

Report

Spinal Anesthetic Management for Hydrodistension of the Bladder in Patients with Interstitial Cystitis

Eiko HIRAI¹, Makiko KOMORI¹, Keiko NISHIYAMA¹,
Izumi KONDO¹, Miwako KAWAMATA¹ and Hikaru TOMOE²

¹Department of Anesthesiology, Tokyo Women's Medical University Medical Center East

²Department of Urology, Tokyo Women's Medical University Medical Center East

(Accepted Dec. 3, 2008)

Interstitial cystitis is characterized by non-specific, chronic inflammation of the bladder and symptoms such as increased frequency of urination, increased desire to void, and bladder pain. Hydrodistension of the bladder has been used to treat interstitial cystitis. Because the bladder of interstitial cystitis is not very distensible, distension can cause severe pain. Few studies have reported on patients who received hydrodistension under anesthesia. Hypersensitivity of type C sensory fibers is regarded to be one cause of interstitial cystitis. We therefore considered spinal anesthesia to be indicated because sensory input to the posterior horn of the spinal cord is blocked. Hydrodistension of the bladder was thus performed under spinal anesthesia. We studied the required level of anesthesia and patients' degree of satisfaction and problems during and after the procedure. The study group comprised 5 men and 62 women with a mean age of 64.4 ± 11.6 years. The mean volume of 0.5% isobaric bupivacaine injected for spinal anesthesia was 2.8 ± 0.4 ml. Inhaled anesthetics or fentanyl was concomitantly used for pain. Hydrodistension under spinal anesthesia with isobaric bupivacaine for interstitial cystitis was associated with minimal fluctuations in hemodynamics, minimal perioperative complications, and high levels of patient satisfaction. Favorable outcomes were obtained.

Key words: spinal anesthesia, hydrodistension of the bladder, interstitial cystitis

Introduction

Interstitial cystitis is characterized by non-specific, chronic inflammation of the bladder and symptoms such as increased frequency of urination, increased desire to void, urinary urgency, and bladder pain, with no specific pathological features^{1,2)}. Several theories have been proposed to explain the causes of interstitial cystitis. In particular, damage of glycosaminoglycans, serving as a mucosal barrier of the bladder, is considered an important factor³⁾. Lack of glycosaminoglycans increases mucosal permeability of the bladder. Substances normally found in the urine, such as potassium, penetrate the mucosa, thereby stimulating type C sensory fibers as well as activating mast cells⁴⁾. Mast cells are multifunctional immunocompetent cells that release potent inflammatory mediators such as histamine, leu-

kotrienes, serotonin, and other cytokines^{5,6)}. A cascade of reactions is initiated, causing symptoms such as pain and increased frequency of urination.

Hydrodistension has been used to treat interstitial cystitis^{7,8)}. With this method, the bladder is filled with physiologic saline at a pressure of 80 to 100 cm of water, thereby causing distension. Because the bladder is not very distensible, distension can cause severe pain. Few studies have reported on patients who received hydrodistension under anesthesia. We thus performed hydrodistension under spinal anesthesia in patients with interstitial cystitis and studied the required level of anesthesia and patients' degree of satisfaction and problems during and after the procedure.

Case Reports

After informed consent was confirmed, we stud-

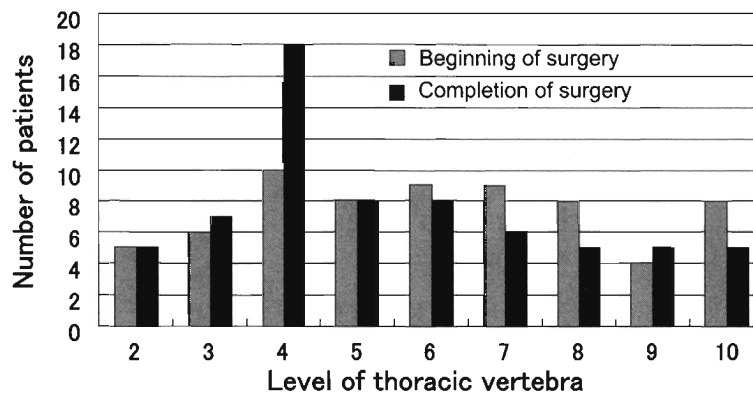


Figure Blocked level of the spinal cord at the beginning and the completion of surgery

ied 67 patients (5 men and 62 women) from September 2004 through May 2007. All patients were scheduled to undergo elective hydrodistension for interstitial cystitis. Their mean age was 64.4 ± 11.6 (range, 19 to 78) years. The mean height was 153.6 ± 7.2 cm, and the mean body weight was 53.0 ± 7.4 kg. Complications were hypertension in 15 patients, diabetes mellitus in 8, ischemic heart disease in 4, and cerebrovascular disease in 2.

