Meeting Proceedings

OPEN

Geriatric proximal femur fracture updates

Vincenzo Giordano, MD, PhD, FBCS[a,b], Pierre Marie Woolley, MD[c], Martin J. Heetveld, MD, PhD[d,e], Carla S. Smith, MD, PhD[f,*], Victor de Ridder, MD[g]

Abstract Proximal femur fractures in the aging population present a variety of challenges. Physiologically, patients incurring this fracture are typically frail, with significant medical comorbidities, yet require early surgical treatment to restore mobility to prevent deterioration. Socioeconomically, the occurrence of a fragility fracture may be the beginning of the loss of independence, and the burdens of rehabilitation and support are borne by the individual patient and health care systems.

Keywords: geriatric fracture, hip fracture, proximal femur

Biomechanically, achieving fracture reduction with restoration of normal anatomy is challenging, as is maintaining stable fixation that allows early mobilization.

Although outnumbered in total incidence by distal radius and proximal humerus fractures, patients with proximal femur fractures incur greater morbidity and mortality and cost to health care systems and themselves.[1,2] Presented are 3 aspects of proximal femur fracture (PFF) care: a summary of the latest overall approach to the care of geriatric patients incurring PFF; a novel approach to surgical treatment of PFFs; and the impact on care of National Hip Fracture Registries. These summarize presentations from the Orthopaedic Trauma Association (OTA) International Trauma Care Forum October 2022.

1. A Summary of the Latest Overall Approach to the Care of Patients Incurring PFF

In this section, we summarize the current recommendations for categorization of patients as "geriatric" and discuss perioperative management, implant selection, postoperative care, and rehabilitation for such patients. The explosion of literature with respect to PFFs in the geriatric patient in the past decade underscores the interest in this injury and increasing understanding of the components of the care of these patients. A team approach with input from multiple specialties including medical, geriatric, anesthesia, orthopaedic, nutrition and social work optimize outcomes for these increasingly frail patients. Avoiding unnecessary preoperative testing, expedient surgery, and appropriate implant choice all contribute to offsetting the morbidity and mortality of this injury.[3–5]

As the worldwide burden of hip fractures has increased, it has galvanized research into novel implants for better biomechanical purchase, better medical treatment of comorbidities, and the creation of centers of excellence with standardized protocols. The population growth predicted in the next few decades is likely to impact low- and middle-income countries (LMICs) disproportionately and with that the cost of high-impact fractures such as geriatric PFFs. Novel approaches such as the Surgical Implant Generation Network (SIGN) Hip Construct present options with multiple benefits. Originally designed for the tibia, the SIGN nail has been incorporated into a construct to address the PFF. Benefits of this approach include the ability to use the construct in lower resourced environments without c-arm, minimization of inventory, and lower overall cost of the implants.[6–8] Implant costs have been shown to be a significant driver of cost of care in many systems.[9] We describe the SIGN hip construct implementation in Haiti and promising early outcome studies from other LMICs.

One benefit of increasing numbers of patients with PFFs is the ability to create large databases and the opportunity to use the resulting data to improve outcomes, standardization, and care. We demonstrate one such example using the Dutch Hip Fracture Audit to show how sharing of data and transparency to benchmark outcomes at individual local hospitals and to improve overall care. Such large-scale data sets with increasingly detailed data will surely help improve the future care of patients with PFFs.

2. Section 1: Proximal Femur Fracture Fixation in the Elderly Population: What is New?

2.1. Background

As noted above, PFFs place increasing demands on health care systems worldwide.

It is estimated that approximately 30% of these patients will die in the first year after the fracture, and the rest will experience

None of the authors has a conflict of interest nor have they received funding.

