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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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MID-TERM CLINICAL AND RADIOLOGICAL OUTCOMES OF SHORT-STEM VERSUS CONVENTIONAL-STEM TOTAL HIP ARTHROPLASTY IN PATIENTS WITH OSTEONECROSIS OF THE FEMORAL HEAD: A PROSPECTIVE CASE-CONTROL STUDY

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Abstract.

Background: Total hip arthroplasty (THA) in young patients with osteonecrosis of the femoral head (ONFH) poses unique challenges related to bone preservation and implant longevity. Short femoral stems have gained popularity due to their bone-conserving design, but limited evidence exists regarding their performance in ONFH.

Methods: A single-centre, prospective case–control study was conducted involving 108 patients undergoing primary cementless THA for ONFH. Twenty-seven patients received a metaphyseal-fitting short femoral stem (Exacta RS®), while 81 received a conventional length stem (Alteon® or Exacta®). All patients received the same uncemented acetabular cup (Jump System Traser®). Clinical outcomes were assessed using the Harris Hip Score (HHS) and Roles and Maudsley score. Radiographic evaluation included stem fixation (Moore signs), subsidence, radiolucency, and cup position.

Results: At a mean follow-up of 4.2 years, both groups demonstrated excellent clinical improvement. The postoperative HHS was 91 ± 3.7 in the short stem group and 92 ± 3.5 in the conventional stem group. Radiological assessments revealed complete osseointegration, with no evidence of periprosthetic osteolysis, femoral radiolucency, or cup loosening in either group. Minor, asymptomatic subsidence (2 mm) was observed in 2 short stem and 3 standard stem cases. There were no significant differences in complication rates, operative time, or length of hospital stay.

Conclusion: Short femoral stems provide comparable mid-term clinical and radiographic outcomes to standard stems in young patients with ONFH. These findings support their use as a reliable, bone-preserving option in THA for this population.

Level of Evidence: Level III (Case-Control Study)

Key words. Total hip arthroplasty, osteonecrosis, short stem, metaphyseal fixation, femoral implant, case-control study.

Introduction.

Total hip arthroplasty (THA) is one of the most successful procedures in orthopaedic surgery [1]. As the population ages and indications for THA continue to expand, there is an increasing demand for surgery in younger and more active patients [2]. THA in younger individuals presents unique challenges; including higher functional expectations, longer life expectancy, and an increased liklihood of future revision surgery [3,4]. Short femoral stems have emerged as a promising solution, offering metaphyseal fixation that preserves bone stock and facilitates a more physiological load distribution [4-7]. Furthermore, biomechanical studies have demonstrated that these designs can achieve stable fixation and durable osseointegration [8]. Short-stem femoral implants showed a mid-term survival rate of 99.6%, with favourable radiological and clinical outcomes. The principal complications reported include: intraoperative fracture, thigh pain and subsidence, with rates comparable to those observed with conventional stem THA [9].

Osteonecrosis of the femoral head (ONFH) is a painful disabling condition affecting approximately 20,000 new patients annually in the United States, predominantly adults aged between 35 and 55 years [10,11]. ONFH is a progressive disease resulting from impaired blood bone supply due to either traumatic and non traumatic causes. Once subchondral microcirculation and bone remodelling are compromised, microfractures progressively accumulate until collapse of the femoral head occurs [12]. Various pharmacological and surgical treatments have been proposed for the treatment of early stage ONFH, however, once subchondral bone has collapsed THA remains the only reliable treatment option [13,14]. OFNH accounts for approximately 3.2% - 6% of all primary total hip replacements in Australian and Emilia Romagna (Italy) registries [15,16].

Although the relatively young age of patients with ONFH makes them ideal candidates for short stem THA, concerns remain regarding implantation within or adjacent to pathological bone, which may adversely affect osseointegration and implant survival. In particular, altered bone quality may increase the risk of stem subsidence and incomplete osseointegration [17]. Nevertheless, published short- to mid-term outcomes of short stems THA in ONFH have generally been favourable, without an increased risk of early loosening [18].

