CASE REPORT

Treatment and reconstruction of a complicated infected scalp squamous cell carcinoma with CNS invasion

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SUMMARY

A 60-year-old male patient with a large infected cranial apex lesion was admitted with lethargy and mental status changes. The patient underwent evaluation with imaging studies, a skin biopsy, cultures with microscopy and a diagnostic burr hole. MRI and positron emission tomography/CT scan revealed a squamous cell carcinoma with ingrowth in the midline of the brain and subdural empyema infected with *Streptococcus anginosus* and *Staphylococcus aureus*.

High dose intravenous antibiotic treatment was initiated and the patient subsequently underwent a surgical resection of the carcinoma with a 1 cm margin of surrounding skin and skull. The defect was reconstructed using a titanium plate and a free microvascular latissimus dorsi muscle flap then covered with a split skin graft. The patient received 37 radiation therapy sessions (66 Gy) as adjuvant therapy.

Intensive neurorehabilitation slowly improved an initial paraparesis. The 7-month follow-up revealed a satisfactory cosmetic result and residual gait impairment secondary to central nervous system invasion.

BACKGROUND

Squamous cell carcinomas can be found in any clinical setting. The tumour accounts for up to 20% of non-melanoma skin cancers and is the second most prevalent skin cancer after basal cell carcinomas.¹

Early treatment usually results in a very good prognosis. With the correct approach and a timely treatment, the 5-year survival is approximately 99%. However, the ability of squamous cell carcinoma to aggressively infiltrate bone, nerves and other tissues and to metastasise to regional lymph nodes results in elevated morbidity in cases with delayed treatment.

In the following case, the tumour was left untreated for 3 years and had eroded through skull and dura, leaving a direct pathway for infection to the cranial cavity.

In complicated cases, a multidisciplinary approach can result in functional recovery as well as a good cosmetic outcome.

CASE PRESENTATION

A 60-year-old Caucasian male with no prior contact to the health system and no known cancer history was admitted with generalised seizures to the Department of Neurosurgery from a local hospital.

Due to his seizure activity and lethargy, the patient was intubated and sedated before being transported to the Department of Neurosurgery. Prior to intubation, he received a score of 12 on the Glasgow Coma Scale (GCS).

After thorough lavage of infected tissues, inspection of the head revealed a malodorous 13×14 cm oval infected wound, with elevated inflamed borders. Destruction of cortical bone in the centre of the wound provided direct visualisation of bone matrix. No haemorrhage was noted from skin or bone (figure 1A).

The patient lived with his wife, was highly educated and was on a strict vegetarian diet. The family explained that the patient started becoming more introverted and non-verbal 14 days before admission and that they had been unable to contact him for a number of days prior to hospitalisation. As the patient was regularly meditating, his wife believed that his low consciousness level might be a result of her husband performing meditational arts.

The patient later explained that his wound originally started as a small lesion approximately 2–3 years prior to hospitalisation, and as it enlarged and became infected, he would conceal it with a hat.

According to the patient, his father had a similar ailment a few years prior, and the patient had taken care of his father's scalp wound. The patient was not known to have cancerophobia.

INVESTIGATIONS

On day 1, a CT scan of the head revealed the destruction of the underlying bone, ingrowth of tumour in the falx cerebri and subdural empyema (figure 2A–D). A direct smear did not reveal any pathogens.

On day 2, a skin biopsy was evaluated by the Department of Pathology. It was diagnosed as squamous cell carcinoma. Purulent matter was evacuated with a diagnostic burr hole and revealed a subdural empyema with *Streptococcus anginosus* and *Staphylococcus aureus*. Echocardiography demonstrated normal pericardium and endocardium.

The patient received coordinated surgical procedures by staff from the Departments of Neurosurgery and Plastic Surgery. The cutaneous tumour was resected in toto. Infiltrated and infected skull bone was excised with a resection margin of at least 1 cm (figure 1B). Unfortunately, the tumour grew into a functioning superior sagittal vein and it was not

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Figure 1 (A) The 13×14 cm wound after thorough rinsing. The destruction of the bone is visible at the centre of the wound. At the patient's left temple, sutures after the burr hole are visible. The resection border is drawn on the skin. (B) The head after removing the cutaneous tumour and the pathological bone. Dura is removed on the right side of the patient. In the centre, the tumorous growth in the midline is visible. (C) After tumour resection, the brain is covered with dura substitute and a titanium plate is fixed with screws. (D) The defect is reconstructed using a free microvascular latissimus dorsi flap. The great saphenous vein graft is used in a loop to extend pedicle length. Finally, a split skin graft is used on the muscle flap.

possible to obtain a radical resection of the tumour and maintain cerebral venous blood flow.

