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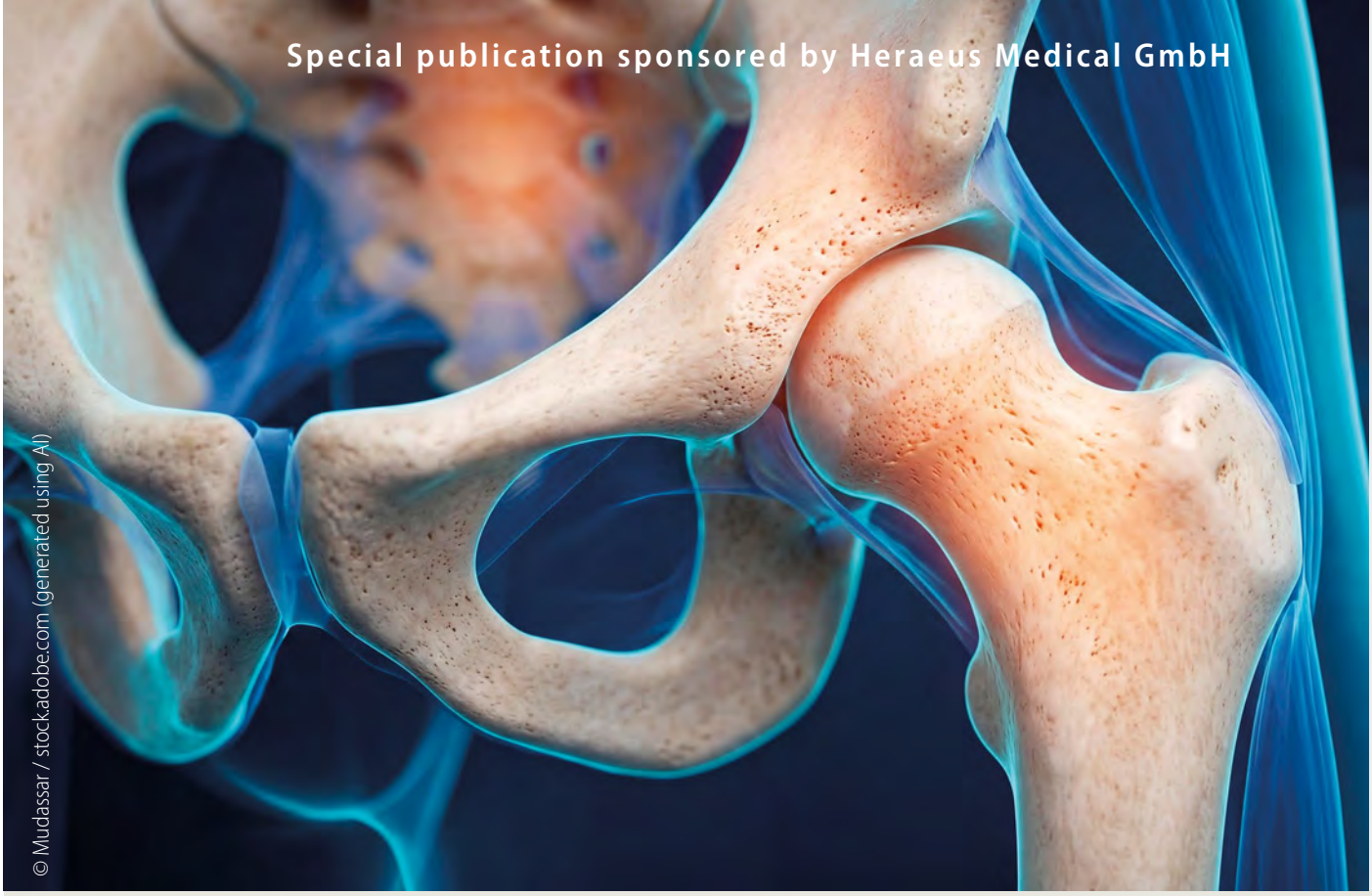
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The challenge of hip replacement in older patients

Avoiding revisions, improving treatment outcomes

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Heraeus Medical GmbH

Heraeus Medical, based in Wehrheim (Germany), is an expert in the development of innovative products for surgical orthopaedics and trauma surgery. The company's portfolio comprises solutions for orthopaedic implant fixation and stabilisation, the specialised management of musculoskeletal infections, as well as bone regeneration with innovative resorbable biomaterials. All bone cements for the global market are manufactured at the company's headquarters in Wehrheim and distributed in around 90 countries. The company's overarching aim is to drive the development of innovative technologies in order to ensure patient-centred, future-oriented care in orthopaedics and trauma surgery.



