RHABDOMYOLYSIS FOLLOWING TOTAL HIP ARTHROPLASTY

PAUL F. LACHIEWICZ, HARRISON A. LATIMER

From the University of North Carolina

We report six cases of contralateral limb involvement during total hip arthroplasty including swelling of the gluteal muscle compartments, rhabdomyolysis, myoglobinuria, and sciatic nerve palsy. The risk factors for such complications include obesity, prolonged operative time, and positioning in the lateral decubitus position. The laboratory and clinical findings are consistent with a gluteal muscle crush-injury with consequent compartment syndrome. The patients should be treated conservatively as symptoms can be expected to resolve.

Complications in the contralateral limb after total hip arthroplasty are rare. Smith, Pellicci and Sharrock (1989) recently reported six complications in the opposite leg, including transient paraesthesia, rhabdomyolysis, acute renal failure due to myoglobinuria, and arterial insufficiency. The aetiology suggested by these authors was venous obstruction due to compression of the femoral triangle by the pelvic holding device. They suggested that a pulse oximeter be placed on a toe of the contralateral or 'down-side' leg to anticipate this complication.

At our institution, total hip arthroplasty is performed on an identical operating table as that used for the patients previously reported. We experienced complications involving the contralateral limb, including rhabdomyolysis, myoglobinuria (without acute renal failure), and sciatic nerve palsy after six total hip arthroplasties. The patients tended to be obese and were anaesthetised in the lateral decubitus position for a long period of time during the procedure. While these findings support the assertion that the dependent leg is at risk during total hip arthroplasty, the laboratory findings and localised clinical symptoms in our patients are more consistent with a crush-injury of the contralateral gluteal muscle compartments.

PATIENTS AND METHODS

During the last three years, approximately 250 patients have had a primary or revision total hip arthroplasty at the University of North Carolina Hospitals by the senior author (PFL). All patients had the procedure on a Chick model 10010 Orthopedic Table in the lateral decubitus position. The patient's down-side rests against a well padded metal plate measuring 27 cm long and 18 cm wide. The posterior pelvic support measures 26 cm in length and 18 cm in width. The anterior pubic support measures 22 cm in length and 18 cm in width. Patients were in the lateral decubitus position with the pelvis secured between these two pelvic supports. During acetabular preparation, the entire table was tilted posteriorly, 10° to 15°.

Six patients had postoperative myoglobinuria and physical signs involving the contralateral limb. Serial serum total creatinine kinase levels were obtained in all six patients, and peak levels exceeded 4000 IU/l with over 95% MM fraction. The patient's body-weight, the operative procedures performed, and operative time in the lateral decubitus position were recorded. All patients were seen at follow-up by the senior author.

RESULTS

The patients' general data are listed in Table I. Operative time in the lateral decubitus position, peak serum total creatinine kinase, postoperative complications, and follow-up data are given in Table II.

The first patient had pressure measurements taken of the right gluteal compartment on the day after operation, because of severe pain and swelling. The

P. F. Lachiewicz, MD, Associate Professor of Orthopaedics
H. A. Latimer, MD, Orthopaedic Surgeon
Division of Orthopaedic Surgery, University of North Carolina, 250
Burnett-Womack Building 229-H, Chapel Hill, North Carolina 27599-
7055, USA.

Correspondence should be sent to Dr P. F. Lachiewicz.

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Table I. Characteristics of patients who developed complications of the contralateral limb after total hip arthroplasty

Case	Sex	Age	Ideal body-weight (per cent)	Diagnosis	Procedures
1	M	32	100	Loose cemented bipolar, malunion type-2 femur fracture	Revision arthroplasty trochanteric osteotomy, iliac graft, reduction and fixation malunited femoral fracture
2	F	37	138	Infected, cemented total hip prosthesis	Revision arthroplasty, trochanteric osteotomy, bilateral iliac crest grafts
3	F	65	120	Loose surface replacement	Revision, extensive bone grafting
4	M	66	100	Post-traumatic arthritis, ORIF acetabular fracture	Total hip arthroplasty, removal acetabular hardware, 'difficult'
5	M	61	133	Loose hip prosthesis, excessive distal cement	Revision arthroplasty, iliac graft, trochanteric osteotomy
6	M	62	123	Loose hip prosthesis, nonunion type-2 femur fracture	Revision arthroplasty, iliac graft, trochanteric osteotomy, internal fixation fractured femur

