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Hybrid Total Hip Arthroplasty in Patients Aged Over 75: Patient-Reported Outcomes and Complication Rates

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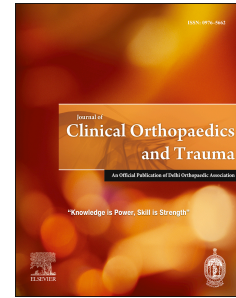
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Title: Hybrid Total Hip Arthroplasty in Patients Aged Over 75: Patient-Reported Outcomes and Complication Rates

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Journal Pre-proof

Hybrid Total Hip Arthroplasty in Patients Aged Over 75: Patient-Reported Outcomes and Complication Rates

Hybrid THA is a safe and effective option for elderly patients

POPULATION

Patients ≥ 75 years
n = 642
Mean age: 80 years
Multicenter study

INTERVENTION

Hybrid THA
Cemented femoral stem
Uncemented acetabular cup
Mini-posterolateral approach

OUTCOMES

OHS: 22.4 \rightarrow 42.1
Satisfaction: 93.5%
Low complication rates

1 Hybrid Total Hip Arthroplasty in Patients Aged Over 75: Patient-Reported Outcomes and Complication 2 Rates

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5

6 Abstract

7 Background:

8 As the number of total hip arthroplasties (THA) performed in elderly patients continues to rise, the optimal
9 fixation strategy for individuals over 75 years remains debated. Hybrid constructs, combining a cemented
10 femoral stem with an uncemented acetabular component, may offer a balance between immediate
11 mechanical stability and durable biological fixation. This study aimed to evaluate clinical outcomes,
12 complications, implant survivorship, and patient-reported satisfaction following hybrid THA in patients
13 aged >75 years.

14 Methods:

15 A retrospective multicenter study was conducted including patients ≥ 75 years who underwent primary
16 hybrid THA between 2017 and 2023, with a minimum follow-up of 12 months. All procedures were
17 performed using a mini-posterolateral approach within a standardized fast-track perioperative protocol.
18 Patients were further stratified into two subgroups based on acetabular articulation: Group A, treated with
19 a dual-mobility construct, and Group B, treated with a fixed-bearing liner. Outcomes included the Oxford
20 Hip Score (OHS), patient satisfaction, complications, and Kaplan–Meier survivorship analyses using best-
21 and worst-case scenarios.

22 Results:

23 A total of 642 patients were included (mean age 80.0 ± 4.0 years; 72.6% female), with a mean follow-up of
24 39.9 ± 19.4 months. The OHS improved from 22.4 ± 3.3 preoperatively to 42.1 ± 2.8 at final follow-up.
25 Overall satisfaction was high, with 93.5% of patients reporting a score of 3 or 4 on a 5-point scale.
26 Complication rates were low, including dislocation (1.2%), periprosthetic fracture (0.5%), infection (0.2%),
27 aseptic loosening (0.2%), and reoperation (1.2%). Thirty-day readmission was 0.8%. Overall mortality during
28 follow-up was 6.4%, with no procedure-related deaths. Implant survivorship was 98.6% in the best-case
29 and 84.1% in the worst-case scenario.

30 Conclusion:

31 Hybrid THA in patients over 75 years provides excellent functional recovery, high satisfaction, and low
32 complication rates, supporting its safety and effectiveness in the elderly population. Further long-term
33 prospective studies are warranted.

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37 **Keywords** Arthroplasty, prosthesis fixation, hip prosthesis, dual mobility

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40

41 Introduction

42 As life expectancy increases worldwide, the number of total hip arthroplasties (THA) performed in
43 elderly patients—especially those over the age of 75—continues to rise. In this age group, the
44 choice of implant fixation method is critical for balancing long-term implant survival, perioperative
45 safety, and patient satisfaction. Given the prevalence of osteoporotic bone and multimorbidity in
46 older adults, cemented femoral fixation has regained popularity due to its predictable
47 performance in poor-quality bone [1–3]. Recent literature has emphasized the evolving
48 understanding and refinement of cementation techniques, advocating for standardized protocols
49 and stem design classification systems that can improve outcomes, especially in the geriatric
50 population [4–6].

