British Journal of Anaesthesia **94 (1)**: 100–6 (2005)
doi:10.1093/bja/aei012 Advance Access publication October 29, 2004

BJA

Corticosteroid injections for trochanteric bursitis: is fluoroscopy necessary? A pilot study†

S. P. Cohen[1]*, J. C. Narvaez[2], A. H. Lebovits[3] and M. P. Stojanovic[4]

[1]*Pain Management Centers, Departments of Anesthesiology, Johns Hopkins Medical Institutions, Baltimore, Maryland, USA and Walter Reed Army Medical Center, Washington, DC, USA.* [2]*Department of Physical Medicine and Rehabilitation, Walter Reed Army Medical Center, Washington, DC, USA and Department of Radiology, Loma Linda University, Loma Linda, California, USA.* [3]*Pain Management Center, NYU School of Medicine, New York, USA.* [4]*MGH Pain Center, Deparment of Anaesthesia and Critical Care, Massachusetts General Hospital, Harvard Medical School, Boston, Massachusetts, USA*

**Corresponding author. E-mail: spc5_2000@yahoo.com*

Background. Numerous studies have demonstrated that therapeutic injections carried out to treat a variety of different pain conditions should ideally be performed under radiological guidance because of the propensity for blinded injections to be inaccurate. Although trochanteric bursa injections are commonly performed to treat hip pain, they have never been described using fluoroscopy.

Methods. The authors reviewed recorded data on 40 patients who underwent trochanteric bursa injections for hip pain with or without low back pain. The initial needle placement was done blindly, with all subsequent attempts done using fluoroscopic guidance. After bone contact, imaging was used to determine if the needle was positioned on the lateral edge of the greater trochanter (GT). Once this occurred, 1 ml of radiopaque contrast was injected to assess bursa spread.

Results. The GT was contacted in 78% of cases and a bursagram obtained in 45% of patients on the first needle placement. In 23% of patients a bursagram was obtained on the second attempt and in another 23% on the third attempt. Four patients (10%) required four or more needle placements before a bursagram was appreciated. Attending physicians obtained a bursagram on the first attempt 53% of the time *vs* 46% for fellows and 36% for residents (P=0.64). Older patients were more likely to require multiple injections than younger patients.

Conclusions. Radiological confirmation of bursal spread is necessary to ensure that the injectate reaches the area of pathology during trochanteric bursa injections.

Br J Anaesth 2005; **94**: 100–6

Keywords: complications, trochanteric bursitis; hormones, corticosteroids; injection; pain, hip; radiology, fluoroscopy

Accepted for publication: September 16, 2004

Trochanteric bursitis (TB) is a common cause of hip pain and leg pain.[1–3] Although the lack of clinical studies make the precise incidence difficult to estimate, one study prospectively evaluating 100 patients with chronic 'low back pain', found 35% to have TB.[4] Another study found 15% of patients with rheumatoid arthritis to suffer from this condition.[5] In most cases the disorder is self-limiting, with treatment consisting of conservative measures such as behaviour modification, physical therapy, weight loss, and non-steroidal anti-inflammatory drugs. When these interventions fail, bursa injections performed with corticosteroid and local anaesthetic (LA) have been shown to provide good pain relief, with response rates ranging from 60 to 100%.[3 6–10] In all these studies, trochanteric bursa injections have been performed blindly using anatomical landmarks for guidance.

Recently, fluoroscopy has been advocated for many procedures previously performed blindly including lumbar, caudal and cervical epidural steroid injections, sacroiliac joint injections, and piriformis muscle injections.[11–17] This is because radiological studies have repeatedly demonstrated that injections performed blindly frequently result in

†Presented at the XXIII Annual European Society of Regional Anaesthesia Congress, Athens, Greece, September 2004.

failure of the injectate to reach the desired area of pathology. In our experience, many patients with 'confirmed' TB fail to obtain any relief with therapeutic injections done with LA and steroid. As these patients should all respond with at least temporary relief from the LA, one must question either the diagnosis itself or the accuracy of the injection.

Up to 21 bursae have been described in the hip region, with at least three being present around the greater trochanter (GT).[2] These bursae are dispersed throughout numerous soft tissue structures, including muscles, tendons, and fibrous tissues. This and factors such as anatomical variance and referred pain may potentially contribute to inaccuracies in blindly performed trochanteric bursa injections. Despite numerous studies assessing the potential benefits of steroid injections to treat TB, to our knowledge radiological guidance has never been utilized in these injections. This study was undertaken to determine whether or not fluoroscopy is necessary when performing trochanteric bursa injections.

