Correspondence

We welcome letters to the Editor concerning articles which have recently been published. Such letters will be subject to the usual stages of selection and editing; where appropriate the authors of the original article will be offered the opportunity to reply.

Letters should normally be under 300 words in length, double-spaced throughout, signed by all authors and fully referenced. The edited version will be returned for approval before publication.

Catastrophic failure of the Elite Plus total hip replacement, with a Hylamer acetabulum and Zirconia ceramic femoral head

Sir

I read with interest the article in the July 2002 issue by Norton et al entitled 'Catastrophic failure of the Elite Plus total hip replacement, with a Hylamer acetabulum and Zirconia ceramic femoral head'. The failures in devices are only too seldom analysed in published reports with detailed data.

My interest in the subject derives from a study I am doing on the early history of total hip replacement. As is well known, Charnley's early efforts with acetabular components made of a teflon-like polymer did not succeed, whereas his subsequent use of a polyethylene acetabular component on which his fame rests, was successful. He never reported on his failures, or indeed, on his successes, in detail, and one wonders whether, in failed cases, there was excessive wear and osteolysis as in the cases of Norton et al.

I am informed by polymer chemists that there has been no significant change in the chemistry or the manufacture of polyethylene since 1962. One may infer from Charnley's publications that his initial polyethylene components were machined, and one wonders to what degree wear occurred on the articular surfaces, and whether there was any osteolysis attributable to wear particles.

It is noteworthy that even in the first advertisement of his device in your Journal in 1967, the data supplied by the manufacturer (Thackray) are lacking in the necessary details. Perhaps among the Journal's subscribers there are individuals who, in the interest of history, can contribute relevant details from their personal observations.

J. COHEN, MD, Deputy Editor Emeritus Journal of Bone and Joint Surgery Needham Massachusetts. USA.

1. Norton I, Yarlagadda R, Anderson GH. Catastrophic failure of the Elite Plus total hip replacement, with a Hylamer acetabulum and Zirconia ceramic femoral head. *J Bone Joint Surg [Br]* 2002;84-B:631-5.

©2004 British Editorial Society of Bone and Joint Surgery doi:10.1302/0301-620X.86B1.15006 \$2.00 *J Bone Joint Surg [Br]* 2004;86-B:148-51.

Internal fixation compared with total hip replacement for displaced femoral neck fractures in the elderly

Sir.

I read with interest the article in the April 2003 issued by Tidermark et al¹ entitled 'Internal fixation compared with total hip replacement for displaced femoral neck fractures in the elderly, but would like to clarify certain points.

Firstly, regarding the random allocation of patients, it was mentioned that those with chronic arthritis, either rheumatoid or osteoarthritis, were not considered for internal fixation. Does this mean that the patients ultimately selected in this study had no arthritic changes in the hip joint, and if so, how were they randomised to each study group?

Secondly, in the internal fixation group, I note that all the fractures were reduced by closed manipulation and the reductions were classified as good, fair or poor depending on the persistent displacement or angulation. There was no mention of the percentage of good or poor reductions, or what was done in cases with poor reduction since surgery is bound to be unsuccessful in poorly reduced fractures.

Finally, hemi-arthroplasty still remains an option to be considered, particularly in elderly patients, ² as it is certainly less time-consuming with lower blood loss compared with total hip arthroplasty. While this was considered an option for patients with failed internal fixation, why was it not the first line of treatment in those who were lucid but frail and elderly?

S. KAMATH, Specialist Registrar in Orthopaedics Western Infirmary Glasgow, Scotland.

- Tidermark J, Ponzer S, Svensson O, Søderqvist A, Tørnkvist H. Internal fixation compared with total hip replacement for displaced femoral neck fractures in the elderly. J Bone Joint Surg [Br] 2003; 85-B:380-7
- **2. Rogmark C, Carlsson A, Johnell O, Sernbo I.** A prospective randomised trial of internal fixation versus arthroplasty for displaced fractures of the neck of the femur: functional outcome for 450 patients at two years. *J Bone Joint Surg [Br]* 2002;84-B:183-8.

Author's reply:

Sir,

I thank Mr Kamath for his interest in our paper, and will try to clarify the points he mentions.

Patients with displaced femoral neck fractures and rheumatoid arthritis (RA) should not be considered for internal fixation (IF) due to the increased rate of complications of fracture healing. Radiographically visible osteoarthritis (OA) is extremely rare in patients with femoral neck fractures. In such patients a primary total hip replacement (THR) is usually indicated. In two patients, one in each group, RA was diagnosed post-operatively and accordingly, both patients were excluded. No patient with radiographically visible OA was included.

