CASE REPORT

Calvarial osteomyelitis and intracranial extension post-Mohs micrographic surgery

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Accepted 9 July 2018

SUMMARY

Mohs micrographic surgery (MMS) is a specialised micrographic technique used for the treatment of locally invasive skin cancers. Despite being a relatively low risk surgery, the overall complication rates range between 1.6% and 3%. Common complications include postoperative haemorrhage, haematoma formation, wound infection, wound dehiscence and flap/graft necrosis. Osteomyelitis after dermatological cancer surgery is exceedingly rare. There have only been two cases of osteomyelitis in association with Mohs surgery reported in the literature to date. Here, we describe an epidemiologically atypical patient who initially presented with fever and altered mental status and later found to have calvarial osteomyelitis, intracranial abscess (empyema) and meningoencephalitis as a result of Mohs surgery. Although rare, it is a predictable side effect postsurgery, and prevention of such complications are critical to decrease morbidity and mortality in patients undergoing MMS.

BACKGROUND

Calvarial osteomyelitis is a rare complication of Mohs micrographic surgery (MMS) for skin cancers; however, it is a predictable side effect often undermined due to its rarity. Our case emphasises the severity of the condition and reinforces the importance of prevention of such complications to decrease morbidity and mortality in patients undergoing MMS.

CASE PRESENTATION

A 76-year-old Caucasian woman with a medical history of invasive basal cell carcinoma of the scalp, atrial fibrillation, hypertension, hyperlipidaemia and obstructive sleep apnoea who presented to the hospital with altered mental status 3 months after a Mohs surgery for left scalp basal cell carcinoma. Associated symptoms included fever, right-sided weakness, new-onset seizures, word-finding difficulties and echolalia. On physical examination, she was found to be haemodynamically stable and febrile at 38.5 °C. She was also found to have a 4x 5x 2cm irregular non-healing wound (given lack of follow-up after recent Mohs surgery), along with weakness in the right arm and leg.

INVESTIGATIONS

Laboratory studies showed an elevated white cell count of $24.0 \times 10^9/L$, along with increased inflammatory markers erythrocyte sedimentation rate and C reactive protein. She was started on empirical antibiotic treatment with vancomycin and ceftriaxone for a

presumed central nervous system infection. A CT scan of the head showed the presence of anterior frontal bone marrow lesion with bilateral scalp soft tissue swelling with a question for suspected bone marrow lesion, osteomyelitis or metastatic disease (figure 1). Furthermore, MRI of the brain showed findings of meningoencephalitis, involving the left frontal lobe with a left frontal subdural empyema along with a midline frontal calvarial osteomyelitis and skin defect at the site of reported prior scalp surgery (figure 2).

DIFFERENTIAL DIAGNOSIS

The clinical evidence, temporal association and radiographic findings were consistent with calvarial osteomyelitis with intracranial extension leading to meningoencephalitis. Given the absence of localised sinus, dental or ear infections and negative blood cultures ruling out either a contiguous spread from other sources or a haematogenous spread, localised extension of the osteomyelitis was the obvious explanation for the meningoencephalitis, obviating the need for further cerebrospinal fluid analysis and culture.

TREATMENT

Later, antibiotic therapy was modified to ceftriaxone and metronidazole to cover for anaerobic organisms given the concurrent presence of an empyema. Meanwhile, phenytoin and levetiracetam were started for treatment of seizures.

OUTCOME AND FOLLOW-UP

Within the next 3 days, patient showed signs of improvement with absence of fever, decreasing white cell count, improved mental status, absence of seizures and interval improvement on repeat MRI imaging. She was later discharged to a short-term rehabilitation facility with a 4-week course of intravenous antibiotics via a peripherally inserted central catheter line, with weekly imaging and laboratory workup for monitoring.

DISCUSSION

MMS is a specialised micrographic technique used for the treatment of locally invasive skin cancers.^{1–3} It involves multiple horizontal sectional cuts of the tumour allowing complete excision and evaluation of deep margins of the tumour. Despite being a relatively low risk surgery, the overall complication rates range between 1.6% and 3%.^{4,5} Common complications include postoperative haemorrhage, haematoma formation, wound infection, wound dehiscence and flap/graft necrosis.⁴ Wound infection occurs in among

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To cite: Desai A, Krishnan A, Zaghloul A, et al. *BMJ Case Rep* Published Online First: [please include Day Month Year]. doi:10.1136/bcr-2018-224861

Figure 1 CT scan of the head. Arrows demonstrate the areas involved.

