

## CASE REPORT

# WELL LEG COMPARTMENT SYNDROME: THE DEBIT SIDE OF HEMILITHOTOMY POSITION

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We describe a case of well leg compartment syndrome following unilateral lithotomy position in a patient undergoing contralateral antegrade intramedullary femoral nailing. Following two-incision four compartment fasciotomy, the patient recovered with no residual defects. We dissuade use of the hemilithotomy position for antegrade femoral nailing procedures in favour of another previously described position, because this predisposes patients to position-associated complications without offering any substantial advantage.

**Keywords:** Compartment syndrome, well-leg, hemilithotomy

## INTRODUCTION

Traditionally orthopaedic surgeons have preferred a traction table for antegrade femoral intramedullary nailing procedures due to the advantage of fluoroscopic guidance and relative ease in fracture reduction.<sup>1-3</sup> The non-operated limb can be positioned on the fracture table in a number of ways. Placing the non-operated limb in a hemilithotomy position predisposes this leg to developing well-leg compartment syndrome with no added advantage as compared to another simpler position on the fracture table.<sup>1</sup> We describe a case of an isolated closed femur shaft fracture complicated by well-leg compartment syndrome.

## CASE REPORT

A 35 year old gentleman (approximate height 150 cm, weight 65 kg), with no known comorbidities presented to emergency room with a closed, mid shaft, femoral fracture four hours after a road traffic accident. No other injuries were found on systemic examination. There was no history of veno-occlusive disease of the lower extremities. Preoperative motor and sensory examinations were normal, and there were no signs of increased compartment pressures in either leg. All laboratory data were within normal limits. The patient was taken to operating room for closed antegrade intramedullary femoral nailing twenty four hours after the injury.

Following induction of general anaesthesia, the patient was transferred to a traction table with the well leg placed in hemilithotomy position on a well padded calf rest (Lloyd-Davies leg holder) with the hip in approximately 90° flexion, 40° abduction, 40° external rotation and the knee in 90° flexion. His left calf was raised about 45 cm above his heart and the ankle was free with no constriction of the popliteal space. Following closed reduction of fracture, an 11 mm × 380 mm AO femoral nail was inserted. During proximal locking, the interlocking bolt disengaged from the screw driver and displaced in the medial

compartment of the thigh. This screw was successfully retrieved through the same incision and one dynamic proximal and two distal interlocking bolts were applied. However the surgical time was prolonged due to this event to four and a half hours. Per- and post-operatively the patient remained haemodynamically stable.

Next morning (14 hours later) the anterolateral compartment of the non-operated leg was found to be firm with decreased sensations in the peroneal compartment and he also reported pain in the same distribution, without any motor deficit. Urinary output remained adequate. A diagnosis of well-leg compartment syndrome was made and the patient was urgently transferred to the operating room. A double-incision, four compartment fasciotomy of the left leg was performed and the muscles of the anterior and lateral compartment were found to be tense and oedematous but viable and bulging, with a lax posterior compartment. Within 24 hours, hypoesthesia in the common peroneal territory resolved and 48 hours later the fasciotomy was closed primarily with ease. The patient was discharged on the sixth postoperative day without any residual sequelae. Follow up on tenth postoperative day, at six weeks and seven months was unremarkable with normal gait, symmetric leg lengths, painless ambulation, and a clinically and radiologically healed fracture, with the patient returning to his preinjury activity level.

## DISCUSSION

Successful surgical intervention requires adequate exposure of the operative site, which often is attained by placing patients in physiologically abnormal positions.<sup>4</sup> Complications related to positioning range from postoperative sensory alteration and swelling in the lower leg, back pain, deep venous thrombosis, and damage to peripheral nerves, to the more serious iliac and distal arterial thromboses, lower limb compartment syndromes, limb loss, renal failure and

death.<sup>5</sup> In younger patients with increased muscle mass, the elevation of hemilithotomy position can be enough insult to induce a compartment syndrome. A patient with a traumatized lower extremity developing compartment syndrome in the contralateral uninvolved lower extremity, represents a potentially devastating situation, adversely effecting the rehabilitation potential.<sup>6</sup> Postoperative compartment syndrome occurs in the setting of a reperfusion injury to a closed osteofacial compartment. Presentation may be delayed up to 24 hours or longer postoperatively.<sup>5</sup>