To date, there is paucity of studies directly comparing short and conventional femoral stems THA in patients diagnosed with osteonecrosis. The aim of the present study was therefore to evaluate and compare the clinical and radiological outcomes of a recent short stem versus conventional femoral stems in patients undergoing primary cementless THA for ONFH.

Materials and Methods.

Study design:

This prospective case-control study was conducted at a single centre, after Institutional Review Board approval was obtained (HJMP 05/2020). Written informed consent was obtained from all patients. From November 2020 to November 2022, 108 patients were diagnosed with ONFH following a magnetic resonance imaging (MRI). Patients with advanced osteonecrosis, classified as Stage III or IV according to Ficat and Arlet [19], were scheduled for cementless THA with either short of conventional stem.

Patients aged between 21 and 65-years-old, and with minimum 2-year follow-up were included in the study. Exclusion criteria included previous surgery on the affected hip, metabolic bone disease or infection. In case of bilateral hip surgery for ONFH,

only one side was considered in the study for analysis. Therefore, a total of 108 patients were enrolled in the study.

Surgical Technique and Postoperative Care:

All procedures were performed by the same arthroplasty team using a standardized posterolateral approach with preservation of the piriformis tendon [20]. Epidural anaesthesia was used in all but two cases, in which previous lumbar spine fixation surgery conditioned an alternative technique.

Femoral neck osteotomy was performed according to preoperative templating, using the measured distance from the lesser trochanter as a reference and taking stem length into account. Acetabulum was reamed until reaching the subchondral bone. All the patients received the highly porous uncemented Jump System® Traser cup (Permedica Orthopaedics, Italy), fixed with 2 cancellous screws.

Femoral preparation was performed using progressive compaction reamers. Patients in the short stem (SS) study group received Exacta RS® short femoral stem (Permedica Orthopaedics, Merate, Italy), introduced on the market in 2021. This collarless calcar loading stem is characterized by a double-taper trapezoidal shape (Figure 1A). Its angulated distal end is in contact with the lateral cortex, thus enhancing load transfer laterally, preventing varus tilting, and providing three-point fixation [21]. Patients in the conventional stem (CS) control group received either the Alteon® Taper Wedge Femoral Stem (Exactech, Gainesville, FL, USA) or Exacta® femoral stem (Permedica Orthopaedics, Merate, Italy). Both implants feature a plasm-sprayed double-coating of titanium and hydroxyapatite (Figure 1B-C). The choice of stem type was based on the surgeon's preference in order to minimize selection bias, propensity score matching analysis for age, gender, and BMI was performed in order to have two comparable groups. Groups were matched 1:3, as the short stem was introduced to the market only recently.

A cobalt chromium femoral head and highly cross-linked vitamin E polyethylene liner with 10° posterior lip were used in all cases.

Perioperative prophylaxis included Cefazolin (1 g every 8h x 3 doses) and thromboprophylaxis with Enoxaparin (40 mg daily x 30 days) were administered. Mobilisation began on the first postoperative day with full weight-bearing allowed as tolerated.

Outcomes.

Operative parameters including surgery time, incision length, blood loss, hospital length of stay, and complications, both intraoperative and postoperative, were recorded.

Patients were then followed up at 45 days, 3 months, 6 months, 12 months, and yearly thereafter. Clinical evaluation included