The defect was reconstructed using dural substitute and a titanium plate (figure 1C). The titanium plate was covered with a free microvascular latissimus dorsi flap using a great saphenous

Figure 2 Initial CT cerebrum of the patient. (A) Three-dimensional reconstruction of the patient's skull depicting the loss of bone structure due to ingrowth of tumour and concomitant infection. (B–D) Frontal, coronal and sagittal slices, respectively, depicting the excess of the damage in the bone and the subdural empyema.

Figure 3 MRI of cerebrum with contrast. (A and B) Preoperative frontal and sagittal images depicting the ingrowth of the tumour in the midline and a small subdural accumulation of cerebrospinal fluid after burr hole drainage. (C and D) One month postoperative frontal and sagittal images, relatively, depicting the flap and brain.

venous loop to the superior thyroid artery and external jugular vein. The muscle graft was then covered with a split skin graft from the thigh.

On day 14, MRI with contrast (figure 3) revealed regression of the subdural and intrahemispherical empyema and a debulked carcinoma in the cerebral midline including at the falx cerebri.

On day 26, a whole-body positron emission tomography (PET) scan with F-18 fluorodeoxyglucose (FDG) demonstrated absence of cutaneous tumour, no signs of distant metastasis and no signs of infection of the skull or dura. Furthermore, operational sequela and the titanium plate were visible. A PET scan was co-registered with MRI images of the cerebrum (with gadolinium), which demonstrated no residual malignant or infectious foci. PET-CT found possible disease of the prostate.

DIFFERENTIAL DIAGNOSIS

The anamnesis and inspection of the wound suggested infected squamous cell carcinoma. As soon as the Departments of Pathology and Microbiology confirmed the findings, the lesion was further characterised using MRI and PET/CT.

TREATMENT

Before surgery

Before being transported to the Neuro Intensive Ward, the patient was treated at a local hospital with the following:

- ▶ Piperacil/tazobac (4 g+0.5 g intravenously) and ceftriaxone (4 g intravenously).

In the Neuro Intensive Ward, the patient received:

- ▶ Ceftriaxone (3 g×3 intravenously).
- ▶ Piperacil/Tazo (4 g×3 intravenously).
- ▶ Metronidazol (500 mg×3 intravenously).

In addition, the patient's seizures were treated with:

- ▶ Stesolid (diazepam 10 mg p.r.n.).

When the empyema was evacuated, the patient was administered methylprednisolone. The treatment was stopped when the patient could tolerate radiotherapy without side effects:

- ▶ Solu-Medrol (100 mg×1 daily).

After surgery

Based on the analysis of the infectious matter from the diagnostic burr hole, the patient was treated for 8 weeks, guided by paraclinical evaluations:

- ▶ Metronidazol (500 mg×3 intravenously).
- ▶ Benzylpenicillin (5 MIU×4 intravenously).
- ▶ Cefuroxim (3 g×3 intravenously).

Seizure treatment was started while the patient was still intubated and sedated. The treatment rendered the patient seizure free:

- ▶ Keppra (levetiracetam) was titrated to 1 g×2 daily.
- ▶ Orfiril (valproat) was titrated to 600 mg×1 daily.

Furthermore, the patient received vitamins to supplement his diet.

Radiation therapy

Radiotherapy started 1 month after reconstruction surgery.

The patient received a total of 37 fractions (five fractions a week) of radiation therapy (66 GY), targeting the tumour at the superior sagittal vein, with a +3 mm margin. The treatment started after initial wound healing and the patient continued in an oncological outpatient clinic after being discharged from the Department of Neurosurgery.

Pathological evaluation

Punch biopsy

The specimen included dermis and subcutis. Squamous cell carcinoma was identified with irregular islands and strings of tumour with moderate nucleus pleomorphism, widespread mitosis and dyskeratosis. Connection to epidermis was observed at the border.

Dura, right side

A 6 cm×3 cm squamous cell carcinoma ingrowth with thickened dura in red/grey colouration.

Bone

A 10 cm×10 cm in three pieces, decalcified.