51 Several studies have shown that cemented femoral stems are associated with significantly lower
52 rates of intraoperative and early postoperative periprosthetic femoral fractures in elderly patients
53 [7,8]. Data from the American Joint Replacement Registry revealed that cemented fixation in
54 patients over 65 years significantly reduces the risk of periprosthetic femur fractures compared to
55 cementless stems [7]. Similarly, long-term registry data from the Australian Orthopaedic
56 Association demonstrated lower revision rates with polished cemented stems compared to
57 commonly used cementless stems, up to 17 years of follow-up [9]. These findings are supported
58 by recent technical recommendations outlining best practices for cementation, particularly in
59 patients with reduced bone stock [4,5].

60 In contrast, uncemented acetabular components have maintained a leading role even in older
61 patients, particularly due to advances in implant design and surface technology. These
62 improvements have enabled reliable osteointegration and stable fixation, especially when paired
63 with dual mobility (DM) cups, which reduce the risk of dislocation—a major concern in the
64 geriatric population [10–12].

65 The combination of a cemented femoral stem and an uncemented acetabular component—
66 commonly referred to as a hybrid construct—has become an increasingly attractive option in THA
67 for the elderly. This strategy aims to harness the primary stability and reduced fracture risk of
68 cemented stems while benefiting from the long-term biological fixation of uncemented cups
69 [3,11,13]. Additionally, the use of DM bearings further improves implant stability and lowers the
70 incidence of dislocation, particularly in high-risk patients [12].

71 Despite this theoretical advantage, current literature offers limited data specifically addressing
72 clinical outcomes, complication rates, and patient-reported satisfaction following hybrid THA in
73 patients over 75 years of age. Most existing studies focus on either stem or cup fixation
74 independently, or compare cemented versus cementless fixation, without evaluating the hybrid
75 construct as a distinct approach in this age group [2,14,15].

76 Therefore, the present study aimed to evaluate the clinical outcomes, complication profile, and
77 patient satisfaction following primary hybrid total hip arthroplasty in patients aged >75 years. This
78 investigation seeks to provide evidence on whether the hybrid construct represents an optimal
79 fixation strategy in this growing and vulnerable population.

80

81 **Materials and Methods**

82 This research was designed as a retrospective, multicenter observational study based on clinical
83 data retrieved from the orthopedic departments of two hospitals, covering procedures performed
84 between January 2017 and December 2023. The study protocol complied with the ethical standards
85 outlined in the Declaration of Helsinki. The study adhered to the ethical principles established in the
86 Declaration of Helsinki and received approval from the local Ethics Committee (approval code
87 27764_oss).

88 Patients were considered eligible if they were 75 years of age or older at the time of primary THA,
89 underwent surgery for either primary or secondary osteoarthritis, and received a hybrid implant
90 configuration consisting of a cemented femoral stem and an uncemented acetabular component.
91 In one institution, dual-mobility constructs were routinely used as the default acetabular option,
92 whereas the second center employed fixed-bearing liners coupled with 32- or 36-mm femoral
93 heads. Only patients with a minimum follow-up of 12 months were included.

94 Patients were stratified according to the type of acetabular bearing into two subgroups.
95 Group A included patients receiving a modular dual mobility acetabular component, whereas Group
96 B comprised patients treated with a fixed-bearing liner. A predefined subgroup analysis was
97 performed to compare complication rates and patient-reported outcomes between the two bearing
98 strategies.

99 Exclusion criteria were: age under 75 years, implantation of an uncemented femoral component,
100 incomplete clinical records, or follow-up duration of less than one year.

101 All procedures were performed through a mini-posterolateral approach under a standardized fast-
102 track perioperative care protocol. Regional anesthesia (spinal) was routinely administered, ensuring
103 rapid postoperative recovery. The use of intra-articular drains was avoided unless specifically
104 indicated. Patients were mobilized on the day of surgery with assistance from a physiotherapist,
105 initially using two crutches. Discharge was typically planned for postoperative day three, contingent
106 upon achieving two main functional goals: safe ambulation with crutches and independent stair
107 navigation.

108 Pain control was achieved through a multimodal analgesic regimen, which included acetaminophen,
109 a short-course opioid, and a nonsteroidal anti-inflammatory drug (NSAID). Clinical follow-up focused
110 on both general and implant-related complications, such as dislocation, deep infection,
111 periprosthetic fracture, aseptic loosening, wound complications (including dehiscence), clinically
112 perceived limb length discrepancy, and the need for surgical revision.

