A CT was performed to evaluate possible intracranial and intracerebral complications such as epidural, subdural and brain abscesses. Emergent surgical drainage was performed with prolonged administration of antibiotic therapy. 12 weeks later, he had recollection in the frontal sinus requiring incision and drainage. 6 weeks afterwards, he underwent planned Lothrop procedure and endoscopic sinus surgery. Although clinically the patient presented with overwhelming features of PPT, we emphasise that PPT involves osteomyelitis of frontal bone, which is absent in our case.

BACKGROUND

Acute and chronic rhinosinusitis of frontal sinus can be associated with serious complications that are typically classified as orbital, osseous and endocranial, with the osseous complications being the least common.¹ Pott's puffy tumour (PPT), first described by Sir Percival Pott in 1768, is characterised by a subperiosteal abscess associated with osteomyelitis of the frontal bone—a rare complication of frontal sinusitis.² Osteomyelitis of the anterior frontal plate presents clinically as oedema of the skin, producing a swelling on the forehead.¹ As PPT is associated with intracranial complications such as epidural or subdural abscess and cavernous sinus thrombosis, it is important to identify it early so that appropriate treatment be initiated.¹ It manifests as an adverse sequela of head trauma (including iatrogenically) but can also arise as a complication of frontal sinusitis.² PPT is more common in the paediatric population and is regarded as a surgical emergency due to the risk of intracranial complications.^{3 4} Treatment for PPT includes surgical drainage and long-term antibiotics.¹ We describe a case that clinically presented as PPT but without the presence of osteomyelitis of frontal bone.

CASE PRESENTATION

A 63-year-old Caucasian man presented with 5-day history of large painful forehead swelling and mild rhinorrhoea following upper respiratory tract infection symptoms (figures 1 and 2). He was

systemically well without fever or headache but did have a history of neurodisability following a road traffic accident (RTA) 25 years previously when frontal craniotomy with insertion of a ventriculoperitoneal shunt had been performed. He had not had any recent head trauma and had not had antibiotics prior the presentation.

He was on regular medications for hypertension and hypercholesterolaemia, and he was a smoker (40 pack-year).

Clinical examination revealed 9×8 cm fluctuant swelling with erythematous and flushed overlying skin. Nasoendoscopy showed mucopurulent discharge bilaterally in nasal cavity around ostia of maxillary sinuses.

INVESTIGATIONS

Bacteriology swab of pus was taken for direct Gram staining, bacteriology culture and sensitivity testing.

Blood tests on admission, white cell count (WCC), neutrophils (Neu) and C reactive protein (CRP), were elevated: 12.2 (normal range 4.0–11.0×10⁹/L), 9.4 (normal range 2.0–7.5×10⁹/L) and 73 (normal range 0–10 mg/L), respectively.

An urgent CT head and sinuses showed almost complete opacification of the right maxillary and ethmoid sinuses and a polyp within the left maxillary sinus. Complete opacification of the frontal sinus with clear communication with the collection that had pushed two bungs (inserted during craniotomy in the past) forward with a bone defect at this level but intact periosteum and dura and no definite intracranial collection or extension (figures 3–6).

These findings were compared with his CT head scan done 3 years prior this presentation showing frontal bone defect with prosthetic studs in situ and absent roof of frontal sinus (figures 7 and 8).

DIFFERENTIAL DIAGNOSIS

Differential diagnosis with such a presentation would be skin and soft tissue infection, infected haematoma, benign or malignant tumours of the skin, soft tissue and bone or frontal sinus.⁵

For correct diagnosis, it is necessary to focus on presentation (acute or chronic), history of trauma and/or taking regular antiplatelet or anticoagulant medications, systemic symptoms like fever, as well as assessment of swelling by examining it externally and endoscopically with discharge of pus from paranasal sinuses and assessment of inflammatory markers and correlate that with CT or MRI findings.

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Figure 1 Sagittal view of forehead swelling and erythema.

TREATMENT

On the admission he was treated with empirical antibiotic therapy: intravenous ceftriaxone 2 g twice a day and oral metronidazole 400 mg three times a day.

Endoscopic drainage with frontal recess exploration and removal of infected forehead prosthetic studs (24 mm in diameter, 8.5 mm in depth) via midline glabellar incision was performed ([figure 9](#)). The size of the prosthetic studs warranted external approach to the swelling as it would not have been possible to remove it endoscopically.