The results of fracture reduction and screw position are presented in the first paragraph of the results section. The reduction was considered good in 46 of 53 patients (87%) and fair in the remaining seven. The screw position was good in 51 of 53 patients (96%). Our results in the IF group, with 36% complications of fracture healing, compare favourably with those of most studies with a two-year follow-up.

CORRESPONDENCE 149

The secondary arthroplasty procedures were THR in 69% and hemi-arthroplasty in 31%. The main reasons for choosing hemiarthroplasty instead of THR were that the general condition or cognitive function of the patients had deteriorated over time and, to a lesser extent, that opinions vary among surgeons (not all secondary arthroplasties were performed by the study surgeons). This mixture of secondary procedures is one of the main reasons why we performed the separate analysis on all patients with an uneventful outcome at the final follow-up, in order to show the expected outcome if the procedure was successful.

The aim of our study was to evaluate the outcome in the relatively healthy, lucid patient, with independent walking ability coming from independent living conditions, and not to study the very frail. A recent study on the long-term follow-up in active patients comparing IF, hemi-arthroplasty and THR showed that hemi-arthroplasty had the worst outcome and THR the best. However, for the old, frail patients with low functional demands, a hemi-arthroplasty may be the best option.

In summary, we believe that the future treatment algorithms should be related more to the patient than the diagnosis and based on age, functional demands and risk factors (e.g. cognitive dysfunction). The treatment options include IF, unipolar or bipolar arthroplasties and THR. Our study supports the choice of a THR for the active, lucid and independent elderly patient with a displaced fracture of the femoral neck.

J. TIDERMARK, Consultant Orthopaedic Surgeon Stockholm Söder Hospital Stockholm, Sweden.

- 1. Cameron HU. Femoral neck fractures in osteoarthritis of the hip. *Arch Orthop Trauma Surg* 1978;93:87-8.
- 2. Ravikumar KJ, Marsh G. Internal fixation versus hemiarthroplasty versus total hip arthroplasty for displaced subcapital fractures of femur: 13 year results of a prospective randomised study. *Injury* 2000;31:793-7.

Friction burns within the tibia during reaming

Sir.

We have read with interest the article in the May 2002 issue by Giannoudis et al¹ entitled 'Friction burns within the tibia during reaming'. They are the first to show that measuring cortical temperature during reaming is feasible in a clinical study. Performing these studies will elucidate further the pathophysiology of reaming. However, we have some serious concerns about the method used in this paper and the validity of their conclusions.

This method of measuring the heat developed in the cortical wall, while reaming the medullary cavity, has been questioned before. It is a complex matter and no method has been validated and proved reliable so far.

- 1) Bone has limited conductivity. It has been shown before that the presence of thermocouples in a radial position in the cortical wall maximally reflects only 14% of the temperature of the reamer.² Does this mean that a much higher temperature is generated and conducted through reaming than has been shown in this study?
- 2) Probes were positioned 2 mm from the inner side in the cortical wall under fluoroscopic control. The method of fixation is unclear. Were the probes repositioned after every step? Was reaming performed with specific increments? This procedure is different from the standard method previously described,³ and therefore a description of results from separate probes is mandatory.
- 3) The reaming technique has not been discussed. What increment has been used in how many steps, and which diameter nail has been used for which bone? Has the same surgeon performed each operation with great care and sharp reamers? This is not the

case in everyday practice and we assume that a higher temperature is produced when less care and blunt reamers are used.

4) The amount of reaming has not been quantified. True reaming occurs when the reamer has a larger diameter than the medullary cavity, which is not obvious in Figure 1.

The conclusion that reaming induces a transient generation of temperature in the tibia is unsurprising; the authors are the first to describe it in humans. It may be possible to compare different reaming procedures but we are not able to determine the absolute temperature, and whether it is critical for the development of heat-induced necrosis. Most importantly, the safety of reaming with or without a tourniquet cannot be an issue because the absolute temperatures are likely to be much higher than assumed in this article.

J. P. M. FRÖLKE, MD, PhD University Medical Center Nijmegen The Netherlands.

G. C. REELING BROUWER TNO Prins Maurits Laboratory Rijswijk, The Netherlands.

- Giannoudis PV, Snowden S, Matthews SJ, Smye SW, Smith RM. Friction burns within the tibia during reaming. J Bone Joint Surg [Br] 2002;84-B:492-6.
- Frölke JPM, Peters R, Boshuizen K, et al. The assessment of cortical heat during intramedullary reaming of long bones. *Injury* 2001;32: 683-8.
- 3. Müller Chr, Rahn BA, Pfister U, Weller S. Intramedullary pressure, strain on the diaphysis and increase in cortical temperature when reaming the femoral medullary cavity: a comparison of blunt and sharp reamers. *Injury* 1993;24 Suppl 3:22-30.

