An algorithm to standardise the investigation of the undiagnosed traumatic painful adult hip: results at one year

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ABSTRACT

INTRODUCTION A significant number of adults present to accident and emergency departments with a painful hip following a fall. When plain radiography is non-diagnostic, it has been traditionally difficult to decide on further investigations as rapid access MRI is still unavailable in many NHS hospitals and, therefore, alternative methods of reliable investigation are required.

PATIENTS & METHODS An algorithm was designed for the management of these patients without the availability of MRI investigation. Over a 60-week period, 278 patients were admitted of whom 31 were adult patients with trauma-related hip pain with no fracture on plain radiography.

RESULTS We revealed 42% had fractures of the hip or pelvic girdle. None of the hip fractures deteriorated to a worse prognostic grade during the investigation process and no hip fractures were missed.

CONCLUSIONS This approach towards a challenging diagnostic problem has been successful in identifying all hip fractures, and no fracture has deteriorated to a worse prognostic group.

KEYWORDS

Trauma – Hip – Diagnosis

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Hip pain is a common presenting symptom in the elderly, osteoporotic patient following a fall. Often, the radiograph at the time of presentation will show clear evidence of a fracture of the proximal femur, the common patterns of which are either extracapsular or intracapsular, and will usually occur in a ratio of approximately 1:1. Sometimes, however, although the hip remains painful, a diagnosis is not forthcoming from the radiograph and the dilemma arises of how such patients should be most appropriately managed. In the authors' experience, this is often in an unstructured and inefficient way, ranging from mobilisation to further radiology and, occasionally, direct discharge. As a result, this will lead to wasteful, unnecessary investigations, delayed diagnoses and occasionally missed diagnoses, which may directly affect fracture prognosis. It is a common problem and one which many trauma units will recognise. In the literature addressing this, the suggestion is that rapid-access MRI is most sensitive and cost effective.^{1,2} However, not all hospitals are capable of this idealism without daily magnetic resonance availability. To address this, following consultation, an algorithm was devised for the stepwise investigation of such patients.

Patients & Methods

To address this problem the 'Painful Hip Guidelines' (Fig. 1) were introduced into the orthopaedic and casualty departments and prospectively, over a period of 60 weeks, all adult patients with trauma-related hip pain and no obvious fracture on the admission X-ray, were included. At the daily trauma meeting, the radiographs (AP pelvis and lateral hip) were reported by a consultant radiologist. Patients in whom no fracture was identified were given oral analgesia and attempts were made to mobilise them. The patients' progress was re-assessed at 48 h and if no improvement was seen in mobility, then repeat radiography was performed and again reported by the consultant radiologist. Those patients who failed to improve and had no fracture on repeat radiography provoked further investigation with a radioisotope bone scan. A CT scan was performed only in those patients with an abnormality seen on bone scintigraphy that was not diagnostic. In those patients where mobility improved, further in-patient investigation was halted, but they were subsequently followed up at 2 weeks with repeat radio-

graphy in the out-patient setting. Alternatively, patients departed the algorithm for appropriate management if they were suspected of having a neoplastic process.

Results

Over the 60-week period of this study, 247 patients were admitted with hip fractures, having presented no diagnostic difficulty with radiography. Thirty-one patients, however, did qualify for the algorithm, with a mean age of 83 years (range, 59–96 years) and a sex distribution of 20 females and 11 males. The mean time for establishing a diagnosis in

all patients was 4.5 days (range, 1–14 days) and 5.8 days for patients found to have fractures. The mean orthopaedic in-patient stay was 13 days (range, 1–52 days), which was not altered by the diagnosis.

Diagnoses

Amongst the group of 31 patients, 42% ($n = 13$) had fractures, which were seen in a variety of regions. The hip fractures identified included 4 undisplaced intracapsular fractures and 2 extracapsular fractures. Five of these received operative treatment and one patient was treated conservatively for medical reasons. In addition, 3 patients had fractured pubic

Table 1 Identification of each fracture per investigation

Investigation	Fracture diagnosis
Initial radiographs (31)	1 intertrochanteric fracture #NOF 1 undisplaced intracapsular #NOF 2 pubic rami
Repeat radiographs (22)	1 undisplaced intracapsular #NOF 1 pubic rami
Bone scans (14)	2 undisplaced intracapsular #NOF 1 intertrochanteric #NOF 1 greater trochanteric
CT (5)	3 marginal acetabular 1 sacral alar

#NOF, fracture of neck of femur

rami, 3 had acetabular fractures and one had an isolated greater trochanteric fracture. Sixteen had a diagnosis of degenerative disease or soft tissue injury. Finally, one patient had femoral neuralgia with low back pain and one patient required further investigation for neoplastic disease. In particular, no hip fractures were missed and none changed prognostic grade during this period.

