Case report

Well leg compartment syndrome

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ABSTRACT

Well leg compartment syndrome refers to the occurrence of compartment syndrome in an uninjured limb in the absence of an underlying systemic predisposing cause. It is a rare phenomenon with devastating clinical consequences resulting from commonly utilized operative positions and requires a high index of suspicion for diagnoses. There are only a few reports in the literature and a lack of awareness of the condition. Identifying patients with at risk predisposition and increasing surveillance in these patients may allow for early detection and decrease the morbidity and potential mortality associated with well-leg compartment syndrome.

Introduction

The occurrence of well-leg compartment syndrome was first described in 1979 by Leff and Shapiro after a urological procedure lasting six and a half hours [1]. The condition has been described in general surgical, urological and orthopaedic patients placed in the lithotomy or hemilithotomy position for a prolonged period. There is a paucity of reports in the literature with only twenty-six cases being reported over a twenty-year period of 1979–1999 [2]. The clinical index of suspicion is usually low and the phenomenon often commences while the effect of anaesthesia is still onboard often resulting in a delay in diagnosis [2]. A case of well-leg compartment syndrome is presented here to highlight the presentation and enlighten clinical awareness.

Case

An otherwise well 53 years old farmer presented to hospital after being hit from his bicycle by a motor vehicle. He reportedly lost consciousness for approximately 3 min based on eyewitness reports. On presentation he complained of pain to the entire right lower limb, specifically the hip, thigh and leg, with an inability to weight bear. He was initially treated and stabilized at a peripheral hospital before being transferred to our institution.

Examination findings revealed a heavy-set man with swelling and deformity to his right hip, thigh and leg. There were no distal neurovascular deficits. Plain radiographs done revealed a pertrochanteric fracture of his right femur with ipsilateral femoral and tibial shaft fractures. Laboratory investigation on admission revealed a haemoglobin of 8.6 g/dL. He was placed on calcaneal traction on his right side and was transfused to a haemoglobin of 10.2 g/dL. His preoperative period was complicated by a multi-resistant urinary tract infection, which was treated with culture directed antibiotics until a sterile culture was obtained.

On day 18 post his injuries operative fixation of his right hip, femur and tibia fractures were undertaken. His left lower limb was placed in the hemi-lithotomy position with the hip flexed, abducted, externally rotated and the knee flexed at 90°. He had...
interlocking nailing of his tibia and retrograde nailing of his femur done in the hemi-lithotomy position. Intra-operatively his urine output exceeded 120 mls/h (adequate for his weight) whilst in the hemi-lithotomy position. The total operating time was six hours and fifteen minutes. During the final stage of fixation i.e. dynamic hip screw placement, the patient had a drastic fall in his urine output to < 25mls/h. The urine was noted to have a “pepsi” colour and urinalysis revealed a pH of 6.5.

Based on the fall in urine output and pepsi coloured urine with an acidic pH, the patient was presumptively diagnosed with rhabdomyolysis with acute myoglobinuria. During transfer of the patient from the fracture table to a stretcher his well leg was noted to be swollen and tense. A diagnosis of well leg compartment syndrome was made. The limb was kept at the level of the heart and supplemental oxygen commenced. A four compartment fasciotomy was done.

Laboratory investigations done revealed an elevated potassium 6 mmol/L (normal 3.5–5), elevated blood urea nitrogen of 36.9 mmol/L(normal 2.5–6.7), creatinine of 959 μmol/L(9–124), creatine phosphokinase(CPK) of 19939 μ/I(40–240) and a bicarbonate of 21. He was admitted to the high dependency unit and treated with high flow rate crystalloids (normal saline), up to 1000 mls/h, IV mannitol, IV bicarbonate and dextrose/insulin cocktails for hyperkalemia.

He responded partially with the aforementioned treatment with improvements in his laboratory parameters. Day 12 post-operative the patient started on haemodialysis three times per week until his electrolytes, BUN and creatinine normalized on Day 25 post operative. Clinically, the well leg had neurological deficits in the post-operative period with absent power at the ankles and hypoesthesia in the L5/S1 distribution. This improved steadily up to his discharge on post-operative day 37.

On last out-patient clinic review (8 months post-op), the patient has had almost full recovery of function in his left lower limb with S- power in all groups and return of sensation to the L5/S1 dermatome. His tibial and femoral fractures were healed.

