



■ TRAUMA

Caring for patients with periprosthetic femoral fractures across England and Wales in 2021

RESULTS OF THE NATIONAL HIP FRACTURE DATABASE FACILITIES AUDIT

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Aims

The aim of this study was to describe services available to patients with periprosthetic femoral fracture (PPFF) in England and Wales, with focus on variation between centres and areas for care improvement.

Methods

This work used data freely available from the National Hip Fracture Database (NHFD) facilities survey in 2021, which asked 21 questions about the care of patients with PPFFs, and nine relating to clinical decision-making around a hypothetical case.

Results

Of 174 centres contributing data to the NHFD, 161 provided full responses and 139 submitted data on PPFF. Lack of resources was cited as the main reason for not submitting data. Surgeon (44.6%) and theatre (29.7%) availability were reported as the primary reasons for surgical delay beyond 36 hours. Less than half had a formal process for a specialist surgeon to operate on PPFF at least every other day. The median number of specialist surgeons at each centre was four (interquartile range (IQR) 3 to 6) for PPFF around both hips and knees. Around one-third of centres reported having one dedicated theatre list per week. The routine discussion of patients with PPFF at local and regional multidisciplinary team meetings was lower than that for all-cause revision arthroplasties. Six centres reported transferring all patients with PPFF around a hip joint to another centre for surgery, and this was an occasional practice for a further 34. The management of the hypothetical clinical scenario was varied, with 75 centres proposing ORIF, 35 suggested revision surgery and 48 proposed a combination of both revision and fixation.

Conclusion

There is considerable variation in both the organization of PPFF services England and Wales, and in the approach taken to an individual case. The rising incidence of PPFF and complexity of these patients highlight the need for pathway development. The adoption of networks may reduce variability and improve outcomes for patients with PPFF.

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Introduction

A periprosthetic fracture is one associated with an implant,¹ and in the femur this can occur around a joint arthroplasty or fracture fixation device. Their management is challenging; being influenced by fracture

location, implant stability, host bone stock, and functional status.²

Patients who sustain this injury are living longer, more active lives. Coupled with advances in arthroplasty, this has created a dramatic increase in the number of

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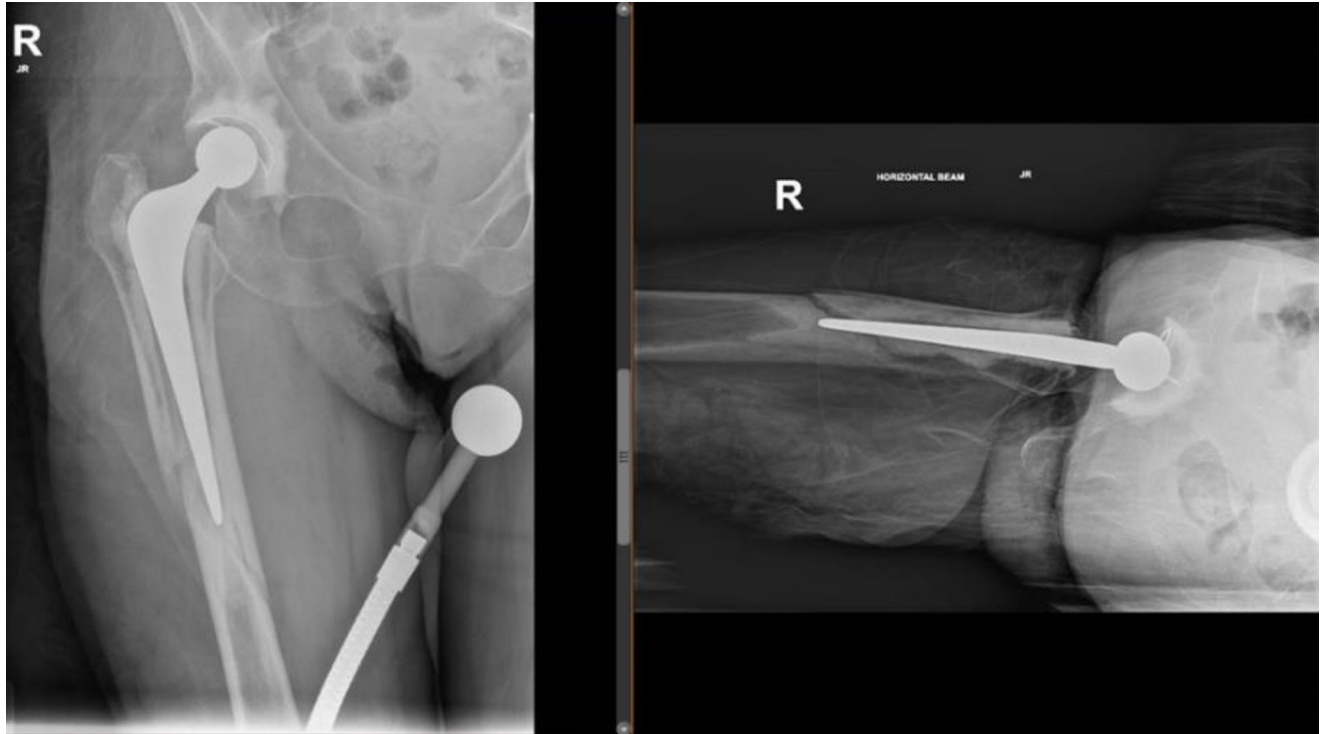