0.1%–2.3% of patients undergoing surgery. Wound infections may include infections ranging from superficial skin infections to infections extending into and eroding the bone. Osteomyelitis after dermatological cancer surgery is exceedingly rare. There are only two cases with osteomyelitis following Mohs surgery that have been

reported so far. Synder *et al* reported osteomyelitis of the frontal bone in a patient with a recurrent basal cell carcinoma that was allowed to heal via secondary intention after Mohs chemosurgery.⁶ Meanwhile, Lane *et al*⁷ reported another case of osteomyelitis after dermatological skin cancer excision and grafting. To date, there have been no cases reported to have intracranial extension of calvarial osteomyelitis post-MMS. We present a rare case of subdural empyema and meningoenophalitis secondary to calvarial osteomyelitis occurring as a complication of Mohs surgery. Postsurgical osteomyelitis primarily occurs as a result of direct inoculation after surgery, which can then extend into the brain if left untreated.^{8,9} Classically, patients present with fever and symptoms/signs involving the area of the calvarium as well as the brain when involved. Symptoms may include but are not limited to seizures, memory impairment, confusion and altered mental status. Non-specific symptoms of night sweats, nausea and vomiting are also reported. Laboratory findings may be unrevealing, although elevated white blood cell count, sedimentation rates and C reactive protein may occur as in other forms of osteomyelitis.¹⁰ Radiographic imaging is essential for diagnostic confirmation as well as extent of involvement. CT and/or MRI provides an accurate assessment of the extent of cortical destruction and evaluation of the accompanying bone marrow and soft tissue inflammation.¹¹ Once diagnosis is established, empirical antibiotic treatment with broad spectrum antibiotics is usually started. Most common aetiological agents causing osteomyelitis include *Staphylococcus aureus* (methicillin-susceptible (MSSA) and resistant (MRSA)), non-group D streptococci, coagulase-negative staphylococci and *Pseudomonas aeruginosa*.¹² Empirical antibiotic therapy should include coverage of *S. aureus* with either vancomycin (MRSA) or semisynthetic antistaphylococcal penicillins (MSSA). Studies have also shown use of ceftriaxone and ofloxacin, often times in conjunction with rifampin.⁹ Despite these guidelines, empirical antibiotic therapy needs to be tailored according to site of infection, local susceptibility of strains with anaerobic coverage when indicated. Culture and sensitivity results should guide long-term antibiotic therapy. Single-agent antimicrobial therapy for

Figure 2 MRI scan of the brain with contrast. A) Left frontal lobe meningoenophalitis B) Skin defect at the site of reported prior scal surgery

4–6 weeks is usually indicated for isolated cases of osteomyelitis, with longer duration of therapy with intracranial involvement.⁹ A combined surgical and antimicrobial treatment approach may be required in severe cases with sequestered, necrotic bone formation, especially in cases of frontal bone osteomyelitis with a high risk of intracranial abscess formation. However, surgical intervention itself remains a risk factor for osteomyelitis and should be evaluated on a case by case basis.¹² Other treatment options including use of hyperbaric oxygen have been reported in studies¹³ but are not widely used currently.

Learning points

- ▶ Common complications of Mohs micrographic surgery include postoperative haemorrhage, haematoma formation, wound infection, wound dehiscence and flap/graft necrosis.
- ▶ Wound infection occurs in among 0.1%–2.3% of which may include infections ranging from superficial skin infections to infections extending into and eroding the bone.
- ▶ Postsurgical osteomyelitis primarily occurs due to direct inoculation after surgery which can then extend into the brain if left untreated.
- ▶ Radiographic imaging is essential for diagnostic confirmation and extent of involvement. CT and/or MRI provides an accurate assessment of the extent of cortical destruction and evaluation of the accompanying bone marrow and soft tissue inflammation.
- ▶ Most common aetiological agents causing osteomyelitis include *Staphylococcus aureus* (methicillin-susceptible (MSSA) and resistant (MRSA)), non-group D *Streptococci*, coagulase-negative *Staphylococci* and *Pseudomonas aeruginosa*.
- ▶ Empirical antibiotic therapy should include coverage of *S. aureus* with either vancomycin (MRSA) or semisynthetic antistaphylococcal penicillins (MSSA).

Contributors AD: wrote the manuscript. AK, AZ, MM: edited the manuscript.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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