Do Outcomes of Core Decompression for Osteonecrosis of the Femoral Head Improve with Concomitant Hip Arthroscopy? A Systematic Review

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Disclosures

I (and/or my co-authors) have something to disclose.

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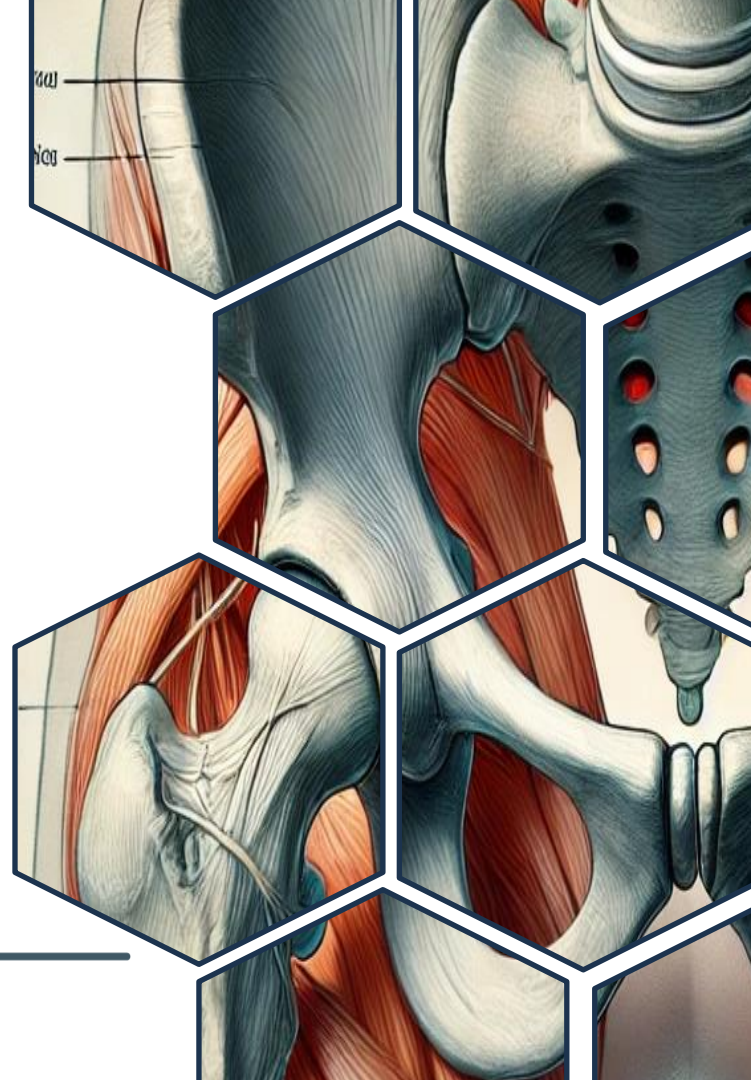
Background

- Osteonecrosis of the femoral head (ONFH) is a progressive disease that can lead to femoral head collapse and often requires total hip arthroplasty (THA).

- Core decompression (CD) is a widely used treatment for early-stage ONFH, though results are variable.
- Hip arthroscopy (HA) has been suggested as an adjunct to CD to manage intra-articular pathology.
- This systematic review investigates whether adding HA to CD improves outcomes compared to CD alone.



Methods

Systematic review per PRISMA using PubMed, MEDLINE, and Cochrane (through July 2024)