113 Functional status was evaluated using the Oxford Hip Score (OHS), administered preoperatively and
114 at follow-up visits. Additionally, patient satisfaction was assessed through two measures: a visual
115 analogue scale (VAS) [13] and a 5-point Likert scale ranging from 0 (very dissatisfied) to 4 (very
116 satisfied) [14].

117

118 *Statistical Analysis*

119 Statistical analysis was performed using SPSS software (Version 26.0, IBM Corp., Armonk, NY, USA).

120 Continuous variables were assessed for normality and are reported as mean and standard deviation;
121 comparisons between groups were performed using the Student's t-test or the Mann–Whitney U
122 test, as appropriate. Categorical variables are presented as absolute numbers and percentages and
123 were compared using the chi-square test or Fisher's exact test when expected cell counts were <5.

124 Kaplan–Meier survival analysis was used to estimate implant survivorship, with reintervention
125 defined as the primary event in the best-case scenario, and both reintervention and death
126 considered as events in the worst-case scenario. Differences in survivorship between groups were
127 assessed using the log-rank test.

128 Patients without events at the last follow-up were censored at the time of final evaluation.

129 All statistical tests were two-tailed, and a p value of <0.05 was considered statistically significant.

130 Failure was defined as any revision procedure requiring removal or replacement of at least one
131 prosthetic component (femoral stem and/or acetabular component), regardless of the underlying
132 cause (aseptic or septic), and open reduction of a dislocation. Closed reductions, non-surgical
133 treatments, and procedures that did not involve component replacement were not considered
134 failure events.

135

136 **Results**

137 A total of 642 patients were included in the analysis. The cohort was predominantly female
138 (72.6%), and the average patient age was 80.03 ± 4.03 years. Right-sided procedures were slightly
139 more common (54.8%) than left-sided ones (45.2%). Regarding preoperative health status, 77.6%
140 of patients were classified as ASA II, while 21% were ASA III and 1.4% ASA I. The mean BMI was
141 26.79 ± 5.78 .

142 The mean follow-up duration was 39.9 ± 19.4 months. Functional outcomes improved markedly
143 following surgery, with the Oxford Hip Score increasing from 22.37 ± 3.26 preoperatively to
144 42.08 ± 2.75 postoperatively. Pain control was satisfactory, as indicated by a mean VAS score of
145 89.81 ± 10.92 . Patient satisfaction was consistently high: 93.5% of respondents reported a

146 satisfaction score of 3 or 4, with nearly 70% choosing the highest score. Only 4% of patients were
147 lost to follow-up.

148 When stratifying patients according to acetabular bearing type, 460 patients (71.7%) received a
149 dual mobility cup, while 182 patients (28.3%) were treated with a fixed-bearing liner.

150 Subgroup analysis revealed a significantly lower dislocation rate in the dual mobility group
151 compared with the fixed-bearing group (0.7% vs. 2.75%, $p = 0.045$).

152 No statistically significant differences were observed between groups regarding periprosthetic
153 joint infection, aseptic loosening, periprosthetic fracture, reoperation rate, 30-day readmission, or
154 mortality.

155 Postoperative Oxford Hip Scores were comparable between groups, whereas pain control and
156 overall patient satisfaction were significantly higher in the dual mobility cohort.

157 Postoperative complication rates were low. Dislocations occurred in 1.2% of cases, while
158 infections, aseptic loosening, and wound dehiscence were rare ($\leq 1.1\%$). Periprosthetic fractures
159 were reported in 0.5%, and reoperations in 1.2% of patients. Limb length discrepancy greater than
160 1 cm was observed in 1.7%. The 30-day readmission rate was 0.8%.

161 All reoperations ($n = 8$; 1.2%) corresponded to revision procedures involving the removal or
162 exchange of at least one prosthetic component and were therefore considered failure events in
163 the survivorship analysis.

164 Indications for revision included postoperative dislocation requiring component exchange ($n = 3$),
165 deep periprosthetic joint infection ($n = 1$), periprosthetic femoral fracture requiring stem revision
166 ($n = 3$), and aseptic loosening of the acetabular component ($n = 1$). No additional surgical
167 procedures outside these revision events were performed.