Table II. Length of surgery and postoperative details of the six cases

Case	Duration of operation (hr: min)	Peak total serum creatinine kinase (IU/l)	Complication	Follow-up
1	10: 5	12 070	Pain, swollen gluteal region; sciatic nerve palsy; urine myoglobin positive	Myoglobinuria resolved in 48 hours. At two years, normal sensation on dorsum of left foot, normal gluteal strength
2	9:10	13 910	Pain, swollen gluteal region; urine myoglobin positive	Myoglobinuria resolved in 48 hours. Normal gluteal strength at two years
3	5: 40	19 632	Pain, swollen gluteal region; sciatic nerve palsy	Sciatic nerve palsy resolved in two weeks. Normal gluteal strength at one year
4	8	13 920	Pain, swollen gluteal region; urine myoglobin positive	Myoglobinuria resolved in 48 hours. One dislocation THA. Normal gluteal strength at one year
5	8: 5	27 540	Pain, swollen gluteal region; sciatic nerve palsy; urine myoglobin positive	Myoglobinuria resolved within 48 hours. Postoperative symptomatic pulmonary embolus. At two years slight decrease in sensation on dorsum of the left foot; motor function normal
6	8: 10	4 278	Pain, swollen gluteal region; decreased urine output increased serum creatinine; complete sciatic nerve palsy	Urine output returned to normal in 24 hours. At two years paraesthesia of dorsum of the right foot; motor function normal

reading was 50 mmHg, using the needle-manometer technique (Whitesides et al 1975), and gluteal fasciotomy was performed with rapid resolution of symptoms. Compartmental pressure measurements and fasciotomy were not performed on the other patients with tense, swollen gluteal compartments; they were treated conservatively, with intravenous hydration and changes of position, with similar good results.

To assess the significance and validity of myoglobi-

nuria and elevated serum creatinine kinase, we studied six randomly selected patients, two women and four men, who had revision surgery or complex primary total hip arthroplasty. Five were considered to be obese. Myoglobin in the urine was not detected in the recovery room nor during the first postoperative day. The patients had no symptoms in the contralateral limb. The total serum creatinine kinase ranged from a minimum of 668 IU/l to a maximum of 3045 IU/l.

DISCUSSION

These six cases of 'down-side' leg complications after total hip arthroplasty highlight the risk factors reported by Smith et al (1989). The mean patient weight was 119% of the ideal, and the mean period of time in the lateral decubitus position was eight hours 11 minutes. The use of hypotensive anaesthesia was not unique to this group of patients. In a series of 141 primary cemented arthroplasties, performed by the same surgeon, the average patient weight was 73 kg and the average anaesthesia time was three hours, 28 minutes.

Although incorrect positioning of the patient in the pelvic holding supports and increased pressure on the contralateral limb during the operation may place the patient at risk, venous obstruction secondary to pressure by the anterior clamp does not adequately explain the site of injury in these six cases. In the large or obese patient, undergoing a lengthy operative procedure, crush-

which added to the length and complexity of the procedure.

Rhabdomyolysis secondary to compression is most often seen in comatose drug abusers (Gabow, Kaehny and Kelleher 1982). It has also been ascribed to malpositioning on the fracture table (McLaren, Ferguson and Miniaci 1987). The crush syndrome, first described in victims of the London blitz, involves shock, swollen limbs, myoglobinuria, and renal failure following prolonged compression of an extremity by heavy debris (Bywaters 1944). Mubarak and Owen (1975) related crush syndrome with compartment syndrome. These authors describe a pathogenesis that begins with prolonged limb compression leading to muscle ischaemia and necrosis, followed by oedema and finally full compartment tamponade. Local skeletal muscle necrosis causes potassium and later myoglobin to be released into the circulation, thus producing the systemic manifesta-

Fig. 1a

Fig. 1b

Figure 1a - Photograph of patient on operating table with incorrect placement of posterior pad on gluteal muscles. Figure 1b - Correct placement of posterior pad over sacrum, with gluteal muscles free of compression.

injury to the gluteal muscle compartments probably occurs due to sustained pressure of the down-side buttock against the posterior clamp. The increase in total serum creatinine kinase seen in these six patients was due to skeletal muscle injury exceeding that inherent in the arthroplasty, as compared with normal peak elevation of serum total creatinine kinase (mean 427 IU/l) in the first 24 hours after total hip arthroplasty (Wukich et al 1989).