Included studies comparing CD with vs. without HA

Outcomes: PROs, survivorship, THA conversion

Excluded diagnostic-only HA

Quality assessed with MINORS and ROBINS-I

Extracted: demographics, techniques, PROs, THA-free survival

Results

6 studies included (4 Level III, 2 Level IV), totaling 632 hips

Mean patient age: 35.5–41.1 years

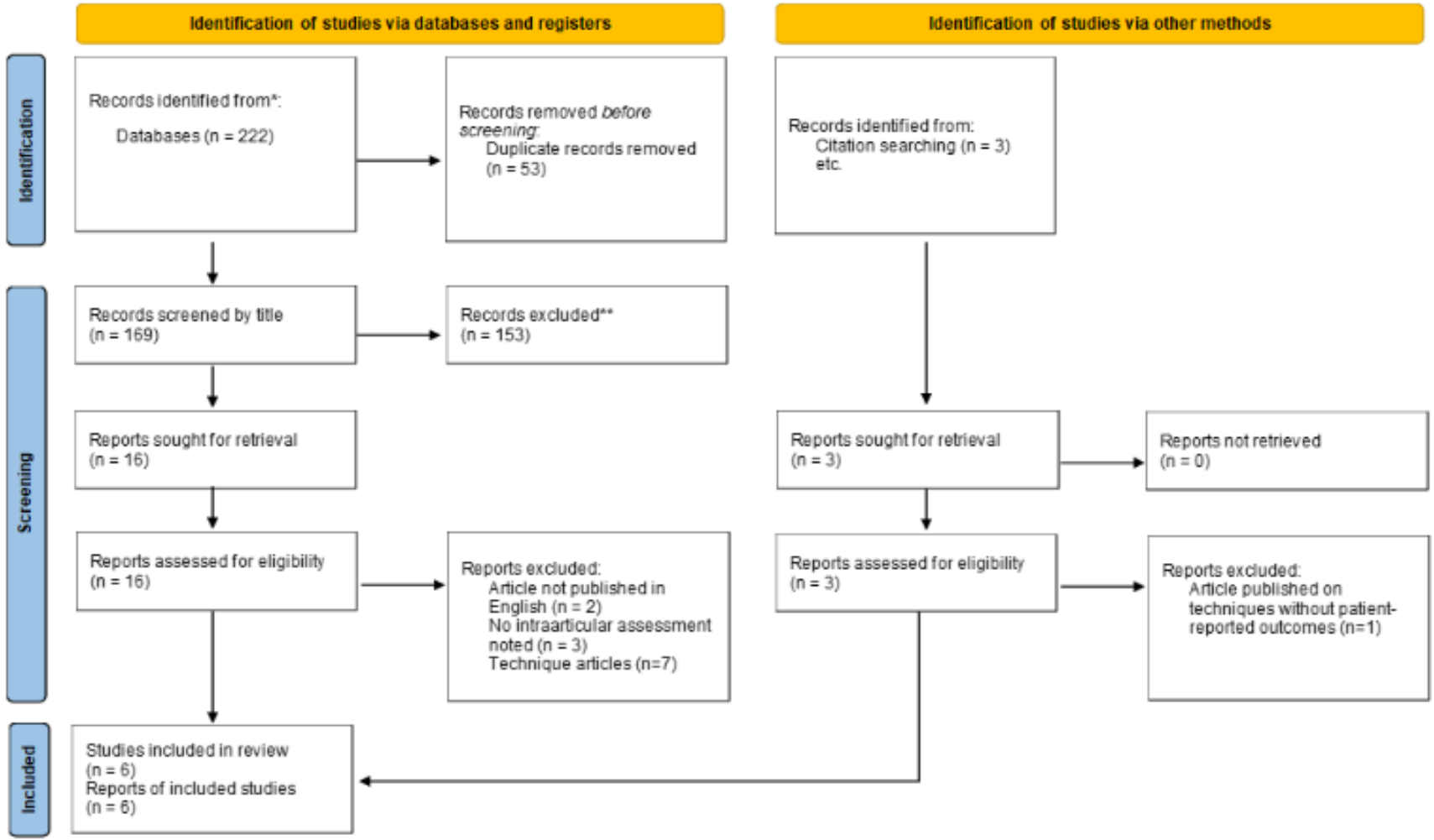
All studies reported pre/postoperative HHS; one reported VAS pain scores

CD with HA showed higher post-op HHS (71.41–93.33) and better survivorship

3 of 4 comparative studies showed lower THA conversion and collapse rates with HA

No study showed that HA improved bone healing directly

PRISMA 2020 flow diagram for new systematic reviews which included searches of databases, registers, and other sources



From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71.

