In-circuit high frequency jet ventilation (HFJV) in a 7 year-old to minimise organ motion during CT-guided ablation

L Elgie, K McPherson, J Yeung, S Bandula University College London Hospitals

The case

- 23kg 7-year-old girl with metastatic alveolar soft part sarcoma of the nasopharynx
- Nasopharyngeal tumour resections in 2017 and 2018
- Proton beam therapy in 2018 and surgical removal of lung metastases in April and July 2019
- Referred for CT guided-microwave ablation of a right lung metastatic nodule not amenable to surgical resection (Figure 1)

The procedure

- Alternative to surgical resection of solid tumours or metastases, using CT-guidance to insert a needle into the tumour target and perform microwave ablation (Figure 2)
- Reducing movement is important so that treatment can be targeted to defined margins
- In order to minimise organ motion secondary to conventional ventilation there has been a shift to in-circuit HFJV
- HFJV can reduce procedure times and exposure to ionising radiation [1] and reduce the technical difficulty of CT-guided percutaneous applicator placement for lung tumour ablations [2]
- This patient's follow-up CT scans (Figures 3 & 4) confirmed successful ablation of the tumour

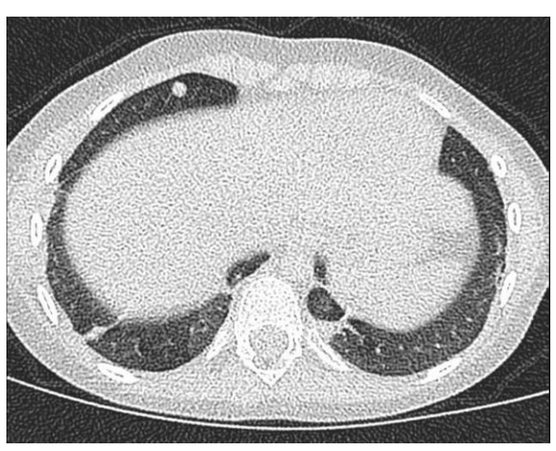

Figure 1. Right lung metastatic nodule

Figure 2. Image during ablation

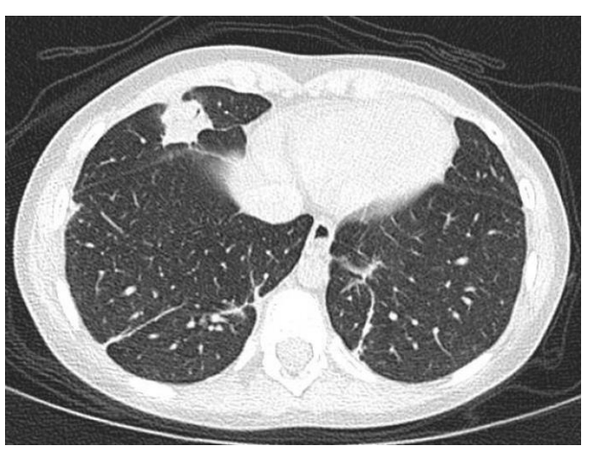

Figure 3. One month post ablation

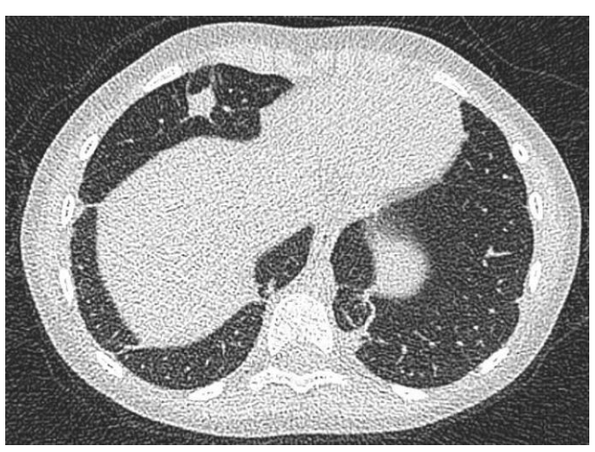

Figure 4. Three months post ablation

The anaesthetic

- Induction and maintenance with a Propofol 1%/ Remifentanil 6mcg/ml mix
- Intubated after 25mg rocuronium with a 5.5mm cuffed oral tracheal tube
- Ventilated with in-circuit HFJV using a jet swivel adaptor (Figure 5) for 45 minutes on the following settings: driving pressure 0.3 bar, FI_{O2} 100%, frequency 120 breaths per minute
- Peak inspiratory pressure during HFJV was 3cmH_2O
- Et_{CO_2} check a few minutes after starting HFJV showed an Et_{CO_2} of 4.5kPa
- Et_{CO_2} at the end of HFJV was 4.1kPa
- She received 35mcg fentanyl, a further 10mg of rocuronium, paracetamol, ondansetron, dexamethasone, 250mls of crystalloid and 50mg sugammadex
- Extubation and recovery were uneventful
- She was discharged home the following day

Figure 5. Jet swivel adaptor (Acutronic Medical Systems)

Discussion

- In our institution these procedures are most commonly performed on adults with renal, liver or lung tumours.
- We are not aware of in-circuit HFJV being used previously in a patient this young for a CT-guided ablation, though a similar technique has recently been described to ventilate children during cardiac Magnetic Resonance Imaging [3]
- CT-guided therapies for paediatric patients with solid tumours may become more commonly performed and in-circuit HFJV is a useful technique to minimise organ motion
- Research may be required to establish the optimum in-circuit HFJV settings for this population
- Systems should be in place to ensure patient safety and positive patient experience …

References

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2. Chung, D. Y. F., Tse, D. M. L., Boardman, P., Gleeson, F. V., Little, M. W., Scott, S. H., & Anderson, E. M. (2014). *High-Frequency Jet Ventilation under General Anesthesia Facilitates CT-Guided Lung Tumor Thermal Ablation Compared with Normal Respiration under Conscious Analgesic Sedation. Journal of Vascular and Interventional Radiology, 25(9), 1463–1469.* doi:10.1016/j.jvir.2014.02.026
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