Historically, management of apical lung tumours (superior sulcus tumours or Pancoast tumours) that involve the brachial plexus has been very limited, and usually all that was offered was palliative care. However, several advances have been made in the management of these tumours, such that the aim of treatment now is complete clearance of macroscopic tumour. The surgical approach, as well as changes in the use of induction radiotherapy and chemotherapy have resulted in improved functional and survival outcome in these patients. Based on our experience in treating these patients at the Austin Hospital, we present the following overview of our strategy in managing these difficult tumours.

Clinical presentation and investigation

Patients with apical lung tumours involving the brachial plexus will present with symptoms relating primarily to the lung tumour itself, or alternatively, may present with neurological symptoms, including pain, numbness, wasting or weakness in the ipsilateral hand, and may have a Horner's syndrome. The mode of presentation may result in a delay in diagnosis (eg hand pain mistaken for carpal tunnel syndrome), however, these tumours are always seen on a chest x-ray, and therefore, diagnostic delay should not be a common occurrence (figure one).

The imaging studies required include chest x-ray, CT of the chest, and MRI of the chest, brachial plexus and cervical spine. The features peculiar to this type of tumour that need to be evaluated include the intra-thoracic extent of tumour (including other tumours within the lungs, bronchi, etc), as well as the neurological involvement of the lower trunk of the brachial plexus and the C8 and T1 nerve roots (figure two). The tumour may invade directly through the nerve root exit foramen, along the path of the nerve root, and enter the spinal canal, with resultant spinal cord compression. This needs to be thoroughly evaluated on the pre-operative imaging studies, as well as systemic staging.

In the absence of significant systemic disease, a multidisciplinary approach is used to treat the apical lung tumour.

Treatment

All patients are now receiving induction chemotherapy and radiotherapy before undergoing surgery. Despite our initial reservations, we have not found that this causes any significant peri-tumoural fibrosis. In all cases, surgical dissection has proceeded smoothly despite the completion of radiotherapy a few weeks earlier. However, in a few tumours, we have noted significant intra-tumoural fibrosis, which was noted histologically, with replacement of viable tumour by fibrotic tissue. The chemotherapy and radiotherapy protocols are beyond the scope of this paper, however further details are available. In some of our patients, definite reduction in tumour size has followed the pre-operative chemotherapy and radiotherapy, however this is not a universal finding.

The surgical procedure is performed by a thoracic surgeon and a neurosurgeon working together. A modification of the posterior subscapular approach is used. A thoracotomy approach is utilised with the patient in a lateral position, with the ipsilateral arm brought across the chest to help with lateral mobilisation of the scapula. The dissection exposes the first and second ribs, their articulation with the spinal column, and the upper lobe of the lung. The first priority is to display the lower elements of the brachial plexus, and to dissect the tumour off C8, T1 and the lower trunk. The tumour is then ‘delivered’ into the chest, and the resection proceeds according to the anatomical profile of the tumour, as shown on the pre-operative imaging. We have encountered three types of tumour, and treated each type differently. Type 1 tumours are small and restricted to the lung apex, in which case a segment of lung is resected. Type 2 tumours are more extensive and have required a formal lobectomy. Type 3 tumours have invaded the chest wall, and require resection of chest wall elements as well as the lung resection (figure three).
Results

In five patients treated by the authors with apical lung tumours and brachial plexus involvement, macroscopic clearance of tumour has been achieved in each case, with preservation of upper limb function. One patient did have pre-operative weakness of hand intrinsic muscle function that failed to recover post-operatively, but no patient developed a new deficit. Tumour type has varied, with at least one patient in each group of type 1, 2 and 3 as defined above. Our follow-up period is only two years at present (all patients still alive), however, a detailed survival analysis will not be completed until five-year results are available.

Discussion

As with most cancer surgery, prognosis is dependant largely on the extent of tumour resection. Complete resection offers the best results. However, apical lung tumours offer several unique problems that limit management options in many cases. Many surgeons are reluctant to operate on lung tumours that involve the brachial plexus for fear of permanently injuring the ipsilateral upper limb. Furthermore, some surgeons are still concerned about operating on such tumours after radiotherapy and chemotherapy has been administered. There is now sufficient evidence in the literature, as well as our own personal experience, that these tumours can be safely resected after chemotherapy and radiotherapy, and that hand function can be preserved. It is the multidisciplinary approach that is critical to achieving good results for these patients, and such patients should be managed in a hospital that offers the combined expertise of a thoracic surgeon, neurosurgeon, radiation oncologist and medical oncologist.

References