Premedication with atropine sulfate (0.5 mg) and midazolam (2 mg) or hydroxyzine hydrochloride (25 to 50 mg) was administered intramuscularly. For spinal anesthesia, 0.5% isobaric bupivacaine (2.0 to 4.0 ml) was delivered into the space between the 2nd and 3rd lumbar vertebrae or the space between the 3rd and 4th lumbar vertebrae using a 25-gauge pencil-point needle.

The mean injection volume of bupivacaine was 2.8 ± 0.5 ml. Immediately after puncture, the spinal cord was blocked from the 5th thoracic vertebra to the 1st lumbar vertebra, with a mean thoracic level of 9.5 ± 0.2 . At the beginning of surgery (15 to 20 minutes after puncture), the spinal cord was blocked from the 2nd to the 10th thoracic vertebrae, with a mean thoracic level of 6.0 ± 2.4 (Figure). At the completion of surgery (90 to 100 minutes after puncture), the spinal cord was blocked from the 2nd to the 10th thoracic vertebrae, with a mean thoracic level of 5.5 ± 2.3 (Figure). As for symptoms at the time of maximal distension of the bladder during the procedure, 2 patients had discomfort when blockade was up to the 4th thoracic level, 2 had abdominal distension when blockade was up to the

6th thoracic level, and 12 had abdominal pain when blockade was up to the 9th thoracic level. Inhaled anesthetics (sevoflurane or nitrous oxide) or intravenous fentanyl (0.05 to 0.1 μ g) was given to the patients. The others had no complaints during surgery.

After surgery, 2 patients had transient neurologic symptoms; no patient had headache. All patients recovered uneventfully after surgery and were discharged from the hospital on the third or fourth hospital day, with no problems or dissatisfaction.

Discussion

Interstitial cystitis is a chronic progressive inflammatory disease that occurs more frequently in females. Its cause remains unknown. Hypersensitivity of type C sensory fibers⁹⁾ is considered to be one factor leading to bladder pain. Neurotransmitters of C-fibers (e.g., substance P and calcitonin gene-related substances) have efferent activities. Once stimulated, C-fibers transmit signals to the central nervous system, and these neurotransmitters are released at nerve endings in the bladder, causing local inflammation. C-fiber dysfunction, hypertrophy, and increased neurotransmission are implicated in the onset of interstitial cystitis. Chronic pain associated with interstitial cystitis may be caused by impairment of descending inhibitory neurons in spinal posterior horn cells, involved in C-fiber-related sensory input. Nociceptive neuron activity may increase, lowering the pain threshold and thereby increasing sensitivity to pain⁹⁾. Hydrodistension mechanically dilates the atrophied bladder, affected by fibrosis, and is therefore accompanied by severe

pain.

Given the role of C fibers in interstitial cystitis, blockade of sensory input to the posterior horns of the spinal cord is considered appropriate. Spinal anesthesia is a straightforward approach with minimal effects on hemodynamics, producing good results. The bladder is governed by sensory nerves arising from the 11th to the 12th thoracic vertebrae and sympathetic nerves arising from the 8th to the 11th thoracic vertebrae. When only sensory nerves were blocked, symptoms such as discomfort and abdominal pain developed. This treatment allows the bladder to be extended as much as possible. Therefore, up to about the 4th thoracic level of the spine should be blocked to inhibit peritoneal stimulation.

Even if isobaric bupivacaine blocks the spine at a high thoracic level, blood pressure is minimally decreased because the blockade level increases gradually. Epidural anesthesia at a high thoracic level tended to decrease blood pressure. Our study showed that spinal anesthesia with isobaric bupivacaine is a straightforward, effective approach with minimal complications and high patient satisfaction. There were no serious complications during spinal anesthesia¹⁰⁾, such as nerve injuries, meningitis, and hematoma. Two patients had transient neurologic symptoms. One study of discomfort associated with spinal anesthesia¹¹⁾ reported that patients had relief of pain and anxiety during surgery. Patients with certain personality types or anxiety might thus require sedation during surgery. Prospective studies comparing spinal anesthesia with general anesthesia should be performed in the future. Ideally, the advantages and disadvantages of general and spinal anesthesia should be explained, and patients should select the type of anesthesia by themselves.