Following the first report of compartment syndrome resulting from surgical positioning in 1953<sup>7</sup>, many cases have been chronicled with this complication following operations in the lithotomy position for general surgery<sup>4</sup>, colorectal, urology, gynaecologic and orthopaedic procedures.<sup>8,9</sup> In most of the literature reporting complications following the lithotomy position, a common feature is an operating time exceeding five hours<sup>2,4</sup> and three hours for the knee –chest position. A self-perpetuating cycle of ischaemia and tissue oedema develops, further increasing local tissue pressure.<sup>4</sup> No particular lithotomy suspension equipment including skids, straps, boots, metal or cloth stirrups<sup>6,8</sup> are immune to this serious complication.

Retrospectively in our patient, several factors might have contributed to development of compartment syndrome: (a) uphill arterial gradient to the calf in hemi-lithotomy position, (b) partial vascular occlusion due to hip and knee flexion (c) mechanical compression of extremity tissue by the calf rest (d) additional wrappings to secure the leg in the holder and (e) prolonged operative time. Pfeffer and colleagues<sup>10</sup> reported that a particular body habitus, i.e., slim volunteers with small muscle mass are predisposed to developing compartment syndrome. Ischemia is followed by reperfusion, capillary leakage from the ischemic tissue and a further increase in tissue oedema thus perpetuating the cycle. It has been shown that perfusion pressure is decreased by 0.78 mmHg for each centimetre that an extremity is raised above the right atrium. Thus, perfusion in each compartment is reduced by approximately 24 mmHg by lower extremity elevation of 30.5 cm (one foot). Tan V *et al*<sup>3</sup> reported the baseline calf compartment pressure was 9.2±3.9 mmHg, prior to placing the leg in a hemilithotomy position, rising to 27.3±3.3 in the final position. Once the leg was lowered, the pressure immediately returned to a near-baseline level of 8.1±4.0 mmHg. They also found a significant correlation between BMI (kg/m<sup>2</sup>) and calf pressure during hemilithotomy positioning.

Meyer RS *et al*<sup>11</sup> reported that changing from the supine to the calf-supported position significantly increased the intramuscular pressure in the anterior compartment (from 11.6 to 19.4 mmHg) and in the lateral compartment (from 13.0 to 25.8 mmHg). Furthermore, changing from the calf-supported to the heel-supported position significantly decreased intramuscular pressure in the anterior, lateral, and posterior compartments. They concluded that leaving the calf free, instead of using a standard well-leg holder, may decrease the risk of acute compartment syndrome.

Prevention is the best way to avoid lower extremity complications. In agreement with Carlsen DA *et al*<sup>1</sup> we recommend that rather than unilateral lithotomy, a combination of knee extension and hip flexion for the operated extremity and knee extension with hip extension for the contralateral well leg should be routinely adopted. Tan V and colleagues<sup>3</sup> and Mathews *et al*<sup>2</sup> also recommended avoiding hemilithotomy position for fracture fixation in at-risk patients because it significantly increases calf compartment pressures.

Other alternates to avoid hemilithotomy position, would be to use lateral positioning on a fracture table or a regular radiolucent table and to use a femoral distracter as the distracting device followed by reduction and antegrade intramedullary nailing. In cases where the hemilithotomy position cannot be avoided, periodic intraoperative repositioning of the leg is recommended when possible to avoid prolonged pressure on the calf.<sup>6</sup>

Based on our experience, we avoid routine use of hemilithotomy position for antegrade intramedullary femoral nailing. Although the lithotomy position is useful and even necessary to the success of some surgical procedures, the patient should be repositioned after 2 hours, the maximal time one would use an extremity tourniquet. Often, fluoroscopy is only necessary during certain portions of the case, and the well leg may be returned to a more physiological position in the interval periods.<sup>2</sup> The presence of any predisposing factors, such as peripheral vascular disease, concurrent bony or soft tissue injury to the contralateral leg (i.e., nonoperative lower extremity), anticipated prolonged surgery and obesity, may require a different positioning approach.

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