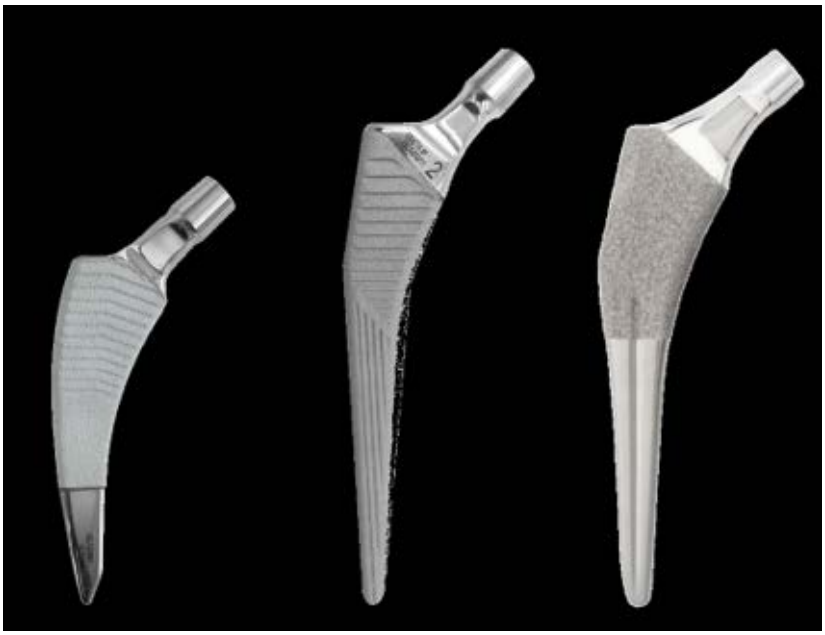

Figure 1. *Photographs of the short and conventional stems. (A) Exacta RS short stem with the proximal 2/3 of the short stem are double-coated with plasma-sprayed titanium and hydroxyapatite. (B) Exacta conventional stem and (C) Alteon Taper Wedge conventional stem.*

Figure 2. *Radiographs of a patient in the short stem group. Preoperative anteroposterior (A) and cross-leg (B) radiographs of a 47-year-old male with osteonecrosis of the left hip. At 5-year follow-up both the femoral and acetabular cup, appear well osseointegrated.*

