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Regional Anesthesia to the Rescue: Phrenic Nerve Block to Prevent Wound Dehiscence From Intractable Hiccups—A Case Report

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Increased intra-abdominal pressure (IAP) following large abdominal surgeries can lead to postoperative complications, including wound dehiscence and surgical reoperation. Numerous factors can contribute to increased postoperative IAP, and intractable hiccups have been implicated as a culprit. Different treatment modalities have been widely used with variable success in addressing intractable hiccups. Here, we present a case in which postoperative hiccups leading to wound dehiscence and reoperation were successfully treated with an indwelling phrenic nerve catheter. Following placement, a significant reduction in hiccup severity and frequency was noted, improving the patient's quality of postoperative course and preventing further surgical intervention. (A&A Practice. 2021;15:e01452.)

GLOSSARY

ASM = anterior scalene muscle; **CT** = computerized tomography; **IAP** = intra-abdominal pressure; **Mid. Tr.** = middle trunk of the brachial plexus; **PhN** = phrenic nerve; **POD** = postoperative day; **Sup. Tr.** = superior trunk of the brachial plexus

Hiccups are thought to be caused by irritation of the hiccup reflex arc, causing diaphragmatic contractions. This irritation is commonly caused by surgical, neurological, or gastrointestinal disruptions.[1] Although most hiccups are transient in nature and resolve without further intervention, persistent (>48 hours) and intractable (>30 days) hiccups can cause significant morbidity for patients, especially in the postoperative setting, leading to reoperation and a potentially increased length of hospital stay.[1,2] While the inadvertent phrenic nerve block during an interscalene block is well established,[3] to our knowledge, there are no reported cases of "intentional" phrenic nerve block to prevent postsurgical wound dehiscence. Here, we present the case of a middle-aged man status post open hiatal hernia repair with intractable hiccups that led to wound dehiscence and reoperation. His hiccups were subsequently successfully treated with an indwelling phrenic nerve catheter that prevented further wound complications.

A written Health Insurance Portability and Accountability Act authorization to use and disclose existing protected healthy information was obtained.

CASE DESCRIPTION

A 58-year-old man with a body mass index of 24 kg/m^2 with hypertension and gastroesophageal reflux disease presented to the emergency department with a 1-month history of intermittent hiccups, which had become constant over the preceding days. He also complained of throat pain, abdominal bloating and distention, nausea, and worsening heartburn symptoms with no relief from over-the-counter medications. An abdominal computerized tomography (CT) scan revealed a hiatal hernia containing the gastric fundus with a dilated and fluid-filled distal esophagus. An esophagogastroduodenoscopy demonstrated a 5-cm hiatal hernia with no incarceration or necrosis. The patient subsequently underwent an open hiatal hernia repair and gastrostomy tube placement.

During his immediate postoperative course, he continued to experience nausea and consistent intermittent hiccups every 1 to 2 minutes. Trials of baclofen, carbamazepine, chlorpromazine, gabapentin, metoclopramide, promethazine, and midazolam in various combinations over the following week did not result in any significant relief of his hiccups. An abdominal CT on postoperative day (POD) 6 demonstrated a ventral abdominal wall hernia with protruding small bowel and minimal movement of oral contrast, which was concerning for evolving wound dehiscence. On POD 7, the patient reported hearing a "popping" sound, which he described as sounding like "the sutures were coming out." On POD 8, he returned to the operating room and underwent an exploratory laparotomy, lysis of adhesions, and abdominal closure, with significant wound dehiscence noted.

On POD 10, in the setting of continued intractable hiccups, anesthesiology was consulted, and it was decided to perform a left phrenic nerve block. A left-sided block was chosen, because in the event that the left phrenic nerve may have been inadvertently injured during the operation, the patient would still have the right phrenic nerve intact for

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respiratory function. A cervical epidural injection was considered but was decided against because of the inability for prone positioning due to the patient's abdominal wound and a reluctance to cause any hemodynamic instability. After obtaining written consent and placing the patient on standard American Society of Anesthesiologists monitors, the patient was placed in a semiupright position with his head turned to the right. A SonoSite SII Ultrasound System (FUJIFILM SonoSite, Bothell, WA) with a 13- to 6-MHz linear transducer probe was placed on the patient's left neck 3 cm above the clavicle and slightly inferior to the cricoid cartilage. The anterior scalene muscle, middle scalene muscle, superior and middle trunks, and the phrenic nerve were identified (Figure A). Using an in-plane technique, a 2 in 21-gauge echogenic needle (Hakko Medical, Chikuma-shi, Nagano, Japan) was inserted, with the tip in the proximity and posterior to the phrenic nerve and anterior to the anterior scalene muscle. Absence of blood aspiration or paresthesia was confirmed, and 10 mL 0.5% ropivacaine was injected. The patient reported immediate improvement in symptoms after the block was performed. However, his hiccups returned 18 hours later.