Fig. 1

Anteroposterior and lateral radiographs of a Vancouver 2B fracture around a cemented, taper-slip stem, with well-fixed bone-cement interface, used for the hypothetical clinical case.

individuals living with, and demanding more of, orthopaedic implants.³ As a result, the estimated incidence of periprosthetic femoral fractures (PPFFs) has been reported as rising by as much as 13% each year between 2015 and 2018.⁴ Despite this increasing incidence, research around PPFF remains in its infancy due to availability of accurate data. To date, the services available to patients who experience PPFF in the UK, and the variation between individual hospitals, has not been quantified.

Where surgery is indicated, options for PPFF include revision arthroplasty, open reduction internal fixation (ORIF), or a combination of both. Surgery for PPFF is technically complex, expensive, and places significant physiological demand on a predominantly frail cohort of patients.⁵⁻⁷ For patients, the impact of PPFF can be devastating, with associated loss of independence and inpatient mortality of 4.3% to 11%.^{4,6,7}

The National Hip Fracture Database (NHFD) is a national quality improvement project and part of the Falls and Fragility Fracture Audit Programme delivered by the Royal College of Physicians.⁸ It allows care of patients to be audited using evidence-based performance indicators and enables local healthcare providers to benchmark their performance against national data. In 2020, the NHFD started collecting data on patients admitted with non-hip femoral fractures including PPFF. In addition to the core audit activity, the NHFD also circulates an annual

Facilities Survey with the aim of better understanding the provision of care at centres around the country. The focus of the 2021 Facilities Survey was PPFF and results of this survey are available for download on the NHFD website.

Using these open access data, we aimed to describe the services available to patients with PPFF in England and Wales, focusing on variation between centres and areas for potential improvement.

Methods

Study design and data sources. This is a nationally conducted snapshot survey to evaluate the care of patients with PPFF in England and Wales. It uses open access data from the 2021 Facilities Survey which is available for download from the NHFD's website. Electronic surveys (Supplementary Material) were sent to all orthopaedic trauma hospitals in England and Wales that contribute to the NHFD and completed by multidisciplinary teams involving professionals from across the hip fracture care pathway. Respondents were asked to answer in the context of their normal practice or standard policy. We also asked that data provided were agreed by the lead orthopaedic and orthogeriatric consultants within each unit.

Study outcomes. The questionnaire comprised 21 questions related to the organization of PPFF services, including data capture, preoperative care, planning, surgical capability, and transfer of patients. A further nine questions

Table I. Percentage of centres discussing patients with periprosthetic femoral fracture at local and regional multidisciplinary team meeting by joint.

Variable, n (%)	Preoperative only	Postoperative only	Pre- and postoperative	Not routinely discussed
PPFF around THA				
Local MDT	62 (38.5)	7 (4.3)	71 (44.1)	21 (13.0)
Regional MDT	23 (14.5)	13 (8.2)	17 (10.7)	106 (66.7)
PPFF around TKA				
Local MDT	63 (39.1)	7 (4.3)	71 (44.1)	20 (12.4)
Regional MDT	23 (14.5)	13 (8.2)	17 (10.7)	106 (66.7)

MDT, multidisciplinary team meeting; PPFF, periprosthetic femoral fracture; THA, total hip arthroplasty; TKA, total knee arthroplasty.

related to the hypothetical case of an 82-year-old female with a reducible, Vancouver 2B periprosthetic hip fracture around a cemented, taper-slip stem, with a well-fixed bone-cement interface (Figure 1; Supplementary Material).^{9,10} Units were asked to comment on decision-making including proposed treatment modality, implant or fixation device, kit availability, surgeon speciality, need for transfer, joint aspiration, and postoperative weight-bearing status. Questions were predominantly single best answer with free text available to expand some answers.

