COPYRIGHT © BY THE JOURNAL OF BONE AND JOINT SURGERY, INCORPORATED

http://dx.doi.org/10.2106/JBJS.RVW.20.00263

The following content was supplied by the authors as supporting material and has not been copy-edited or verified by JBJS.

Appendix Table 1. Risk of bias in the included studies using the MINORS tool.

	Clearly stated aim	**Inclusion of consecutive patients**	**Prospective data collection**	**Appropriate endpoint**	**Unbiased endpoint assessment**	**Appropriate follow-up period**	**Follow-up loss <5%**	**Prospective study size calculation**	**Total score (out of 16)**
Alonso 1994[44]	2	2	0	2	0	2	2	2	12
Baschera 2015[7]	2	2	0	2	2	2	1	2	13
Bilekdemir 2020[36]	**2**	**2**	**0**	**2**	**0**	**2**	**2**	**1**	**11**
Burd 2001[20]	2	2	2	2	2	2	1	2	15
Chen 2021[37]	**2**	**2**	**0**	**2**	**2**	**2**	**1**	**2**	**13**
Childs 2000[45]	2	1	2	2	0	1	2	2	12
d'Heurle 2016[39]	2	2	2	2	2	2	1	2	15
Daum 1992[28]	2	2	0	2	0	2	1	2	11
Elhassan 2016[40]	2	2	0	2	0	1	2	2	11
Firoozabadi 2014[13]	2	2	0	2	0	1	1	2	10
Ghalambor 1994[41]	2	2	2	2	0	2	2	2	14
Johnson 1994[34]	2	2	0	2	0	2	1	0	9
Johnson 1994[30]	2	0	0	2	0	2	1	1	8
Joseph 2020[31]	**2**	**2**	**1**	**2**	**0**	**2**	**1**	**1**	**11**
Kaempffe 1991[14]	2	2	0	2	0	2	1	1	10

COPYRIGHT © BY THE JOURNAL OF BONE AND JOINT SURGERY, INCORPORATED

http://dx.doi.org/10.2106/JBJS.RVW.20.00263

Karunakar 2005[42]	2	2	0	2	2	2	2	2	14
Leucht 2013[38]	2	2	2	2	0	2	1	2	13
Mathew 2014[46,a]	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Moed 1993[35]	2	2	0	2	2	2	1	2	13
Mourad 2012[43,b]	2	2	0	2	2	2	2	2	14
Mourad 2012[19,b]	2	2	0	2	2	2	2	2	14
Negrin 2017[29]	2	2	0	2	0	2	2	2	12
Triantaphillopoulos 2007[8]	2	1	0	2	0	2	2	0	9
Rath 2002[32]	**2**	**2**	**0**	**2**	**0**	**2**	**1**	**0**	**9**
Salameh 2020[33]	**2**	**2**	**0**	**2**	**1**	**2**	**2**	**1**	**12**
Webb 1990[27]	2	2	0	2	0	2	2	1	11

[a]Risk bias could not be assessed for this conference abstract. [b]The two studies may share the same patient population; the results from Mourad 2012[19] were given precedence.

COPYRIGHT © BY THE JOURNAL OF BONE AND JOINT SURGERY, INCORPORATED

http://dx.doi.org/10.2106/JBJS.RVW.20.00263

REFERENCES

1. Meyers C, Lisiecki J, Miller S, Levin A, Fayad L, Ding C, Sono T, McCarthy E, Levi B, James AW. Heterotopic Ossification: A Comprehensive Review. JBMR Plus. 2019;3(4):e10172.

2. Bossche L Vanden, Vanderstraeten G. Heterotopic ossification: A review. J Rehabil Med. 2005;37(3):129-136.

3. McCarthy EF, Sundaram M. Heterotopic ossification: A review. Skeletal Radiol. 2005;34(10):609-619.

4. Amar E, Sharfman ZT, Rath E. Heterotopic ossification after hip arthroscopy. J Hip Preserv Surg. 2015;2(4):355-363.

5. Łęgosz P, Otworowski M, Sibilska A, Starszak K, Kotrych D, Kwapisz A, Synder M. Heterotopic Ossification: A Challenging Complication of Total Hip Arthroplasty: Risk Factors, Diagnosis, Prophylaxis, and Treatment. Biomed Res Int. 2019;2019.

