Pleomorphic Sarcoma in a Pilot

Katrina Franke
BSc MBBS MPH DCH Grad Dip Sports Med
Senior Medical Officer at 1 Expeditionary Health Squadron, Aviation Medical Officer to No. 1 Squadron, RAAF Amberley

Introduction
Sarcomas are rare malignant soft tissue tumours. This case report outlines a pilot diagnosed with a pleomorphic sarcoma, his management and discusses aeromedical considerations for return to flying duties. Review of the literature shows a paucity of published data of sarcomas in aviators, and concomitant recommendation for return to flying duties, requiring sound medical reasoning for aeromedical decision making.

Case Report
A 45 year old pilot presented to his Aviation Medical Doctor with a non-tender mass in his left medial thigh, first noticed two weeks earlier. There was no history of trauma. The patient was otherwise well with no systemic features and no noted weight loss. His aircrew medical had been performed just a few weeks earlier, which confirmed him medically fit for restricted flying duties in aircraft not equipped with an ejection system. The patient had undergone successful C5/6 cervical arthroplasty in early 2014 (RAAF MEC J11 A2, restriction 6-5).

Ultrasound and MRI were performed on the mass which showed a large encapsulated heterogeneous lesion in the adductor magnus of the left thigh, measuring 12.6cm x 9.2cm x 9.5 cm in size. Histology from FNA gave the diagnosis of a pleomorphic sarcoma, with considerable necrosis and presence of lipoblasts, with possible diagnosis of pleomorphic liposarcoma or dedifferentiated liposarcoma with a pleomorphic liposarcoma like high-grade component. PET scan, CT chest and MRI brain showed no evidence of metastatic disease.

The patient underwent 6 weeks of radiotherapy, followed by 6 weeks of recovery prior to surgical removal of the sarcoma. Surgery was performed successfully, with complete removal of the adductor magnus of the left thigh, with noted wide excision margins of the tumour. An abdominal muscle rotation flap was used to fill the soft tissue defect.

Histological analysis of excised tumour was consistent with FNA findings. Of note, a fibrous pseudocapsule encased the tumour. There was no node involvement or metastases. Grading was considered FNCLCC grade 3 from FNA histology, as surgical specimen was difficult to interpret due to extensive post radiotherapy necrosis. Histopathology from excised tumour did not however show features of pleomorphic liposarcoma.

Abstract
Sarcomas are rare malignant soft tissue tumours. This case report outlines a 45 year old pilot, presenting with a non-tender mass in his left medial thigh, subsequently diagnosed with a pleomorphic sarcoma. His management consisted of radiotherapy and surgical removal. Grading was considered FNCLCC grade 3 and there were no metastases. Surgery was followed by a structured rehabilitation program. The paper discusses aeromedical considerations for return to flying duties, regarding the natural history of the condition and recurrence risk as well as the operational mitigations to flight incapacitation risk.

Postoperative recovery was largely uncomplicated and the member returned to ground duties roughly 8 weeks post surgery. The member underwent a structured rehabilitation program, to regain range of motion, strength and endurance. There was some post operative left thigh lymphoedema, but this was managed well with a support stocking, self massage, exercise and weight loss. Most recent review shows excellent control of thigh swelling. The member did require left inguinal and femoral hernia repairs 7 months post tumour removal, and he has recovered well from this.

The member is now 13 months post surgery. He has been discharged from physio. He has returned to full active lifestyle, performing non flying duties, and consistently engaging in exercise – running, cycling, swimming and weights. He has passed his RAAF PFT 2.4km run and push up component. Routine surveillance of chest X-ray and clinical review has found no recurrence of the sarcoma.
DISCUSSION

Sarcomas are a rare group of malignant tumours of mesenchymal origin. They comprise less than 1% of all adult malignancies (1) and approximately 80% of sarcomas originate from soft tissue, with the remainder from bone. There are about 11,930 new cases of soft tissue sarcomas diagnosed in the USA yearly, with 4870 deaths (2).

There are more than 100 different histologic types of soft tissue sarcomas, of which liposarcoma is one of the more common types. Liposarcomas arise from precursors of adipocytes and are most commonly found in the extremities; particularly the thigh, where they commonly arise deep in the muscle mass; and the retroperitoneum.

Sarcomas are thought to arise de novo and not from a preexisting benign lesion (UTD). In the majority of cases, there is no defined etiology, however some predisposing factors have been suggested, including exposure to radiation.

