

Case Report

Cerebellar haemorrhage and tension pneumocephalus after resection of a Pancoast tumour

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Summary

We present an unusual case of cerebellar haemorrhage followed by tension pneumocephalus several days after thoracotomy for resection of a Pancoast tumour. The postoperative course of the 32-year-old patient was complicated by a cerebellar haemorrhage and hydrocephalus caused by compression of the fourth ventricle. Immediate surgical evacuation of the haemorrhage and placement of an external ventricular drain was performed. Respirator ventilation maintaining a continuous positive airway pressure was required. Following weaning and extubation the patient rapidly deteriorated and became comatose. A cranial CT scan revealed a dilated ventricular system filled with air, and air in the subarachnoid space. Recovery of consciousness was observed after aspiration of intracranial air through the ventricular drainage. Recurrent deterioration of consciousness after repeated air aspiration indicated rapid refilling of the ventricles with air.

The patient underwent emergency surgical re-exploration of the thoracic resection cavity: dural lacerations of the cervico-thoracic nerve roots C8 and Th1 were identified. Subarachnoid-pleural fistula, cerebellar haemorrhage and tension pneumocephalus after discontinuation of continuous positive airway pressure respiration are unusual complications of thoracic surgery. We discuss the putative pathomechanisms and present a brief review of the literature.

Keywords: Tension pneumocephalus; subarachnoid-pleural fistula; thoracotomy; cerebellar haemorrhage.

Introduction

Cerebellar haemorrhage after spinal surgery and pneumocephalus resulting from an elective thoracic procedure involving the posterior chest wall are uncommon or are rarely recognized, but may, however, represent potentially lethal complications. In the case

presented here a tension pneumocephalus caused by a subarachnoid-pleural fistula presented with a delay of eight days.

Case report

A 32-year-old female after radiation and chemotherapy for a non-small cell lung carcinoma of the left upper pulmonary lobe (Fig. 1) presented with no significant treatment response and underwent elective left upper lobectomy with en-bloc resection of the left first, second and third rib and partial resection of the adjacent vertebral bodies. Because of an impaired level of consciousness, respirator ventilation was maintained over the next days. On postoperative day 5 a cranial CT revealed a cerebellar haemorrhage and hydrocephalus caused by compression of the fourth ventricle (Fig. 2).

Evacuation of the space occupying cerebellar haemorrhage and placement of an external ventricular drain was performed immediately. Over the next days the patient's condition required respirator treatment maintaining a continuous positive airway pressure. After extubation on postoperative day 8 the patient was initially alert but complained of headache.

Twelve hours later the patient rapidly deteriorated and became comatose. Neurological examination showed a dilated right pupil not reacting to light. An emergency CT scan of the neurocranium revealed the ventricular system and the subarachnoid space dilated and filled with air (Fig. 3). Immediate relieve of intracranial pressure was achieved by aspiration of intracranial air through the ventricular drain. Recurrent deterioration of consciousness indicated rapid refilling of the ventricles with air. A review of the patient's chest radiographs showed persistent air in the upper left hemithorax, raising the suspicion of a subarachnoid-pleural fistula.

The patient underwent emergency surgical re-exploration of the thoracic resection cavity. Dural lacerations of the left nerve roots C8 and T1 were identified and sealed.



Fig. 1. MRI scan of the chest showing a tumour of the left upper pulmonary lobe, invading the brachial plexus and the posterior chest wall

Discussion

Remote cerebellar haemorrhage is a well recognized but rare complication in supratentorial neurosurgical procedures with a reported incidence of 0.3–0.6% [7]. Fortunately, this complication often remains asymptomatic or tends to have a benign outcome, but fatal cases have also

been documented [4]. Chaddock first described this complication in 1981 after a spinal surgical procedure [2]. Dural opening with loss of CSF is common in these reported cases including our case. On the basis of this association there is a growing consensus that a cerebellar downward displacement, or “sag” as a result of intracranial hypovolemia is the primary event leading to remote cerebellar haemorrhage. The cerebellar “sag” may lead to stretch occlusion of superior cerebellar bridging veins draining in the cephalad direction into the deep venous system. In patients with insufficient venous collaterals this may cause venous infarction subsequently leading to haemorrhagic transformation.

The most frequent cause of pneumocephalus is intracranial surgery and head trauma. Pneumocephalus after thoracotomy was first reported in 1974 [3] and in addition to the patient presented here, a number of cases with pneumocephalus secondary to iatrogenic subarachnoid-pleural fistulas (SPF) resulting from resection of apical chest tumours have been reported [1, 6].

The clinical presentation of pneumocephalus is characterized by headaches, vertigo, and altered mental status, decreased level of consciousness and occasionally hemiparesis, diplopia and aphasia. The most characteristic sign of pneumocephalus is the bruit hydro-aérique, which is a splashing sound heard only by the patient on postural change [5]. In the case presented here acute loss of consciousness and a dilated right pupil were the main signs. The onset of clinical symptoms is usual on postoperative day 4–6, however, cases of symptomatic