On POD 12, given the success of the single-shot phrenic nerve block, it was decided to place an indwelling catheter to provide sustained relief. The patient was prepared and positioned as before, and a similar view (Figure A) was obtained under ultrasound. After skin infiltration with 1% lidocaine, a 22-gauge × 3 in Touhy epidural needle (B. Braun, Melsungen, Germany) was inserted superior and anterior to the anterior scalene muscle in proximity and posterior to the phrenic nerve. Approximately 3 mL 0.5% ropivacaine was injected to confirm appropriate placement of the needle tip. A 20-gauge polyamide epidural catheter (Perifix Epidural Catheter, B. Braun) was inserted through the Tuohy needle and advanced 3 cm further than the depth of the needle insertion. Absence of blood aspiration or paresthesias was confirmed. A 5-mL bolus of sterile sodium chloride was administered through the catheter to confirm the location of the catheter tip (Figure B). The Touhy needle was removed, and 10 mL 0.5% ropivacaine was injected. A continuous infusion of 0.2% ropivacaine at 2 mL/h was initiated with 2-mL boluses available on demand with a lockout period of 1 hour. The patient remained on continuous pulse oximetry and electrocardiogram monitoring during the infusion.

Over the next several days, the patient and staff noted significant improvement in frequency and intensity of the hiccups. The patient reported a 90% improvement in his symptoms. He was able to rest and sleep well and participate in physical therapy during the day. The only patient-reported adverse effect was lateral shoulder numbness, which did not concern the patient. No respiratory compromise was noted. The phrenic nerve catheter was removed on POD 17. It was noted that the patient received a total of 319 mL ropivacaine. After catheter removal, he continued to have intermittent short-lived hiccups in the setting of bowel movements, which he reported as tolerable. He was discharged on POD 18 and presented for a postoperative visit 7 days later with no postsurgical complications and reported minimal hiccups during bowl movements only.

DISCUSSION

The physiology of a hiccup, although unclear, incorporates a complex dynamic of interactions involving afferent pathways (phrenic, vagus, and T6–T12 sympathetic nerves), efferent pathways (recurrent laryngeal nerve, phrenic nerve, C5–C7 anterior scalene branches, and T1–T11 intercostal muscles), and supratentorial modulation (thalamus, hypothalamus, and the reticular activating system, with the hiccup center involving the medulla and C3–C5 cervical cord).[4] Hiccups also reduce the intensity and frequency of esophageal peristalsis, reduce lower esophageal sphincter pressure, and increase esophageal acid exposure. Imaging studies have demonstrated that contraction of the diaphragm during a hiccup is usually unilateral, with the left side more often involved than the right side and synchronized with interscalene and intercostal muscle activity.[5] Although most hiccups are short-lived, chronic hiccups can result from a range of causes including lung malignancies, pancreatitis, mass effects on the posterior cervical region, multiple sclerosis, brainstem tumors, central lesions, hiatal hernias, gastric distention, hepatomegaly, abdominal tumors, and a variety of surgical procedures, including Nissen fundoplication.[1,4,6]

In addition to negatively impacting patients' quality of life by interfering with sleep and causing frustration and exhaustion, hiccups in the postoperative setting can lead to increased intra-abdominal pressure (IAP) and subsequent

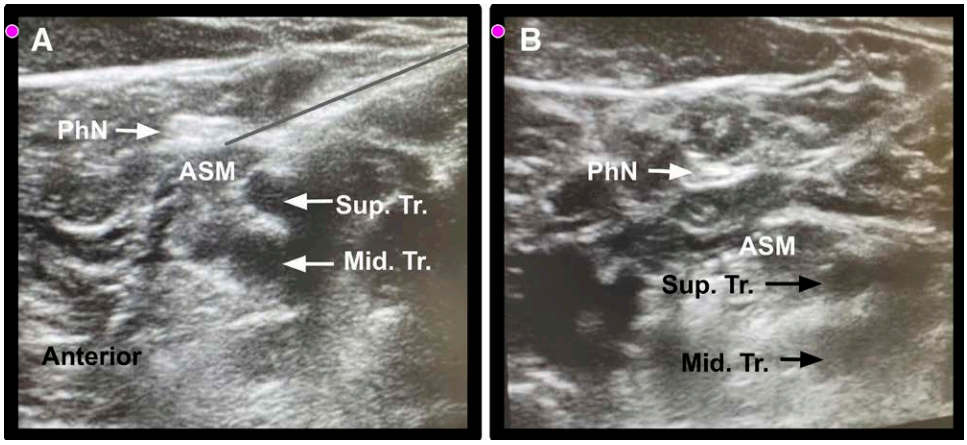

Figure. Ultrasound image illustrating the pertinent anatomy for a phrenic nerve block. The line in (A) illustrates the plane of insertion with the tip target anterior and superior to the anterior scalene muscle. The image in (B) highlights the spread of sodium chloride separating the phrenic nerve from the anterior scalene muscle. ASM indicates the anterior scalene muscle; Mid. Tr., middle trunk of the brachial plexus; PhN, phrenic nerve; Sup. Tr., superior trunk of the brachial plexus.