Methods

Permission to conduct this study was granted from the Departments of Clinical Investigation at Walter Reed Army Medical Center and Massachusetts General Hospital who designated it as an exempt protocol, and all patients who gave their informed consent for the procedure. The study patients were 40 men and women with a clinical diagnosis of TB who underwent therapeutic trochanteric bursa injections using fluoroscopic guidance. The criteria for a diagnosis of TB were adapted from Anderson[18] and Ege Rasmussen and Fano.[6] In one patient magnetic resonance imaging of the hip was used to confirm TB.

All injections were performed under sterile conditions in the lateral decubitus position with 22-gauge spinal needles and superficial anaesthesia. The initial needle placement was done blindly based on anatomic landmarks and physical examination. If the GT was not contacted on the first attempt, fluoroscopy was utilized to redirect the needle until bone was contacted. Once this occurred, antero-posterior fluoroscopy was used to ascertain that the tip of the needle was on the lateral edge of the GT. If needle placement was still considered inaccurate, the needle was repositioned and the process repeated. When the clinician felt the needle was correctly positioned, 1.0 ml of radiopaque contrast was injected under fluoroscopy to confirm bursa spread. If bursa spread was not appreciated, the needle was repositioned and the process repeated until a clearly recognized bursagram was obtained. After radiographic confirmation of correct needle placement, a 5 ml mixture containing depomedrol 80 mg and bupivacaine 15 mg was deposited. As radiological (e.g. magnetic resonance) imaging is not routinely used to diagnose TB, the affected bursa could not definitively be identified before injection in all but one of the patients. Consequently, spread into any one of the three major bursae surrounding the GT constituted success. In all cases, the arbiter of accuracy was the attending physician.

The patient and clinical data recorded included age, sex, duration of hip pain, side of injection, and whether or not the patient was obese. The latter variable was defined as a body mass index (BMI) more than 28. In addition, the following procedural information was analysed: (i) whether or not the needle needed to be repositioned before the GT was contacted; (ii) the number of times contrast was injected (indicating the needle was on the lateral edge of the GT) before a bursagram was obtained; (iii) needle location relative to the bursa when the needle was incorrectly positioned; (iv) training level of the injector.

Accuracy was assessed by two variables. The primary outcome measure was the total number of needle placements needed before a bursagram was obtained. This figure includes needle placements not contacting bone. The secondary outcome measure was whether or not the GT was contacted on the first attempt. Both outcome measures were used to determine success rates based on the level of training and clinical variables. Among the 40 procedures were five difficult ones that required an attending to replace the trainee as the clinician completing the injection. In these cases, the total number of injections required was ascribed to the trainee. Only injections whereby >50% of the contrast was visually determined to be in a bursa were considered correct. All residents were postgraduate yr (PGY) 3 or 4 anaesthesia or physical medicine and rehabilitation residents. The fellows were all board-certified anaesthesiologists, half (two of four) of whom had been in private pain practices before embarking on fellowship training. The attending physicians included four pain-certified anesthesiologists and one pain-certified physical medicine and rehabilitation physician with a minimum of 5 yr experience at staff level. Continuous data are presented as mean (SD), and were analysed by use of analysis of variance (ANOVA) and independent-groups *t*-tests. Categorical data were analysed by use of χ^2 tests.

Results

The 40 subjects included 12 males and 28 females, whose average age was 61 yr (range 38–84, SD 14.5). The mean duration of hip pain was 2.2 yr (range 2 months to 5.0 yr, SD 1.4). There were 24 right-sided blocks and 16 left hip injections. Residents performed 14 injections, fellows 11 blocks, and attending physicians the remaining 15 procedures. There were no significant differences with respect to age, sex, duration of pain, side of injection, and percentage of obese patients when broken down by the training level of the injector. The effects of sex and side of injection on accuracy were not statistically significant. There was a propensity for trochanteric bursa injections to be less accurate in elderly patients. The mean age of patients in whom bursagrams were obtained on the first attempt was 54.7 yr (SD 13.1) [range 39–84] *vs* 65.6 (14.1) [38–84] in patients requiring more than one needle placement (P<0.02). With respect to the secondary outcome measure of hitting the GT on the first needle insertion, the average age of patients in whom the GT was contacted on the first try was 59.0 yr (14.4) [38–84], compared with 66.4 (14.1) [42–81] in subjects in whom bone was missed (P=0.18; Figures 1–3 and Table 1).

