Implications of interscalene brachial plexus block in the elderly patient

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INTRODUCTION

Shoulder arthroplasty with synthetic prosthesis is a relatively recent advance in orthopaedic surgery. The main indications for it are the replacement of worn or diseased shoulder joints in a mainly elderly population. This presents a challenge for the anaesthetist because of age-related generalized reduction in physiological reserve, a lower ability to tolerate the stresses of anaesthesia and surgery, and an increased incidence of coexisting diseases.

Regional anaesthesia combined with general anaesthesia has been widely used for perioperative analgesia and to optimize the haemodynamic response to surgery.

CASE REPORT

A 75-year-old, 83 kg woman had been scheduled for a right shoulder replacement. Apart from an asymptomatic hiatus hernia, polymyalgia rheumatica and osteoporosis, she was otherwise healthy. Her medication included omeprazole and prednisolone 5 mg. Preoperative blood tests, electrocardiogram (ECG) and a chest X-ray (*Figure 1*) were within normal limits.

As part of a combined anaesthetic technique, a right interscalene brachial plexus block was performed with the aid of a nerve stimulator before inducing general anaesthesia. Bupivacaine 0.25% 40 ml with adrenaline 1:200 000 was injected under aseptic conditions. General anaesthesia was established with midazolam 2 mg, alfentanil 1 mg, propofol infusion and vecuronium 8 mg. The trachea was intubated, and the patient was ventilated with an air/oxygen mixture, while anaesthesia was maintained with a propofol infusion. At the beginning of surgery, a single bolus of papaveretum 15.4 mg was given. Intraoperatively, the patient was haemodynamically stable with oxygen saturation (SaO_2) >98% as measured by pulse oximetry. No further analgesia or muscle relaxant was used. The surgery lasted 2.5 hours and was uneventful. Muscle relaxation was reversed with neostigmine 2.5 mg and glycopyrrolate 0.5 mg. Shortly afterwards, the patient was awake, fully conscious, breathing spontaneously with good tidal volumes >500 ml. However, the SaO_2 was 88% while breathing 100% oxygen. Continuous positive airway pressure at 5 cmH_2O was applied for about 10 minutes before the patient was extubated. She was maintained on high flow oxygen 6 litres/minute via facemask with SaO_2 of 94–95%. The patient did not complain of any difficulty in breathing.

A 12 lead-ECG in the recovery room was unchanged to the preoperative one. A chest X-ray (*Figure 2*) showed no evidence of a pneumothorax. However, there was a markedly elevated right hemidiaphragm which had not been present on the preoperative film. The diagnosis of right hemidiaphragm paresis as a result of blockade of the right phrenic nerve during the interscalene block was made.

The patient needed high flow oxygen at 6 litres/minute and chest physiotherapy for the first postoperative day to maintain her SaO_2 > 95% until the interscalene block had worn off approximately 18 hours later (*Figure 3*). She made an uneventful recovery.

DISCUSSION

The interscalene approach to the brachial plexus has been widely used since Winnie first described it in 1970. Diaphragmatic paresis resulting in phrenic nerve block has been a known side effect of the brachial plexus block. With different approaches to the brachial plexus, the frequency of phrenic nerve block varies (Dhuner et al, 1955; Knoblanche, 1979).

A 100% incidence of ipsilateral hemidiaphragmatic paresis starting 5 minutes after interscalene blockade diagnosed by ultrasonography has been reported by Urmey et al (1991).

Local anaesthetic diffusion through the fascia of the anterior scalene muscle has been suggested as a cause of phrenic nerve palsy, which lies directly on the surface of the fascia (Winnie, 1970). The 'upwards' tracking of local anaesthetic solution towards the C3–5 roots in the facial sheath of the brachial plexus has also been suspected. The use of a low volume or low concentration of local anaesthetic solution as well as digital pressure above the injection site in order to prevent upward spread have made no difference to the incidence of phrenic nerve blockade (Pere, 1993; Sala-Blanch et al, 1999).

Most patients remain asymptomatic (Knoblanche, 1979; Fujimura et al, 1995) despite complete hemidiaphragmatic paresis, which lasts as long as the interscalene brachial plexus block itself (Urmey et al, 1991). Fujimura et al (1995) found that an increased rib cage contribution to the tidal volume and an increased respiratory frequency might be the compensatory mechanisms for the abnormal hemidiaphragmatic movements. If these mechanisms fail in the otherwise healthy patient, chest wall distortion during hemidiaphragmatic paresis may lead to regional atelectasis and respiratory failure.