Older patients with a fractured neck of femur (FNOF) or advanced hip osteoarthritis represent a particularly vulnerable and challenging group in arthroplasty. Multimorbidity, reduced bone density and impaired physiological regenerative capacity increase the risk of serious complications such as periprosthetic fractures and periprosthetic joint infections. A patient-centred, evidence-based treatment approach is therefore essential for long-term treatment success. Current evidence indicates that cemented hip arthroplasty can offer advantages in this patient group, particularly with regard to implant survival and reducing the risk of infection.

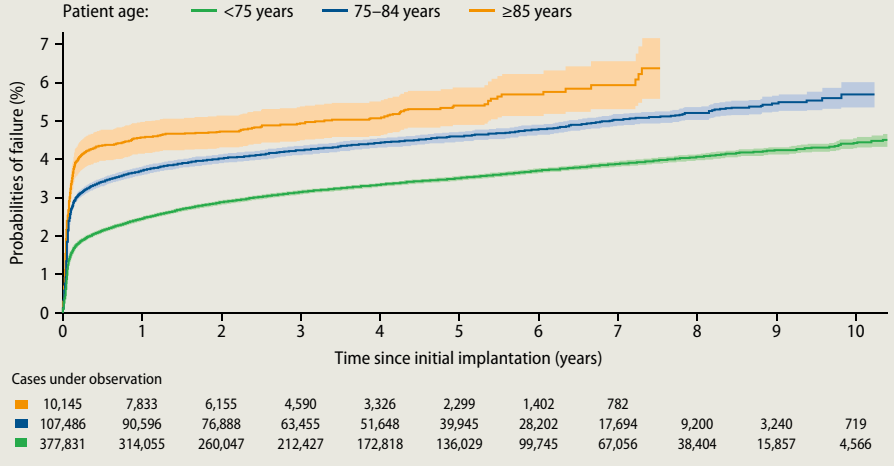
The number of arthroplasty procedures due to proximal femoral fractures or degenerative hip disorders continues to rise, not least as a result of demographic change. In the year 2024, 218,708 hip arthroplasty procedures, including primary and revision procedures, were recorded in the German Arthroplasty Registry (EPRD). People over the age of 75 accounted for 38.9 % of primary procedures and 52.1 % of revision procedures [1].

Patient group with an increased revision risk

With increasing age, comorbidities such as osteoporosis, diabetes mellitus and cardiovascular disease become more common, they can frequently present in combination. This can lead to an increased risk of revision surgery [2], which in turn may be associated with increased mortality [3]. Pain-free implant survival and, consequently, the long-term preservation of mobility and quality of life are therefore top priorities in this patient group.

Periprosthetic joint infections (PJIs) and periprosthetic fractures (PPFs), along with aseptic loosening, are among the most common causes of revision procedures and represent a major challenge in hip arthroplasty [1]. This places the reduction of these complications at the centre of attention. A patient-centred, evidence-based treatment approach can help to identify risk patients at an early stage, select the appropriate fixation method and implement preventive measures in a targeted manner.

Fig. 1: Failure probabilities of elective total hip arthroplasties with cementless stems, stratified by patient age (modified from [1])



Cemented hip arthroplasty can reduce the risk of revision

Alongside implant choice, the fixation method used in hip surgery plays a key role in long-term stability and, consequently, in patients' quality of life [1]. The question of whether the hip stem should be cemented is particularly important in older patients. Uncemented stem systems are associated with a significantly increased risk of intraoperative and postoperative periprosthetic fractures, as well as aseptic loosening (**Fig. 1**) [1, 4]. Especially in older women, reliable primary stability with uncemented stems can often not be achieved because of the frequently osteoporotic bone quality [4].

