

G. O'Reilly
A. Tatman
A. D. Hockley

Intraoperative anaphylaxis during neurosurgery

Received: 22 August 1997

G. O'Reilly · A. D. Hockley (✉)
Department of Neurosurgery,
Birmingham Children's Hospital,
Birmingham, UK

A. Tatman
Department of Anaesthesia,
Birmingham Children's Hospital,
Birmingham, UK

Abstract Intra-operative anaphylaxis is of particular concern in neurosurgery. Not only is there an increased risk of major anaphylaxis, but the frequent placement of patients in the prone or sitting position may make resuscitation difficult. We describe two cases of per-operative anaphylaxis during neurosurgery and the techniques used in the successful management and investigation of these patients.

Key words Anaphylaxis · Neurosurgery · Allergy

Introduction

The incidence of severe acute perioperative allergic reactions is approximately 1:5000 [3]. These are most commonly due to anaesthetic agents, but may occur with other allergens [6]. Anaphylaxis during neurosurgical procedures is particularly important because of the unusual body positions encountered during surgery and the frequent placement of the patient in a prone position. This can lead to extreme difficulty with cardiac massage in the event of a cardiac collapse. Also, certain subgroups of neurosurgical patients, such as those with hydrocephalus who have had multiple shunt revisions and patients with spina bifida who have undergone numerous operations, are more prone to intra-operative anaphylaxis than the general population. It is likely that such frequent operations result in repeated exposure to allergens.

Awareness of the possibility of anaphylaxis is important in neurosurgery, and its successful management requires the combined expertise of both the anaesthetist and the neurosurgeon, as illustrated by the following two cases.

Case reports

Case 1

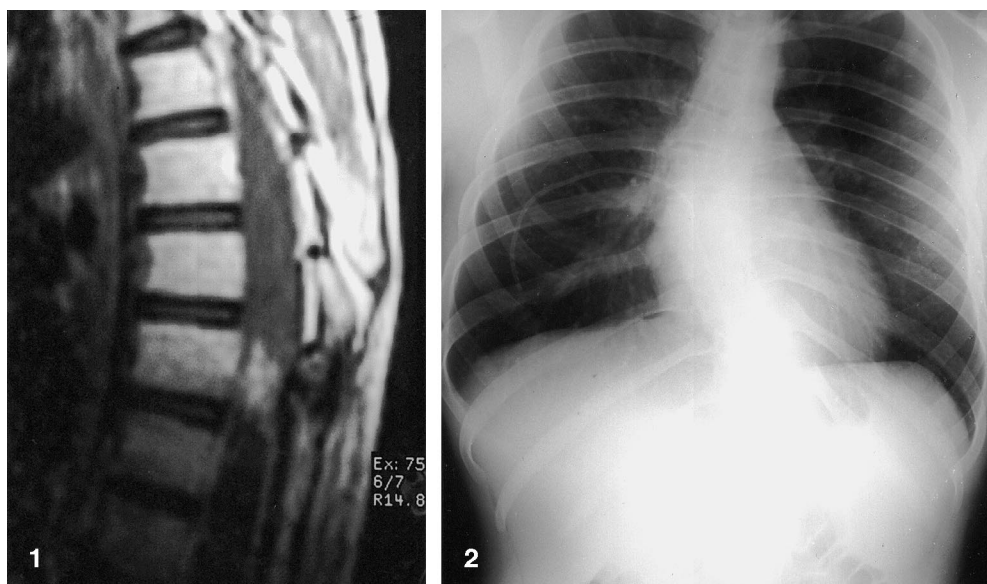
A 13-year-old girl had a sub-total resection of a cervico-thoracic intramedullary spinal ependymoma 6 years previously. Post-operative radiotherapy was given. She re-presented with recurrent symptoms, including deterioration of lower limb function and bladder awareness. MRI imaging of her spine (Fig. 1) revealed an enhancing upper thoracic tumour nodule with a cyst above and below.

Surgery was advised. Anaesthetic induction was performed with thiopentone, and atracurium was used for paralysis. The patient was intubated, two large-bore peripheral venous cannulae and a radial artery cannula being inserted. The patient was placed in the prone position. Surgery commenced 1 h after induction of anaesthesia. An upper thoracic laminectomy was performed and a mid-line dorsal myelotomy made, and the tumour nodule was excised. Approximately 30 min after commencement of the operation, the patient was given 100 ml of Haemacel. Within seconds, the patient's airway pressure increased from 15 to 40 cmH₂O and the arterial blood pressure became unrecordable. The presence of both bronchospasm and cardiovascular collapse strongly suggested acute anaphylaxis, which was immediately treated with intravenous adrenaline and volume replacement (human albumin solution). Hydrocortisone and chlorpheniramine were also given. This produced a rapid and sustained improvement, and the operation was completed successfully. The patient made a satisfactory postoperative recovery with improvement in lower limb and sphincter function.