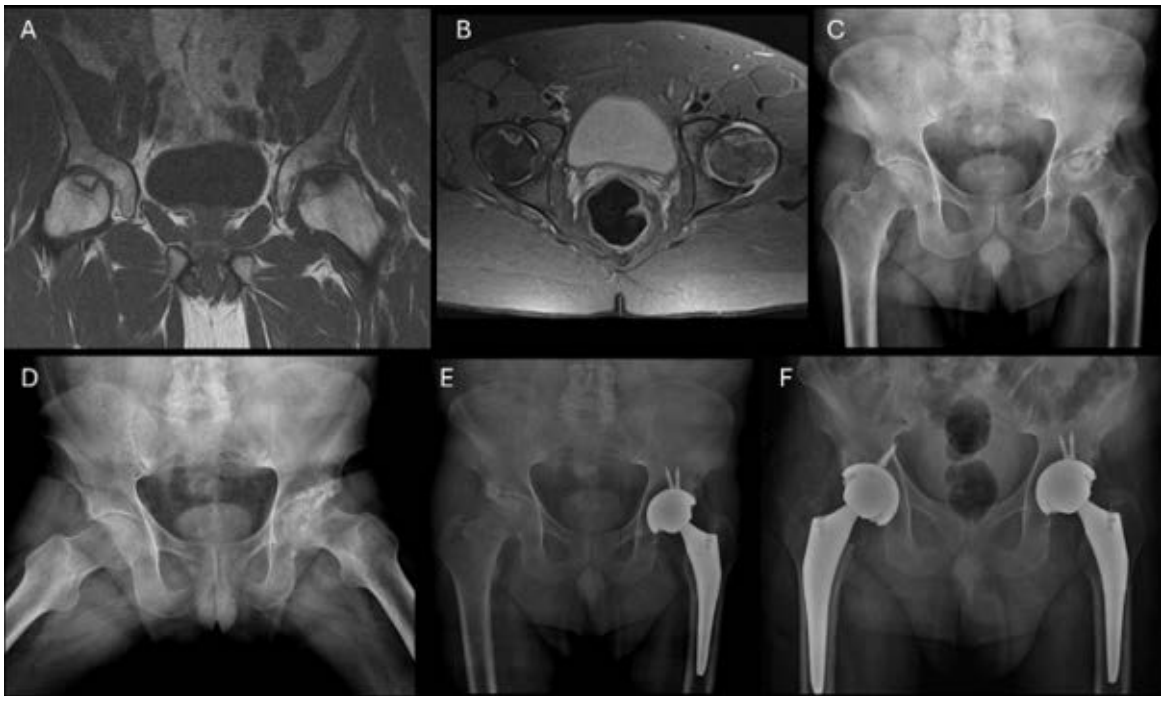

Figure 3. *MRI scans and radiographs of a patient in the conventional stem group. 51-year-old female with bilateral osteonecrosis of the femoral heads. Left femoral head collapse can be appreciated in the frontal (A) and axial (B) MRIs, frontal (C) and cross-leg (D) radiographs. The patient first underwent left THA, which remained well osseointegrated at 5 years follow up (E). Right THA was performed 6 months later. At final follow up, both implants remained are stable at last follow-up 5 years and 4.5years, for the left and right side, respectively.*

Table 1. *Demographics characteristics of the two stem groups. (NA, not Available; SD, standard deviation; BMI, body mass index; OFNH, osteonecrosis of the femoral head).*

Parameter	**Short stem (n=27)**	**Conventional stem (n=81)**	***p*-value**
Number of patients (hips)	27	81	NA
Sex (male:female)	16:11	50:31	0.8236
Mean age (years) (SD, range)	41.8 (8.6)	43.2 (8.0)	NS
Mean BMI (kg/cm^2) (SD, range)	26.7 (2.9) 23-35	27.1 (2.8) 23.2-34.5	NS
OFNH aetiology Idiopathic Corticoids induced Traumatic	 17 8 2	 44 32 5	
OFNH stage – Ficat and Arlet III (Moderate to Severe) IV (Severe)	 20 7	 51 30	
Follow-up (years) (SD, range)	4 ±0.35 years (2 – 5.3)	4 ±0,3.7 years (2 – 5.2)	NS

Harris Hip Score (HHS) [22], the Roles and Maudsley score for satisfaction evaluation [23] and assessment of thigh pain [24].

Radiographic evaluation was performed on anteroposterior pelvic radiographs and included assessment of both femoral and acetabular components. For the cup, anteversion and inclination were measured using the Ackland method [25], osseointegration was evaluated with the Moore signs [26], the presence of radiolucency lines was evaluated in the DeLee-Charnley zones [27]. Cup loosening was radiologically defined as a change in implant tilt greater than 5°, migration greater than 2mm, or thick radiolucent line greater than 1 mm in all three zones on sequential X-rays and/or broken screws. Femoral radiolucencies were evaluated according to the Gruen zones [28]. Stem subsidence was defined if migration greater than 2 mm relative to the postoperative radiographs, measured as the distance from the stem shoulder to the lesser trochanter. Varus-valgus shift greater than 3° was considered significant [29].

Leg length discrepancy (LLD) was measured on weight bearing anteroposterior pelvic radiographs as the distance between a horizontal line through the inferior aspect of the teardrops and the most prominent point of each lesser trochanter [30]. Heterotopic ossifications were recorded and classified according to Brooker [31].

Statistical analysis:

Data were analysed using SPSS v20 (IBM Corp., NY, USA). Continuous variables were compared using Student's t-test, and categorical data with Fisher's exact test.

A 1:3 allocation ratio was adopted to optimize the statistical power of the non-inferiority assessment given the limited availability of short stem cases. This unbalanced design was selected to enhance the precision of the estimate within the conventional stem group while maintaining an overall power of 80% to detect a non-inferiority margin of 8% in terms of stem osseointegration, assuming a one-sided alpha level of 0.05.

The Intention to treat (ITT) analysis was performed for the 27 patients included in the SS group.

Results.

A total of 108 patients were included in the analysis: 27 in the SS group and 81 in the CS group (51 Alteon and 30 Exacta Stems). One patient in the SS group was lost of follow-up after relocating abroad at 5 years postoperatively.