Overall accuracy

Bursagrams were obtained on the first attempt in 18 patients (45%), on the second attempt in nine patients (23%), on the third attempt in another nine patients (23%), and on four or more attempts in four cases (10%). In one patient who had undergone a unilateral total hip replacement 2 yr earlier, a bursagram was not appreciated despite eight injections (four each by a fellow and attending). The maximum number of attempts required to successfully obtain a bursagram was six, four by a resident, and two by an attending. The GT was contacted on the first attempt in 78% (n=31) of patients. In the nine patients in whom the GT was missed on the first attempt, the mean number of attempts required to obtain a bursagram was 3.9 (range 3–6, SD 1.4).

Accuracy by level of training

Attendings obtained a bursagram on the first attempt in 53% (8 of 15) of injections, compared with 46% (5 of 11) for fellows, and 36% for residents (P=0.64). Overall, the mean number of attempts required to obtain a bursagram was 1.7 (range 1–3, SD 0.9) for attendings and 2.5 each for fellows (range 1–8, SD 2.2) and residents (range 1–6, SD 1.7). These differences were not statistically significant (P=0.65). Attending physicians contacted the GT on the first attempt in 87% of injections *vs* 82% for fellows and 64% for residents. This difference was also not significant (P=0.33; see Table 2).

Duration of pain

The mean duration of pain for the study population was 2.2 yr (range 2 months to 5.0 yr, SD 1.4). The average duration of pain for patients in whom bursagrams were obtained on the first attempt was 2.0 (range 3 months to 4.5 yr, SD 1.5) *vs* 2.3 yr (range 2 months to 5.0 yr, SD 1.4) for those patients requiring more than one injection (P=0.58). In those patients in whom the GT was contacted on the first attempt, the mean duration of hip pain was 2.1 yr (range 3 months to 5.0 yr, SD 1.5) compared with 2.3 yr (range 2 months to 4.0 yr, SD 1.3) for subjects requiring more than one attempt to hit bone. Pearson's correlation coefficient for duration of pain and accuracy was 0.13 (P=0.42).

Obesity

In obese patients, a bursagram was obtained on the first attempt in 38% (three of eight) of obese patients *vs* 47% in non-obese patients (15 of 32). The average number of attempts it took to obtain a bursagram was 2.9 in obese patients compared with 2.0 in non-obese subjects (P=0.38). With respect to the secondary outcome measure of hitting the GT on the first attempt, the percentages for obese and non-obese patients were 78 and 75%, respectively. None of these differences were statistically significant.

Location of first miss

The direction of missed blocks was determined only for first attempts. Of the 22 misses, the breakdown was as follows: four needles were placed too anteriorly, two too posteriorly, four too superiorly and two were too inferior. There were four misses each in the antero-superior and