Cemented implants are superior when it comes to avoiding the complications mentioned above in older patients. Registry data underline the benefit of cemented hip arthroplasty for implant survival, particularly in hemiarthroplasty [1].

Against this background, patients with a fractured neck of fe-

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mur are of particular interest, as this group is often characterised by restricted mobility, poor general health and limited life expectancy, creating additional challenges. Available randomised studies and registry data demonstrate the advantages of cemented over uncemented hemiarthroplasty after fractured neck of femur. Cemented hemiarthroplasty is associated with lower rates of intraoperative and periprosthetic fractures, fewer dislocations and a reduced risk of infection, thereby resulting in an overall lower revision risk [5–7].

Patients also benefit from better mobility during the first postoperative year and a moderate but significant improvement in quality of life (p=0.02) [7]. The use of bone cement provides immediate primary stability and thus enables early functional mobilisation, which may reduce the risk of systemic complications [8, 9].

Revision risk due to periprosthetic fracture

One of the most common and serious complications after hip implantation is periprosthetic fracture (PPF), accounting for 15.5 % [1]. PPFs are associated with high mortality. Their prevention is therefore a central aspect of treatment, particularly in older patients.

Registry data from various countries, including Germany and Norway, show that uncemented femoral components cause significantly more PPFs and revision operations in both sexes than cemented systems [1, 4]. In women, the revision risk due to PPF with uncemented treatment was in some cases up to twelve times higher, regardless of age group [4].

Conversely, further studies confirm the preventive effect of bone cement. In patients over 60 years of age, the risk of an intraoperative or postoperative PPF was found to be reduced by more than fourfold [7]. In women over 60, switching to cemented fixation significantly reduced the incidence of PPF from 4.1 % to 2.0 % (**Fig. 2**) [9]. The decision to use cemented fixation is therefore a relevant factor in minimising risk in geriatric trauma care, particularly when treating fractured neck of femur.

Infection management using local antibiotics

In addition to fracture-related complications, periprosthetic joint infections (PJIs) are among the most common causes of revision surgery. In Germany, the proportion of infection-related hip revisions, including reimplantation in two-stage revision, was 29.1 % in 2024 [1].

PJIs occur more frequently in proximal femoral fractures than in elective procedures and are associated with further complications [10]. Here too, older patients with multiple comorbidities are particularly at risk because their impaired immune function and reduced tissue regeneration increase the risk of infection. Comprehensive treatment concepts should therefore be considered for these patient groups.

Antibiotic-loaded bone cement is an established element of targeted, patient-specific infection prevention [11]. As a local antibiotic carrier, it enables high antibiotic concentrations directly at the surgical site while keeping systemic exposure low. The release of the active substances during surgery and throughout the early postoperative period can support the eradication of relevant pathogens and contribute to reducing the risk of infection [12].

Antibiotic combinations for increased infection protection

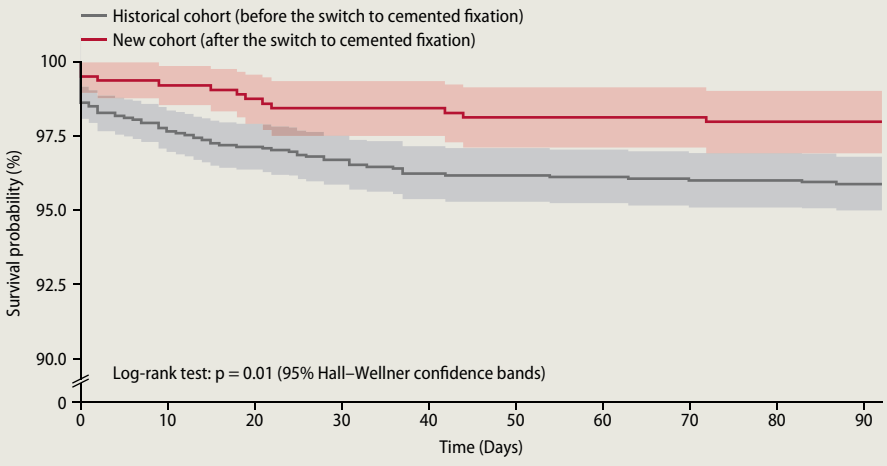
Dual antibiotic-loaded bone cement (DALBC) plays a central role in infection management for patients at increased risk of infection. Antibiotic combinations offer the advantage that their combined spectrum of activity covers a large proportion of the pathogens relevant to PJI. This can provide additional protection for the implanted endoprosthesis beyond standard prophylaxis using bone cement with a single antibiotic (single antibiotic-loaded bone cement/SALBC) [12].