Author's reply:

Sir

We thank Drs Frölke and Reeling Brouwer for their constructive comments and agree with them that it is difficult to measure accurately the rise in temperature, which occurs during reaming *in vivo*. We are aware of Dr Frölke's previous work¹ in this field and have noted a number of limitations of his recent study.²

In relation to the particular points raised, we would make the following comments.

- 1) Our primary purpose was to measure the temperature of the bone and not the reamer. Furthermore, we believe that the study by Frölke et al, ¹ from which it is concluded that thermocouples in the radial position only measure 14% of the temperature of the reamer, is inaccurate for the reasons outlined in our recent correspondence. ² Therefore, we do not believe that there is a much greater difference between the measured and the actual temperature in the bone using the protocol described in our study.
- 2) The position of the probes relied on a friction fit and there was no evidence of movement during the procedure. There was no further repositioning of the probes during the reaming steps. Reaming was carried out in 5 mm increments. The standard method to which the authors referred is relevant for cadaveric studies and could not be applied *in vivo*. Furthermore, use of many separate probes may be useful but is not practical *in vivo*. We chose to position the probes in the isthmus of the tibia, where the temperature rise is likely to be maximal.
- 3) We agree that blunt reamers and less attention to good surgical practice would generate a higher rise of temperature, but we would hope that neither circumstance would prevail in safe clinical practice.
- 4) The Figure shown in our manuscript illustrates a 9 mm reamer head to demonstrate the experimental set-up. However, in this particular case, reaming up to 12 mm was carried out.

We agree that the *in-vivo* measurements are subject to experimental error. However, we do not believe that the absolute temperature in the bone is likely to be substantially higher than those reported using the protocol described in our study. We conclude,

therefore, that on the basis of the present evidence the application of a tourniquet and reaming 1.5 mm above the required diameter of the nail appears to be safe clinical practice.

P. V. GIANNOUDIS, MD, EEC (Orth) St James's University Hospital Leeds, UK.

- **1. Frölke JPM, Peters R, Boshuizen K, et al.** The assessment of cortical heat during intramedullary reaming of long bones. *Injury* 2001;32: 683-8
- Giannoudis PV, Snowden S, Smye SW. The assessment of cortical heat during intramedullary reaming of long bones. Letter to the editor. *Injury* 2003; in press.

Turn-up bone flap for lengthening the below-knee amputation stump

Sir.

I read with interest the article in the March 2003 issue by Pant and Younge¹ entitled 'Turn-up bone flap for lengthening the below-knee amputation stump'.

My main concerns are in the technique of fixation, especially following the previous failed reconstruction, where the bone quality is likely to be poor due to disuse osteoporosis. The authors, in their discussion, concluded that four out of five patients had a simple fixation device like a staple or cerclage wire. I would appreciate it if they could comment on the following:

- 1) whether this was supplemented with plaster?;
- 2) how long did it take for the bone to heal?;
- 3) what was the knee function?

S. RAJA, MS Orth, FRCS Whalley Lancashire, UK.

 Pant R, Younge D. Turn-up bone flap for lengthening the below-knee amputation stump. J Bone Joint Surg [Br] 2003;85-B:171-3.

Author's reply:

Sir,

We thank Mr Raja for his comments and would like to reply to his questions, as follows:

- 1) Regarding the minimal fixation, we initially thought that a short-locking, intramedullary nail or a plate would be necessary, but access to the part of the flap with bone was a little difficult so we used wires only:
- 2) They all healed quickly, within six to eight weeks or less, with plaster splinting for about three weeks. We think that this was because the patients were young and the bone surfaces were wide and cancellous, i.e. just below the knee joint at one end and just above the ankle at the other. They healed exactly like a high tibial osteotomy in a young person. Certainly, a compression plate could be placed easily on each side, and we have no objection to this, but think it unnecessary;
- 3) Knee function was almost exactly the same as in any normal, below-knee amputation. One patient lacked about 20° of full flexion.

This is a useful salvage operation which can be used after major loss of tibial shaft. It gives a very good, below-knee amputation stump, using a technique easily peformed by any orthopaedic surgeon. It is just a long, posterior flap, leaving the distal tibia attached.