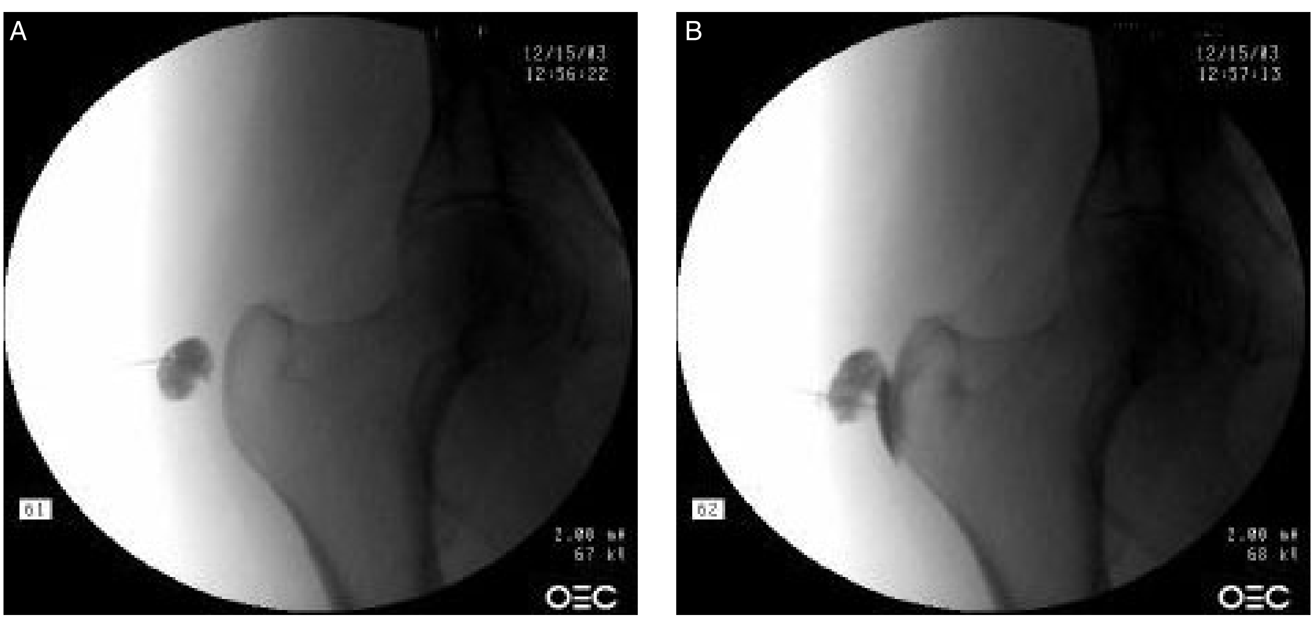

Fig 1 (A) Antero-posterior (AP) radiograph of the right GT revealing soft tissue spread; (B) AP radiograph revealing a subgluteus maximus bursagram after the needle was redirected inferiorly.