Discussion

Acute compartment syndrome refers to the clinical phenomenon resulting from elevated compartment pressure above perfusion pressures in an unyielding osteofascial space. There are a number of proposed aetiologies and most cases are due to a traumatic event. The occurrence of compartment syndrome in an uninjured limb in the absence of an underlying systemic predisposing cause, well-leg compartment syndrome, is a rare phenomenon and requires an high index of suspicion. Tan et al. defined well-leg compartment syndrome as elevated compartment pressures within the leg after being placed in the lithotomy or hemilithotomy position [1]. More recently, well-leg compartment syndrome has also been described in patients placed in the lateral decubitus position [3]. The condition itself has however mostly been described in general surgical, urological and gynecological procedures in which patients were placed in the lithotomy position. The vast majority of cases described in the literature have all been lengthy procedures with surgical time above 5 h. The hemilithotomy position is often utilized in closed intramedullary nailing of the femur or compression hip screw placement. Compartment syndrome as a complication of the hemilithotomy position has only been reported in nine orthopaedic cases to the author’s knowledge.

There are several postulates with regards to the genesis of well-leg compartment syndrome. The Lithotomy or hemilithotomy position is thought to influence the limb perfusion by affecting both the compartment pressures and pressures at the arterial end. Tan et al. found an initial increase in compartment pressures of over 18 mm Hg of mercury with just placement of the leg within the leg holder [4]. Myers et al. also had similar findings with an increase in the compartment pressures when the limb was elevated from a supine position to the lithotomy position [5]. In their measurement of compartment pressures in eight healthy individuals they also found that moving from a calf-supported to a heel-supported hemilithotomy position resulted in a significant decrease of over 10 mm Hg in all compartments. In this regard a heel-supported position had less effect on compartment pressures versus a calf-supported position. The hemilithotomy position regardless of whether it was heel-supported or calf-supported was also shown to decrease the diastolic blood pressure in the ankle by over 30 mm Hg on average. This phenomenon was previously proposed by Adler et al. as one of the causes of well-leg compartment syndrome. Additionally, it has also been shown that there is a 0.78 mm Hg decrease in arterial pressure for every centimeter the limb is elevated above the heart [6–9]. The arterial pressure is also thought to be influenced by the flexed position of the hip and knee with some degree of kinking of the femoral and popliteal vessels respectively [10]. Hypotension during surgery will also decrease the end arterial pressure and negatively affect perfusion pressures. The position of the ankle has also been shown to influence leg compartment pressures. The dorsiflexed position was shown to increase leg compartmental pressures by Gershuni et al.

Tan et al. in their study also noted that there was a direct correlation between the body mass index and initial compartment pressures after the limb was placed in the leg holder. The authors interpreted this observation to be due to a rise in external compressive forces brought about by the weight of the leg on the leg holder decreasing intracompartment volume and thus increasing pressure. This has been corroborated by Peters et al., who found a linear relationship with increasing body mass index and decreasing ankle blood pressures [8]. Prolonged limb compression may also cause muscle injury with resultant oedema that will further increase intracompartment pressure and decrease tissue perfusion. The index increase in compartment pressures was also noted to progress up to higns of 30 mm Hg [10].

The clinical recognition of well leg compartment syndrome is often delayed because of the effect of anaesthesia, general or regional as per index case. The cardinal feature of pain is often masked in the immediate post-operative period and a high index of suspicion has to be maintained. Clinical features such as leg swelling usually leads to investigation for more common differentials such as DVT resulting in further delay in diagnosis. The time to diagnosis, based on case reports, has been noted to be shorter when the patient was managed by an orthopaedic team.

Increasing the awareness of this complication of the lithotomy or hemilithotomy position and identifying patients with increased risk factors may decrease potential morbidity and mortality as the incidence may be higher than what is reported. Identifiable risk
factors based on case reports and various studies for well-leg compartment syndrome include increased body mass index, operating
time above 4 h, and intraoperative hypotension resulting in decreased peripheral arterial pressures.

We recommend the use of alternate patient positioning in cases that are likely to be prolonged where possible such as the
scissoring technique in femoral nailing and exercising caution in patients with at risk factors in whom the lithotomy or hemilithotomy
position cannot be avoided. In cases in which the hemilithotomy or lithotomy position is utilized measures should be taken to
decrease the risk of well leg compartment syndrome including heel support versus calf support, decreasing the extent of flexion at the
groin and knee and the level of elevation of the limb above the heart [6–8,10].

The lithotomy and hemilithotomy positions are often utilized for various procedures. Knowledge of the risk factors of the de-
bilitating complication of well-leg compartment syndrome allows for the use of preventative measures and a heightened suspicion
which may facilitate early diagnosis if the condition should develop.

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