The combination of gentamicin and clindamycin, as contained in COPAL® G+C, may target up to 90% of the pathogens relevant to PJI and provides high

Fig. 3: bone cement prepared for application



Fig. 2: Pooled rate of intraoperative and postoperative periprosthetic femoral fractures: 90-day Kaplan–Meier estimates of the cumulative probability of fracture-free implant survival following total hip arthroplasty in the new cohort (after the switch to cemented fixation) and the historical cohort (before the switch to cemented fixation) (modified from [9])



prophylactic efficacy in clinical use [13]. According to a recent meta-analysis, the use of DALBC in the treatment of fractured neck of femur with cemented hemiarthroplasty can reduce deep surgical site infections by up to 53 % compared with the use of bone cement containing a single antibiotic (SALBC) [14]. Accordingly, the infection rates with DALBC in the studies considered in this context remained consistently between 1.1 % and 1.2 % and were therefore lower than with SALBC (3.5 %–1.7 %) [14–18].

Modern cementing technique with closed mixing systems

The long-term survival of a cemented endoprosthesis depends to a large extent on the technique used. Modern cementing technique is considered more important in this regard than the choice of implant [19]. To fully exploit the benefits of cemented arthroplasty with antibiotic-loaded bone cement, optimum bone cement quality and good cooperation in the operating theatre are also required. The use of closed mixing systems can help to standardise workflows, reduce the risk of contamination of the bone cement components and apply one element of modern cementing technique by mixing the bone cement under vacuum.

Conclusion

The aim of modern arthroplasty remains to ensure a safe, stable and pain-free implant well into old age. The challenges posed by an ageing society can be addressed through age-appropriate, patient-centred treatment concepts based on the available evidence. Bone cement can make a significant contribution to this: choosing cemented implants and using antibiotic-loaded bone cements can reduce the risk of periprosthetic fractures and postoperative infections, and therefore also the risk of revision procedures.

Expertise in orthopaedics, arthroplasty and trauma surgery from a single source

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Heraeus Medical has many years of expertise in developing medical devices and biomaterials for surgical orthopaedics in order to improve treatment outcomes for patients.
Heraeus Medical's product portfolio includes specialised products, above all various bone cements with and without antibiotics or with antibiotic combinations for use in arthroplasty and the management of periprosthetic joint infections (PJI), as well as accessories for modern cementing technique. The portfolio of resorbable biomaterials comprises products for the treatment of bone defects in orthopaedics and trauma surgery.
The educational programme from Heraeus PALACADEMY® provides physicians and operating theatre staff with insights and know-how relating to bone cement and PJI management, supported by leading experts, and in a broad variety of formats, including live events, courses, workshops, symposia, webinars and digital learning formats.

Further information: www.heraeus-medical.com

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Imprint

Company Profile
„The challenge of hip replacement in older patients - Avoiding revisions, improving treatment outcomes"

Report: Dr. med. Joachim Sauer, München

Editor: Andrea Krahnert

Head of Corporate Publishing: Ulrike Hafner (responsible)

Printing: Druckpress GmbH, Leimen

With the kind support of Heraeus Medical GmbH, Wehrheim

Supplement to: „**Die Orthopädie**" Volume 55, Issue 10, October 2026
„**Orthopädie und Unfallchirurgie – Mitteilungen und Nachrichten**" Volume 16, Issue 5, October 2026

Springer Medizin Verlag GmbH
Heidelberger Platz 3, 14197 Berlin

Managing Directors: Fabian Kaufmann, Dr. Cécile Mack, Dr. Hendrik Pugge

Springer Medizin Verlag GmbH is part of the Springer Nature professional publishing group.

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