[a] Serviço de Ortopedia e Traumatologia, Prof. Nova Monteiro—Hospital Municipal Miguel Couto, Rio de Janeiro, Brazil, [b] Clínica São Vicente—Rede D'or São Luiz, Rio de Janeiro, Brazil, [c] Department of Orthopaedic Hopital, Universitaire de La Paix HUP, Port au Prince, Haiti, [d] Spaarne Gasthuis, Haarlem, The Netherlands, [e] Department of Trauma Surgery, Spaarne Gasthuis, AK Haarlem, The Netherlands, [f] St Lukes Orthopedics, Boise, ID, [g] Emergency Care and Logistics, Trauma and Pediatric Trauma University Medical Center Utrecht, Utrecht, Netherlands

** Corresponding author. Address: St Lukes Orthopedics, Boise, 5084 Snowberry Lane, Victor, ID 83455. E-mail address: carlasmithxc@gmail.com (C. S. Smith).*

OTAI (2024) e323

Received: 7 September 2023 / Received in final form: 26 December 2023 / Accepted: 28 December 2023
Published online 3 May 2024

http://dx.doi.org/10.1097/OI9.0000000000000323

continuous repercussions from the disease that will directly and negatively affect their physical and mental quality of life.[4,5] In this scenario, perioperative management must be handled attentively to avoid complications and decrease mortality rates, and orthogeriatric comanagement has been proven successful to improve medical and surgical outcomes.[4]

2.2. Who Can Be Called "Geriatric"?

Medical research often defines a person as elderly when they are aged 65 years or older; however, there is no consensual definition of aging.[10,11] In addition to chronological age, other factors must be considered to define the elderly patient.[12] Therefore, based on the expected age-associated decline in physiological reserve and function in various organ systems, with increased vulnerability to adverse health outcomes and increased risk of falling, nowadays the most accepted definition of a geriatric patient is as a patient older than 80 years or a patient with typical geriatric multimorbidity in combination with an age older than 70 years.[12] Indeed, some literature has been shown that patients with PFFs experience multiple overlapping geriatric nutritional problems, such as undernutrition, sarcopenia, and frailty at hospital admission, which significantly affects on disability and the occurrence of complications after a hip fracture.[12,13] As a result, between 40% and 60% of patients with PFFs will be able to recover their prefracture level of independence (mobility and ability to perform activities of daily living) 1 year after injury.[11]

2.3. Perioperative Management

Comprehensive geriatric assessment (CGA) helps to identify treatable geriatric conditions.[13] CGA is a coordinated, multidisciplinary collaboration that assesses the medical, psychosocial, and functional capabilities and limitations of an older person, with the goal of establishing a treatment plan and long-term follow-up.[13] One of the most important aspects of CGA after acute hospital admission is minimizing the use of medications prone to causing delirium and adjusting dosing for geriatric syndromes, as well as adequate pain management.[13,14] There is consistent evidence that effective pain management reduces the risk of delirium and peripheral nerve blocks may be considered in these patients before and after the surgical procedure. Recent literature demonstrates improvement in the mobility of persons with hip fracture, facilitating rehabilitation protocols and reducing PFF-related complications.[14]

Approximately 40% of elderly patients presenting with a PFF receive anticoagulant or antiplatelet therapy. Early surgery may be safe, and no bridging therapy is generally recommended; however, some of these drugs requires reversal before surgical intervention.[15,16] Managing anticoagulants and antiplatelets requires close coordination according to the CGA. In addition, basic versus routine laboratory tests should be discussed on a case-by-case basis. For these patients, surgery is the lifeline, and unnecessary preoperative examinations must be avoided.[17]

2.4. Femoral Neck Fracture

Hip arthroplasty is preferable to all femoral neck fractures, even when the fracture is initially nondisplaced.[9] If the surgeon prefers osteosynthesis in nondisplaced fractures, the patient should be aware of the increased risk of avascular necrosis (AVN) and pseudarthrosis (Fig. 1). Although the choice between hemi or total hip arthroplasty (THA) for management of femoral neck fracture is controversial, it seems that THA is better for the healthy, active elderly patient.[18] Cemented femoral stem leads to better fixation in osteoporotic bone while the acetabular component can be either noncemented or cemented (Fig. 2).[18]