Statistical analysis. Given the descriptive nature of this study, no attempt was made to make statistical comparisons between groups of patients. Data are presented as raw figures, medians with interquartile ranges (IQRs), and percentages.

Results

Data capture. Of the 174 centres that contribute data to the NHFD, 161 (92.5%) provided full responses. Of these, 153 (94.4%) were aware of the requirement to record PPFF in the mandatory national audit and 139 (85.8%) stated that they contribute data. The reasons for not reporting such data were reported as: lack of local resources (n = 8), lack of a Best Practice Tariff payment for PPFF (n = 3), and lack of patients (n = 1).

Preoperative care. A total of 134 centres (82.7%) reported routine senior (speciality trainee/registrar or above) orthogeriatric review for all patients admitted with a PPFF. Surgeon (n = 66; 41.0%) and theatre (n = 44; 27.3%) availability were more frequently listed as reasons for surgical delay beyond 36 hours than kit availability (n = 23; 15.6%) or patient optimization (n = 15; 9.8%).

Surgical capability. The median number of consultant or specialty and associate specialist grade surgeons who operate on trauma patients at each centre was 14 (IQR 11 to 18). The median number who would feel comfortable performing either revision or fixation of a PPFF occurring around both hip and knee implants was reported as just 4 (IQR 3 to 6). A total of 65 (40.4%) and 61 (37.9%) centres reported a formal process, or rota, whereby a specialist surgeon is available to operate on hip and knee PPFFs at least every other weekday. A total of 44 (37.9%) and 42 (27.3%) centres reported having at least one nominated, dedicated theatre list for urgent primary, urgent revision

or periprosthetic fractures each week for hip and knee cases, respectively.

Perioperative planning. Overall, 128 centres (79.5%) reported the routine discussion of patients requiring revision hip arthroplasty (any aetiology) at a local multidisciplinary team (MDT) meeting, and 86 (53.4%) reported discussion at a regional meeting. Similarly, 124 (77.0%) and 87 (54.0%) centres reported local and regional MDT meetings to discuss patients for revision knee arthroplasty. The routine discussion of patients with PPFF at local and regional MDT meetings was lower than that of all-cause revision arthroplasties and is summarized in Table I.

Transfer of patients with PPFF. One-quarter of centres 40 (24.5%) reported transferring patients with a PPFF around a hip joint to other trusts. The majority (n = 34; 82.4%) did so only occasionally, but six did so exclusively. Of the 34 centres (21.0%) that reported transferring patients with PPFF around a knee joint, 28 (78.6%) did so occasionally, and six did so exclusively. Only a minority of centres (six for each hip and knee respectively) transferred patients directly from the emergency department. In contrast, 16 centres (9.9%) reported occasional (n = 15) or exclusive (n = 1) transfer for patients with native hip fractures. A total of 43 centres (26.5%) reported receiving patients from other centres with PPFF around both hips and knees respectively (Table II). Of these, only 12 (38.7%) reported using a formal referral pathway, with the remainder transferred on an ad hoc basis. In contrast, 34 centres (21.0%) reported receiving patients from other centres with native hip fractures, either as a formalized process (n = 11), or on an ad hoc basis (n = 23).

Clinical scenario. Questions around the clinical scenario (an 82-year-old woman with a reducible, Vancouver 2B fracture around a cemented, taper-slip stem THA, with well-fixed bone-cement interface) were completed by 158 centres. ORIF with the existing stem was the most frequently proposed treatment strategy (n = 75; 47.5%). Revision surgery, or a combination of both revision and fixation, was proposed by 35 (22.2%) and 48 (30.4%) centres, respectively. There was considerable variation in the proposed combinations of implants and plates used (Supplementary Table i and Supplementary Figure a). Most centres (n = 129; 81.6%) stated that their proposed system would be available to use "on the shelf" (Table III).

Table II. Number and percentage of centres receiving patients with periprosthetic femoral fractures from other centres and nature of referral pathway.

Fracture, n (%)	Ad hoc	Formalized process/policy	Total
PPFF around THA	31 (19.1)	12 (7.4)	43 (26.5)
PPFF around TKA	31 (19.1)	12 (7.4)	43 (26.5)
Native hip fracture	23 (14.2)	11 (6.8)	34 (21.0)

PPFF, periprosthetic femoral fracture; THA, total hip arthroplasty; TKA, total knee arthroplasty.

