Because of its structure, atosiban also has affinity for vasopressin receptors and inhibition of anti-diuretic effects may cause congestive heart failure and hypertension.[6] Betamethasone is probably not a major risk factor for pulmonary oedema as it has little mineralcorticoid activity. Nevertheless the full pathogenesis of non-cardiogenic pulmonary oedema is unknown and the pharmacological risk factors are incompletely defined.

Despite a GCS score of 12/15, our patient maintained a degree of cooperation, tolerated CPAP well and the GCS increased rapidly within 5 min. Had this not been the case, general anaesthesia with tracheal intubation would have been performed. However, in this case the early use of CPAP was an effective method of ventilatory support and allowed avoidance of tracheal intubation and its potential complications.[7,8]

A. Fernández, D. Domínguez, L. Delgado
Department of Anesthesiology, Intensive Care and Pain Treatment, Nuestra Sra. de Candelaria University Hospital, Tenerife, Spain
E-mail address: anabfp@gmail.com

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0959-289X/$ - see front matter

doi:10.1016/j.ijoa.2010.09.008

Minimally-invasive spinal surgery to remove a broken epidural catheter fragment

A healthy 24-year-old woman was referred to our neurosurgery department from another hospital seven days after delivery. An epidural catheter had been inserted for labor analgesia at what was presumed to be the L3–4 interspace. The catheter had been inserted too far and when attempting to withdraw it through the Tuohy needle, the catheter had broken. A second catheter had been inserted successfully for analgesia and after an uneventful delivery, the second catheter was removed without difficulty. The patient had been advised that a fragment of the first catheter remained in her back.

On day 1 postpartum the patient had no radicular deficit but described moderate low back pain located on her right side which was triggered after sitting up for a long time. Neurological examination was normal. She had no fever, the puncture point was clean with no sign of inflammation and laboratory blood tests were normal. A computerized tomography (CT) scan showed the catheter located in the epidural space in the right lateral recesses, extending from L2–3 to the lower extremity of the T12 pedicles (Fig. 1).

Faced with the patient's symptoms and her strong wish to have the catheter removed, it was agreed among anesthesiologists and neurosurgeons to remove the catheter surgically after full informed consent. Surgery took place on the fifteenth day after insertion of the epidural catheter following a repeat CT scan on the eve of the surgery to ensure the fragment had not migrated. Under general anesthesia, the patient was positioned in a prone knee-chest position and a minimally invasive tubular retractor (Quadrant system; Medtronic Sofamore Danek, Memphis, TN, USA) was inserted under endoscopic monitoring. The spinal canal was accessed at the level of the L1–2 right epidural space. After a trans-muscle approach, resection of the lateral extension of the ligamentum flavum was performed without laminectomy while preserving the posterior apophyseal joints. The dural sac, right L2 nerve root and catheter were easily identified (Fig. 2). The catheter fragment was free, with no observed reactional fibrosis, and was removed easily. The procedure lasted 40 min with estimated blood loss of 20 mL.

At post-operative follow-up the patient did not describe any neurological complications and was able to walk on the evening of the surgery. Upon discharge the next day she reported a complete disappearance of her back pain and only pain in the surgical area for which she was prescribed acetaminophen. Three months post-surgery she was free from low back pain and had resumed all her previous activities.

Removing an entrapped catheter presents similar risks to spinal surgery. In our patient the main risk

Fig. 1 Three-dimensional CT-scan surface reconstruction of the skeletal bones showing the catheter located within the spinal canal from the L2–3 disc to the lower extremity of the T12 pedicles.

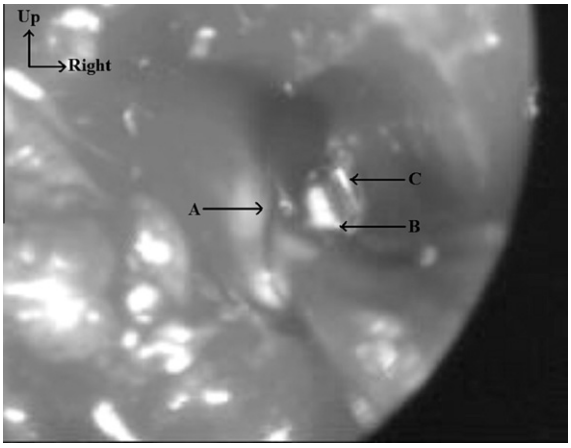

Fig. 2 Intraoperative endoscopic view allowing visualization of the dural sheath (A), L2 right nerve root (B) and the catheter (C).

was a lesion to the conus medullaris since the level of incision chosen to reach the spinal canal was L1–2. This location was preferred to L2–3 as we wanted to avoid the risk of a right hemilaminectomy at L2 in order to reach the tip of the catheter. In fact we wanted to open at a level where we were certain to find the catheter and could remove it laterally; previous reported failures of removal have been attributed to catheter migration.[1,2]

The decision to remove a broken catheter must be a multidisciplinary one based on the patient's symptoms and the imaging data.[3,4] Development of minimally-invasive spinal surgery to remove the catheter by a muscle-splitting approach without laminectomy has the advantage of preserving muscle physiology.[5–7] This allowed our patient to leave hospital the next day to be with her newborn child. Endoscopic monitoring allows better vision and was chosen instead of the surgical microscope by the technical operator. The surgical alternative would have been a classic posterior approach leading to a more complicated postoperative follow-up with more pain and longer hospital stay.

C. Eap, M. Frappart, C.F. Litre, F. Bourgeade,
P. Gomis, J.M. Malinovsky, P. Rousseaux
Service de Neurochirurgie, CHU Reims, France
Département d'Anesthésie, Réanimation,
CHU Reims, France
E-mail address: chris.eap@gmail.com

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0959-289X/$ - see front matter

doi:10.1016/j.ijoa.2010.09.006