2.5. Intertrochanteric Femur Fracture

Intertrochanteric femur fractures (IT fractures) in very elderly patients are preferably treated with cephalomedullary nails.[19,20] Utilization of an intermediate-length nail appears to be an effective treatment option for repair of intertrochanteric femur fractures (Fig. 3).[19] In the decision between a cephalic screw or a helical blade, Chapman et al showed that the use of a helical blade is associated with a higher rate of fracture collapse and concomitant screw cut-out.[21] In severely osteoporotic patients, cement augmentation has been demonstrating fewer complications and reoperations and shorter hospital stay at the expense of a slightly longer operation duration.[20]

Despite improving surgical techniques and implants, fixation failures such as cut-out and cut-through still occur in elderly osteoporotic patients. In these patients, revision fixation with cement augmentation has been shown a safe, cost-effective alternative to arthroplasty when the femoral head defect is limited, and there is no acetabular damage due to the cephalic screw or blade (Fig. 4).[21]

2.6. Postoperative Management

2.6.1. In-Hospital

Comanagement care for pain control and early mobilization reduce complications such as pneumonia, thromboembolism, pressure ulcers, and delirium. Pharmacological prophylaxis of deep venous thrombosis (DVT) with LMWH (low molecular weight heparin) is preferable.[15] The peripheral block has proven to be a valuable adjuvant measure to minimize delirium and

Figure 1. A, AP radiographic view of the right hip and coronal, sagittal, and axial computed tomographic views showing the femur displaced into varus and retroversion of a 70-year-old male patient, who sustained a displaced right femoral neck fracture after falling from a sitting position. B, AP and Lauenstein radiographic views after 6-year follow-up of hybrid THA (cemented stem, noncemented acetabular cup). Harris Hip Score of 93.

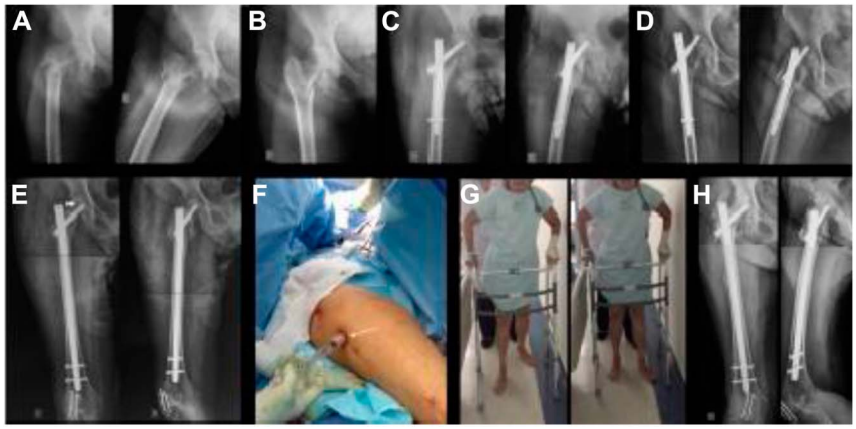

Figure 2. A, AP and Lequesne-DeSéze false profile radiographic views of the right hip of an 85-year-old healthly (<2 comorbidities) female patient, who sustained a displaced right intertrochanteric hip fracture after falling to the ground. B, After a fascia iliac block, AP radiographic view of the right hip with traction and internal rotation was performed. C, Immediate postoperative AP and Lauenstein radiographic views of the right hip. Despite the adequate reduction, note that the cephalic screw is slightly superior. D, AP and Lauenstein radiographic views of the right hip after 45 days show screw cut-out. Femoral head was judged adequate for a reosteosynthesis. E, Immediate AP and Lauenstein radiographic views of the right hip after reosteosynthesis with a long augmented cephalomedullary nail. Small arrows show bone cement filling also the area of the cut-out at the femoral head. F, Clinical intraoperative photograph demonstrating the insertion of the bone cement for augmentation. G, Clinical immediate postoperative photographs of the patient during physical therapy protocol. H, AP and Lauenstein radiographic views of the right hip after 1 year demonstrating adequate fracture healing, with mild heterotopic ossification (Brooker et al grade 3). Harris hip score of 80.