D. YOUNGE, MD, FRCS (C) The United Arab Emirates University Al Ain, United Arab Emirates.

Hyperbaric oxygen therapy as a treatment for stage-I avascular necrosis of the femoral head

Sir,

I read with interest the article in the April 2003 issue by Reis et al¹ entitled 'Hyperbaric oxygen therapy as a treatment for stage-I avascular necrosis of the femoral head'. The authors report very successful results of hyperbaric oxygen therapy for the early stage of avascular necrosis (AVN), but the illustrations suggest that the diagnostic criteria of the authors might be incorrect because they show very typical MR findings of a subchondral stress fracture.

Subchondral stress fracture of the femoral head (SSFFH) is an infrequent cause of hip pain that has been described in recent literature. Most cases have occurred as an insufficiency stress fracture in elderly, osteoporotic people or recipients of renal transplants.²⁻⁷ Visuri⁸ suggested that it can occur as a fatigue stress fracture in young, healthy people and I am currently preparing a manuscript describing seven cases of SSFFH which occurred as a fatigue stress fracture in military recruits. SSFFH heals without collapse simply by avoidance of weight-bearing if it is detected early. Therefore, the differential diagnosis from AVN or transient osteoporosis is important.

The illustrations of MR scans in the article show inner, low-signal and outer, high-signal intensity lines in the subchondral region, as seen in a subchondral fracture (MR crescent sign). The authors describe the lines as a double line sign. However, the double line sign, a typical finding of early AVN in T2-weighted images, means inner, high-signal and outer, low-signal intensity lines which correlate with the reactive zone at the outer margin of a necrotic lesion. AVN, but, there must also be an abnormal signal intensity band representing the outer margin of the necrotic lesion. AVN, but, there must also be an abnormal signal intensity band representing the outer margin of the necrotic lesion. AVN, but, there must also be an abnormal signal intensity band representing the outer margin of the necrotic lesion. AVN, but, there must also be an abnormal signal intensity band representing the outer margin of the necrotic lesion.

H. J. KIM, MD Seoul National University Hospital Korea.

- **1. Reis ND, Schwartz O, Militianu D, et al.** Hyperbaric oxygen therapy as a treatment for stage-I avascular necrosis of the femoral head. *J Bone Joint Surg [Br]* 2003;85-B:371-5.
- Vande Berg BC, Malghem J, Goffin EJ, Duprez TP, Maldague BE. Transient epiphyseal lesions in renal transplant recipients: presumed insufficiency stress fractures. *Radiology* 1994;191:403-7.
- Bangil M, Soubrier M, Dubost J-J, et al. Subchondral insufficiency fracture of the femoral head. Rev Rhum Engl Ed 1996;63:859-61.
- Rafii M, Mitnick H, Klug J, Firooznia H. Insufficiency fracture of the femoral head: MR imaging in three patients. AJR 1997;168:159-63.
- **5. Yamamoto T, Bullough PG.** Subchondral insufficiency fracture of the femoral head: a differential diagnosis in acute onset of coxarthrosis in the elderly. *Arthritis Rheum* 1999;42:2719-23.
- Yamamoto T, Schneider R, Bullough PG. Subchondral insufficiency fracture of the femoral head: histopathologic correlation with MRI. Skeletal Radiol 2001;30:247-54.
- **7. Buttaro M, Della Valle G, Morandi A, et al.** Insufficiency subchondral fracture of the femoral head: report of 4 cases and review of the literature. *J Arthroplasty* 2003;18:377-82.
- **8. Visuri T.** Stress osteopathy of the femoral head: 10 military recruits followed for 5-11 years. *Acta Orthop Scand* 1997;68:138-41.
- **9. Mitchell DG, Joseph PM, Fallon M, et al.** Chemical-shift MR imaging of the femoral head: an in vitro study of normal hips and hips with avascular necrosis. *AJR* 1987;148:1159-64.
- Mitchell DG, Rao VM, Dalinka MK, et al. Femoral head avascular necrosis: correlation of MR imaging, radiographic staging, radionuclide imaging, and clinical findings. *Radiology* 1987;162:709-15.
- **11. Jergesen HE, Lang P, Moseley M, Genant HK.** Histologic correlation in magnetic resonance imaging of femoral head osteonecrosis. *Clin Orthop* 1990;253:150-63.