We examined the effect of hydrodistension under

spinal anesthesia with isobaric bupivacaine in patients with interstitial cystitis. Our results indicate that the spine should be blocked up to the level of the 4th thoracic vertebra. Hydrodistension under spinal anesthesia with isobaric bupivacaine for interstitial cystitis was associated with minimal fluctuations in hemodynamics, minimal perioperative complications, and high levels of patient satisfaction.

References

- 1) **Hanno PM, Landis JR, Matthews-Cook Y et al:** The diagnosis of interstitial cystitis revisited: lessons learned from the National Institutes of Health Interstitial Cystitis Database study. *J Urol* **161**: 553–557, 1999
- 2) **Simon LJ, Landis JR, Erickson DR et al:** The Interstitial Cystitis Data Base Study: concepts and preliminary baseline descriptive statistics. *Urology* **49**: 64–75, 1997
- 3) **Parsons CL, Lilly JD, Stein P:** Epithelial dysfunction in nonbacterial cystitis (interstitial cystitis). *J Urol* **145**: 732–735, 1991
- 4) **Fellows GJ, Marshall DH:** The permeability of human epithelium to water and sodium. *Invest Urol* **9**: 339–344, 1972
- 5) **Peeker R, Enerbäck L, Fall M et al:** Recruitment, distribution and phenotypes of mast cells in interstitial cystitis. *J Urol* **163**: 1009–1015, 2000
- 6) **Theoharides TC, Sant GR:** Immunomodulators for treatment of interstitial cystitis. *Urology* **65**: 633–638, 2005
- 7) **Tomoe H:** Hydrodistension. *In* Clinical Guideline for Interstitial Cystitis (The Society of Interstitial Cystitis of Japan ed), pp38–39, Backwell, Tokyo (2007) (in Japanese)
- 8) **Tomoe H:** Interstitial Cystitis. *Prog Med* **23**: 2091–2094, 2003 (in Japanese)
- 9) **Yoshimura N, Seki S, Chancellor MB:** Targeting afferent hyperexcitability for therapy of the painful bladder syndrome. *Urology* **59** (Suppl 5A): 61–67, 2002
- 10) **Yamamoto K:** Complications in spinal anesthesia. *Rinshou Masui (J Clin Anesth)* **25**: 1390–1396, 2001 (in Japanese with English abstract)
- 11) **Iwata M, Nakahashi K, Matsunari Y et al:** Examination concerning patient's pain in anesthesia and operation. *Nihon Rinshou Masui Gakkaishi (JJSCA)* **22**: 84–90, 2002 (in Japanese)

間質性膀胱炎に対する膀胱水圧拡張術の脊椎麻酔の検討

¹東京女子医科大学東医療センター麻酔科（指導：川真田美和子教授）

²東京女子医科大学東医療センター泌尿器科

ヒライエ イコ コモリ マキ コ ニシヤマ ケイコ
平井 えい子¹・小森 万希子¹・西山 圭子¹
コンドウ イズミ カワマタ ミワ コ トモエ
近藤 泉¹・川真田美和子¹・巴 ひかる²

間質性膀胱炎は膀胱の非特異的な慢性炎症を伴い、頻尿、尿意亢進、膀胱部痛などの症状を呈する。間質性膀胱炎の治療のひとつに膀胱水圧拡張術がある。間質性膀胱炎の膀胱は伸展性に乏しいため、その拡張には著しい疼痛を伴う。これまで水圧拡張術の麻酔の報告例はほとんどない。本疾患の病因のひとつとしてC-fiberの過敏性増加があるので、脊髄後角への入力遮断される脊椎麻酔がよいと考え膀胱水圧拡張術に脊椎麻酔を行った。必要とされる麻酔レベルと術中術後の満足度および問題点について検討した。患者は男性5例、女性62例、年齢は平均64.4±11.6歳であった。脊椎麻酔における0.5%等比重ブピバカインの平均注入量は2.8±0.4mlであった。疼痛時は吸入麻酔薬またはフェンタニルを併用した。間質性膀胱炎に対する水圧拡張術の等比重ブピバカインによる脊椎麻酔は循環動態の変動が少なく、周術期合併症も少なく、さらに患者満足度も高く、良好な結果が得られた。