Author	Article Title	Year of Publication	Journal	Study Design	Length of Follow-Up	Dates of Study Inclusion	Level of Evidence	Average MINORS Score	Average ROBINS Score	Indications	Core Decompression Technique
Ji et al. [22]	Long-term outcomes of arthroscopic synovectomy and core decompression through multiple small bone holes for early-stage avascular necrosis of the femoral head	2023	Arthroplasty	Prospective single-arm case series	10.7 ± 3.4 years (range, 9–12 years)	2005-2008	IV	9/16	Serious Risk	early stage AVN ARCO I-III symptomatic no previous surgical treatment for AVN	Hole drilled into center of the femoral head Decompression was performed either manually or by employing a low-speed power drill
Li et al. [24]	Long-term Outcome of Multiple Small-diameter Drilling Decompression Combined with Hip Arthroscopy versus Drilling Alone for Early Avascular Necrosis of the Femoral Head	2017	Chinese Medical Journal	Comparative cohort study	57.6 months (range: 17–108 months)	2006-2010	III	14/22	Moderate Risk	small- or medium-sized Ficat Stage I or Stage II (early stage) osteonecrosis	3-5 drilled holes, distributed in a fan shape, through one common entry point at metaphyseal region opposite the superior portion of the lesser trochanter, using a 3mm wire.
Nazal et al.[21]	Mid-term outcomes of arthroscopic-assisted Core decompression of Precollapse osteonecrosis of femoral head—minimum of 5 year follow-up	2019	BMC Musculoskeletal Disorders	Case series	7 years ±1.48 years (range, 64—118 months)	2014-2018	IV	9/16	Serious Risk	radiographic findings of stage 0, I, IIa, and IIB based on Ficat-Alret	a 9-mm cannulated reamer was inserted over the guide pin for core decompression. The target of the reamer was the center of the necrotic area.
Yang et al.[23]	Mid-term Clinical	2024	Orthopaedic Surgery	Retrospective	38.3 ± 18.9 months	2007-2013	III	14/22	Moderate Risk	II and IIIA ARCO	Light bulb technique; Single

Author	Article Title	Year of Publication	Journal	Study Design	Length of Follow-Up	Dates of Study Inclusion	Level of Evidence	Average MINORS Score	Average ROBINS Score	Indications	Core Decompression Technique
	Outcomes of "Light Bulb" Core Decompression with Arthroscopic Assistance in Peri-collapse Osteonecrosis of the Femoral Head: A Retrospective Comparative Study			comparative study	(range ,24–90 months)					stage for ONFH	hole, 10 mm reamer introduced to the necrotic area, to create a bone tunnel. Bone particles + bioceramic particles used to fill the necrotic area.
G. Zhao et al. [16]	Hip Arthroscopy Debridement Combined with Multiple Small-Diameter Fan-Shaped Low-Speed Drilling Decompression in the Treatment of Early and Middle Stage Osteonecrosis of the Femoral Head: 14 Years Follow-Up	2024	Orthopaedic Surgery	Retrospective cohort study	14.24 ± 3.54 years	1998-2012	III	14/22	Serious Risk	ARCO II-IIIA stage ONFH	3-5 fan-shaped small-diameter holes distributed evenly from the greater trochanter to the necrotic area of the femoral head using a 3mm wire.
Y. Zhao et al. [15]	Intramedullary core decompression combined with endoscopic intracapsular decompression and debridement for pre-collapse non-traumatic osteonecrosis of	2023	Journal of Orthopaedic Surgery and Research	Comparative cohort study	2-year minimum (range not given)	2015-2019	III	14/22	Moderate Risk	ARCO Stage I and Stage II (early ONFH)	3mm Kirschner wire drilled into necrotic area in fan shape in multiple directions. When drilled close to the necrotic area, drill stopped and wire hammered to reach a site 3-5 mm

