Case Report

Bilateral Well Leg Compartment Syndrome Localized in the Anterior and Lateral Compartments following Urologic Surgery in Lithotomy Position

Tatsuya Yamamoto, Atsuhiro Fujie, Hidenori Tanikawa, Atsushi Funayama, and Kentaro Fukuda

Department of Orthopedic Surgery, Saiseikai Yokohamashi Tobu Hospital, 3-6-1 Shimosueyoshi, Tsurumi Ward, Yokohama, Kanagawa 250-0012, Japan

Correspondence should be addressed to Atsuhiro Fujie; atsuhirof@gmail.com

Received 10 June 2018; Revised 19 October 2018; Accepted 4 November 2018; Published 14 November 2018

Academic Editor: Werner Kolb

Copyright © 2018 Tatsuya Yamamoto et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Well leg compartment syndrome (WLCS) is a rare but severe complication after the surgery in lithotomy position. We present a case of bilateral WLCS that occurred after the prolonged urologic surgery in lithotomy position. A 50-year-old man complained of severe bilateral lower leg pain and swelling sixteen hours after the surgery. Physical examination, elevated serum creatine kinase value, contrasting computed tomography, and elevated compartment pressure strongly suggested the development of bilateral WLCS localized in the anterior and lateral compartments. Emergent single-incision fasciotomy was performed four hours after diagnosis. The patient was treated successfully without any neuromuscular dysfunction. An early and accurate diagnosis is important to avoid the delay of treatment and development of neuromuscular dysfunction.

1. Introduction

Well leg compartment syndrome (WLCS) is a rare but severe complication after the surgery in lithotomy position. The overall incidence is estimated at 1 in 3500 cases; however, only less than 25 bilateral WLCS cases have been previously reported [1–4]. A prompt diagnosis and surgical intervention is necessary because the delay of treatment could cause irreversible muscle necrosis which results in limb dysfunction or amputation. Although two-incision technique to release all four compartments is recommended, fasciotomy itself is associated with a high incidence of acute and long-term complications [5, 6].

Here, we report the case of bilateral WLCS following the surgery in lithotomy position. Only anterior and lateral compartments were affected and successfully treated with single-incision fasciotomy.

2. Case Presentation

The patient was a 50-year-old male, 173 cm tall, and 85 kg in weight (body mass index (BMI): 27.7 kg/m²). He had a medical history of urinary tract cancer, type 2 diabetes mellitus, hypertension, and Hashimoto’s disease. He underwent a robot-assisted radical cystectomy in lithotomy position. The total operation time was 419 min. The operative position was lithotomy position with his lower leg flexed and elevated by soft stirrups. Continuous compression devices on both calves were used for venous thrombosis prophylaxis throughout the procedure. No bleeding-promoting drug was used before and after the surgery.

Sixteen hours after the surgery, he complained of severe bilateral lower leg pain and swelling. Initial evaluation of lower extremities revealed foot drop, swelling, and tightness of the anterolateral aspects, and stretch pain on passive ankle
planter flexion. No remarkable finding was appreciated on the posterior aspects of his lower legs. Serum creatine kinase was elevated to at 28000 U/l. The compartment pressure was measured by an arterial line set with simple 18-gauge needle under the diastolic blood pressure of 98 mmHg. The measurement was performed at three places of each compartment, and the average value was recorded. The anterior and lateral compartment pressures in both legs had increased to 200 mmHg despite normal posterior compartment pressure (35 mmHg) or thigh compartment pressure (35 mmHg). Contrasting computed tomography (CT) showed swelling of the bilateral muscles in the anterior and lateral compartments without contrasting effect compared to the posterior compartments (Figure 1). Based on these findings, WLCS localized in the anterior and lateral compartments was diagnosed.

An emergency fasciotomy was performed twenty hours after initial surgery. Anterior and lateral compartments were released with single incision (Figure 2). Discoloration of the muscles improved within a few minutes after the fasciotomy (Figure 3). Shoe-race procedure was added to prepare for secondary wound closure (Figure 4). Symptoms such as unbearable pain or decreased sensation were drastically improved after the fasciotomy. The serum creatine kinase decreased and normalized eight days after the surgery. He recovered well without any motor and sensory dysfunction in both lower extremities. The fasciotomy wound was closed on the ninth postoperative day without additional stage procedure. Three months after the surgery, he had no neuromuscular dysfunction.

3. Discussion

WLCS was first reported in 1979 as a severe complication after the surgery in lithotomy position [7]. It is rare, with almost one in every 3500 cases, but the delay in diagnosis and treatment may require lower leg amputation or result in death [1, 4]. The perfusion of the lower legs decreases in lithotomy position, which could cause muscle necrosis and massive edema due to ischemia [8]. Thus, the pressure within the compartment increases and affects the blood supply, leading to the vicious cycle.