6. Firoozabadi R, Alton T, Sagi HC. Heterotopic ossification in acetabular fracture surgery. J Am Acad Orthop Surg. 2017;25(2):117-124.

7. Baschera D, Rad H, Collopy D, Zellweger R. Incidence and clinical relevance of heterotopic ossification after internal fixation of acetabular fractures: Retrospective cohort and case control study. J Orthop Surg Res. 2015;10:60.

8. Panagiotis T, Elias P, Constantinos M, Minos T, Panagiotis D, Elias L. Long-term results in surgically treated acetabular fractures through the posterior approaches. J Trauma - Inj Infect Crit Care. 2007;62(2):378-382.

9. Griffin SM, Sims SH, Karunakar MA, Seymour R, Haines N. Heterotopic ossification rates after acetabular fracture surgery are unchanged without indomethacin prophylaxis. Clin Orthop Relat Res. 2013;471(9):2776-2782.

10. Karunakar MA, Sen A, Bosse MJ, Sims SH, Goulet JA, Kellam JF. Indometacin as prophylaxis for heterotopic ossification after the operative treatment of fractures of the acetabulum. J Bone Joint Surg Br. 2006;88(12):1613-1617.

11. Starr AJ, Watson JT, Reinert CM, Jones AL, Whitlock S, Griffin DR, Borer DS. Complications following the “T extensile” approach: A modified extensile approach for acetabular fracture surgery - Report of forty-three patients. J Orthop Trauma. 2002;16(8):535-542.

12. Routt MLC, Swiontkowski MF. Operative treatment of complex acetabular fractures. Combined anterior and posterior exposures during the same procedure. J Bone Joint Surg Am. 1990;72(6):897-904.

13. Firoozabadi R, O’Mara TJ, Swenson A, Agel J, Beck JD, Routt M. Risk Factors for the Development of Heterotopic Ossification After Acetabular Fracture Fixation. Clin Orthop Relat Res. 2014;472(11):3383-3388.

14. Kaempffe FA, Bone LB, Border JR. Open reduction and internal fixation of acetabular fractures: Heterotopic ossification and other complications of treatment. J Orthop Trauma. 1991;5(4):439-445.

15. Schafer SJ, Schafer LO, Anglen JO, Childers M. Heterotopic ossification in rehabilitation patients who have had internal fixation of an acetabular fracture. J Rehabil Res Dev. 2000;37(4):389-393.

16. Bosse MJ, Poka A, Reinert CM, Ellwanger F, Slawson R, McDevitt ER. Heterotopic ossification as a complication of acetabular fracture. Prophylaxis with low-dose irradiation. J Bone Joint Surg Am. 1988;70(8):1231-1237.

17. Moed BR, Letournel E. Low-dose irradiation and indomethacin prevent heterotopic ossification after acetabular fracture surgery. J Bone Joint Surg Br. 1994;76(6):895-900.

18. Burnet NG, Nasr P, Yip G, Scaife JE, House T, Thomas SJ, Harris F, Owen PJ, Hull P. Prophylactic radiotherapy against heterotopic ossification following internal fixation of acetabular fractures: A comparative estimate of risk. Br J Radiol. 2014;87(1042).

19. Mourad WF, Packianathan S, Shourbaji RA, Zhang Z, Graves M, Khan MA, Baird MC, Russell G, Vijayakumar S. A prolonged time interval between trauma and prophylactic radiation therapy significantly increases the risk of heterotopic ossification. Int J Radiat Oncol Biol Phys. 2012;82(3):e339-e344.