wound dehiscence, which can necessitate further surgical intervention.[1,5] It is generally thought that the wound closure site for hiatal hernias and Nissen fundoplication should be as tension- and stress-free as possible during the wound healing period, with attention paid to preventing sources of increased IAP such as vomiting, retching, hiccup, and coughing.[7] Treatment of persistent hiccups incorporates a wide range of modalities and therapies. Medical management includes trials of baclofen, chlorpromazine, gabapentin, haloperidol, metoclopramide, midazolam, olanzapine, and promethazine.[1,5] Physiological maneuvers incorporate vagal maneuvers, carotid sinus pressure, breath-holding, and induction of emesis. More invasive methods that have been reported include phrenic nerve blocks, vagal simulators, phrenicectomies, transesophageal diaphragmatic pacing, cervical epidural injections, and phrenic nerve crushing.[1,5–8] A variety of other controversial modalities have been attempted, including acupuncture, inhalation of mild irritants, fasting, changing patient positioning, and heat/cold applications, all with varying degrees of effectiveness.[5]

Although rare, intractable hiccups following abdominal surgeries can have deleterious consequences. Despite there being a wide array of treatment modalities, options for intractable hiccups remain limited. Case reports have provided mixed results of the efficacy of phrenic nerve blocks for treatment of intractable hiccups.[4,9,10] This may be the result of differences in block techniques or causes of hiccups. The approach of placing a phrenic nerve catheter described above and the improvement in symptoms may have utility in other cases where intractable hiccups place patients at risk for wound dehiscence and subsequent reoperation. Absolute contraindications such as patient refusal, local infection, active bleeding in an anticoagulated patient, and allergies to local anesthetics, as well as relative contraindications including a compromised respiratory system must be considered.[9,10] The technique is simple in its application and can be easily replicated by most anesthesiologists. Furthermore, this case highlights the value of regional anesthesia beyond the perioperative period.

DISCLOSURES

Name: Sassan Rafizadeh, MD, PhD.
Contribution: This author helped participate in patient's care, review the literature, and edit the article.
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Contribution: This author helped participate in patient's care and draft the article.
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REFERENCES

1. Kohse EK, Hollmann MW, Bardenheuer HJ, Kessler J. Chronic hiccups: an underestimated problem. *Anesth Analg*. 2017;125:1169–1183.
2. Hansen BJ, Rosenberg J. Persistent postoperative hiccups: a review. *Acta Anaesthesiol Scand*. 1993;37:643–646.
3. Urmey WF, Talts KH, Sharrock NE. One hundred percent incidence of hemidiaphragmatic paresis associated with interscalene brachial plexus anesthesia as diagnosed by ultrasonography. *Anesth Analg*. 1991;72:498–503.
4. Grewal SS, Adams AC, Van Gompel JJ. Vagal nerve stimulation for intractable hiccups is not a panacea: a case report and review of the literature. *Int J Neurosci*. 2018;128:1114–1117.
5. Launois S, Bizec JL, Whitelaw WA, Cabane J, Derenne JP. Hiccup in adults: an overview. *Eur Respir J*. 1993;6:563–575.
6. Strate T, Langwieler TE, Mann O, Knoefel WT, Izbicki JR. Intractable hiccup: an odd complication after laparoscopic fundoplication for gastroesophageal reflux disease. *Surg Endosc*. 2002;16:1109.
7. Hunter JG, Smith CD, Branum GD, et al. Laparoscopic fundoplication failures: patterns of failure and response to fundoplication revision. *Ann Surg*. 1999;230:595–604.
8. Sato S, Asakura N, Endo T, Naito H. Cervical epidural block can relieve postoperative intractable hiccups. *Anesthesiology*. 1993;78:1184–1186.
9. Kuusniemi K, Pyylampi V. Phrenic nerve block with ultrasound-guidance for treatment of hiccups: a case report. *J Med Case Rep*. 2011;5:493.
10. Zhang Y, Duan F, Ma W. Ultrasound-guided phrenic nerve block for intraoperative persistent hiccups: a case report. *BMC Anesthesiol*. 2018;18:123.