Diagnosis of compartment syndrome is usually described as a clinical diagnosis that includes signs and symptoms of paresthesia, pain, pain on passive stretch, and tightness. Pulselessness and pallor are observed in advanced stage. The serum creatine kinase measurement and imaging study including contrasting CT or MRI may also aid the diagnosis. Although MRI can detect a small change of muscle, it is not
suitable for diagnosis of emergent case due to the time commitment [9]. If the acute compartment syndrome is clinically suspected, the compartment pressure should be measured.

Compartment pressure is measured with several devices [9, 10]. Hammerberg et al. reported that slit catheter, sideported needle, 18-gauge needle may be used with confidence [11]. The recent accepted value for diagnosis of compartment syndrome is 30 mmHg within the diastolic blood pressure [12–14]. Absolute value of 45 mmHg is also proposed [15]. Whitney et al. reported that reliance on one-time intracompartmental pressure measurements can overestimate the rate of compartment syndrome [16]. Repetitive measurement on several compartments is required for accurate diagnosis. In our case, the use of thin needle may produce erroneously the high value. However, additional measurement was determined to be unnecessary because early diagnosis without relying too much on compartment pressure measurement is important to avoid the delay of treatment. WLCS localized in the anterior and lateral compartments was the most probable diagnosis considering the relatively high compartment pressure.

The anterior compartment is the most commonly involved in acute compartment syndrome because it is rigidly surrounded by the tibia, fibula, interosseous septum, and fascia [17, 18]. The lateral compartment is the second most commonly involved. In our case, the patient’s complaint, physical examination, and imaging study strongly suggested that only the anterior and lateral compartments were affected. Compartment pressure measurement also supported this idea. Therefore, we diagnosed this case with WLCS localized in the anterior and lateral compartments.

Definitive treatment for WLCS is emergent fasciotomy to decompress the compartments. As little as 8 hours of critical ischemia results in irreversible damage to the muscles and nerves [19]. Both single- and double-incision fasciotomy techniques have been recommended for releasing all 4 compartments of the lower extremity [18]. Single-incision technique is usually selected for fracture cases demanding internal fixation through another incision. 20 to 25 cm longitudinal incision is necessary for sufficient decompression [18]. However, fasciotomy itself is associated with a high incidence of acute and long-term complications such as nerve damage, bleeding, wound infection, altered sensation, continuing pain, eczematous changes, pruritus, discoloration, and recurrent ulceration [5, 6]. We chose the single-incision fasciotomy for anterior and lateral compartment release based on the localization of the affected compartments.

The time to fasciotomy has a great impact on the outcome of WLCS. For the early recognition of WLCS, the clinician’s awareness of the risk factors is important. In lithotomy position, the mean arterial pressure decreases at the toe by 0.78 mmHg/cm as a result of leg elevation [8]. Furthermore, the lower extremity systolic blood pressure drops by the degree of hip flexion and leg height, which can lead to ischemia [4]. Flexed hip and knee joint may cause the kinking of veins and increase the venous pressure [20]. The direct compression of the lower limbs from solid device also cause the increase of compartment pressure. According to these previous studies, we suggest that the desirable lithotomy position should fulfill the condition of hip or knee flexion not beyond 90 degrees, hip abduction less than 45 degrees, and neutral hip rotation (Figure 5). In addition, releasing the leg from support every 2 hours for a short time is recommended to relieve the direct compression of the calves when operating time is estimated to be more than 4 hours [3]. Other risk factors for developing WLCS include the use of intermittent pneumatic compression devices, ankle dorsiflexion position, muscular lower limbs, solid leg holders, intraoperative hypotension, hypovolemia, and peripheral vascular disease. For patients suspected of WLCS with these risk factors, prompt diagnosis and surgical management are imperative.

Consent

Informed consent was obtained from the patient for this manuscript.

Conflicts of Interest

The authors declare that there was no conflict of interest regarding this manuscript.

Acknowledgments

The authors sincerely thank the patient for participation to this study.

References

[1] M. S. Simms and T. R. Terry, “Well leg compartment syndrome after pelvic and perineal surgery in the lithotomy position,” Postgraduate Medical Journal, vol. 81, no. 958, pp. 534–536, 2005.