The duration of the operative procedures in our series requires some discussion. All patients had at least one previous major operation on the hip; case 1 had four such procedures. The exposure and dislocation of the hip was difficult because of extensive scarring and loss of normal anatomical planes. Removal of cement and/or implanted devices was extremely difficult, and in two cases, a femoral malunion or nonunion required reduction and fixation with multiple wires and a long-stem femoral prosthesis. All patients received extensive bone grafts

tions of the crush syndrome. In a study of compartment pressure measurements, taken with a 'wick catheter', compression of the down-side leg by the superior leg on soft surfaces caused a mean intramuscular pressure of 57 mmHg, sufficient to initiate muscle ischaemia (Owen et al 1979). The gluteal compartment syndrome has been described after prolonged compression following a drug overdose and after blunt trauma (Owen et al 1978). The gluteal muscles become swollen and tense with elevated serum total creatinine kinase and sometimes sciatic nerve palsy. It is probable that this pattern occurred in our cases. Physical examination is not reliable for detection of this complication, as two of our patients presented no physical signs. In our opinion, the use of a pulse oximeter on the down-leg during total hip arthroplasty will not prevent this complication. Care is required during positioning of the patient on the operating table. The posterior pelvic clamp, if used, should be placed high on

the sacrum and not over the gluteal musculature (Fig. 1). The operating table should not be rotated posteriorly during the procedure, except in cases of unusual technical difficulty. The use of a bean-bag device or alternating pressure mattress may also be effective in preventing this serious complication.

Fasciotomy is not generally required for gluteal crush syndrome. Aggressive intravenous hydration is given as prophylaxis for acute renal failure which may result from myoglobinuria (Reis and Michaelson 1986).

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REFERENCES

- Bywaters EGL.** Ischemic muscle necrosis. *J Am Med Assn* 1944; 124:1103-9.
- Gabow PA, Kaehny WD, Kelleher SP.** The spectrum of rhabdomyolysis. *Medicine (Baltimore)* 1982; 61:141-52.
- McLaren AC, Ferguson JH, Miniaci A.** Crush syndrome associated with the use of the fracture-table: a case report. *J Bone Joint Surg [Am]* 1987; 69-A:1447-9.
- Mubarak S, Owen CA.** Compartmental syndrome and its relation to the crush syndrome: a spectrum of disease. *Clin Orthop* 1975; 113:81-9.
- Owen CA, Mubarak SJ, Hargens AR, Rutherford L, Garetto LP, Akeson WH.** Intramuscular pressures with limb compression: clarification of the pathogenesis of the drug-induced muscle-compartment syndrome. *N Eng J Med* 1979; 300:1169-72.
- Owen CA, Woody PR, Mubarak SJ, Hargens AR.** Gluteal compartment syndromes: a report of 3 cases and management utilizing the Wick catheter. *Clin Orthop* 1978; 132:57-60.
- Reis ND, Michaelson M.** Crush injury to the lower limb: treatment of local injury. *J Bone Joint Surg [Am]* 1986; 68-A:414-8.
- Smith JW, Pellicci PM, Sharrock N.** Complications after total hip replacement. *J Bone Joint Surg [Am]* 1989; 71-A:528-35.
- Whitesides TE Jr, Haney TC, Morimoto K, Harada H.** Tissue pressure measurements as a determinant for the need of fasciotomy. *Clin Orthop* 1975; 113:43-51.
- Wukich DK, Maj MC, Callaghan JJ, et al.** Cardiac isoenzyme values after total joint arthroplasty. *Clin Orthop* 1989; 242:232-40.