

Clinical reports

A case report of anesthetic management of the minimally invasive Nuss operation for pectus excavatum

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Abstract

We describe the anesthetic management of a patient with pectus excavatum, receiving the minimally invasive Nuss operation, which corrects chest wall deformity by insertion of a convex steel bar (pectus bar). An 8-year-old female patient was scheduled for the Nuss operation. The manipulation of the bar in the thorax was guided by thoracic endoscopy. Anesthesia was maintained with a combination of general and epidural anesthesia. The intraarterial catheter and epidural catheter were inserted after the induction of general anesthesia. During the manipulation of the pectus bar in the anterior mediastinum, a sudden decrease in arterial pressure might occur due to the compression of the heart. Therefore, the intraarterial line was essential for continuous monitoring of arterial pressure. The pectus bar causes severe postoperative pain, and the patient was required to remain at bed rest for several days. Continuous epidural infusion of ropivacaine and morphine eliminated the postoperative pain and enabled the patient to maintain bed rest. For the anesthetic managements of patients undergoing the Nuss operation, close monitoring of arterial pressure intraoperatively and postoperative analgesia are important.

Key words Endoscopic surgery · Epidural anesthesia · Nuss operation

Introduction

The Nuss operation is a technique for minimally invasive repair of pectus excavatum (MIRPE) in which a convex steel bar is inserted under the sternum through small bilateral thoracic incisions to mechanically raise the sternum and remodel the chest wall [1,2]. This operation is performed mainly in prepubertal patients. The overall result of this operation is favorable, and this procedure is gaining acceptance. However, several com-

plications, including pneumothorax, pericarditis, and puncture of the cardiac chambers, have been reported [2,3]. In the postoperative period, prepubertal patients are required to maintain a supine position on the bed to prevent displacement of the steel bar. Satisfactory postoperative analgesia is essential to enable the pediatric patients to maintain bed rest. The literature on the anesthetic management of this operation is limited. We report a case of a Nuss operation in which the patient was successfully managed with a combination of general and epidural anesthesia in the perioperative period.

Case report

An 8-year-old female patient was scheduled for a Nuss operation. She was indicated for surgery because her pectus index was 3.56 (normal, <3.25). The pectus index is calculated in the computed tomography (CT) scan at the level of the deepest part of the pectus excavatum deformity. The equation is $A - B/C - D$, where $A - B$ is the transverse diameter in centimeters and $C - D$ is the anteroposterior diameter in centimeters measured from the back of the sternum to the front of the vertebral body [4]. She was premedicated with 0.5 mg/kg oral midazolam 30 min before surgery. After standard monitors were attached, an intravenous line was started and anesthesia was induced with 5 mg/kg of thiopental and 0.1 mg/kg of vecuronium. The patient was intubated with a single-lumen endotracheal tube (ETT) and ventilated with a tidal volume of 10 ml/kg. The intraarterial line was secured in the left radial artery. The patient was turned onto the left lateral position, and an epidural catheter (Perifix Paed epidural set with 18-gauge, 50-mm length Tuohy needle; B. Braun Melsungen, Melsungen, Germany) was easily inserted by a median approach at the level of the T8–T9 interspinous space.

The operation was started after turning the patient to the supine position, and a thoracic endoscope was

inserted through the eighth intercostal space in the right anterior axillary line. A steel pectus bar was inserted at the level of the seventh intercostal space at the midaxillary line bilaterally. When the bar was put into the position where it pushed the sternum outward, the bar pressed the heart and caused a sudden drop, from 100 to 50 mmHg, in systemic blood pressure. The anesthesiologist noticed the decrease instantly from the change in the arterial waveform and warned the surgeons. Compression of the heart by the bar was relieved immediately. After this event, manipulation of the bar was performed carefully and the arterial waveform was observed closely. The pectus bar was secured at the level of the seventh rib. At the end of the operation, the lungs were expanded and the endoscope was removed. As the chest X-ray film revealed no pneumothorax, the surgeons decided that a chest tube was not necessary.

After extubation, the patient was sent to the pediatric ward. The epidural catheter was connected to the infusor at a setting of 2 ml/h and 2 ml bolus/h 100 ml 0.2% ropivacaine with 4 mg morphine (by PCA, patient-controlled analgesia). The patient received this combination of ropivacaine and morphine for a total of 100 ml for 2 days postoperatively, and she received 100 ml 0.2% ropivacaine without morphine for 2 more days. The epidural catheter was removed on the fourth postoperative day. The analgesia level obtained by the epidural local anesthetics was from T4 to T10 as determined by cold sensation on the second postoperative day. The patient required no analgesic other than epidural infusion postoperatively to maintain satisfactory bed rest. The patient was discharged 10 days after the operation.

Discussion

We report a case of a Nuss operation in which perioperative anesthetic care was provided by general and epidural anesthesia. The Nuss operation is a minimally invasive technique for the correction of pectus excavatum. It was first described in 1998 and is becoming popular for the correction of pectus excavatum [1,5]. Patients benefit from this operation because it is a much less radical operation with better cosmetic results than previous types of surgery such as sternal turnover [6]. However, the pectus bar, which is inserted between the sternum and the heart, poses two problems.

The first problem is that the bar is inserted in the anterior mediastinum. Complications including pneumothorax, pericarditis, puncture of the cardiac chambers, sinus arrhythmia, and drop in systemic pressure by the compression of the heart have been reported [1,2,6]. Therefore, an intraarterial line is an essential part of the intraoperative monitoring. In our case, the bar caused

sudden arterial hypotension by compressing the heart. Recently, thoracoscopy has been employed to confirm the correct position of the bar, but close monitoring during the manipulation of the bar is important.

The other problem is that the pectus bar causes severe postoperative pain by directly compressing the posterior surface of the sternum. However, prepubertal patients are expected to stay in their bed to maintain the stability of the inserted pectus bar for several days postoperatively. Therefore, continuous epidural infusion has become an indispensable part of the postoperative management, not only for the patients' comfort, but also for a better operational outcome.

The insertion level of the epidural catheter and the choice of epidurally administered agents are important. In our case, the midthoracic insertion of the epidural catheter reduced the need for opioids. Epidural morphine with 0.2% ropivacaine until the second postoperative day provided appropriate analgesia in the immediate postoperative period. For the next 2 days, 0.2% ropivacaine alone provided satisfactory analgesia. The appropriate choice of the level of thoracic insertion of the epidural catheter decreases the need for both opioids and local anesthetics. The incidence of the untoward effects of opioids and local anesthetics are thus avoided. Furthermore, the thoracic insertion can be approached medially in pediatric patients and does not have technical difficulty as in adults [7]. The effective use of epidural anesthesia helps the smooth recovery.

In summary, perioperative management of the Nuss operation needs careful anesthetic control, including invasive arterial monitoring and an epidural catheter.

References

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