Investigations

We found that a senior review of the admission radiographs of the 31 patients established a diagnosis of fracture in 4 patients (2 pubic rami, 1 intertrochanteric and 1 undisplaced intracapsular fracture of the femoral neck; Table 1). Five of the patients became mobile before the next investigation step. The process of reviewing the repeat radiographs (22 taken in total) taken at 48 h enabled a further definitive fracture diagnosis in 2 patients – 1 pubic ramus and 1 undisplaced intracapsular fracture. Again, six of the patients mobilised and hence did not proceed to the next investigation step. Radioisotope bone scan was performed in less than half of the group of 31 patients ($n = 14$). These scans showed increased isotope uptake in 9 patients. For 5 patients this was due to an arthritic flare and the remaining 4 had fractures (2 undisplaced intracapsular, 1 intertrochanteric and 1 greater trochanteric). Four patients who had normal vascularity of the femoral head, had no evidence of a fracture on their bone scan, strongly suggesting a diagnosis of soft tissue injury. There were 5 remaining patients who had increased uptake on their bone scan which was not diagnostic. Further investigation with a CT scan in this sub-group of patients, revealed fractures in three

patients (2 marginal acetabular fractures and 1 patient had both an acetabular and a sacral alar fracture). One patient with neoplastic disease departed the algorithm for appropriate management, and the remaining patient was found to have an arthritic flare only.

Only 1 new fracture was identified through out-patient follow-up. This patient had been mobile without aids, but had subsequently developed a lapse of mobility through increasing hip pain. This patient had an undisplaced intracapsular fracture of the femoral neck which was treated conservatively.

Few ($n = 2$) patients needed prolonged out-patient follow-up beyond the initial review as they had regained their pre-injury level of mobility, without on-going undue discomfort and hence were discharged. The 2 patients who required further follow-up were both discharged by 4 weeks.

Discussion

It has been suggested that MRI can be used investigate these patients in whom a diagnosis is not immediately forthcoming. The literature suggests that MRI is superior to other imaging modalities;^{1,2} however, like many hospitals, our unit does not have daily MRI availability and hence this unrealistic expectation does not feature in our algorithm.

Bone scintigraphy has previously been described for the investigation of patients in whom the suspicion of a fracture is present, despite normal radiography (Fig 2 & 3).³⁻⁵ This imaging modality may highlight an area of fracture before a radiograph. It has been shown to be a sensitive (93%) and specific (95%) indicator of occult fractures of the proximal femur, provided careful interpretation is made to avoid the

Figure 2. Initial radiograph AP and lateral. The AP picture of the right hip was part of a larger pelvic radiograph. Initial and repeat radiographs showed no evidence of a fracture.

Figure 3 Bone scan. Subsequent bone scan shows linear uptake in the intracapsular region, consistent with a fracture.

diagnostic pitfalls (including false negative scans if performed too early or fractures through avascular bone; false positives with acetabular curtain osteophytes and calcific capsulitis).^{5,6,7} We have not found the problems of fracture displacement with our management method and we believe that an interval radiograph has a valuable role in aiding diagnosis. Furthermore, by designing the guidelines specifically emphasising repeat clinical assessment, significantly fewer patients required the radiation exposure of a bone scan and hence this has made more efficient use of our department's services.

Conclusions

The introduction of this simple algorithm has focused attention on this group of patients in a very productive way.

Investigation and management has become more streamlined and efficient thereby optimising resources. For orthopaedic units without rapid MRI access or patients with contra-indications, we would advocate this methodology. This approach towards a challenging diagnostic problem has been successful in identifying all hip fractures, and no fracture has deteriorated to a worse prognostic group.

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References

1. Pandey R, McNally E, Ali A, Bulstrode C. The role of MRI in the diagnosis of occult hip fractures. *Injury* 1998; **29**: 61–3.
2. Vande Berg BC, Malghem J, Lecouvet FE, Maldague B. Hip imaging: what is the best modality? *J Radiol* 2001; **82**: 373–84.
3. Deutsch SD, Gandsman EJ. The use of bone scanning for the diagnosis and management of musculoskeletal trauma. *Surg Clin North Am* 1983; **63**: 567–85.
4. Fairclough J, Colhoun E, Johnston D, Williams LA. Bone scanning for suspected hip fractures. a prospective study in elderly patients. *J Bone Joint Surg Br* 1987; **69**: 251–3.
5. Stevens SC, Male TA, Turner JH. Pelvic fractures diagnosed by bone scintigraphy in patients with normal radiographs after a fall. *Med J Aust* 1999; **171**: 476–8.
6. Lewis SL, Rees JI, Thomas GV, Williams LA. Pitfalls of bone scintigraphy in suspected hip fractures. *Br J Radiol* 1991; **64**: 403–8.
7. Rizzo PF, Gould ES, Lyden JP, Asnis SE. Diagnosis of occult fractures about the hip: MRI compared with bone scanning. *J Bone Joint Surg Am* 1993; **75**: 1879–80.