ORIGINAL ARTICLE

Well leg compartment syndrome after pelvic and perineal surgery in the lithotomy position

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Objective: Lower limb compartment syndrome after prolonged surgical procedures performed in the lithotomy position is a rare but potentially devastating complication. It is recognised after urological, colorectal, and gynaecological procedures. Sixteen cases of compartment syndrome after urological surgery have been reported. The objective of this study was to estimate the incidence of this complication in urological practice and identify risk factors for its development.
Design: A postal survey of UK consultant urologists was conducted.
Results: Replies were received from 261 consultants. In total there were 65 cases of compartment syndrome. Compartment syndrome occurred after radical cystectomy and urinary diversion in 51 cases and was rare in procedures lasting less than four hours. The incidence of compartment syndrome after cystectomy was estimated at around 1 in 500 cases. Risk factors for its development included perioperative blood loss, peripheral vascular disease, and obesity.
Conclusions: Compartment syndrome after use of the lithotomy position may be more common than is generally appreciated and has been underreported in the past. All staff should be aware of this serious complication and adopt strategies for its avoidance.

The lithotomy position is commonly used to access the pelvis and perineum during urological, colorectal, and gynaecoloical surgey. Lower limb compartment syndrome is caused by abnormal increases in intracompartmental pressures within a non-expansile fascial space and has been recognised after prolonged elevation of the lower limbs during surgical procedures in the lithotomy position. Reports of well leg compartment syndrome (WLCS) after procedures in the lithotomy consist of individual cases or small series. Compartment syndrome is a potentially devastating complication resulting in permanent disability and even death. The overall incidence of compartment syndrome after major pelvic surgery in the lithotomy position has been estimated at 1 in 3500 cases[1] but this may be higher in urological surgery. To date a total of 16 urological patients with WLCS have been described in the world literature.

We undertook a survey of consultant urologists in the UK to estimate the incidence of lower limb compartment syndrome after use of the lithotomy position and to identify risk factors for its development.

METHODS

A questionnaire (see appendix) was posted to 520 consultant urologists in the UK. They were asked to fill in the questionnaire anonymously. The results were analysed and are presented.

RESULTS

Replies were received from 261 consultants (50.2%). Fifty one consultants had seen a total of 65 episodes of compartment syndrome. Most consultants had seen this complication on a single occasion, but two surgeons had seen it on three separate occasions. The patient position used was low lithotomy in 33 cases, standard lithotomy in 29, and exaggerated lithotomy in three. Compartment syndrome occurred after cystectomy and urinary diversion in 51 cases, radical prostatectomy (retropubic and perineal) in five, urethroplasty in seven, and other pelvic reconstructive surgery in two cases (see fig 1).

Figure 2 shows the distribution of compartment syndrome according to operative duration. It is noteworthy that only two cases occurred in operations of less than four hours duration.

Apart from surgical time other risk factors for the development of compartment syndrome were identified. Blood loss or significant intraoperative hypotension was seen in 10 cases. Peripheral vascular disease alone was noted in five patients and a high body mass index was seen in four patients. A combination of peripheral vascular disease and high body mass index was noted in two patients and seven patients were reported to have muscular calves. All cases were treated by surgical decompression.

It was felt that there had been a delay in diagnosis in 15 of the 65 cases. Reasons cited for this delay were masking of symptoms by epidural analgesia in seven cases, lack of awareness among staff in five cases, and a wrong diagnosis of deep vein thrombosis in one patient. Ninety eight per cent of surgeons personally supervised the positioning of patients.