168 Overall mortality during the follow-up period was 6.4%, with no deaths related to the index
169 procedure. These data were obtained through institutional hospital records, and that no deaths
170 were recorded as directly related to the index procedure or perioperative complications.

Variables	Frequency	Percentage (%)	171
Centers			172
IFCA	460	71.7	
AOUC	182	28.3	173
Sex			174
F	466	72.6	
M	176	27.4	
Operated side			175
Left	290	45.2	
Right	352	54.8	176
ASA			177
1	9	1.4	
2	498	77.6	178
3	135	21	179
Dislocation	8	1.2	
Infection	1	0.2	180
Aseptic loosening	1	0.2	
Periprosthetic fracture	3	0.5	181
Reoperation	8	1.2	182
Dehiscence	7	1.1	
Heterometry>1cm	11	1.7	183
Rehospitalization within 30 days	5	0.8	184
Death	41	6.4	185
Lost at FUP	26	4	186
Satisfaction			187
1	6	0.9	
2	10	1.6	
3	154	24	188
4	446	69.5	
	Mean	Standard deviation	189
Age	80.03	4.03	190
BMI	26.79	5.78	
Follow-up (in months)	39.9	19.40	191
Oxford pre	22.37	3.26	192
Oxford post	42.08	2.75	
VAS	89.81	10.92	193

194 Table 1. Overall descriptive analysis.

195 Dichotomous and ordinal variables were reported as frequency and percentage. Continuous variables were reported

196 as mean and standard deviation. IFCA: Istituto Fiorentino di Cura e Assistenza; AOUC: Azienda Ospedaliero

197 Universitaria Careggi; ASA: American Society of Anesthesiologists; FUP: Follow-up; BMI: Body Mass Index; VAS: Visual
 198 Analogue Scale.