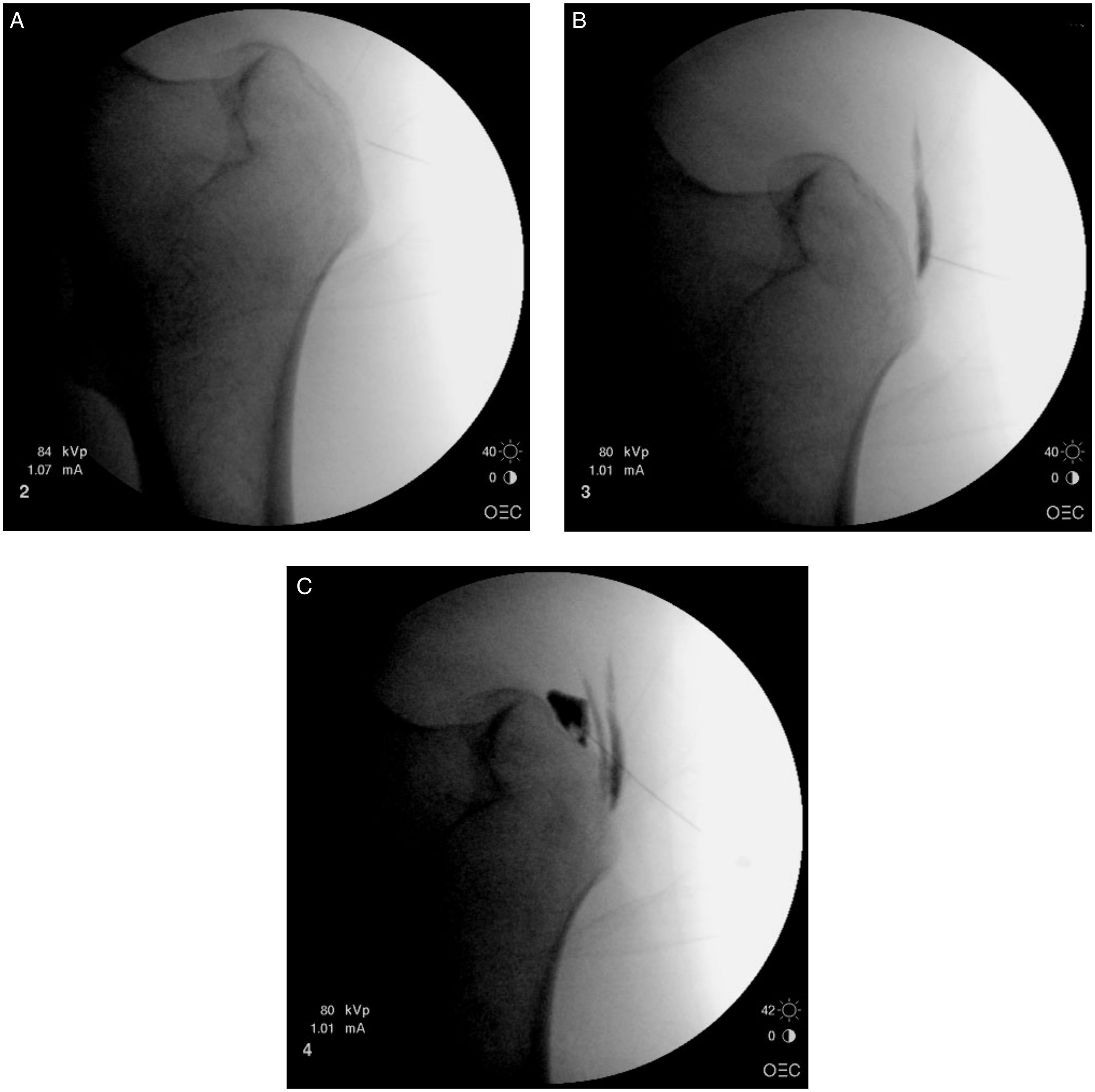

Fig 2 (A) AP radiograph of the left GT showing initial needle position in the centre of the bone. (B) AP radiograph demonstrating injection of contrast into the tendon of the gluteus medius muscle. (C) AP radiograph demonstrating a subgluteus medius bursagram after redirecting the needle superiorly.

antero-inferior directions, one in the postero-inferior direction, and one miss was both superior and superficial.

Discussion

TB is a frequent cause of hip pain in middle-aged and elderly individuals.[2,6,18] Risk factors for this disorder include obesity, female gender, overuse and altered gait mechanics.[2,5,19,20] In a series of 45 patients with TB, Anderson reported that in 55.6% the inflammation was thought to be secondary to an associated medical disorder that frequently led to difficulty in diagnosis.[18] These disorders included leg length discrepancies, degenerative disc disease, degenerative joint disease, radiculopathy, pes planus, muscle strains, tendinitis of the external rotators of the hip, lower extremity amputation, previous back or hip surgery, and rheumatoid arthritis.[2,3,21,22] TB has also been attributed to infection, trauma, and crystal deposition.[1,2,23–26] In many instances no cause can be identified.

Of the three bursae usually present around the GT, two are major and one minor.[3,5] The largest bursa, the subgluteus maximus bursa, lies lateral to the GT and deep to the