Of the 65 reported cases of compartment syndrome, 27 patients (41.5%) had some form of permanent disability. Death occurred in four patients, foot drop or paraesthesia in 11, and significant muscle loss in 12. One case of renal failure secondary to rhabdomyolysis was reported. In cases where a

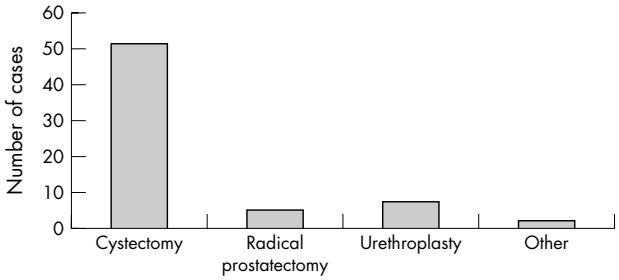

Figure 1 Distribution of compartment syndromes according to operation.

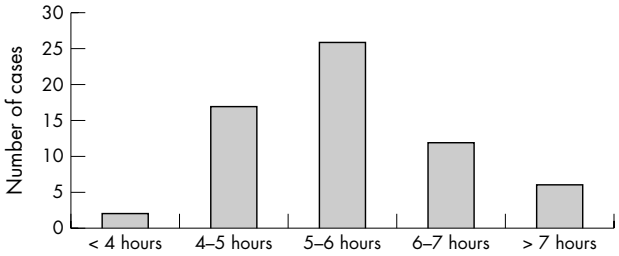

Figure 2 Distribution of compartment syndromes according to operative duration.

delay in diagnosis occurred, 11 of 15 patients had some form of permanent disability. Development of a compartment syndrome resulted in medicolegal action in only six cases from the total of 65.

DISCUSSION

The development of a WLCS is a rare but significant complication after major surgery performed in either the low (Lloyd-Davies), standard, or exaggerated lithotomy position. WLCS typically presents postoperatively with leg pain out of proportion to the clinical findings. The classic findings of calf swelling, paraesthesia, weakness of toe flexion, and pain during passive toe extension are late and may suggest an established compartment syndrome and the presence of foot pulses does not show that the compartment is well perfused. The normal range of compartment pressure during an operation is between 0 mm Hg and 10 mm Hg. The definitive diagnosis of a compartment syndrome is made by a direct measurement of intracompartmental pressure. This can be done by using either a transducer tipped catheter or by a conventional fluid filled system. There is no universal agreement on the precise intracompartmental pressure at which you should consider intervention. The decision to operate should be made in conjunction with clinical findings although a value of >30 mm Hg usually shows that surgical decompression is needed. Once the decision has been made to intervene, urgent fasciotomy of all lower limb muscle compartments is usually an effective treatment.

It has been shown that placing legs in the lithotomy position in an anaesthetised patient causes a decrease in blood pressure in the lower limb and a rise in the compartment pressure.[3] Compartment syndrome is attributable to prolonged impairment of lower limb perfusion secondary to a rise in compartment pressure. A reduction in perfusion pressure causes tissue ischaemia. Ischaemia may be followed by reperfusion with subsequent capillary leakage and tissue oedema. A vicious circle of tissue oedema and further impairment of perfusion then occurs. Once compartment pressure rises above 50 mm Hg for more than four hours irreversible neuromuscular damage will occur[4] although damage is reversible up to two to three hours. In our study only two cases of WLCS occurred after operations that lasted for less than four hours (see fig 2).

Box 1 Risk factors for development of well leg compartment syndrome

- Intraoperative hypotension
- Blood loss/hyopvolaemia
- Peripheral vascular disease
- Prolonged operation
- Muscular calves
- High body mass index

Box 2 Well leg compartment syndrome

- Has a higher incidence than is generally appreciated
- May be particularly associated with radical cystectomy
- Has a poor outcome if not diagnosed and treated early

In this study 51 consultant urologists, almost 10% of the total number of consultants in the UK had experienced a WLCS in their practice. This study was a postal questionnaire and relied upon the recall of the consultants who replied. As the development of a WLCS is such a rare and dramatic complication we feel that the information supplied by individual surgeons is accurate. Although the study targeted urologists, the findings are of relevance to colorectal and gynaecological surgeons as well as anaesthetists and orthopaedic surgeons.