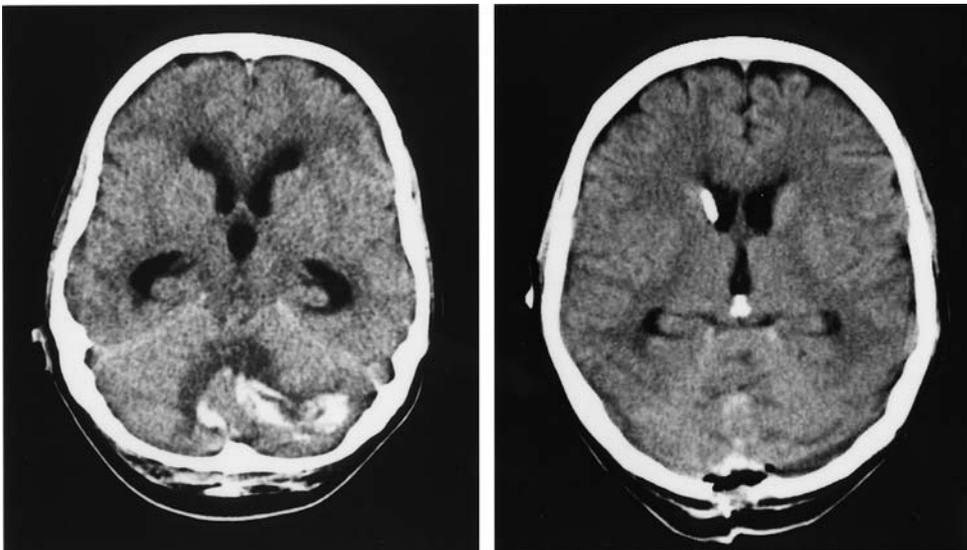


Fig. 2. CCT demonstrating a haemorrhage of the cerebellar vermis and the superior aspect of the left cerebellar hemisphere with compression of the fourth ventricle and hydrocephalus. A marked perifocal oedema indicates that haemorrhage may have occurred earlier



Fig. 3. CT scan of the head showing pneumocephalus with air in the cranial subarachnoid space, the ventricular system and over the left cerebral hemisphere. Note the mass effect on the brain

pneumocephalus have been reported on postoperative day 1 and up to 3 months [1].

In the literature there is no consensus about the treatment modalities for subarachnoid pleural fistulas. For some patients the treatment was reported as conservative consisting of bed rest, low head position, antibiotic prophylaxis, chest drainage with low suction and even lumbar drainage or lumboperitoneal shunting. Surgical repair should probably be contemplated in the event of continuing fistula beyond one or two weeks or symptomatic fistulas failing conservative treatment. Surgical repair of the fistula, combined with a decompression and evacuation of intracranial air is mandatory in a life threatening situation as reported in our case.

In the case presented here the loss of CSF into the pleural cavity supported by the negative pressure maintained by the thoracic drains may have resulted in an intracranial volume decrease and “sag” of cerebellar structures causing venous obstruction and cerebellar haemorrhage resulting in obstruction of the fourth ventricle and hydrocephalus. Surgical evacuation of the haematoma allowed weaning of the patient and spontaneous respiration now with closed chest drains. Under these conditions, with a patent CSF pathway, during inspiration the negative intrathoracic pressure may have aspirated CSF into the pleural cavity, whereas during expiration air may have been forced into the subarachnoid space. These pressure changes, probably combined with a valve mechanism, may have led to a rapidly developing life threatening tension pneumocephalus.

Conclusion

Following thoracotomy requiring paravertebral extra-pleural mobilization jugular compression or Valsava

manoeuvre before closure, may be helpful in detecting a nerve root sheath injury, which should be thoroughly repaired. In the postoperative period a subarachnoid pleural fistula may sometimes be suggested by the collection of large amounts of watery fluid from the chest drainage and may be verified by detection of β -2 transferrin, which is highly suggestive of a CSF fistula.

Neurological deterioration after thoracic or spinal surgery with planned or unintended opening of the subarachnoid space requires immediate spinal and cranial imaging to exclude potentially fatal intracranial complications such as haemorrhage or tension pneumocephalus. The manifestation of a subarachnoid-pleural fistula may be delayed, because a fistula may not be patent under conditions of respirator treatment and/or treatment with thoracic drains.

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References

1. Bilsky MH, Downey RJ, Kaplitt MG, Elowitz EH, Rusch VW (2001) Tension pneumocephalus resulting from iatrogenic subarachnoid-pleural fistulae: report of three cases. *Ann Thorac Surg* 71: 455–457
2. Chadduck WM (1981) Cerebellar haemorrhage complicating cervical laminectomy. *Neurosurgery* 9: 185–189
3. D’Addario R, Greenberg J, O’Neill THE (1974) Pneumocephalus: an unusual cause. *J Neurol Neurosurg Psychiatry* 37: 271–274
4. Friedman JA, Ecker RD, Piepgras DG, Duke DA (2002) Cerebellar haemorrhage after spinal surgery: report of two cases and literature review. *Neurosurgery* 50: 1361–1364
5. Lin MBK, Cheah FK, NG SES, Yeo TT (2000) Tension pneumocephalus and pneumorachis secondary to subarachnoid pleural fistula. *Br J Radiol* 73: 325–327

6. Malca SA, Roche PH, Touta A, Pellet W (1995) Pneumocephalus after thoracotomy. *Surg Neurol* 43: 398–401
7. Siu TLT, Chandran KN (2003) Cerebellar haemorrhage following supratentorial craniotomy. *J Clin Neurosci* 10: 378–384

The case report is clearly written and would serve as a worthy reminder of these complications and need for definitive treatment – identification and closure of fistula in the chest.

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Comment

An unusual case but as cited, a well documented phenomena:

- 1) Cerebellar hemorrhage secondary to CSF drainage
- 2) Pneumocephalus secondary to spino/pleural fistula

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