accelerate the physiotherapy rehabilitation process and hospital discharge.[14] Early mobilization led to a 2-fold increase in the adjusted odds of discharge by 30 days postoperatively. Weight bearing should be allowed as tolerated. At discharge, DVT prophylaxis either with LMWH, oral anti-Xa agents or aspirin and pain control are recommended.[15,16] Adjustment of pain control using multimodal pain management strategies without opioid is preferable. If not possible, it is necessary to have a plan for reduction and discontinuation of opioids as the acute pain resolves.

2.6.1.1. At Home/Nursing Home

Patient must be followed closely in the outpatient clinic with clinical and imaging examinations. Adoption of the "rehabilitation nutrition" concept protocol has been demonstrating improvement in sarcopenic frail patients.[10] Osteoporosis treatment and fall prevention should be done.[4,5] Finally, DVT prophylaxis should be continued for at least 28 days.[4,15]

2.7. Summary

PPFs in the elderly individuals have a negative impact on quality of life, with elevated 1-year morbidity and mortality rates. Avoiding unnecessary preoperative examinations speeds up surgery. Cemented arthroplasty is preferable for femoral neck fractures and, cephalomedullary nails are preferable for IT fractures. Comanagement care improves medical and surgical outcomes and reduces complications.

3. A Novel Approach to Surgical Treatment of PFF

Low- and middle-income countries often lack the financial capabilities to use standard implants used in high-income countries. The Sign Hip Construct (SHC) surgical technique was specifically developed to address this issue in these difficult settings.[7,8,22] The purpose of this novel technique is to treat all extra articular hip

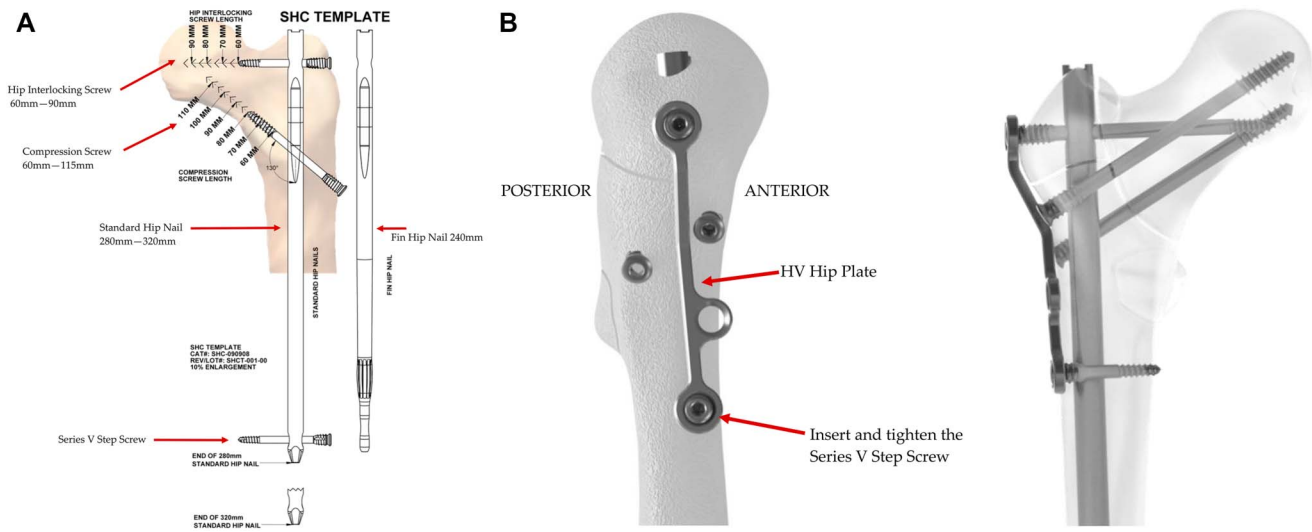

Figure 3. Templating and configuration of SIGN hip construct. A, Template. B, Final Construct.