Table 3. Patient-Reported Outcomes of Included Studies

Author	Number of Hips	Length of Follow-Up (Months)	Baseline Patient-Reported Outcomes	Most Recent Patient-Reported Outcome	Comparison of Patient-Reported Outcomes With Control Group	Survivorship	Complications
Ji et al.[22]	185	128.4 ± 40.8	ARCO Staging: HHS Stage I: 70.15 ± 4.3 Stage II: 68.5 ± 8.3 Stage III: 56.7 ± 11.2 VAS: 9.1 ± 0.5	ARCO Staging: HHS Stage I: 93.33 ± 5.92 Stage II: 87.3 ± 5.5 Stage III: 84.4 ± 7.8 VAS: 9.1 ± 0.5	No control group included	Survival Rate: 79 (51.6%)	Collapse: 44 hips (23.8%)
Li et al. [24]	Scope + CD: 43 CD: 55	Scope + CD 61.4 ± 5.7 CD 53.9 ± 4.1	Scope + CD Ficat Staging: HHS Stage I: 73.24 ± 1.74 Stage II: 51.33 ± 2.74 CD Ficat Staging: HHS Stage I: 73.89 ± 2.18 Stage II: 52.62 ± 2.75	Scope + CD Ficat Staging: HHS Stage I: 84.63 ± 1.26 Stage II: 80.03 ± 5.36 CD Ficat Staging: HHS Stage I: 83.55 ± 1.96 Stage II: 71.41 ± 2.17	Significant differences of postoperative HHS in Stage II patients (P = 0.024) No significant differences of postoperative HHS in Stage I patients (P = 0.562)	Success Rate Scope + CD: 86% CD: 74.5% Difference in success rates between the two groups was significant (P = 0.02)	Collapse: Scope + CD Ficat Stage I: 1 hip (8.3%) Scope + CD Ficat Stage II: 5 hips (16.1%) CD Ficat Stage I: 3 hips (17.6%) CD Ficat Stage II: 11 hips (28.9%)
Nazal et al. [21]	11	84.7 ± 21.2	Not measured	Not measured	No control group included	Ficat-Alret Stage: Conversion to THA Stage I: 0% Stage IIa: 25% Stage IIb: 100% Conversion to THA was significant for Stage IIb patients	No complications

Author	Number of Hips	Length of Follow-Up (Months)	Baseline Patient-Reported Outcomes	Most Recent Patient-Reported Outcome	Comparison of Patient-Reported Outcomes With Control Group	Survivorship	Complications
Yang et al. [23]	Scope + CD: 18 CD: 21	Scope + CD: 38.3 ± 18.9 CD: 34.6 ± 8.2	Scope + CD: VAS: 5.7 ± 0.9 HHS: 59.8 ± 7.7 CD: VAS: 4.4 ± 1.3 HHS: 57.5 ± 5.8	Scope + CD: VAS: 1.2 ± 2.2 HHS: 80.1 ± 9.2 CD: VAS: 2.2 ± 2.8 HHS: 75.1 ± 12.7	Postoperatively, there was a significant difference in VAS scores (p<.01) at 3 days, but no significant difference at last follow-up (p = 0.28) between Scope + CD vs. CD. Postoperatively, there was no significant difference in HHS (p = 0.11) at last follow up between Scope + CD vs. CD.	Scope + CD Survivorship: 88.9% CD Survivorship: 71.4%	Scope + CD: Femoral head collapse: 2 (11.1%) CD: Femoral head collapse: 6 (28.6%) no other major complications
G. Zhao et al.[16]	Scope + CD: 92 CD: 68	Scope + CD: 170.88 ± 42.48 CD: 169.2 ± 36.36	Scope + CD: HHS: 64.62 ± 5.66 CD: HHS: 61.81 ± 7.14	Scope + CD: HHS: 80.65 ± 6.29 ARCO Stage II HHS: 82.66 ± 4.68 ARCO Stage IIIA HHS: 77.59 ± 5.51 CD: HHS: 73.70 ± 5.49 ARCO Stage II HHS: 74.39 ± 5.42 ARCO Stage IIIA HHS: 72.71 ± 5.51	Preoperatively, no significant difference in HHS between Scope + CD vs. CD (p = .797) Postoperatively, significant difference in improvement of HHS between Scope + CD vs. CD (p = .023) Postoperatively, significant improvement in HHS between ARCO II-III A stage patients (p = <0.01) Postoperatively, improvement in HHS for ARCO II stage patients was significantly greater than ARCO III A stage patients (p = <0.01)	Scope + CD Survivorship: 5-year: 84.78% 10-year: 23.91% CD Survivorship: 5-year: 63.24% 10-year: 8.82%	femoral head collapse reported but number not specified
Y. Zhao et al.[15]	Scope + CD: 59 CD: 80	>2 years	Scope + CD: VAS: 6.3 ± 2.1 HHS: 59.5 ± 11.6	Scope + CD: VAS: 3.1 ± 1.7 HHS: 81.9 ± 10.2	Preoperatively, no significant difference in VAS or HHS (p = .4561, p = .3168)	Scope + CD Survivorship: 89.8%	