Subsequent investigations revealed evidence of acute histamine release (urinary methylhistamine 184 ng/ml, NR 5–20 ng/ml). The

Fig. 1 T1-weighted MRI scan of thoracic spine showing enhancing tumour nodule and associated cyst

Fig. 2 Chest X-ray showing disconnected cardiac catheter in right thoracic cavity



latex-specific IgE RAST was negative. From the time-course of events and the exclusion of latex allergy, Haemacel allergy was felt to be the diagnosis. The patient now carries a Medic Alert bracelet for allergy to gelatin-containing colloids.

Case 2

A 15-year-old boy with infantile hydrocephalus had undergone multiple operations to revise his CSF shunt system. Because his peritoneum failed to absorb CSF from his ventriculo-peritoneal shunt and because he had obstructed internal jugular veins, the distal aspect of his shunt had been placed directly into the right atrium by thoracotomy. He presented on this occasion with headaches, intermittent vomiting and chest discomfort. Investigations revealed a disconnected distal catheter within the thoracic cavity (Fig. 2) and ventricular enlargement.

At operation, anaesthesia was induced with thiopentone and the patient was paralysed with vecuronium. Two large-bore venous canulae and a radial artery catheter were inserted. Surgery commenced 30 min after anaesthetic induction. The thoracotomy was reopened, and the disconnected catheters were isolated and clamped. Following successful insertion of the atrial catheter, the patient developed severe bronchospasm and cardiovascular collapse, necessitating internal cardiac massage, intravenous adrenaline and volume replacement. When the patient's condition stabilised, the catheters were reconnected and the thoracotomy closed. The patient was ventilated for a 12 h postoperatively and made a full recovery. The differential diagnosis included air embolism, at either the atrial or the cranial level, cardiac tamponade, endotracheal tube occlusion or acute anaphylaxis. Acute anaphylaxis was initially discounted because no drugs had been given immediately before the collapse. Only after the other differential diagnoses were excluded was the possibility of acute anaphylaxis considered.

Subsequent investigations confirmed the diagnosis of acute anaphylaxis, with plasma cell tryptase 10.4 ng/ml (NR 1–2) and urinary methylhistamine 60 ng/ml (NR 5–20 ng/ml). The latex-specific IgE RAST was positive, and with this time-course of events, a diagnosis of acute latex allergy was made. The patient has subsequently required a further shunt revision. This was undertaken using a latex-free technique and was uneventful. The patient now carries a Medic Alert bracelet for latex allergy and has been warned about the risks from household latex items, such as rubber balloons.

Discussion

Major anaphylactic reactions are graded from one to four. Grade one is a mild reaction, whilst grade four is severe cardiovascular collapse, usually requiring external cardiac massage and admission to the intensive care unit.

In case 1 there was a grade three reaction to Haemacel requiring adrenaline and fluid resuscitation. Had the patient not immediately responded to this treatment, external cardiac massage would have been necessary. As the patient was in the prone position with her spinal column exposed, it would not have been possible to turn her to the supine position. External cardiac massage has been described in the prone position; Sun et al. described two cases [12]. The first involved a 14-year-old child undergoing a craniotomy in the prone position for evacuation of an intracerebellar haematoma. The second case involved a 34-year-old man undergoing an emergency cervical laminectomy. In the former case, the anaesthetist placed his clenched left fist under the patient's sternum and then rhythmically compressed on the midthoracic spine with his right hand. In the second case, the anaesthetist placed his clenched fist under the sternum whilst the surgeon compressed the spine rhythmically between the scapulae. Both cases had a successful outcome. Direct compression over the spine may not be possible if the thoracic spine is the site of the operation, as in this case. In these circumstances, compression on either side of the wound, over the scapulae, has been reported to be successful [14]. The gelatin-based colloids, such as Haemacel and Gelofusine, are known to release histamine. When used in isolation outside the operating theatre, for volume expansion or plasmapheresis, they are very safe. However, in the presence of other histamine-releasing drugs, including some an-

Table 1 Sources of latex in the operating theatre

Gloves
Urinary catheters
Monitoring devices
Operating table and rolls and padding
Face masks
Ventilator tubing and reservoir bag
Rubber endotracheal tubes
Some surgical drains
Stoppers of drug bottles
Stopper of syringes (probably safe)
Tourniquets
Some adhesive tape
Injection ports infusion systems and bags

aesthetic agents, the incidence of serious reactions increases to about 1 in 15 [8].