CORRESPONDENCE 151

- 12. Vande Berg BE, Malghem JJ, Labaisse MA, Noel HM, Maldague BE. MR imaging of avascular necrosis and transient marrow edema of the femoral head. *RadioGraphics* 1993;13:501-20.
- **13. Kim Y-M, Oh HC, Kim HJ.** The pattern of bone marrow oedema on MRI in osteonecrosis of the femoral head. *J Bone Joint Surg [Br]* 2000; 82-B:837-41.
- **14. Glimcher MJ, Kenzora JE.** The biology of osteonecrosis of the human femoral head and its clinical implications (3 parts). *Clin Orthop* 1979; 138:284-309; 139:283-312; 140:273-312.
- **15. Sakamoto M, Shimizu K, Iida S, Akita T, Moriya H.** Osteonecrosis of the femoral head: a prospective study with MRI. *J Bone Joint Surg* [Br] 1997;79-B:213-9.

Author's reply:

Sir

We thank Dr Kim for his comments concerning the 'double line' sign, which are no doubt correct. Perhaps we should have been chary of using the term 'double line' sign. We have always considdered the high resonance outer delineating line in the T2 MR image as denoting an hyperaemic oedematous reaction around the necrotic lesion. This 'double line' appears early, while a reverse 'double line' in which the inner necrotic lesion gives high resonance is a later phenomenon. Much confusion surrounds these appearances on MRI, but we defer to Dr Kim in his definition of the pathognomonic sign.

We agree with him that his early 'double line' is due to a subchondral fracture, since we believe that all symptomatic grade I avascular necrosis (AVN) lesions have fractures. This is the only way to explain the pain which is rapidly relieved by non-weight-bearing. The only other possible cause for pain would be synovitis and this is not present. Hence, we consider that symptomatic AVN and a subchondral fracture are always co-existent. In our view, the cause of the symptoms in AVN is a fatigue fracture in normal (idiopathic?) or pathological bone (steroids, alcohol, chemotherapy, haemoglobinopathy, etc). Thus, there is no mistake in diagnosis as Dr Kim postulates.

Our paper concentrates on the results of the hyperbaric oxygen treatment for these early lesions. We have not expressed our view on the pathogenesis of AVN.

N. D. REIS, FRCSE Elisha Hospital Haifa, Israel.

Linear sebaceous naevus syndrome and resistant rickets

Sir.

We read with interest the article in the May 2003 issue by Hosalker et al¹ entitled 'Linear sebaceous naevus syndrome and resistant rickets'.

The first patient (case 1) is now being followed up at our hospital. The authors mentioned that when he was discharged after follow-up he was walking independently. Unfortunately, he is not doing as well as we had hoped.

He presented to us at 12 years of age having outgrown his Rush nail. He had a right tibia recurvatum deformity with extrusion of the Rush nail from the bone and a leg length discrepancy of 6 cm. Since then, he has undergone revision of the Rush nails in both tibiae and an epiphysiodesis of the upper left tibia. The bone quality of the tibiae has always been poor due to his disease and stress shielding. Despite bone grafting of the right tibia at the time of repeating nailing, the bone quality remains poor. He is now 16-years-old and prefers full-time use of a wheelchair, which is fortuitous because the management of fractures of his tibiae would be exceedingly complex. Needless to say, his compliance with medical treatment has been appalling.

B. GUHAN, Clinical Fellow R. D. D. DUNCAN, Consultant Orthopaedic Surgeon Royal Hospital for Sick Children Glasgow, Scotland.

1. Hosalker HS, Jones DH, Offiah A, Hall C. Linear sebaceous naevus syndrome and resistant rickets. *J Bone Joint Surg [Br]* 2003; 85-B: 578-83.

Author's reply:

Sir

We thank Messrs Guhan and Duncan for describing a finding, which is gradually becoming apparent to us. Their patient (our case 1) is deteriorating after initial good progress. The lack of compliance with medical treatment is also noted.

Case 3 in our series is generally doing well and is compliant with treatment because of his gastrostomy. He is also fully weight-bearing on his left lower limb. However, his right lower limb, now straight after nailing of the femur and tibia, has major shortening with growth plate disturbance. This could not be equalised surgically. We are therefore committed to an extension prosthesis with possible surgery to accommodate this.

The long-term outcome of the skeletal problems associated with linear sebaceous naevus syndrome (LSNS) is likely to be less optimistic than originally thought. Only longer term follow-up, continued hopefully with the experiences of others who have treated the condition, will give us more reliable information.

We would be very interested to hear of experiences of the skeletal problems associated with LSNS.

D. H. JONES, FRCS, FRCS Ed (Orth) Great Ormond Street Hospital for Children London, UK.