Group A streptococcus and mixed anaerobes were isolated from intraoperatively obtained pus, which was sensitive to ceftriaxone and metronidazole.

After 8 days of inpatient stay, the patient was discharged home with 2-week treatment of intravenous ceftriaxone 2 g once a day and metronidazole 400 mg three times a day. Such a long antibiotic course was given due to previous craniotomy and potential risk of infection spreading intracranially. Intravenous antibiotic treatment was organised with a help of Outpatient Parenteral Antimicrobial Therapy (OPAT) service. The patient was instructed to use nasal topical treatment Otrivine (xylometazoline hydrochloride), three drops to both nostrils three times a day for 1 week and nasal douches for several weeks postoperatively.

Elective MRI head and sinus scan, arranged on discharge from hospital, done 2 weeks postoperatively showed almost complete resolution of the collection with subtle residual subcutaneous

Figure 2 Coronal view of forehead swelling and erythema.

thickening in the frontal subcutaneous tissues and sinuses with mild mucosal thickening in paranasal sinuses with a small polyp in left maxillary sinus. No epidural collection although mild dural thickening was present over both frontal lobes with some enhancement, likely to be postoperative and/or postinflammatory changes. Based on this, advice was given by OPAT colleagues to continue intravenous ceftriaxone and oral metronidazole for another week and switch to oral amoxicillin 1 g three times a day and metronidazole 400 mg three times a day for 1 week.

The patient was seen in ears, nose and throat (ENT) outpatient clinic at planned appointment 3 weeks after the discharge from hospital with results of the MRI. Patient had no foul discharge from the nose, and endoscopy showed widely opened sinus cavities with no mucopus draining from frontal sinuses. Follow-up appointment in 3 months was arranged.

Nine weeks after, the patient was acutely readmitted with forehead swelling extending over left eye without any nasal symptoms as discharge or blockage ([figure 10](#)).

Blood tests: WCC: 11.6, Neu: 8.6 and CRP: 143.

CT head and sinuses revealed mild mucosal thickening of the right maxillary sinus with known polyp within the left maxillary sinus. Ethmoid and frontal sinuses minimally opacified. Some superficial soft tissue swelling around the left orbit; no orbital collection identified. Subcutaneous gas in the forehead region not extending intracranially with completely resolved collection ([figure 11A, B](#)). It turned out the gas was present due to the patient exhaling through closed mouth and pinched nose shut as when performing Valsalva maneuver.

Figure 3 Axial view of CT maxillary sinuses.

Figure 5 Axial view of CT head.

Figure 4 Axial view of CT ethmoid sinuses.

Figure 6 Sagittal view of CT head.

No microbiology swabs were obtained from nose as there was no rhinorrhoea.

During this 4-day admission, the patient was treated conservatively with intravenous ceftriaxone 2g twice a day for first 24 hours changed to once a day afterwards with oral metronidazole 400 mg three times a day. He was discharged home with further 6 days of oral coamoxiclav 625 mg three times a day, as well as Otrivine two sprays to both nostrils three times a day for 1 week and Avamys (fluticasone furoate) two sprays to both nostrils once a day. Follow-up in outpatient clinic was arranged in 4 weeks' time.

Figure 7 Axial views of CT head 3 years prior the presentation.

Twelve weeks after initial presentation, again he was acutely readmitted with a swelling over forehead, being clinically well otherwise.

Blood tests: WCC: 13.1, Neu: 9.4 and CRP: 170.

Fifteen millilitres of offensive purulent fluid was aspirated with a needle from the swelling via external approach.

CT head or sinus scan was not indicated at this stage as presence of pus was confirmed with the aspiration, and the patient was clinically well without any nasal or central nervous system symptoms.

Gram stain revealed Gram-positive, Gram-negative and anaerobes. Initially treated with intravenous ceftriaxone 2g twice a day and clindamycin 600mg four times a day. One day after, the forehead was more oedematous and incision and drainage of the swelling via external approach was performed, as a temporary treatment for the purulent collection, leaving Yates drain in situ for 2 days. A plan was made to perform a definite endoscopic surgical treatment for the patient once the infection has completely settled.

Three days after the admission bacteriology of pus revealed profuse growth of *Streptococcus sanguinis*, *Streptococcus constellatus* and mixed anaerobes. Clindamycin was switched to intravenous metronidazole 500mg three times a day for further 48 hours with continuation of intravenous ceftriaxone 2g twice a day.