Kayerker and Dick (1983) published two reports of young women experiencing breathing difficulties and respiratory distress 1 hour after insertion of interscalene brachial plexus blockade, which resolved with high-inspired oxygen. Smith et al (1998) reported the case of a 90-year-old woman undergoing a shoulder arthroplasty solely under interscalene brachial plexus block who developed

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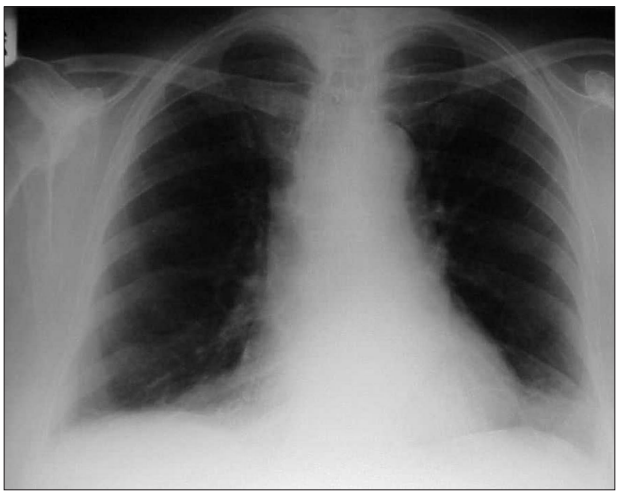

Figure 1. Preoperative chest X-ray.

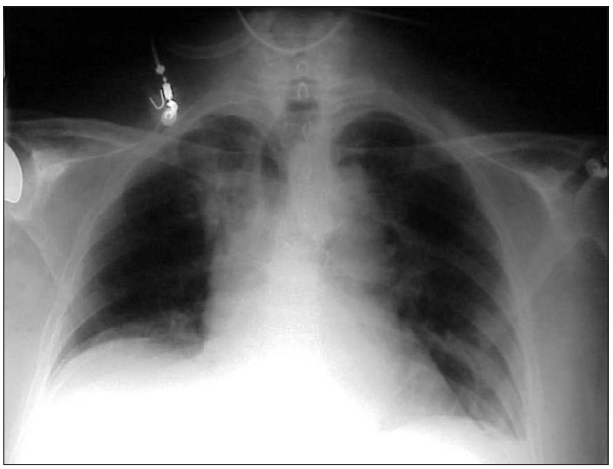

Figure 2. Immediate postoperative chest X-ray showing elevated right hemidiaphragm.

intraoperatively an asymptomatic profound desaturation to oxygen saturation of 75–85%, requiring intubation and ventilation.

The hypoxia in our patient was mainly caused by the hemidiaphragmatic paresis, as the duration of the hypoxaemia lasted as long as the interscalene block. The sedative and analgesic given at induction may have contributed to the respiratory compromise but are unlikely to have played a significant part, as the effect would not have lasted until the next day. Continuing muscle paralysis, as a result of neuromuscular block, may be another factor, but this is again unlikely because no additional neuromuscular blockers were used and the patient was adequately reversed. In addition, the patient was on oral steroids for her polymyalgia rheumatica, which may have contributed to the magnified effect of the phrenic nerve block.

CONCLUSION

Use of regional blocks with general anaesthesia is the mainstay of modern anaesthesia. However, it is important to remember that all regional blocks used for analgesia are themselves associated with side effects. An interscalene brachial plexus block, which is often used for shoulder surgery, has an almost 100% incidence of phrenic nerve block. Although asymptomatic in many, elderly patients can often compensate little and become hypoxic, as highlighted in this report. It also emphasizes the need for close monitoring of patients who have undergone regional anaesthetic techniques. HM

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Urmey WF, Talts KH, Sharrock NE (1991) One hundred percent incidence of hemidiaphragmatic paresis associated with interscalene brachial plexus anesthesia as diagnosed by ultrasonography. *Anesth Analg* **72:** 498–503

Winnie AP (1970) Interscalene brachial plexus block. *Anaesth Analg* **49**(3): 455–66

Figure 3. Postoperative chest X-ray 24 hours later with diaphragm returned to normal position.