All patients were employed before surgery and 81% of them reported participation in regular physical activity before hip pain adversely affected their quality of life. The presumed aetiology of osteonecrosis was idiopathic in 51 hips (47%), corticoids induced in 36 hips (33%) and traumatic event in 21 hips (20%).

Intraoperative Outcomes.

Mean operative time was 51.5 ± 4.5 minutes (range 42-61 minutes), with a range of skin incision length between 12 to 16 cm (average of 14.5 cm) in SS group and 52.2± 3.8 minutes (range 43-60 minutes), skin incision length ranged 12 to 17 cm (15 cm average) in the CS group.

Mean blood loss during the surgery was 375 ± 60 ml and 412 ± 70 ml, in the SS group and CS group, respectively. 5 patients required postoperative transfusion (one on short stem group and 4 in standard group).

Mean hospital stay was 3.6 ± 1.5 days, (range 3 - 6 days) in the SS group and 4 ± 1 days (range 3 – 6 days) in CS group.

There were no neurovascular complications observed after the surgery.

One patient in the CS group suffered deep vein thrombosis. There were three intraoperative fractures. One patient in the SS group sustained a greater trochanter fracture, treated successfully with cerclage wiring. Two patients in the CS group sustained calcar crack, which remained stable during the follow-up with no progression or stem subsidence. No statistically significant difference lin intraoperative fracture rate was identified between groups.

Clinical Outcomes.

Mean pre-operative HHS were 41.4 ± 6.1 points (range 36–48 points) in the SS group and 40.7 ± 7.5 points (range 35–49 points) in the CS group. At final follow-up, mean postoperative HHS improved to 91 ± 3.7 points (range 87–96 points) in the SS group and 92 ± 3.5 points (range 86–96 points) in the CS group.

According to the Roles and Maudsley Patients' satisfaction score, all but one patient in the SS group achieved excellent result, while in the CS group 76 patients were rated excellent and 5 as good.

Thigh pain was assessed throughout follow-up. At 3 months, 3 patients with short stem had symptoms during daily activities, and 8 with the standard stem. At 6 months, one patient in SS group experienced pain only during running, while 3 patients in CS group had pain during physical activities. At final follow-up, no patient referred thigh pain in SS group, whereas 3 (3,7%) patients referred it in CS group continued to experience symptoms.

No implant related complications or revision procedures occurred during follow up. One patient in the CS group underwent debridment antibiotics and implant retention (DAIR) at 21 days after surgery due to wound hematoma and subsequently recovery without further complications.

Radiographic outcomes.

Mean cup inclination and anteversion were 44°± 3.01 (range 38 to 50°), and 10° (0 to 15°) respectively, in the SS group versus 43± 5◦ (range 37 to 50◦) and 5° (3 to 15◦) in CS control group. All acetabular components were positioned within the safe range area defined by Lewinnek.

No radiolucent line, cup migration or broken screws were detected in both groups during the follow-up period. All 5 Moore's radiographic signs were observed in SS group (Figure 2). In the CS group, 67 hips demonstrated 5 Moore´s signs (Figure 3) and the remaining hips had 4 signs, thus indicating successful osseointegration of all implants in both groups.

No femoral radiolucency nor periprosthetic osteolysis was observed during follow-up. Stem subsidence of 2 mm was identified in 2 hips in the SS group and in 3 hips in the CS group at 3-month follow-up, however these finding were clinically asymptomatic and did not progress. No loosening of the stem was observed during the follow-up period.

LLD less than 1cm was observed in 2 hips in the SS group (average 4±3 mm) and in 3 hips in the CS group (average 5±2 mm), in all cases no clinical or functional discomfort was reported. No heterotopic ossification was detected in the radiographic follow-up.

Discussion.

The present study demonstrates that metaphyseal fitting short femoral stems deliver excellent mid-term clinical and radiological outcomes in patients with ONFH, comparable with conventional stems results. To the best of our knowledge, only Kim et al. [32] compared 41 SS and 45 CS THAs in patients with ONFH. One femoral crack occurred in each group. At 5 years follow up, no significant differences were identified in the radiological outcomes, although the short stem group demonstrated significantly less stress shielding.