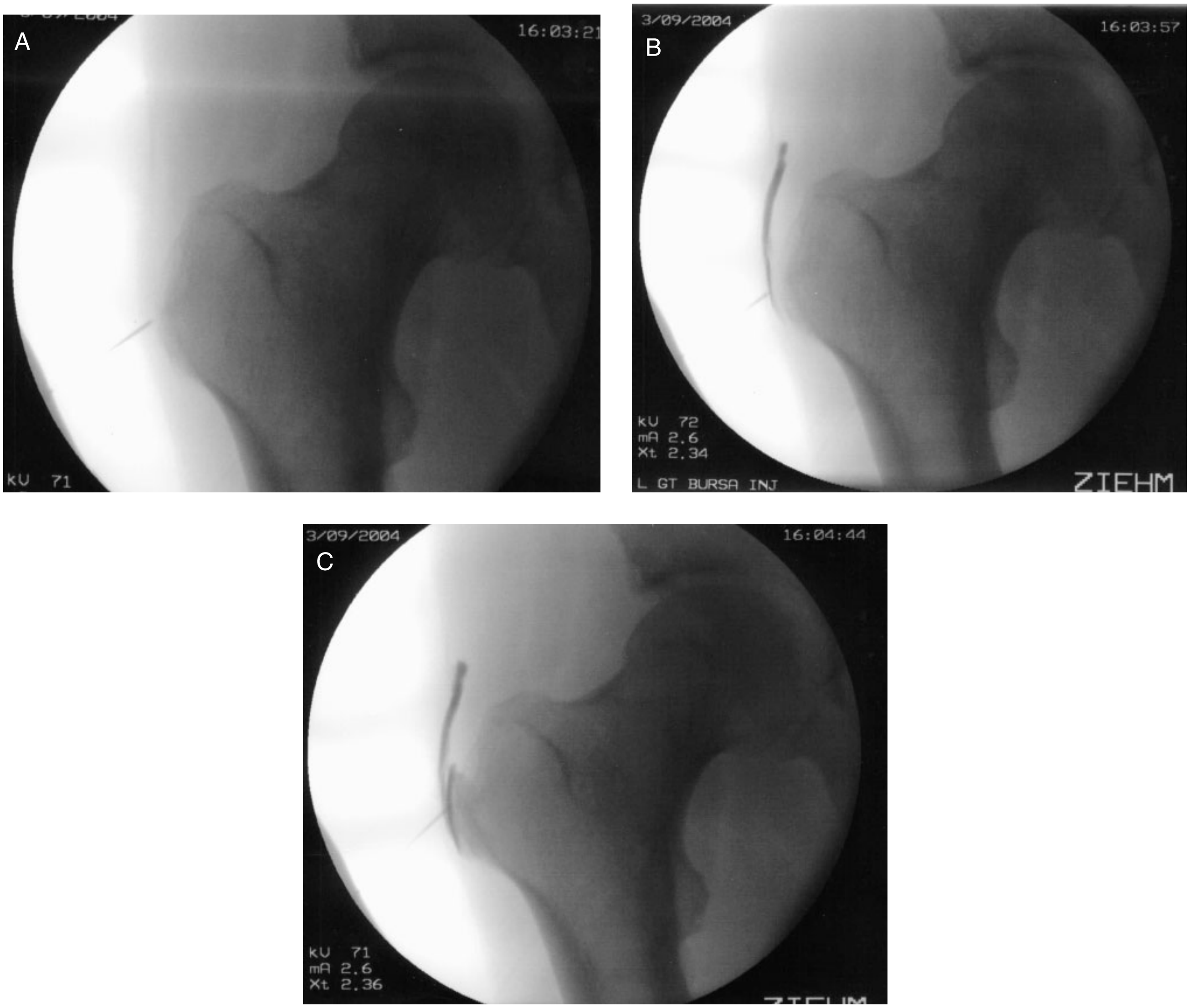

Fig 3 (A) AP radiograph of the right GT showing initial needle placement. (B) AP radiograph showing injection of contrast into a tendon. (C) AP radiograph showing a subgluteus maximus bursagram after slight adjustment of the needle.

converging fibres of the tensor fasciae latae and the gluteus maximus muscle as they join to form the iliotibial tract.[2,5] Separating it from this bony protuberance is the gluteus medius muscle. The other major bursa is the subgluteus medius bursa, which lies beneath the gluteus medius muscle, and is situated superiorly and posteriorly to the GT. The subgluteus minimus bursa lies anterior and superior to the proximal surface of the GT. Although these three bursae are constant, others can sometimes be identified.[2] Inflammation or irritation of any of these bursae can lead to the symptoms of TB.[2,23]

The main finding in this study is that irrespective of the level of training, fluoroscopy was necessary in a majority of patients in order to ensure the spread of injectate into the targeted bursa. The inaccuracy of trochanteric bursa injections was observed across all patient and clinical variables. Not surprisingly, the GT was contacted on the first attempt in 78% of patients. While this finding may seem auspicious at first glance, the ramifications of this bode worse than if the opposite had held true. Missing bone should never result in medication being deposited outside the bursa, as it is obvious that the needle is positioned in the wrong place. The consequences of missing bone are therefore limited to increased procedure-related pain and possibly infection.

A more striking finding was that a bursagram was obtained on the first attempt in only 45% of procedures. As a bursagram was not obtained on the second attempt in any of the nine patients in whom the GT was initially missed, this meant that in 55% of cases where the attending physician was reasonably sure that they were injecting into a bursa, they was actually depositing the medication in the surrounding soft tissue. The consequences of this error are more profound than just increased pain and a nominally

Table 1 Accuracy of trochanteric bursa injections based on demographic and clinical data. Number of attempts includes all needle placements. Obesity defined as BMI >28