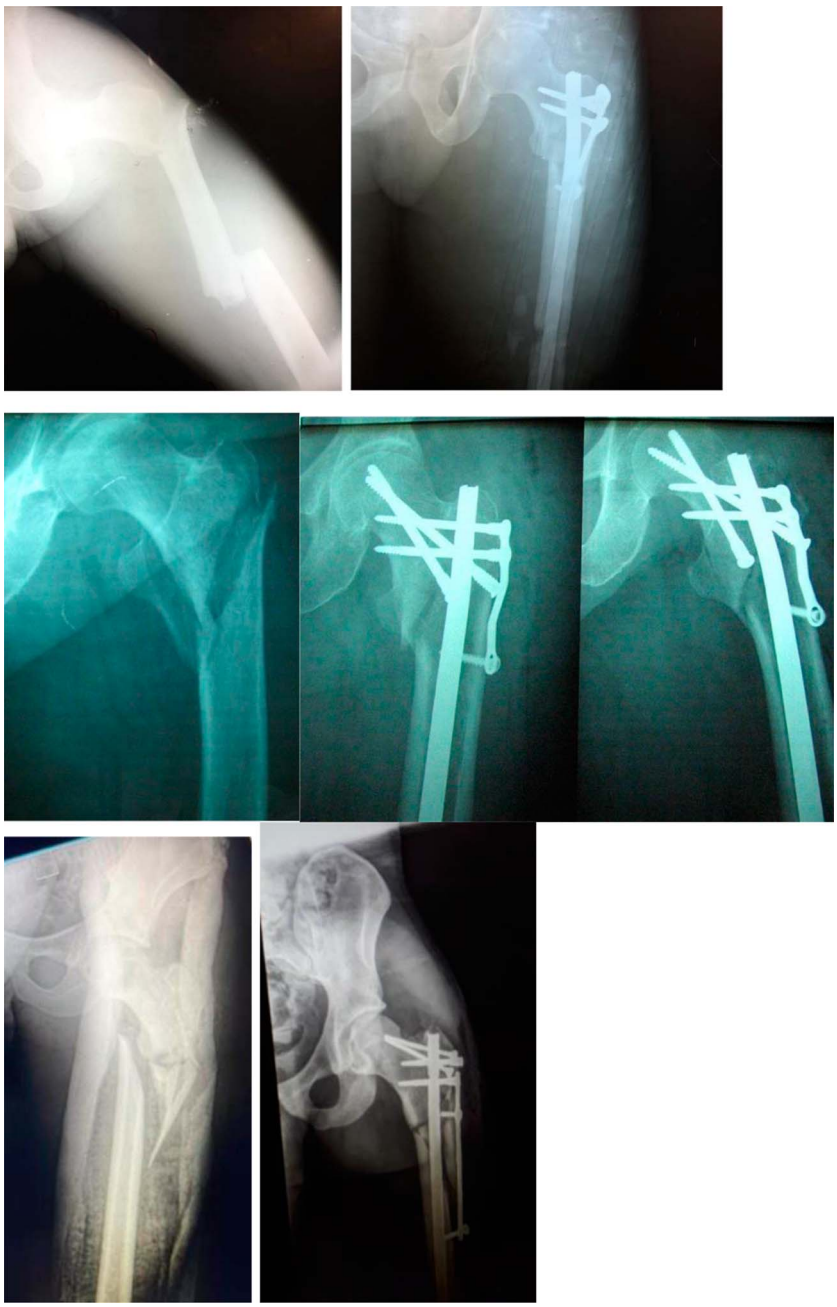

Figure 4. SIGN hip constructs.

fracture patterns as defined in standard classifications: AO/OTA 31 (stable or unstable) without the use of fluoroscopy. The principle of the technique is to maximize compression at the fracture site and like other hip fracture systems have a stable construct for optimal result. The goal was to have early mobilization and return to function while the fracture heals biologically.