Our findings are consistent with previous studies reporting reliable osseointegration, stable fixation, and favourable clinical improvement with short stem design [4,5]. In particular, Exacta RS short stem has demonstrated safe and effective performance in young obese patients, with no stem loosening [33]. A recent meta-analysis [34], SS and CS in primary THA were compared to evaluate their effectiveness. The authors analysed the results of 16 randomized controlled clinical trials, and concluded that SS reduced the incidence of thigh pain and improved proximal bone remodelling, while HHS and revision rates remained comparable between groups.

With regard to ONFH specifically, cementless THA with conventional long stems has consistently demonstrated to be a safe and effective treatment [35-37]. Contemporary cementless acetabular and femoral components have shown excellent survivorship, without osteolysis or aseptic loosening at 10-year follow-up in young patients with ONFH [35,36]. Osawa et al. [37] reported comparable functional outcomes and implant survival at 10 years follow up, between patients with ONFH and those with osteoarthritis (OA) undergoing cementless THA. Similarly, a systematic review of 67 studies concluded that osteonecrosis is not associated with inferior outcomes in THA [38].

Radiographic analysis in the present study demonstrated excellent implant positioning, with all acetabular components placed within the Lewinnek safe zone. Successful osseointegration, confirmed by Moore criteria. The minor stem subsidence observed in both groups was clinically asymptomatic and comparable to previously published series [39,40] suggesting that limited early subsidence is not predictive of long-term loosening.

Tippimanchai et al. [39] followed 45 patients with ONFH who underwent short stem THA up to 10-year and reported one hip (2.2%) with a 5 mm stem subsidence which stabilised after 3 months. In the present series, LLD of less than 1 cm was observed in a small number of cases, specifically in 3 hips in the SS group and in 5 hips in the CS group, with no clinical relevance nor patients' discomfort. Fujita et al. [41], in a study involving 132 patients, highlighted the importance of accurate preoperative templating and intraoperative assessment in minimising LLD and suggested that discrepancies below 7 mm are generally well tolerated. All discrepancies in the current study remained below this threshold.

The substantial improvement in HHS across both groups reflects significant functional recovery. The mean postoperative HHS of 91±3.7 in the short stem group represents an excellent outcome and is comparable to previous reports. Capone et al. [42] reported the long-term outcomes of 37 hip with ONFH treated with short stem THA, with a mean HHS value of 90 points and predominantly good to excellent outcomes.

Thigh pain was less common in the SS group. Kim et al. [32] reported thigh pain in 2 hips (44%) in the CS group at mid-term follow-up, whereas no cases occurred in the SS group. Similarly in our series no thigh pain was detected in the SS group and 3 hips (3.7%) had symptomatic thigh pain in the CS group at last follow-up.

Patients with ONFH often exhibit compromised bone quality, which may increase the risk of intraoperative fracture [43]. Nevertheless, no statistically significant difference in fracture rate was observed between the groups in the current study.

Several limitations should be acknowledged. First, the relatively small sample size limited the ability to investigate factors associated with stem subsidence. Although the 27 hips included in SS study group were sufficient for assessment of clinical and radiological outcomes, larger studies are required for more detailed subgroup analyses. Second, the mean follow-up period of 4.2 years does not allow conclusions regarding long-term implant survival and revision rates, but promising radiographic results were achieved with all implants that appeared well osseointegrated, although all implants demonstrated excellent radiographic osseointegration and favourable clinical outcomes and patient perception. Third, stem subsidence was assessed using standard anteroposterior radiographs rather than radiostereometric analysis, which would have provided greater measurement accuracy.

Conclusion.

Short femoral stems in total hip arthroplasty for osteonecrosis of the femoral head provide excellent mid-term clinical and radiographic outcomes, comparable to those of conventional-length stems. Their bone-preserving design and reliable fixation make short stems a valuable option in younger, high-demand patients with long life expectancy and increased lifetime risk of revision.

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