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Case report

Right radial nerve dysfunction following laparoscopic sigmoid colectomy

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KEYWORDS

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Abstract Here, we report a case of right radial nerve dysfunction following laparoscopic sigmoid colectomy under general anesthesia. A 75-year-old man was intubated without excessive retroflexion, and his upper body was held in place by lateral body positioners with protective cushions over the chest and acromioclavicular joints. The patient's head was maintained at the center and held on the operation table with a memory-foam pillow to prevent hyperextension of the neck. The arms, abducted 80° with the forearms supinated, were held in place on the armrests with protective cushions. The surgical position was a 20° head-down lithotomy position with the right side of the body lowered by 15°. Surgery was completed successfully with no complications, and anesthesia time was 7 h and 37 min. After surgery, however, the patient complained of numbness and hypoesthesia on the radial and ulnar side, respectively, of the right arm from the elbow to the fingertips, with the boundary running between fingers 3 and 4. Dysesthesia was observed in the right fingertips of fingers 1–3. After 3 months of silver spike point low-frequency electrotherapy, hypoesthesia improved, while dysesthesia partially improved, in the dorsal area between right fingers 1 and 2.

Abbreviations: CRE, creatinine; Hb, hemoglobin; MRI, magnetic resonance imaging; MMT, manual muscle test; SpO_2, oxygen saturation; SSP, silver spike point

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1. Background

Brachial plexopathy may be caused by inappropriate body positioning during surgery under general anesthesia [1–3]. Here, we report a case of right radial nerve dysfunction in laparoscopic sigmoid colectomy under general anesthesia—a common surgical procedure in recent years—after the patient was held by body positioners at the shoulders in a head-down position with the arms abducted. Written informed consent was obtained from the patient for publication of this report.

2. Case presentation

A 75-year-old man (height: 173 cm; weight: 67.9 kg) with a history of cerebral infarction at the age of 62 years had been taking an antiplatelet drug and oral hypoglycemic agent for diabetes since the age of 67 as well as an antihypertensive drug and warfarin for hypertension and arterial fibrillation since the age of 72. Family history was remarkable for liver cancer in his older brother. The patient had no history of cigarette smoking but consumed approximately three glasses per day of alcohol 3 times a week.

The patient was diagnosed with anemia one year earlier at the Department of Internal Medicine, and gastrointestinal endoscopy revealed gastric ulcer scar. Although the patient initially resisted, he underwent total colonoscopy because bloody bowel discharges had occurred one month earlier, leading to a diagnosis of sigmoid colon cancer. He was subsequently admitted to the Department of Surgery for laparoscopic sigmoid colectomy.

Hematological examination on admission revealed anemia with 10.6 g/dL hemoglobin (Hb) and 32.6% hematocrit. Blood biochemistry results were within normal ranges, except for high Hb-A1c and creatinine (CRE) levels of 6.5% and 1.31 mg/dL, respectively. Physiological findings showed no neurological abnormalities of the extremities, including diabetic neuropathy.

2.1. Intraoperative course

Upon entering the operation room, the patient had blood pressure of 142/60 mmHg, heart rate of 64 bpm, 100% SpO_2, and body temperature of 36.2 °C. An automatic non-invasive blood pressure monitor was placed on the right upper arm, and an intravenous line was established on the left forearm. At this point, there were no signs of neurological abnormalities. General anesthesia was achieved by intravenous administration of 0.25 μg/kg/min remifentanil, 250 mg thiopental, and 50 mg rocuronium. The patient was intubated with a 7.5-mm tracheal tube without excessive backward bending. The upper body was held in place using lateral body positioners with protective cushions placed between the positioners and the patient's chest and acromioclavicular joints. The patient's head was maintained in the center position and held on the operating table with a memory-foam pillow to prevent hyperextension of the neck due to gravity. Both arms, abducted 80° with supinated forearms, were held on armrests with protective cushions. Anesthesia was maintained with 4 L/min of air, 2 L/min of oxygen, and 0.25 μg/kg/min of remifentanil. Settings on the pressure-limited respirator were 15 cm H_2O, 15 times per min, and a positive end-expiratory pressure of 3 cm H_2O. The surgical position of the patient was a 20° head-down lithotomy position with the right side lowered by 15°. Abdominal air pressure was 12 mmHg, and blood pressure during the operation was maintained around 120/60 mmHg. Operation and anesthesia time were 7 h and 37 min and 6 h and 38 min, respectively. The patient received 1800 mL of blood transfusion and had a small amount of blood loss and 500 mL of urine.