Patient was discharged home after 6 days with instructions to douche the nose and use Otrivine two sprays to both nostrils three times a day for 1 week.

Peripherally inserted central catheter was placed for 5-week course of intravenous ceftriaxone 2g once a day and to continue

Figure 8 Sagittal view of CT head 3 years prior the presentation.

Figure 9 Prosthetic studs.

to take oral metronidazole 400mg three times a day prior the planned surgical treatment.

Two weeks after, preoperative CT sinuses revealed minimal mucosal thickening in bilateral frontal sinuses with previously noted subcutaneous emphysema in bilateral frontal regions fully resolved and no evidence of neurovascular dehiscence (figure 12).

A definitive frontal sinus/recess procedure (Lothrop or Draf 3) and endoscopic sinus surgery was performed 5 weeks after the last admission to hospital involving removal of inferior portion of the interfrontal septum, the superior part of nasal septum and frontal sinus floor to the orbit laterally providing good frontal sinus drainage. He was discharged home the next day.

Figure 10 Coronal view of forehead and left eye swelling.

Figure 11 (A and B) Sagittal view of CT head and sinuses.

Postoperatively, he received another week of intravenous ceftriaxone 2g once a day and oral metronidazole 400 mg three times a day with 3-week course of Flixonase (fluticasone propionate) nasule drops six drops to each nostril twice a day.

During each in-patient admission, the patient received saline nasal douches, Otrivine three drops or two sprays and Flixonase nasule six drops to both nostrils three times a day.

OUTCOME AND FOLLOW-UP

He was followed up 3 weeks after the final surgical procedure. Nasal endoscopy revealed minimal crusting around his freely draining frontal sinus with no evidence of any infection or mucopus within the nose. A few small inflammatory polyps were noted for which Avamys two sprays to both nostrils once a day for 3 months was prescribed.

Next follow-up was planned 3 months after, but due to outpatient waiting times, he was seen 2 months later than that. The patient felt his nose was 'as good as it has ever been'. He no longer had a bad taste from the nose, and his breathing was good. Nasal endoscopy showed well-healed widely patent common frontal drainage pathway with healed roof of frontal sinus with no contact to the site of the previous prosthetic craniotomy studs and no ongoing infection (figure 13). Avamys spray was stopped as the polyps were not present any more.

During the treatment period, while receiving intravenous antibiotics in community, his bloods were monitored once a week for inflammatory markers (WCC, Neu and CRP), which in all occasions were in normal ranges.

Fifteen months since the last follow-up appointment, the patient does not have any nasal symptoms and has not warranted acute admission to hospital with similar presentation.

DISCUSSION

PPT is a potentially life-threatening entity even in the postantibiotic era.⁶

This patient clinically presented with PPT.

Up to 70% patients presenting with PPT are younger than 30 years of age. Male-to-female ratio has been reported 9:1 without clear explanation of male predominance.^{5,7}

Figure 12 Coronal views of preoperative CT.

Figure 13 Endoscopic views of frontal sinus.

Main predisposing factors are acute or chronic sinusitis, head trauma or neurosurgical intervention as craniotomy or cranioplasty.^{5,7} Least common causes of PPT are mastoiditis, intranasal methamphetamine use, cocaine abuse, dental infection, hair transplantation, ethmoidal sinusitis, acupuncture, insect bite and infected frontal sinus mucocele.⁵ In our patient's case, potentially the abscess was caused by foreign body reaction of the prosthetic studs, but it is very unlikely as the patient had had it for 25 years.

The diagnosis of PPT is confirmed based on examination of clinical presentation and imaging (CT scan and MRI).^{1,5}

Commonly patients with PPT present with fever, headache and being systemically unwell and/or neurological deficit.³ In 1879, Lannelongue demonstrated that PPT resulted from progression of frontal sinusitis to osteomyelitis with erosion through the frontal bone anteriorly, which is currently known as the main aetiological factor.⁵ The infection spreads either directly through the sinus wall or by means of retrograde thrombophlebitis. The anterior wall and the floor of the frontal sinus are frequently the pathway of least resistance for the infection.⁵ In our patient, frontal sinus infection spread via patent roof of the frontal sinus to prefrontal soft tissue space following the pathway of least resistance and not spreading intracranially. Our patient did not have fever, headache or neurological deficit on the presentation.