Table III. Availability of proposed implant and/or fixation plate.

Availability, n (%)	ORIF	Revision	Revision and ORIF	Total
On the shelf	67 (42.4)	27 (17.1)	35 (22.2)	129 (81.6)
Loan from the company	7 (4.4)	8 (5.1)	11 (7.0)	26 (16.5)
Loan from other local hospital	1 (0.6)	0 (0)	2 (1.3)	3 (1.9)

ORIF, open reduction and internal fixation.

A total of 152 centres (95.6%) reported that they would manage the patient in their own hospital, whereas four (2.5%) and three (1.8%) stated that they would transfer the patient to either a local specialist centre or another hospital site within the same trust, respectively. Most centres (n = 144; 90.6%) stated that the operation would be conducted by a hip specialist with revision practice, as opposed to the general orthopaedic trauma surgeon on call (n = 15; 9.4%). Only 14 centres (8.8%) reported that they would routinely aspirate the joint prior to revision or fixation. Following surgery, 110 centres (69.2%) stated that they would allow patients to mobilize fully weight-bearing. Partial weightbearing and non-weightbearing were suggested by 47 (29.6%) and two (1.3%) centres, respectively.

Discussion

This study is the first to comprehensively describe the services available to patients with PPFF in England and Wales. Most centres (85.8%) submit data on patients with PPFF to the NHFD, with lack of resources cited as the primary reason for omission. Surgeon (44.6%) and theatre (29.7%) availability were reported as the primary reasons for surgical delay beyond 36 hours. Less than half reported a formal process whereby a specialist surgeon would be available to operate on PPFF at least every other day, and around one-third of centres reported having one dedicated theatre list per week. The routine discussion of patients with PPFF at local and regional MDT meetings was lower than that of all-cause revision arthroplasties. The transfer of patients with PPFF around the hip or knee to other centres, on either an occasional or exclusive basis, is common (24.5% and 21.0% of centres, respectively). The clinical scenario highlighted considerable variation in surgical decision-making and implant use between centres. These data demonstrate the variation in services delivered across England and Wales and highlight the need for greater standardization of care.

The rising burden of PPFF has fuelled a growing interest in its research. However, the incidence and management of these injuries in England and Wales remain poorly understood due to inadequate data capture.^{4,11} Researchers have attempted to use both the National Joint Registry (NJR) and International Classification of Diseases 10th Revision (ICD-10) codes to estimate the incidence of PPFF in the UK with limited success.^{4,11} The recent addition of these injuries to the NHFD aims to provide a more accurate assessment.⁸ However, to date, the current services available to patients with PPFF and the variation between centres have not been evaluated. The Facilities Survey provides insight into these areas and with it, valuable context to the main audit. For example, the NHFD audit identified that in 2021, only 26% of patients with PPFF underwent surgery within 36 hours.¹² From the Facilities Survey, respondents identified surgeon and theatre availability as the primary and secondary reasons for surgical delay. Given the potential increased mortality associated with surgical delay in this population,¹³ such information has important implications for orthopaedic workforce planning, service design, and infrastructure. Similarly, recently published guidelines from the British Hip Society (BHS) on the management of fractures around THAs state that all patients should be entered into the NHFD.¹⁴ While 85.8% of centres stated that they do contribute data, the main audit demonstrates that the number of patients contributed by each centre is highly variable (one to 101).¹² In the current study, lack of resources was identified as a common cause for omission. Centres should therefore aim to provide further administrative support in this area.

Patients with PPFF are complex, requiring input from specialist surgeons, orthogeriatric, nursing, and rehabilitation teams. Both our data and the main audit suggest good compliance with guidance that patients with PPFF should undergo senior medical review prior to surgery.¹² We found an average of four surgeons at

each centre who felt confident in the management of PPF around each hips and knees, with less than half of centres capable of supporting PPF surgery at least every other day. In the post-COVID-19 era, it is important to note that these same surgeons and theatres are required to tackle backlogs in elective arthroplasty surgery.¹⁵ For this reason, among others, a proportion of arthroplasty surgeons may be unavailable for the management of trauma patients. Given the limited resources available, a network-based approach may provide the concentration of skills and facilities required.¹⁶ Indeed, there is a drive towards a hub and spoke model for elective revision TKA and THA, with different approaches suggested by the British Association for Surgery of the Knee (BASK) and the BHS.^{17–19} Application of such models to PPF, i.e. trauma, would present distinctive challenges to elective surgery and to our knowledge, its clinical and economic implications have not been fully evaluated in practice. One such consideration would be the impact of hospital transfer on time to surgery. While direct emergency department to emergency department transfers (as is the case for open fractures and major trauma) could minimize waiting times, the transfer of patients admitted to a ward may further exacerbate preoperative delays. The BHS's PPF guidelines advocate consideration of transfer to regional centres depending on available local surgical skills, equipment, and high-level medical support.¹⁴ In the current study, 24.5% and 21.0% of centres reported transferring patients to other centres on either an occasional or exclusive basis, indicating that this, to an extent, is already happening. Importantly however, we are unable to comment on the overall proportion of patients that are transferred.

