A series of four fractured Exeter™ stems in hip arthroplasty

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ABSTRACT

We describe the cases of four patients who presented with painful hips and were found to have fractured cemented Exeter™ V40™ stems. Failure was multifactorial. Fractured Exeter™ stems are rarely reported and this series raises a concern that a population of patients may be at risk of such morbidity.

KEYWORDS

Arthroplasty – Exeter™ hip – Stem failure

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The Exeter™ Universal cemented femoral component (Stryker, Newbury, UK) is currently the most commonly used cemented total hip replacement (THR) prosthesis in the UK.¹ Historically, there have been few reports of fracture of the femoral component unless related to revision or older component design.^{2,3} We have treated four patients who presented with fracture of their Exeter™ V40™ femoral component.

Case 1

A 69-year-old woman (102kg, 152cm, body mass index (BMI): 44kg/m²) presented with a 7-week history of pain in her thigh 5 years following a right THR (Exeter™ V40™ 35.5mm congenital dysplasia of the hip [CDH] stem with a standard 26mm femoral head and 46mm polyethylene cemented cup) with good outcome. After seven weeks of conservative management, radiography demonstrated a stem fractured in the middle third of the body (Fig 1). Revision surgery comprised a femoral osteotomy, replacement of the femoral component (Restoration™ PS [Stryker] distal stem 11mm x 127mm straight, 21mm x 0mm body, +4mm 26mm diameter head) and cerclage wiring (Cable-Ready® Cable Grip System; Zimmer, Swindon, UK) of the osteotomy. The acetabular component was left in situ. The stem was returned to the manufacturer, where analysis demonstrated failure had been due to metal fatigue.

Case 2

A 48-year-old man (98kg, 172cm, BMI 33kg/m²) presented with a 1-month history of right thigh pain 10 years follow-

ing a right THR (Exeter™ V40™ 44mm no 1 stem) that was performed as a revision procedure from a thrust plate. Radiography demonstrated a right THR with eccentric wear of the acetabular liner. There was a fracture through the calcar, significant bone loss at the greater trochanter and a fracture through the body of the femoral component. He underwent revision of both components (Restoration™ 14mm x 155mm conical distal stem, 21mm x +10mm cone body, +4mm 32mm diameter ceramic head, Trident® [Stryker] titanium 54mm shell and ceramic liner). This was achieved with a femoral osteotomy and the use of cerclage wires.

Case 3

A 57-year-old man (110kg, 182cm, BMI 34kg/m²) was seen 4 years following a right THR (Exeter™ V40™ 44mm no 0 stem, 28mm standard head, BiomEx™ [Biomet, Swindon, UK] 58mm cup with standard polyethylene liner) with a 4-month history of groin pain. Radiography taken when the pain first began appeared normal. However, repeat radiography showed a displaced, fractured stem (Fig 2). This was treated conservatively due to advanced hepatocellular cancer.

Case 4

A 64-year-old man (111kg, 154cm, BMI 47kg/m²) presented 2 years following a right THR (Exeter™ V40™ 35.5mm CDH stem, +4mm head, 48mm cup) with a 5-day history of sudden onset right groin pain. Surgical records stated that the femoral canal would only accept a 35.5mm component at his original surgery. Radiography demonstrated a fracture

Figure 1 Anteroposterior radiography of the right hip of case 1 (taken on presentation to the outpatient department), demonstrating stem fracture

of the femoral stem (Fig 3). Revision was carried out via a window in the femur using a cement-in-cement technique (CPT® [Zimmer] size 0 extended offset with a +3.5mm head, acetabular component unchanged).

Discussion

To our knowledge, this is the first paper describing a series of femoral stem fractures relating to the Exeter™ V40™ prosthesis. The Exeter™ stem is a cemented, double tapered, highly polished stainless steel femoral stem and has been a popular hip replacement in the UK over the past ten years. Despite the highly successful nature of this implant,¹ the significance of failure should not be underestimated as revision surgery carries significant risk of morbidity and mortality.

Risk factors for stem breakage can be divided into patient or implant factors. Patient factors include weight, bone density, age and activity level. Factors affecting the implant such as cementing technique and a small cross-sectional area of the stem can also contribute to failure.

Failure in our series occurred between 2 and 10 years, and was multifactorial, with no one factor identified as causative. All four patients had elevated BMIs (with weights above 88kg), described as a risk factor for fracture.⁴ Harrington *et al* investigated the effects of multiple factors in

Figure 2 Anteroposterior radiography of the hips of case 3 (taken when seen in the outpatient department), demonstrating right stem fracture

Figure 3 Anteroposterior radiography of the hips of case 4 (taken when seen in the outpatient department), demonstrating right stem fracture

loosening of cemented femoral stems.⁵ They found that body weight had the largest effect on the peak strain of the proximal cement mantle and postulated that cemented femoral stems should not be used in heavy patients with small medullary canals who require a small stem as this leads to high cement stresses. In case 2, there was significant bone loss around the calcar and in the other three cases, neck cuts were felt to be low. However, the Exeter™ surgical guide states that the level of the femoral neck resection is unimportant and does not stipulate a maximum weight limit for the stem.⁶

Another factor leading to potential failure is incorrect stem size. Cristofolini *et al* compared optimal and undersized Exeter™ V40™ stems in vitro, and recognised that undersizing led to micromotion and failure due to crack formation in the proximal cement mantle.⁷ It is not uncommon to find that the size of the femoral canal at the time of surgery will only accept a prosthesis that does not provide enough strength for the load placed on it. In the primary hips in our series, offset was reproduced in all cases and stems were all as large as could be accommodated by the narrow femoral canals present in the patients. While stems were small, they were not felt to be undersized.

Conclusions

We have described a series of fractured Exeter™ stems (three following primary hip and one following revision surgery) that presented to a single institution performing approximately 400 hip arthroplasties a year from a population of 160,000. The three primary hip replacements were considered to have lower neck cuts and the revision hip case had poor proximal support due to bone loss following the first revision procedure. All patients were obese and no

stems were considered undersized although stems in the primary hip replacements were small. We believe that failure is multifactorial. The failure of smaller stems in obese patients is worrying and there may be a population of patients at risk of failure in the future.

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