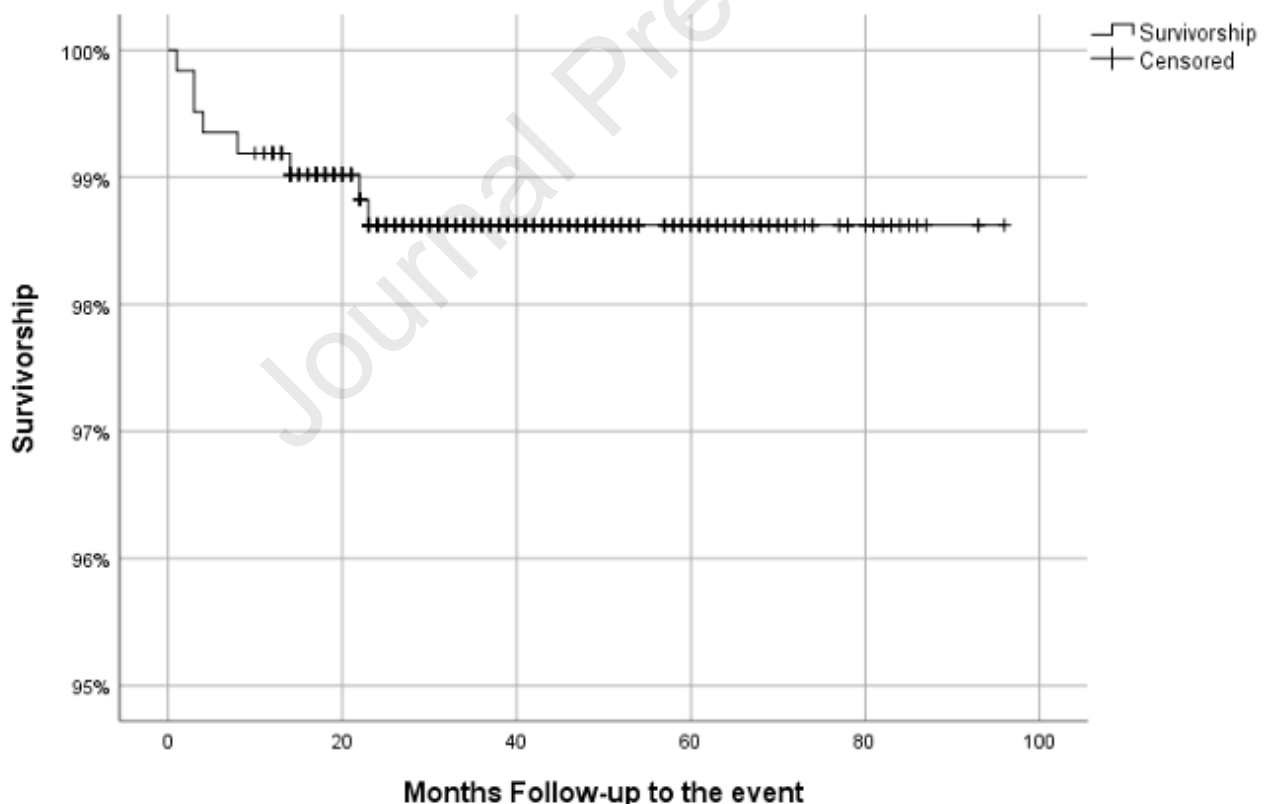
199

200 In the present study, two Kaplan–Meier survival curves were generated

201 The **first curve** represents the **best-case scenario**, in which only **reinterventions** were considered as
 202 events. All patients from both cohorts were included in the analysis. Censored cases included
 203 deaths, losses to follow-up, and patients without events at the final follow-up.

204 The **second curve** corresponds to the **worst-case scenario**, in which both **reinterventions and**
 205 **deaths** were considered as failures (events). Additionally, patients lost to follow-up were assigned
 206 an estimated failure rate equivalent to that of the overall cohort, in line with the assumption of data
 207 missing at random (MAR).

208 Both curves were used to assess and compare long-term survivorship of the implant.



209

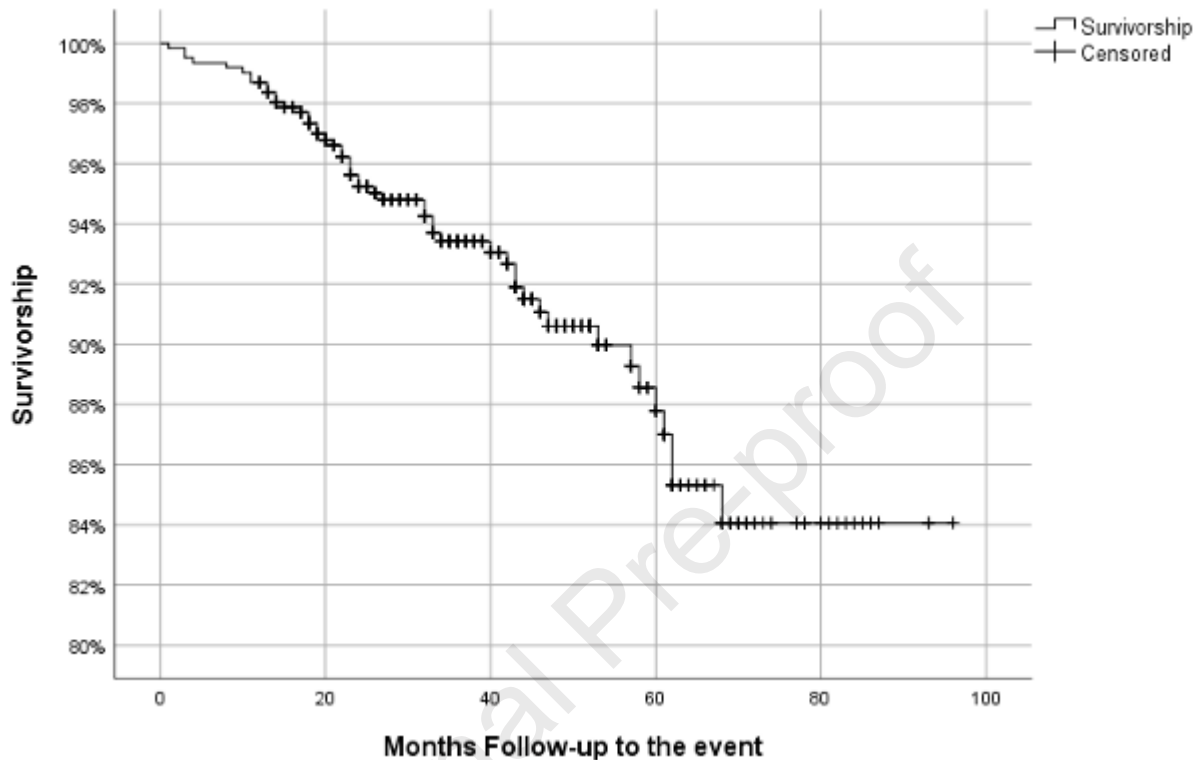
210 Figure 1. Overall survivorship in best scenario