In practice, it may not be practical or necessary to transfer all patients. However, the discussion of such patients at local and regional MDTs should be encouraged.¹⁴ In the current study, only 14.3% of centres reported the routine discussion of patients with PPF regionally. In the absence of networks, care providers should aim to ensure that dedicated pathways for these patients are in place and minimize variation between centres. For patients with native hip fractures, eligibility for best practice tariff (BPT) payments (a national price paid to providers designed to incentivize high-quality and cost-effective care) has resulted in improved care and better outcomes for patients in England.²⁰ Patients with PPF are not currently eligible for the BPT payments, and in future incentivization of good practice might help reduce variation between centres and provide the financial means to support changes in care pathways.

Responses to the clinical scenario highlight considerable variation in the approach to the management of PPF between centres. BHS guidelines state that PPF fractures should be classified according to the Unified Classification System modification of the Vancouver Classification

which guides treatment options.⁹ Typically, B1 fractures are treated with ORIF, B2 fractures are treated with revision to a longer-stemmed prosthesis, and B3 fractures are treated with revision and augmentation of bone stock in the young, or proximal femoral arthroplasty in the elderly.²¹ BHS guidelines also state that cemented stems should be further classified using the B2W (where the cement is well-fixed to the bone) and B2L (where the cement is loose) modification.¹⁰ For patients with B2W fractures around polished, taper slip stems, cement-in-cement revision has demonstrated good outcomes, with reduced operating time and need for destructive cement removal when compared with revision.^{10,22} Meanwhile, The Edinburgh group have demonstrated that these patients can also be treated with ORIF.²³ They have also shown reduced need for blood transfusion and lower risk of further revision surgery compared with revision arthroplasty.²³ The variation in treatment approaches and implant selection highlighted in the current study reflect uncertainty in the published literature and the need for further comparative studies within the field.

The high response rate of this national study is a key strength that helps to provide a representative overview of PPF services in England and Wales. However, the study has several limitations. As with all surveys, the accuracy of data is dependent upon that of the responses and is vulnerable to potential recall bias. To minimize this, respondents were asked to answer in the context of their normal practice or standard policy. In addition, although we asked that data provided were agreed by both the lead orthopaedic and orthogeriatric consultants within each unit, we cannot reliably confirm that this was done. Therefore, we are unable to determine the extent to which responses were discussed within specialist teams. The current study focused on peri-prosthetic fractures of the femur specifically. The inclusion of fractures around acetabular and/or tibial components would likely highlight even greater disparities in care, and we recognize their value in future work. Finally, we did not attempt to assess the outcomes of patients with PPF and therefore make no attempt to influence treatment decisions.

In future, we encourage those involved in the care of patients with PPF to contribute data to the NHFD and other endeavours which aim to strengthen the evidence base underpinning this condition. A key step in improving the value of research in the field, will be defining what success looks like for PPF. The development of a core outcome set for this population would contribute to such improvement and would facilitate evidence synthesis. It is also important to define which outcomes matter to patients so that research priorities can be set.

There is considerable variation in the care delivered to patients with PPF in England and Wales. Given the rising incidence of PPF, and the complexity of the patients that obtain them, service providers should prioritize the care of such patients and ensure dedicated pathways are in

place. Extension of financial incentives to these patients, and the adoption of PPF networks, may reduce variability and ultimately improve outcomes for patients with these injuries. Further research should aim to identify which outcomes are important to patients, and which treatment methods are best placed to achieve them.



Take home message

- There is considerable variation in both the organization of periprosthetic femoral fracture (PPFF) services England and Wales, and in the approach taken to an individual case.
- The rising incidence of PPFs and the complexity of these patients highlights the need for pathway development.

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Supplementary material



The electronic survey sent to all orthopaedic trauma hospitals in England and Wales; as well as a table and figure demonstrating variation in the proposed combinations of implants and plates used.

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- D. S. Inman: Conceptualization, Investigation, Writing – review & editing.
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