The technique requires a template of the uninjured side to give the surgeon a precise idea of screw placements, measure the appropriate length of the screws, and have a general idea of fracture reduction and surgical approach. The next step of the procedure is prebending the lateral wall side plate also known as HV plate system on the back table. This will help to reduce surgical time while allowing for final adjustments to be made during surgery. The technique itself consist of the use of an intra medullary nail (SIGN HIP Construct or SHC) through a trochanteric entry point with the addition of the lateral wall side plate and independent screws for maximum compression and stability.[6–8] The stages of the technique are as follows: The patient is positioned on a standard operating table in the lateral position (avoiding varus). Manual traction and reduction techniques are used. The first step is placement of the anterior compression screws at the tension side. This is followed by placement of the IM nail with target arm attached for anteversion control and then placement of the distal interlock screw. Once this is completed, proximal fixation is achieved through a single or double interlocking screw with 2 independent compression screws and the addition of the lateral wall plate if needed depending on the fracture pattern and specific characteristic. There are multiple

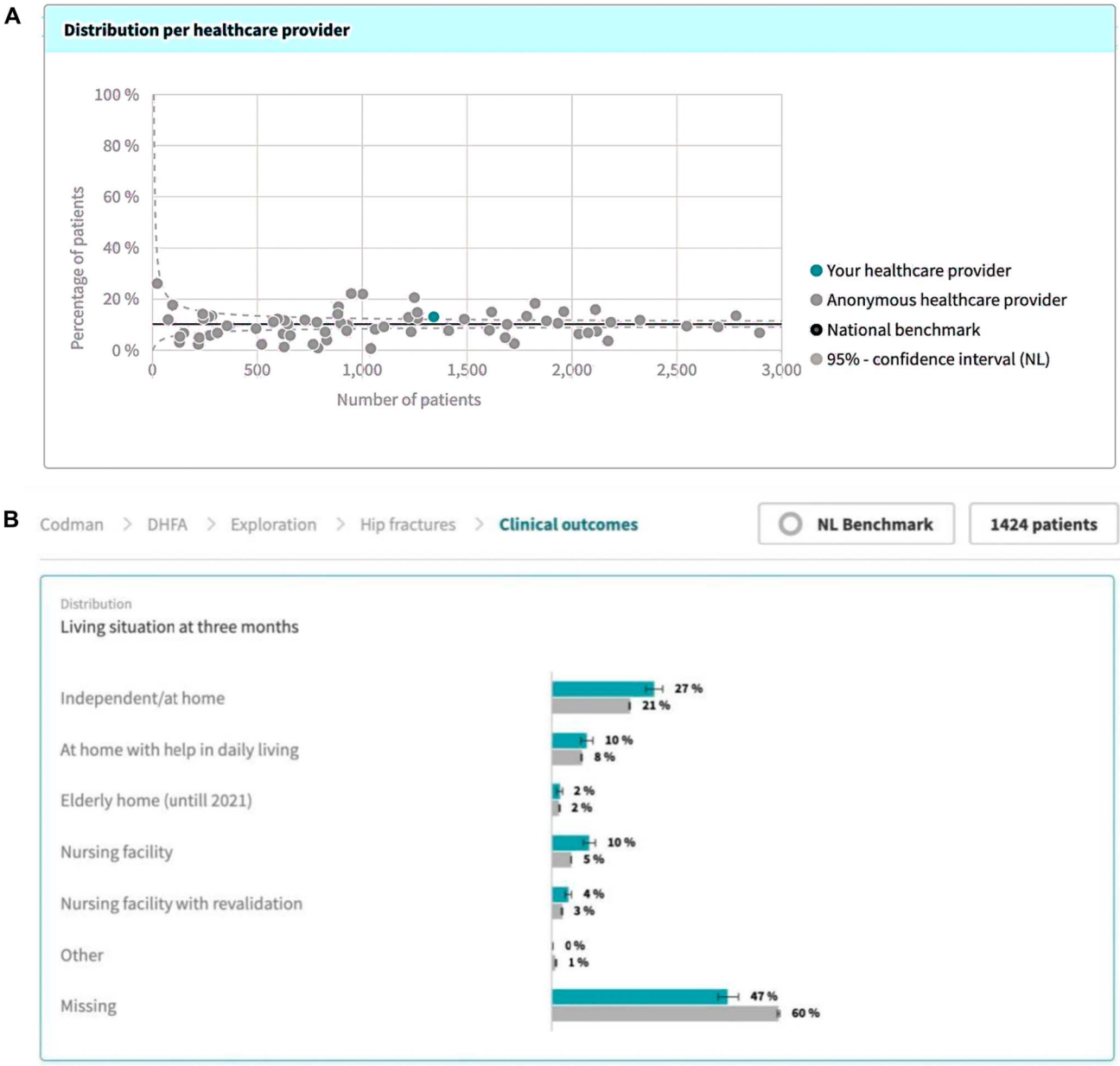

Figure 5. A, Comparison with national benchmark and funnel plot for delirium care. B, Living status locally (top bar) and national benchmark (bottom bar) at 3-month follow-up. C, Mobility locally (top bar) and national benchmark (bottom bar) at 3-month follow-up. Source: DICA (Dutch Institute Clinical Auditing) Dutch Hip Fracture Audit.