211 Survivorship: 98.6%

212 Mean Survivorship: 94.82% [CI95: 95.63-94.01]

213

214 In the best-case scenario analysis, overall survival estimates remained consistently high over time.
 215 At 1 year, the survival estimate was 99.7%, followed by 99.3% at 3 years and 98.7% at 5 years.
 216 These results indicate excellent implant survivorship when considering reintervention as the sole
 217 event, with minimal decline observed throughout the 5-year follow-up period.



218

219

220 Figure 2. Overall survivorship in worst scenario

221 Survivorship: 84.1%

222 Mean Survivorship: 87.24% [CI95: 89.65-84.83]

223

224 In the worst-case scenario analysis, overall survival estimates showed a gradual decrease over
 225 time. At 1 year, the survival estimate was 99.2%. This declined to 94.1% at 3 years and further to
 226 88.0% at 5 years. These figures reflect a more conservative projection of implant survivorship, in
 227 which both reinterventions and deaths were considered as events, and losses to follow-up were
 228 assigned the expected failure rate of the overall cohort.

229

230 Discussion

231 This study evaluated the clinical and patient-reported outcomes of hybrid total hip arthroplasty
 232 (THA) in patients aged over 75 years, with a focus on complication rates, survivorship, and
 233 satisfaction. Our findings support the hybrid construct—cemented femoral stem combined with
 234 an uncemented acetabular component—as a safe and effective strategy in this vulnerable
 235 population, offering favorable mid-term outcomes and low complication rates.

236 The observed difference in dislocation rates between dual mobility and fixed-bearing constructs
237 deserves specific consideration. Although the multicenter design introduced heterogeneity in
238 acetabular bearing selection, this allowed a clinically meaningful comparison within a
239 homogeneous hybrid fixation framework.

240 The significantly lower dislocation rate observed in the dual mobility group supports the growing
241 evidence that dual mobility bearings provide enhanced stability in elderly and high-risk patients,
242 particularly when a posterior approach is used [12-13]. Importantly, this benefit was achieved
243 without an increase in other complications, including infection, aseptic loosening, or periprosthetic
244 fracture.

245 These findings indicate that the favorable outcomes observed in the overall cohort are partly
246 driven by the use of dual mobility bearings, which should therefore be considered a key
247 component of contemporary hybrid THA strategies in elderly patients rather than a secondary or
248 marginal factor.

249 Our results are consistent with large registry-based studies highlighting the mechanical safety and
250 durability of cemented femoral stems in older adults. Data from major registries, including the
251 American Joint Replacement Registry (AJRR), have consistently shown that cemented fixation
252 significantly reduces the risk of both intraoperative and postoperative femoral fractures in
253 patients over 65 years of age [7,18,19]. These observations are further supported by Brüggemann
254 et al. [8], who identified uncemented fixation and advanced age as major risk factors for
255 intraoperative femoral fractures in a national cohort exceeding 200,000 primary THAs.

256 Within this context, hybrid fixation emerges as a clinically relevant middle ground between fully
257 cemented and fully uncemented THA in elderly patients. In the present cohort, low rates of
258 periprosthetic femoral fracture (0.5%), dislocation (1.2%), and revision (~1.2%) were observed.
259 Fully cemented constructs have long been considered the reference standard in octogenarians,
260 largely due to their consistently low rates of periprosthetic femoral fracture—reported below 0.5%
261 in contemporary registry data [20,21]. However, these advantages may be counterbalanced by
262 longer operative times and the potential risk of bone cement implantation syndrome in frail
263 patients [22].

264 By contrast, fully uncemented THA, although often associated with shorter surgical times, remains
265 burdened by a substantially higher incidence of early periprosthetic femoral fractures in elderly
266 patients with age-related bone loss, with reported rates exceeding 3.5% in individuals over 75
267 years [20,23]. In our series, the periprosthetic fracture rate was comparable to that of fully
268 cemented stems while avoiding routine acetabular cementation. Likewise, the overall dislocation
269 rate of 1.2% compares favorably with the 2.1%–3.8% reported for fully uncemented THA in similar
270 elderly populations [21]. Although the selective use of dual-mobility acetabular components may
271 have contributed to this finding, the combination of cemented femoral fixation and uncemented
272 acetabular components appears to provide a balanced strategy optimizing both mechanical
273 stability and biological fixation. These results are in line with previous studies reporting improved
274 survivorship of hybrid constructs compared with fully cemented and fully uncemented fixation in
275 older patients [24].