The patient presented here as case 2 had a cardiopulmonary collapse. The differential diagnosis included air embolism, at either the atrial or the cranial level, cardiac tamponade, endotracheal tube occlusion or acute anaphylaxis. Acute anaphylaxis was initially discounted because no drugs had been given immediately before the collapse. Only after the other differential diagnoses were excluded was the possibility of latex allergy reconsidered. The prevalence of latex allergy is increasing. It is commoner in those with repeated exposure to latex, such as patients undergoing multiple operations, children with spina bifida or uri-

nary tract anomalies who require repeated urinary catheterisation, and health care workers [2, 4, 5, 7, 9]. Surprisingly, these patients have often had repeated uneventful operations, and it is unclear what triggers the sensitisation to latex.

Latex anaphylaxis usually presents late in the operation, often after 30–120 min, thereby distinguishing it from many anaesthetic drug-related episodes. However, there are several reports of immediate anaphylaxis [2, 5] soon after induction of anaesthesia. Hence, an early onset does not exclude latex as the cause of the reaction.

A history of a previous reaction to latex is not uncommon, but may be quite obscure [1]. Many household items contain latex, including rubber balloons, gloves and balls. A history of perioral swelling whilst blowing up balloons or coughing/sneezing whilst in contact with latex is highly suggestive of latex allergy [10, 11, 13].

Any latex that comes into contact with the patient, particularly their blood or mucous membranes, can trigger a reaction. Many items used in the operating theatre contain latex (Table 1).

The management of severe anaphylaxis requires the close co-operation of the surgeon and the anaesthetist. This is particularly so in neurosurgery, where there is an increased risk of major anaphylaxis and the frequent positioning of the patient in the prone or sitting position may make resuscitation difficult.

References

- Ballantyne JC, Brown E (1995) Latex anaphylaxis: another case, another cause. *Anesth Analg* 81:1303–1304
- Banta JV, Bonanni C, Prebluda J (1993) *Dev Med Child Neurol* 35:540–548
- Beard K, Jick H (1985) Cardiac arrest and anaphylaxis with anaesthetic agents. *JAMA* 254:2742
- D'Astous J, Drouin MA, Rhine E (1992) Intraoperative anaphylaxis secondary to allergy to latex in children who have spina bifida. *J Bone Joint Surg [Am]* 74:1084–1086
- Dormans JP, Templeton JJ, Edmonds C, Davidson RS, Drummond DS (1994) Intraoperative anaphylaxis due to exposure to latex (natural rubber) in children. *J Bone Joint Surg [Am]* 76:1688–1691
- Fisher M (1991) Anaphylaxis to anaesthetic drugs: aetiology, recognition and management. *Curr Anaesth Crit Care* 2:182–186
- Hodgkin CA, Anderson BD (1994) Latex allergy: an unfamiliar cause of intra-operative cardiovascular collapse. *Anaesthesia* 49:507–508
- Lorenz W, Duda Dick W, Sitter H, Doenicke A, Black A, Weber D, Menke H, Stinner B, Junginger T, Rothmund M, Ohmann C, Healy MJR (1994) Incidence and clinical importance of perioperative histamine release: randomised study of volume loading and antihistamines after induction of anaesthesia. *Lancet* 343:933–940
- Meehan PL, Galina MP, Daftari T (1992) Intraoperative anaphylaxis due to allergy to latex. *J Bone Joint Surg [Am]* 74:1087–1089
- Pasquariello CA, Lowe DA, Schwartz RE (1993) Intraoperative anaphylaxis to latex. *Pediatrics* 91:983–986
- Slater JE (1989) Rubber anaphylaxis. *N Engl J Med* 320:1126–1130
- Sun W-Z, Huang F-Y, Kung K-L, Fan S-Z, Chen T-L (1992) Successful cardiopulmonary resuscitation of two patients in the prone position using reversed precordial compression. *Anesthesiology* 77:202–204
- Swartz J, Braude BM, Gilmour RF, Shandling B, Gold M (1990) Intraoperative anaphylaxis to latex. *Can J Anaesth* 37:589–592
- Tobias JD, Mencio GA, Atwood R, Gurwitz GS (1994) Intraoperative cardiopulmonary resuscitation in the prone position. *J Pediatr Surg* 29:1537–1538