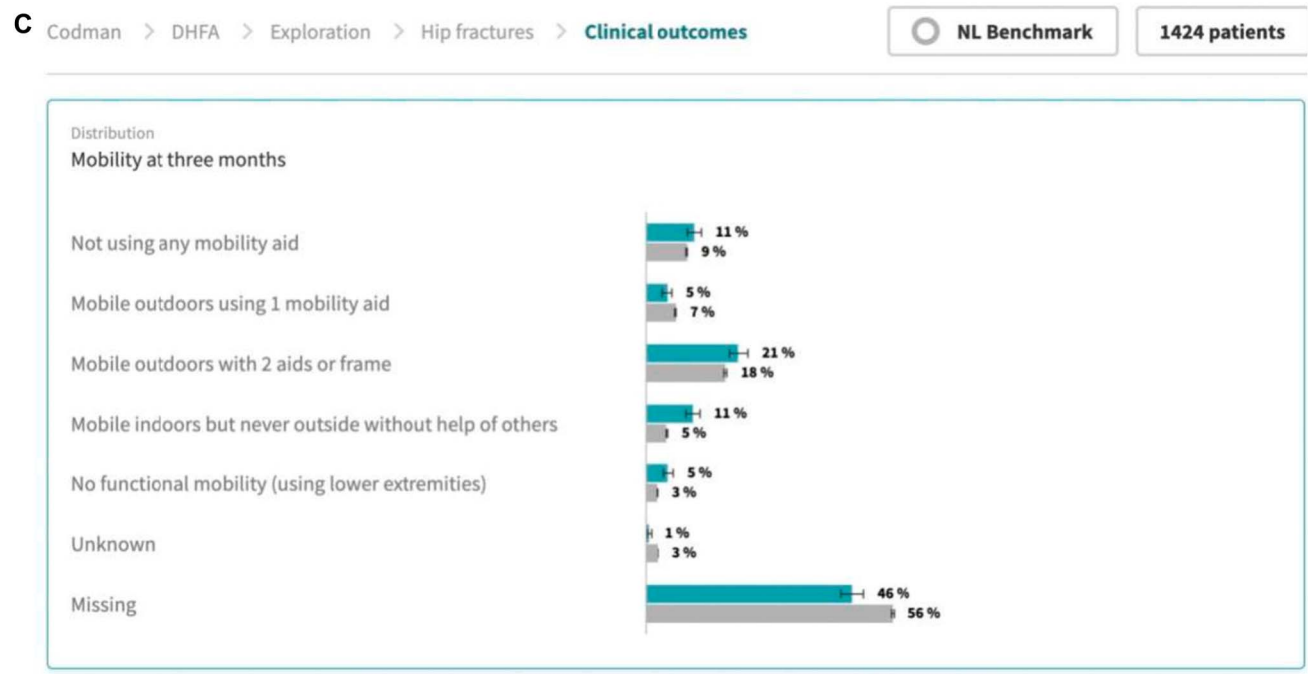

Figure 5. (Continued)

variations of surgical fixations depending on the fracture pattern and complexity. Additional screws can be added depending on the fracture type. In the postoperative phase for maximizing stability return to function, we emphasize clear instruction for weight bearing as tolerated and principles of auto protection. Passive hip and knee PT protocols are started at day 1 postoperatively with full weight bearing as tolerated at 6–8 weeks or after clinical and radiographic signs of healing. It is our experience that preoperative planning and good surgical technique is key to achieve optimal results for this technique. As this is a relatively new technique design for a specific context, there are very few studies in the literature. In conclusion, in the absence of more standardized implants and without image intensifier, PFF can be successfully treated with this technique in LMICs where resources are often very limited.[22–24] This represents a lower cost alternative for this common fracture pattern.

4. Impact on Care of National Hip Fracture Registries

Many developed countries have implemented National Hip Fracture Databases to serve as collective databases for further research and improve quality of care on a national and local level. Missing data should be limited as much as possible to provide reliable feedback. Hip fracture registries improve guideline adherence, uniformity in treatment, and patient outcomes through benchmarking.[25–27] This section focuses on how a national registry can help improve local care.

The Dutch Hip Fracture Audit is a multidisciplinary participation of trauma and orthopaedic surgeons, geriatric, and rehabilitation specialists, all mandated by their associations. Data verification using other available databases is organized by the registry host. The registry went online in 2016 and contains around 80,000 patients and data from 64 (96%) hospitals. It includes a 3-month follow-up with patient-reported living and mobility status. Local mobility status before admission and at 3-month follow-up is a transparent parameter which is available to the health care inspection in The Netherlands.