[2] K. Y. Chin, S. J. Hemington-Gorse, and C. M. Darcy, “Bilateral well leg compartment syndrome associated with lithotomy (Lloyd Davies) position during gastrointestinal surgery: a case report and review of literature,” Eplasty, vol. 9, article e48, 2009.
N. Stornelli, F. B. Wydra, J. J. Mitchell, P. F. Stahel, and S. Fabbri, “The dangers of lithotomy positioning in the operating room: case report of bilateral lower extremity compartment syndrome after a 90-minutes surgical procedure,” Patient Safety in Surgery, vol. 10, no. 1, p. 18, 2016.

J. R. Halliwill, S. A. Hewitt, M. J. Joyner, and M. A. Warner, “Effect of various lithotomy positions on lower-extremity blood pressure,” Anesthesiology, vol. 89, no. 6, pp. 1373–1376, 1998.

A. Fitzgerald, Y. Wilson, A. Quaba, P. Gaston, and M. McQueen, “Long-term sequelae of fasciotomy wounds,” British Journal of Plastic Surgery, vol. 53, no. 8, pp. 690–693, 2000.

J. Heemskerk and P. Kitslaar, “Acute compartment syndrome of the lower leg: retrospective study on prevalence, technique, and outcome of fasciotomies,” World Journal of Surgery, vol. 27, no. 6, pp. 744–747, 2003.

R. G. Leff and S. R. Shapiro, “Lower extremity complications of the lithotomy position: prevention and management,” The Journal of Urology, vol. 122, no. 1, pp. 138-139, 1979.

A. Raza, D. Byrne, and N. Townell, “Lower limb (well leg) compartment syndrome after urological pelvic surgery,” The Journal of Urology, vol. 171, no. 1, pp. 5–11, 2004.

N. Mauser, H. Gissel, C. Henderson, J. Hao, D. Hak, and C. Mauffrey, “Acute lower-leg compartment syndrome,” Orthopedics, vol. 36, no. 8, pp. 619–624, 2013.

E. K. Konstantakos, D. J. Dalstrom, M. E. Nelles, R. T. Laughlin, and M. J. Prayson, “Diagnosis and management of extremity compartment syndromes: an orthopaedic perspective,” The American Surgeon, vol. 73, no. 12, pp. 1199–1209, 2007.

E. M. Hammerberg, T. E. Whitesides Jr., and J. G. Seiler III, “The reliability of measurement of tissue pressure in compartment syndrome,” Journal of Orthopaedic Trauma, vol. 26, no. 9, article e166, 2012.

M. M. McQueen, A. D. Duckworth, S. A. Aitken, and C. M. Court-Brown, "The estimated sensitivity and specificity of compartment pressure monitoring for acute compartment syndrome," The Journal of Bone and Joint Surgery, vol. 95, no. 8, pp. 673–677, 2013.

N. Ozkayin and K. Aktuglu, “Absolute compartment pressure versus differential pressure for the diagnosis of compartment syndrome in tibial fractures,” International Orthopaedics, vol. 29, no. 6, pp. 396–401, 2005.

M. J. Prayson, J. L. Chen, D. Hampers, M. Vogt, J. Fenwick, and R. Meredick, "Baseline compartment pressure measurements in isolated lower extremity fractures without clinical compartment syndrome," The Journal of Trauma: Injury, Infection, and Critical Care, vol. 60, no. 5, pp. 1037–1040, 2006.

F. A. Matsen 3rd, R. A. Winquist, and R. B. Krugmire Jr., “Diagnosis and management of compartmental syndromes,” The Journal of Bone & Joint Surgery, vol. 62, no. 2, pp. 286–291, 1980.

A. Whitney, R. V. O’Toole, E. Hui et al., “Do one-time intracompartmental pressure measurements have a high false-positive rate in diagnosing compartment syndrome?,” Journal of Trauma and Acute Care Surgery, vol. 76, no. 2, pp. 479–483, 2014.

S. J. Mubarak and A. R. Hargens, “Acute compartment syndromes,” Surgical Clinics of North America, vol. 63, no. 3, pp. 539–565, 1983.

S. Beraldo and S. R. Dodds, "Lower limb acute compartment syndrome after colorectal surgery in prolonged lithotomy position," Diseases of the Colon & Rectum, vol. 49, no. 11, pp. 1772–1780, 2006.

T. E. Whitesides and M. M. Heckman, “Acute compartment syndrome: update on diagnosis and treatment,” The Journal of the American Academy of Orthopaedic Surgeons, vol. 4, no. 4, pp. 209–218, 1996.

D. Turnbull and G. H. Mills, “Compartment syndrome associated with the Lloyd Davies position. Three case reports and review of the literature,” Anaesthesia, vol. 56, no. 10, pp. 980–987, 2001.