Conclusion

- CD with HA shows better PROs and femoral head survivorship vs. CD alone
- Likely benefit from treating intra-articular pathology and improving joint function
- HA's role in bone healing remains unclear
- More RCTs needed to assess impact on revascularization and disease progression
- For now, HA is best seen as an adjunct for symptom relief in early ONFH

References

Singh M, Singh B, Sharma K, Kumar N, Mastana S, Singh P. A Molecular Troika of Angiogenesis, Coagulopathy and Endothelial Dysfunction in the Pathology of Avascular Necrosis of Femoral Head: A Comprehensive Review. Cells 2023;12:2278. https://doi.org/10.3390/cells12182278.

[2] Konarski W, Poboży T, Śliwczyński A, Kotela I, Krakowiak J, Hordowicz M, et al. Avascular Necrosis of Femoral Head—Overview and Current State of the Art. Int J Environ Res Public Health 2022;19:7348. https://doi.org/10.3390/ijerph19127348.

[3] Guerado E, Caso E. The physiopathology of avascular necrosis of the femoral head: an update. Injury 2016;47:S16–26. https://doi.org/10.1016/S0020-1383(16)30835-X.

[4] Salas AP, Mazek J, O'Donnell J, Mendez-Perez E, Brizuela-Ventura M, Velasco-Vazquez HA, et al. Hip Arthroscopy and Core Decompression for Avascular Necrosis of the Femoral Head Using a Specific Aiming Guide: A Step-by-Step Surgical Technique. Arthrosc Tech 2021;10:e2775–82. https://doi.org/10.1016/j.eats.2021.08.015.

[5] Hoogervorst P, Campbell JC, Scholz N, Cheng EY. Core Decompression and Bone Marrow Aspiration Concentrate Grafting for Osteonecrosis of the Femoral Head. J Bone Jt Surg 2022;104:54–60. https://doi.org/10.2106/JBJS.20.00527.

[6] Ha Y-C, Jung WH, Kim J-R, Seong NH, Kim S-Y, Koo K-H. Prediction of Collapse in Femoral Head Osteonecrosis: A Modified Kerboul Method with Use of Magnetic Resonance Images. VO LUM E n.d.

[7] Woo MS, Kang JS, Moon KH. Outcome of Total Hip Arthroplasty for Avascular Necrosis of the Femoral Head in Systemic Lupus Erythematosus. J Arthroplasty 2014;29:2267–70. https://doi.org/10.1016/j.arth.2013.12.028.

[8] Vanstockstraeten S, Ghijselings S, Vles GF, Simon J-P. Excellent Long-Term Survival Rate of Polished, Tapered, Cemented Stems in Patients Aged 35 Years or Younger With Avascular Necrosis or Inflammatory Arthritis of the Hip. J Arthroplasty 2022;37:897-904.e1. https://doi.org/10.1016/j.arth.2022.01.055.

[9] Väänänen M, Tervonen O, Nevalainen MT. Magnetic resonance imaging of avascular necrosis of the femoral head: predictive findings of total hip arthroplasty. Acta Radiol Open 2021;10:20584601211008379. https://doi.org/10.1177/20584601211008379.

[10] Andronic O, Weiss O, Shoman H, Kriechling P, Khanduja V. What are the outcomes of core decompression without augmentation in patients with nontraumatic osteonecrosis of the femoral head? Int Orthop 2021;45:605–13. https://doi.org/10.1007/s00264-020-04790-9.

[11] Andronic O, Hincapié CA, Burkhard MD, Loucas R, Loucas M, Ried E, et al. Lack of Conclusive Evidence of the Benefit of Biologic Augmentation in Core Decompression for Nontraumatic Osteonecrosis of the Femoral Head: A Systematic Review. Arthrosc J Arthrosc Relat Surg 2021;37:3537-3551.e3. https://doi.org/10.1016/j.arthro.2021.04.062.