2.2. Postoperative course

Upon returning to the recovery ward, the patient described pain in both shoulders, severe numbness in both arms (upper arm to fingertips), and motor impairment. On postoperative day 1, right shoulder pain was 100 mm on a visual analogue scale (VAS) of 100 mm, and left shoulder pain was 75 mm. Despite improvement in the symptoms of the left arm, the right arm from the elbow to the fingertips continued to experience numbness on the radial side and hypoesthesia on the ulnar side with the boundary running between fingers 3 and 4. Dysesthesia was observed in the areas between right fingers 1–3. In a manual muscle test (MMT), the common digital extensor muscle scored 1/5, each short radial extensor muscle, long radial extensor muscle, supinator muscle, and biceps muscle scored 2/5, and other muscles scored 3/5. Hand grip strength was 5.4 kg on the left side, but could not be determined on the right side. Head and neck magnetic resonance imaging (MRI) failed to show findings indicative of infarction, bleeding, or nerve root compression that could explain the above symptoms. In addition, nerve conduction velocity testing showed no upper arm asymmetry. Based on these findings, we made a diagnosis of right brachial plexopathy due to intraoperative positioning and immediately started the administration of vitamin B12 and rehabilitation. Pain in both shoulders disappeared on postoperative day 2, and the patient was able to elevate his shoulders. Although hypoesthesia improved, numbness in the area between right fingers 1 and 2 on the dorsal side and on the ball of the thumb persisted. MMT scores were 2/5 for the supinator muscle, 3/5 for each of the common digital extensor muscle, short and long radial extensor muscles, and biceps, and 4/5 for other muscles. On postoperative day 4, even though MMT scores improved to 4/5 for all muscles, except for 2/5 for the supinator muscle, dysesthesia of the right arm was exacerbated when the arm was elevated. By postoperative day 6, the MMT score of the supinator muscle had increased to 4; however, hypoesthesia and dysesthesia remained. Despite no improvement in dysesthesia, grip strength on postoperative day 8 was 31.0 kg and 27.4 kg in the left and right hand, respectively. On the same day, we started silver spike point (SSP) low-frequency electrotherapy, and by postoperative day 11, the patient was able to eat with chopsticks and take care of himself. By postoperative day 16, dysesthesia had almost resolved with the symptoms in the area between right fingers 1 and 2 improving from numbness to hypoesthesia and in other areas from hypoesthesia to normal.

After 3 months of SSP therapy, no significant changes in grip strength or dysesthesia were observed; however, hypoesthesia in the area between right fingers 1 and 2 on the dorsal side had improved, with dysesthesia remaining only between fingers 1 and 2 on the dorsal side.

3. Discussion

Inappropriate surgical positions under general anesthesia can cause brachial plexopathy with a rate of 0.020–0.056% [2,4], and many studies have reported a head-down position as the cause [2]. The incidence of brachial plexopathy is 0.16% in all types of laparoscopic surgery [5], 6.2% in colectomy [6], 0.71% in urological surgery [7], and 0.34% in obstetric and gynecologic surgery [8], showing a particularly high occurrence after colectomy. The brachial plexus originates from the roots of the fifth cervical to the first thoracic spinal nerves. It travels through the space between the clavicle and first rib and the axilla and branches into musculocutaneous, median, ulnar, and radial nerves before entering the shoulder girdle and superior ramus. Because of its close proximity to the mobile clavicle, first rib, coracoid process, and humerus head, the brachial plexus is susceptible to compression and hyperextension injuries [2].

Surgical body positioners need to be placed precisely on the acromioclavicular joints, especially for surgery in a head-down position. If placement of positioners is more toward the center, the brachial plexus will be compressed between the clavicle and the first rib. On the other hand, placement toward the distal side will depress the humerus and hyperextend the brachial plexus [2,3]. Even with accurately placed positioners, the weight of the patient in a head-down position opposing the positioners will place an excess load directly on the clavicle, compressing and hyperextending the brachial plexus, pulling it toward the caudal side [3]. Compression of the brachial plexus causes disorders such as ischemic re-circulation, venous pressure increase on the nerves, and edema at nerve endings. On the other hand, hyperextension results in ruptured blood vessels and connective tissue surrounding nerves as well as development of neural hematoma, ischemia, and necrosis [3]. When the upper arm is abducted, especially more than 90°, the brachial plexus is hyperextended, resulting in postoperative nerve impairment [2]. Even at 80°, as in the present case [9], or as low as 60°, abduction of the nerve can cause brachial plexopathy [2].

Brachial plexopathy develops during laparoscopic sigmoid colectomy, including peripheral neuropathy of the musculocutaneous nerve, median nerve, radial nerve, and combinations of these nerves [10,11]. In the present case, postoperative MMT scores and sensory test findings indicated radial nerve dysfunction.

4. Conclusion

In this laparoscopically assisted surgery, abduction of the arm caused compression and hyperextension of the brachial plexus due to the head-down and right side-down position with the use of lateral body positioners to stabilize the acromioclavicular joints, resulting in development of right radial nerve dysfunction. In laparoscopic surgery under general anesthesia in a head-down position, the right arm should be placed alongside the body to prevent development of brachial plexopathy. Instead of holding the body directly by positioners, the whole body should be held in place according to body shape using a negative pressure care mattress to prevent displacement and sliding of the body and thus reduce local loads. Since implementing these precautions, no cases of brachial plexopathy have been observed at our institution.

Although MRI successfully revealed subcutaneous edema of the area covering the left axilla and shoulder joint due to an abnormal intraoperative position in a previous study [11], no other study has reported imaging abnormalities due to surgical positioning. It is therefore necessary to conduct thorough pre- and postoperative physical examinations. If brachial plexopathy is suspected after surgery, the administration of vitamin B12, rehabilitation, and low-frequency electrotherapy should be started immediately.

Contribution

MM and MY carried out rehabilitation. YT and DY conceived the study, participated in its design and coordination, and helped to draft the manuscript. All authors read and approved the final manuscript.

Conflict of Interest

The authors declare that they have no competing interests.

Role of the funding source

None.

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