van der Poel *et al* reported 2 of 3 patients with intracranial spread of PPT presented with no neurological signs.¹

In our patient, right maxillary and ethmoid sinuses were involved in the disease process; the involvement of more than one sinus is very common.⁵

CT or MRI should be performed to evaluate possible intracranial and intracerebral complications as epidural, subdural and brain abscesses, as well as osteomyelitis of frontal bone.³ CT scan has become the standard tool for diagnosis and for identification of osteomyelitis of frontal bone as bone destruction and periosteal reaction.⁵ These signs of osteomyelitis were absent in our patient's case, and CT scan done 3 years prior to the presentation shows that frontal bone defect was present already at that time likely secondary to craniotomy and/or RTA 25 years ago (figures 7 and 8). Salomoa *et al* demonstrated their case series of six paediatric patients with PPT that frontal bone thickness erosions of variable size were identified in all CT head scans and intraoperatively in operated patients.⁵ No signs of osteomyelitis were identified intraoperatively in our patient's case.

Most common organisms are streptococci, staphylococci and anaerobic bacteria as it was in this case.^{3,5} Multiple germs have been reported in up to two-thirds of the cases.⁵ Empirical broad-spectrum antibiotic treatment should be focused on these microorganisms. Our choice was ceftriaxone and metronidazole.

Prolonged broad-spectrum antibiotic therapy from 6 to 8 weeks with initial anaerobe coverage is necessary if osteomyelitis and/or abscesses are found, but surgical drainage is the mainstay of the therapy as antibiotics alone seem to be ineffective, with a high rate of recurrence.^{3,5,8}

Radical sinus surgery has usually been performed that includes the resection of osteomyelitic bone and the re-establishment of the drainage of the sinus.¹ In our case, no bone was removed as there

were no clinical or radiological signs of frontal bone osteomyelitis. PPT may be successfully treated without removing the affected bone as it has been shown on follow-up CT scans that after surgical and long-term antibiotic treatment bone recovers back to normal.¹

Traditionally, surgical drainage has been conducted using an external approach. In cases of intracranial spread of infection, external approach ranges from drainage of the subperiosteal collection to the wide removal of the calvarial bone and evacuation of intracranial abscesses. The approach to be chosen will depend on the extent of the infection.⁵

When the infection is confined to the sinuses, surgical treatment includes drainage of sinuses, sinusotomy, sequestrectomy and evacuation of the subperiosteal abscess.⁵

Simple drainage of the subperiosteal abscess also seems to be associated to recurrence as it proved in our case when the abscess was drained with needle aspiration.⁵

In confined infections to the sinuses, as there is no intracranial compromise, a frontal sinus trephination, endoscopic approaches or a combination of these techniques may be effective.⁵ In our patient's case, combined approach was used—endoscopically to improve drainage of frontal sinus and frontal trephination to remove the prosthetic studs due to its size (24 mm in diameter, 8.5 mm in depth).

Endoscopic drainage of PPT has been suggested as a less invasive technique with advances and accumulated experience in endoscopic sinus surgery.¹

Learning points

- Osteomyelitis of frontal bone as a complication of frontal sinus infection is a requirement to fit criteria for Pott's puffy tumour.
- Osteomyelitis of frontal bone is diagnosed based on clinical presentation, imaging (CT and MRI) and/or intraoperatively.
- Prosthetic studs, used for cranioplasty in the past, should be removed preferably endoscopically or via external approach due to size of it if the treatment and recovery of frontal sinus infection is likely to be affected.
- In Pott's puffy tumour cases, osteomyelitic bone fully recovers with 6–8 week antibiotic course and surgical intervention without a requirement to remove it.
- Surgical treatment to drain subperiosteal abscess and to improve frontal sinus drainage has shifted from external approach to endoscopy.

The endoscopic sinus surgery of inflamed mucosa tends to be more difficult due to increased intraoperative bleeding, as well as higher risk of restenosis of the frontal recess due to infected mucosa.¹ Deutsch *et al* and van der Poel *et al* have reported case series of successful treatment of PTT with solely endoscopic drainage by opening and enlarging the frontal sinus outflow tract.^{1,5}

In our patient's first presentation, decision was made to remove prosthetic studs as part of the treatment. van der Poel *et al* advise not to leave stents or drains in situ during endoscopic management of PPT to prevent restenosis of frontal sinus ostium.¹

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