The Dutch Audit data show that 46% of patients with hip fracture age >18 years were fully mobile, and 55% were not dependent on any care before the hip fracture occurred. Sixty-five percent were discharged to a rehabilitation clinic. Sixty percent of societal costs of hip fracture treatment therefore occurred out of hospital.[28]

Local drivers for quality-of-care improvement are immediate mobilization, complication reduction (delirium prevention, nutritional intake), geriatric cocare within a geriatric trauma unit, falls prevention, and osteoporosis management, improving independent living status and mobility at 3 months with a shorter rehabilitation clinic stay. The Codman dashboard of the registry provides funnel plots with each hospital as an anonymous dot on the plot. Outliers outside the funnel may be identified. Local data are compared with the national benchmark. An example of delirium care is shown in Figure 5A. Follow-up data at 3 months regarding independent living status and mobility are provided in Figures 5B and C. As obtaining correct data for the 3-month follow-up is still evolving, these examples still show too much missing data.

Precise surgical technique according to guidelines, geriatric trauma unit care, and focused physiotherapy may lead to more and sooner independent living with less societal cost of rehabilitation. In addition, more mobility which translates into less invalidity and probably less pain may be achieved. The audit 3-month follow-up data offer real-time opportunity to follow any progress which is made by changes to care in a given hospital. Hospitals may choose to share their data with other clinics in the region with permission from the respective boards. This offers an opportunity to learn from better practices and to adapt local care if necessary. This transparency in sharing registry data benefits hip fracture care.

5. Conclusion

Geriatric proximal femur fractures will continue to present challenges in management and volume: Here, we summarize some of the various work relevant to the management, optimization, and potential cost-effective strategies for fixation of these injures.

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