276 Regarding long-term performance, cemented polished femoral stems have demonstrated
277 excellent survivorship. Babazadeh et al. [9], analyzing over 200,000 procedures from the
278 Australian registry, reported lower revision rates for cemented stems compared with commonly
279 used uncemented designs up to 17 years postoperatively. Similar long-term outcomes have been
280 described by Firestone et al. [25] and Park et al. [26], particularly with polished, tapered designs.
281 The sustained clinical success of Charnley-type stems, even in osteoporotic bone, further supports
282 the reliability of cemented femoral fixation in elderly patients [27,28].

283 Hybrid fixation leverages the complementary strengths of both fixation principles: immediate
284 mechanical stability on the femoral side and durable biological fixation at the acetabulum.
285 Favorable survivorship and functional outcomes with hybrid constructs have been reported at
286 mid- and long-term follow-up [24,25,28–30]. Consistently, our cohort demonstrated substantial
287 functional improvement and high satisfaction, with marked increases in Oxford Hip Scores and the
288 vast majority of patients reporting the highest satisfaction levels. These findings are concordant
289 with prior registry and clinical studies documenting favorable patient-reported outcomes
290 following cemented and hybrid THA in elderly populations [15,31].

291 This study has several limitations that should be acknowledged. First, the multicenter design
292 introduced heterogeneity in acetabular component selection, with different bearing strategies
293 adopted across institutions. Although this reflects real-world clinical practice, it represents a
294 relevant source of variability that may have influenced specific outcomes, particularly instability-
295 related events.

296 Second, the retrospective nature of the study precluded full control over surgical technique. In
297 particular, details related to cementing technique—an important factor influencing the
298 performance and survivorship of cemented femoral stems—could not be standardized or analyzed
299 in detail across centers.

300 Although elderly patients are often assumed to have lower functional demands, this factor should
301 be interpreted with caution. In the present cohort, postoperative Oxford Hip Scores reached values
302 consistent with excellent function, suggesting that the high levels of patient satisfaction observed
303 cannot be solely attributed to reduced activity expectations and are more likely reflective of
304 meaningful functional recovery.

305 Although the use of different acetabular bearings across centers represents a source of
306 heterogeneity, the availability of detailed subgroup data allowed us to directly assess its impact
307 on clinical outcomes, thereby strengthening the robustness and transparency of the present
308 analysis.

309 Finally, no multivariable regression analysis was performed to identify independent risk factors for
310 complications, as the low number of adverse events limited the statistical power for such analyses.

311

312 **Conclusion**

313 In a population of patients aged over 75 years undergoing primary total hip arthroplasty, the
314 hybrid construct combining a cemented femoral stem with a press-fit acetabular component

315 demonstrated excellent mid-term outcomes. The approach was associated with low complication
316 rates, high patient satisfaction, and strong implant survivorship, even under conservative
317 analytical assumptions. Cemented femoral fixation, especially using modern techniques, provided
318 reliable mechanical stability in elderly patients with reduced bone quality, while the use of
319 uncemented cups preserved bone stock and facilitated biological integration. Overall, hybrid
320 fixation represents a safe, effective, and balanced solution for elderly patients, warranting
321 continued use and further investigation in long-term prospective studies.

322

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Guardian/Patient's consent

Informed Consent has been obtained from patient or guardian for the study's participation and publication

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This study, titled “Hybrid Total Hip Arthroplasty in Patients Aged Over 75: Patient-Reported Outcomes and Complication Rates”, was conducted in accordance with the ethical standards of the institutional and national research committees and with the 1964 Helsinki Declaration and its later amendments.

Ethical approval was obtained from the local Ethics Committee Comitato Etico Regione Toscana
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All participants provided informed consent prior to inclusion in the study. Patient data were anonymized before analysis to ensure confidentiality. No additional interventions, beyond standard clinical practice, were performed for research purposes.

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Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

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