Most cases occurred after radical cystectomy and urinary diversion. Radical cystectomy is a long operation that may take four to five hours and longer when it is accompanied by orthotopic bladder reconstruction. Significant blood loss is not uncommon during this procedure and many patients will be smokers with some degree of peripheral vascular disease. These are all factors implicated in the development of WLCS and therefore radical cystectomy must be regarded as a high risk procedure if the lithotomy position is used. The overall frequency of WLCS for patients undergoing procedures in the lithotomy position has been reported at 1 in 3500. We estimate that this figure may be as high as around 1 in 500 for radical cystectomy and urinary diversion in the UK. In our survey WLCS developed in procedures that lasted for as little as 3.5 hours Delay in diagnosis was a feature in nearly a quarter of cases and permanent disability was more common in these circumstances.

There are many factors that cause an increase in compartment pressure but it seems that decreased perfusion pressure due to leg elevation may be the most important of these.[5] It has been shown that local arteriolar pressure decreases 0.78 mm Hg for each centimetre the compartment is elevated above the right atrium.[1] A number of reports have implicated calf compression devices in the development of compartment syndrome.[6 7] Physiological studies however have suggested external intermittent compression devices may decrease compartment pressures by improving venous return[8] although these were conducted in conscious healthy volunteers. Pfeffer *et al*[8] felt that this beneficial effect was not likely to occur with the application of constant pressure as provided by antithrombosis stockings. In our study two consultants who had experienced a WLCS in their practice felt that intermittent calf compression was a causative factor in its development whereas eight felt calf compression was a preventative measure. Pfeffer *et al*[8] suggested in their study that support of the lower limb at the ankle was associated with lower compartmental pressures than when the limb is supported in generic knee supports although in our study WLCS was reported using both types of device. Other authors have advocated the use of Allen stirrups, which support the ankle rather than the calf.[2]

WLCS seems to be more common than is generally appreciated and has been underreported in the past. The length of time spent in the lithotomy position and the degree of elevation are the most important factors in its development. Radical cystectomy in particular seems to be associated with a high risk of compartment syndrome when the lithotomy position is used. The position should be avoided

if possible but if it is used then elevation of legs should be kept to a minimum. The use of hydraulic stirrups may permit easy and minimally disruptive position changes during procedures allowing legs to be elevated when required, for example, for urethrectomy during cystectomy, and then lowered for the completion of an operation. For procedures where elevation is prolonged, legs should be lowered every two hours. When positioning patients, dorsiflexion of the ankle should be avoided[9] and adequate padding around pressure points should be used. Staff should be aware that any degree of head down Trendelenberg tilt may also increase compartment pressures. A delay in diagnosis was a feature in almost a quarter of cases in this series and may be associated with a worse outcome. Lack of awareness among staff may have contributed to this delay and it is essential that all staff involved in the perioperative and postoperative care of such patients have a low index of suspicion for the development of WLCS.

In the future urological, colorectal, and gynaecological radical pelvic and reconstructive surgery will be performed in a smaller number of specialist centres with individual surgeons performing a high number of procedures. The probability of surgeons encountering a WLCS in these centres will therefore increase. All staff involved in the care of such patients should be aware of the risk factors for the development of this devastating complication and adopt strategies for its prevention.

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APPENDIX

- Have you experienced a compartment syndrome following use of the lithotomy position in your practice?
- How many times have you seen this complication?
- What was the position used?
- Following what procedure(s) was this? (Please give details if possible)
- What was the duration of the procedure? (approximately)
- Were there any other risks factors for development of this complication?
- Was there any delay in diagnosing the complication? If yes, why?
- How was the complication treated?
- What was the outcome of treatment?
- How many times a year do you use this position in your practice?
- Do you personally supervise patient positioning when the lithotomy position is needed?
- Do you actively take measures to avoid neurovascular complications when using this position? If yes what do you do?
- Did any medicolegal action result from this complication?
- Any other comments?

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