	Bursagram on first attempt (*n*=18)	**Bursagram on second attempt (*n*=9)**	**Bursagram on third attempt (*n*=9)**	**Bursagram on ⩾4 attempts (*n*=4)**
Age in yr, mean (SD)	54.7 (13.1)	65.8 (16.0)	67.6 (11.3)	60.8 (18.1)
Duration of pain in yr, mean (SD)	2.0 (1.5)	2.3 (1.7)	2.1 (1.1)	2.7 (1.7)
Right-sided injection (*n*=24)	10	5	6	3
Left-sided injection (*n*=16)	8	4	3	1
Non-obese patients (*n*=32)	15	7	8	2
Obese patients (*n*=8)	3	2	1	2

Table 2 Accuracy of trochanteric bursa injections based on physician's level of training. All residents were PGY 4 or 4 anaesthesia or PGY 4 physical medicine and rehabilitation trainees

	Bursagram on first attempt (*n*=18)	**Bursagram on second attempt (*n*=9)**	**Bursagram on third attempts (*n*=9)**	**Bursagram on ⩾4 attempts (*n*=4)**
Resident (*n*=14)	5 (36%)	3 (21%)	4 (29%)	2 (14%)
Pain Management Fellow (*n*=11)	5 (46%)	3 (27%)	1 (9%)	2 (18%)
Board-Certified Pain Management Attending (*n*=15)	8 (53%)	3 (20%)	4 (27%)	0

increased infection risk. Incorrect injections may not only result in failure to relieve pain, but can also lead to misdiagnosing a treatable condition, the prescribing of unnecessary medications, and peripheral and central sensitization.

Recent studies carried out in pain patients have demonstrated the need for fluoroscopy when performing other therapeutic injections. White and colleagues reported that when experienced physicians performed epidural steroid injections without fluoroscopic guidance, they were successful in entering the epidural space in only 30% of cases.[12] In a study by Fredman and colleagues, the authors found the loss of resistance technique to be a reliable indicator of entry into the epidural space during blinded epidural steroid injections; however, the injected contrast dye reached the area of pathology in only 26% of cases.[11] In a study using computerized tomography to localize anatomically guided sacroiliac joint injections, intra-articular injection was accomplished in only 22% of patients.[16]

There are several reasons why corticosteroid injections performed blindly may miss the targeted area of pathology in patients with TB. First, difficulty palpating landmarks, especially in obese patients, may result in the injectate being deposited into the surrounding soft tissue. In our study, only eight patients had a BMI more than 28, with five requiring more than one attempt to obtain a bursagram. The incidence of obesity in our patients is less than that seen in the general population, and reflects the fact that many of our patients were either active duty or retired military. Although there was a trend toward obese patients needing more injections to obtain correct needle placement (2.9 *vs* 2.0), this difference did not reach statistical significance (P=0.38).

Secondly, referred pain and secondary hyperalgesia may lead to the injection of medicine into tender areas not involved in pain generation. This might be expected in those patients who have suffered pain for long periods of time, in whom peripheral sensitization has developed. In this study, we sought to evaluate this possibility by determining the effect duration of pain had on accuracy. While there was a slight trend towards patients with shorter durations of hip pain requiring fewer injections, this difference did not approach statistical significance.

Finally, inflammation within the bursa can lead to scar tissue and adhesions that impair the spread of injectate. This is more likely to occur in patients with a history of trauma, repeated injections, chronic inflammation and previous surgery. As illustrated in one of our patients who had undergone a hip replacement, previous surgery may even obliterate bursae, making a contained injection impossible. With scar tissue and adhesions, even if the needle is correctly placed, the medication may never reach the area of pathology.

A significant flaw in this study is that all injections were performed by pain management physicians whose primary training was in either anaesthesiology or physical medicine and rehabilitation. Had primary care physicians, who generally have less experience with injections, or orthopaedic surgeons, who have a better understanding of the anatomy and spatial relations of the hip, been included in this study, the findings may have been different.

In conclusion, the results of this study provide preliminary evidence that in the absence of fluid aspiration, radiographic guidance is needed in order to ensure accuracy during trochanteric bursa injections. Our findings are consistent with those of other studies evaluating the use of fluoroscopy for diagnostic and therapeutic injections.