Massive infiltration of squamous cell carcinoma with islands and strings of carcinoma cells and keratinisation. The bone showed central disintegration with scattered islands of destruction.

Skin

A 14 cm×14 cm, with a central 10 cm×10 cm ulceration. Tumour tissue was found 1 cm from recession border.

Neurorehabilitation

Approximately 1 week after initial contact, the patient was extubated. He suffered from expressive and impressive aphasia as well as ideomotor apraxia. The patient was unable to move against gravity and required assistance from two or three individuals to sit up and to do basic movements. After 2 days of intensive therapy, he was transitioned to a wheelchair with neck support.

After a week of intensive neurorehabilitation, the patient was able to stand upright, supporting himself by holding onto a high walker. He answered simple questions with some latency and his short-term and long-term memory was impaired. Thereafter, the therapy began to include work in improving language skills, cognitive function and problem solving.

Over the following weeks, physical therapy was combined with practical problem solving. He was trained in using e-mail,

the remote control for the television and taking care of his personal hygiene. He became able to walk to the hospital mini-market using the elevator and a walker. He could buy a technical magazine, read its articles and refer to its content. However, the patient experienced problems recalling usernames and passwords for online applications and accounts.

When the patient was discharged, he could walk 1500 m at a normal pace without the aid of a walker, and he was able to climb stairs with occasional brief breaks. He also trained using a stationary bike. On discharge, his cognitive function appeared to have largely returned to its premorbid baseline.

After hospital discharge

The patient was discharged without further antibiotic treatment. His antiepileptic medicine was continued and he required mild analgesics:

- ▶ Keppra (levetiracetam) was titrated to 1 g×2 daily.
- ▶ Orfiril (calproat) was titrated to 600 mg×2 daily.
- ▶ Paracetamol, 1 g oral maximum×4 daily.

OUTCOME AND FOLLOW-UP

The patient was extubated 8 days after his initial hospitalisation. He was left with paraparesis and later neurological consultations described loss of gait function due to tumour invasion. However, with intensive neurorehabilitation his neurological deficits resolved almost completely.

The patient is followed as an outpatient of the Department of Plastic Surgery and the Department of Neurology. He has shown good reconstructive results in terms of both wound healing and cosmetics (figure 1D). To further evaluate possible prostate disease and lymph node FDG findings (PET-CT findings located to prostate), the patient was referred to the Department of Urology to receive the relevant biopsies.

Following hospital discharge, the patient was seen every other day for wound care. When the wound demonstrated satisfactory healing, a visiting nurse provided continued wound care.

In case of metastasis, the patient will be evaluated for chemotherapy. At our centre, we treat with Taxol (paclitaxel) and Xeloda (capecitabin). Different experimental treatments would require referral to another medical centre.

DISCUSSION

Squamous cell carcinoma is the second most common type of skin cancer.² Most squamous cell carcinomas are located in the head or neck region due to ultraviolet rays from sunlight.³ Surgery is the first choice in treatment. Mohs surgery is preferred over standard excision, since the Mohs method spares tissue and results in a lower recurrence rate. Radiation therapy is the second choice and is primarily used if nerves are involved or as adjuvant therapy to surgery, particularly when high-risk features are present like in the present case.^{4,5}

The prognosis is generally good, but depends on the choice of treatment, tumour localisation, size, depth, the state on the immune system, the presence or absence of perineural invasion and the histological degree of tumour differentiation.^{5,6} Although squamous cell carcinomas are common, the unique extent of the tumour and infectious destruction of the skull in this case has not been previously described in an otherwise healthy individual with an intact immune system.

A recent study by Xu *et al* on cutaneous squamous cell carcinoma treated with surgery followed by radiation therapy, found a 2-year locoregional recurrence, overall survival and cause-specific mortality rates to be 25%, 72%, and 13%, respectively.⁷

This case describes an unusual presentation of a common clinical condition. Its successful treatment was made possible due to the rapid and exacting work within multiple medical, surgical and paraclinical departments.

Patient's perspective

- Patient: 'I am very enthusiastic about the need for publication in order to expand knowledge in the medical and surgical field.'

Learning points

- This very complicated medical and surgical patient was treated as a multidisciplinary case with an excellent outcome.
- Although the patient suffered from a serious carcinoma, it is important to treat the central nervous system empyema adequately before committing to complicated reconstruction surgery.
- Receiving full rehabilitation treatment is critical for the patient to return home and enjoy the best possible quality of life.

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