It is well documented that aircrew is exposed to higher doses of ionizing radiation than that received by non aviator members of the general population (3). This is primarily from galactic cosmic radiation. Non ionizing radiation exposure is also increased by way of electronic and magnetic fields generated by the aircraft, and potentially by aircraft instruments such as radars. Further comment on potential radiation exposure is outside the scope of this case study.

Recurrent disease after treatment of sarcomas can be local or metastatic disease, predominantly through haematogenous spread to the lung. Pleomorphic liposarcomas are associated with a high rate of metastases commonly metastasizing to lung, and less commonly to the liver (4). Soft tissue sarcomas rarely metastasize to skin, soft tissue other than original site, bone, liver and brain (5).

The most important prognostic factor in patients with soft tissue sarcomas is pathological stage at time of diagnosis. The TNM system is the most commonly used in staging soft tissue sarcomas. Histologic grade and tumour size are also very important in predicting prognosis and are independent of stage, as are anatomic site of tumour, patient age and histologic subtype. The most commonly used nomogram for estimating prognosis for a patient with sarcoma is from the Memorial Sloan-Kettering Cancer Centre (MSKCC) (6), developed by Dalal et al (7).

AEROMEDICAL CONSIDERATIONS

The patient in this case study is a highly experienced military pilot with ~3,500 hours on Hawk, Tornado and F-111 aircraft. The patient underwent single level cervical arthroplasty and following this, was deemed unfit for ejection seat aircraft. He was waiting for conversion course to KC-30 prior to diagnosis of his sarcoma.

Aeromedical considerations for return to flying duties include risk of recurrence, risk of sudden incapacitation, possible side effect of treatment impacting flying duties, ability to safely control the aircraft and the ability to egress rapidly in an emergency, and functionality/ potential alteration in risk to the member in the aviation environment.

Risk of Recurrence

Using the MSKCC nomogram, the member has a calculated likelihood of survival at 5 years of 61% and 36% at 12 years. This is an all age, all case risk calculation. Positive factors in this case are young age at diagnosis, clear excision margins, circumscribed tumour and no node involvement of metastases. Negative factors are tumour size >5cm, tumour deep to superficial fascia and Grade 3 histology on FNA. The rate of recurrence significantly decreases around two years post diagnosis (8).

Risk of Sudden Incapacitation

Sarcoma typically metastasizes to lung. It is not known to metastasize to brain. Regular lung surveillance via chest Xray is likely to detect any metastases prior to any symptoms. Hence, sudden incapacitation should be considered as rare, and mitigated by radiological surveillance. The member will be trained on the KC-30, which is a multi-pilot aircraft, further negating the risk.

Treatment Side Effects

The patient has no significant side effects from radiation. He will however avoid sit-ups due to his abdominal flap.

Medical Surveillance

The recommended medical surveillance from the treating team was 4 monthly CXR and clinical review up to 2 years, then 6 monthly CXR and clinical review. Yearly PET scans were requested by The RAAF Institute of Aviation Medicine for higher sensitivity screening for metastases.

Aircraft Control / Egress

The member has demonstrated full aircraft control in the simulator and no issues rapidly egressing the airframe in a simulated emergency.

Aircraft Environment

Transport aircraft cabin environment, including potential decompression, hypoxia, and smoke and fumes are not expected to affect the member beyond other aircrew members, or adversely impact on recurrence of his disease. It is anticipated that the member be considered MECJ23 with restrictions as follows:
1 - 9 exempt physical fitness testing, exempt sit-up component

4 - 2 requires access to medical logistics support, spectacles

4 - 3 requires periodic access to specialist care

4 - 4 requires pre-deployment medical officer check

SPEC A2

6 - 1 to wear (as required) and carry a spare pair of spectacles when flying, reading spectacles

6 - 5 medically fit for restricted flying duties in aircraft not equipped with an ejection system

6 - 6 medically fit for restricted flying duties as pilot, with a pilot who has no employment restrictions

CONCLUSIONS

This case study is an interesting case of a highly experienced pilot with a rare tumour which has been managed well, with an excellent outcome to date. Limited studies and cases are currently in the literature of similar cases to help in the complexities of aeromedical decision making. Although there is a known risk of recurrence, the decreased risk following two years and beyond, combined with rare chance of sudden risk of incapacitation and likely diagnosis of potential recurrence through regular surveillance mitigates flight safety risk.

REFERENCES