References

1 Roberts WN, Williams RB. Hip pain. *Prim Care* 1988; **15**: 783–93

2 Shbeeb MI, Matteson EL. Trochanteric bursitis (greater trochanter pain syndrome). *Mayo Clin Proc* 1996; **71**: 565–9

3 Schapira D, Nahir M, Scharf Y. Trochanteric bursitis: a common clinical problem. *Arch Phys Med Rehabil* 1986; **67**: 815–7

4 Collee G, Dijkmans BA, Vandenbroucke JP, Rozing PM, Cats A. A clinical epidemiological study in low back pain. Description of two clinical syndromes. *Br J Rheumatol* 1990; **29**: 354–7

5 Raman D, Haslock, I. Trochanteric bursitis—a frequent cause of 'hip' pain in rheumatoid arthritis. *Ann Rheum Dis* 1982; **41**: 602–3

6 Ege Rasmussen KJ, Fano N. Trochanteric bursitis. Treatment by corticosteroid injection. *Scand J Rheumatol* 1985; **14**: 417–20

7 Shbeeb MI, O'Duffy D, Michet CJ jr, O'Fallon WM, Matteson EL. Evaluation of glucocorticosteroid injection for the treatment of trochanteric bursitis. *J Rheumatol* 1996; **23**: 2104–6

8 Gordon EJ. Trochanteric bursitis and tendinitis. *Clin Orthop* 1961; **20**: 193–202

9 Swezey RL. Pseudo-radiculopathy in subacute trochanteric bursitis of the subgluteus maximus bursa. *Arch Phys Med Rehabil* 1976; **57**: 387–90

10 Krout RM, Anderson TP. Trochanteric bursitis: management. *Arch Phys Med Rehabil* 1959; **40**: 8–14

11 Fredman B, Ben Nun M, Zohar E, *et al*. Epidural steroids for treating 'failed back surgery syndrome': is fluoroscopy really necessary? *Anesth Analg* 1999; **88**: 367–72

12 White AH, Derby R, Wynne G. Epidural injections for the diagnosis and treatment of low back pain. *Spine* 1980; **5**: 78–86

13 el-Khoury GY, Ehara S, Weinstein JN, Montgomery WJ, Kathol MH. Epidural steroid injection: a procedure ideally performed with fluoroscopic control. *Radiology* 1988; **168**: 554–7

14 Stojanovic MP, Vu TN, Caneris O, Slezak J, Cohen SP, Sang CN. The role of fluoroscopy in cervical epidural steroid injections: an analysis of contrast dispersal patterns. *Spine* 2002; **27**: 509–14

15 Renfrew DL, Moore TE, Kathol MH, el-Khoury GY, Lemke JH, Walker CW. Correct placement of epidural steroid injections: fluoroscopic guidance and contrast administration. *Am J Neuroradiol* 1991; **12**: 1003–7

16 Rosenberg JM, Quint TJ, de Rosayro AM. Computerized tomographic localization of clinically-guided sacroiliac joint injections. *Clin J Pain* 2000; **16**: 18–21

17 Fishman SM, Caneris OA, Bandman TB, Audette JF, Borsook D. Injection of the piriformis muscle by fluoroscopic and electromyographic guidance. *Reg Anesth Pain Med* 1998; **23**: 554–9

18 Anderson TP. Trochanteric bursitis: diagnostic criteria and clinical significance. *Arch Phys Med Rehabil* 1958; **39**: 617–22

19 Little H. Trochanteric bursitis: a common cause of pelvic girdle pain. *Can Med Assoc J* 1979; **120**: 456–8

20 Scoggin JF 3rd. Common sports injuries seen by the primary care physician. Part II: lower extremity. *Hawaii Med J* 1998; **57**: 502–5

21 Collee G, Dijkmans BA, Vandenbroucke JP, Cats A. Greater trochanteric pain syndrome (trochanteric bursitis) in low back pain. *Scan J Rheumatol* 1991; **20**: 262–6

22 Traycoff RB. 'Pseudotrochanteric bursitis': the differential diagnosis of lateral hip pain. *J Rheumatol* 1991; **18**: 1810–2

23 Gerber JM, Herrin SO. Conservative treatment of calcific trochanteric bursitis. *J Manipulative Physiol Ther* 1994; **17**: 250–2

24 Howard CB, Vinzberg A, Nyskan M, Zirkin H. Aspiration of acute calcerous trochanteric bursitis using ultrasound guidance. *J Clin Ultrasound* 1993; **21**: 45–7

25 Rothenberg RJ. Rheumatic disease aspects of leg length inequality. *Semin Arthritis Rheum* 1988; **17**: 196–205

26 Butcher JD, Salzman KL, Lillegard WA. Lower extremity bursitis. *Am Fam Physician* 1996; **53**: 2317–24