20. Burd TA, Lowry KJ, Anglen JO. Indomethacin compared with localized irradiation for the prevention of heterotopic ossification following surgical treatment of acetabular fractures. J Bone Joint Surg Am. 2001;83(12):1783-1788.

21. Kan SL, Yang B, Ning GZ, Chen LX, Li YL, Gao SJ, Chen XY, Sun JC, Feng SQ. Nonsteroidal anti-inflammatory drugs as prophylaxis for heterotopic ossification after total hip arthroplasty. Med. 2015;94(18).

22. Pakos EE, Ioannidis JPA. Radiotherapy vs. nonsteroidal anti-inflammatory drugs for the prevention of heterotopic ossification after major hip procedures: A meta-analysis of randomized trials. Int J Radiat Oncol Biol Phys. 2004;60(3):888-895.

23. Vavken P, Castellani L, Sculco TP. Prophylaxis of heterotopic ossification of the hip: Systematic review and meta-analysis. Clin Orthop Relat Res. 2009;467(12):3283-3289.

24. Cai L, Wang Z, Luo X, She W, Zhang H. Optimal strategies for the prevention of heterotopic ossification after total hip arthroplasty: A network meta-analysis. Int J Surg. 2019;62:74-85.

25. Board TN, Karva A, Board RE, Gambhir AK, Porter ML. The prophylaxis and treatment of heterotopic ossification following lower limb arthroplasty. J Bone Joint Surg Br. 2007;89(4):434-440.

26. Burd TA, Hughes MS, Anglen JO. Heterotopic ossification prophylaxis with indomethacin increases the risk of long-bone nonunion. J Bone Joint Surg Br. 2003;85(5):700-705.

27. Webb LX, Bosse MJ, Mayo KA, Lange RH, Miller ME, Swiontkowski MF. Results in Patients with Craniocerebral Trauma and an

Operatively Managed Acetabular Fracture. J Orthop Trauma. 1990;4(4):376-382.

28. Daum WJ, Scarborough MT, Gordon W, Uchida T. Heterotopic ossification and other perioperative complications of acetabular fractures. J Orthop Trauma. 1992;6(4):427-432.

29. Negrin LL, Seligson D. Results of 167 consecutive cases of acetabular fractures using the Kocher-Langenbeck approach: A case series. J Orthop Surg Res. 2017;12:66.

30. Johnson EE, Kay RM, Dorey FJ. Heterotopic ossification prophylaxis following operative treatment of acetabular fracture. Clin Orthop Relat Res. 1994;305:88-95.

31. Joseph NM, Flanagan CD, Heimke IM, Cho E, Pothireddy S, Scarcella N, Vallier HA. Factors influencing functional outcomes following open reduction internal fixation of acetabular fractures. Injury. 2020 Nov 15 [Epub ahead of print].

32. Rath EMS, Russell G V., Washington WJ, Chip Routt ML. Gluteus minimus necrotic muscle debridement diminishes heterotopic ossification after acetabular fracture fixation. Injury. 2002;33(9):751-756.

33. Salameh M, Hammad M, Babikir E, Ahmed AF, George B, Alhaneedi G. The role of patient positioning on the outcome of acetabular fractures fixation through the Kocher–Langenbeck approach. Eur J Orthop Surg Traumatol. 2020 Sept 28 [Epub ahead of print].

34. Johnson EE, Matta JM, Mast JW, Letournel E. Delayed Reconstruction of Acetabular Fractures 21-120 Days Following Injury. Clin Orthop Relat Res. 1994;305:20-30.

35. Moed BR, Maxey JW. The effect of indomethacin on heterotopic ossification following acetabular fracture surgery. J Orthop Trauma. 1993;7(1):33-38.

36. Bilekdemir U, Civan O, Cavit A, Özdemir H. Acetabular fractures treated surgically: Which of the parameters affect prognosis. Ulus Travma ve Acil Cerrahi Derg. 2020;26(2):265-273.

37. Chen MJ, Tigchelaar SS, Wadhwa H, Frey CS, Bishop JA, Gardner MJ, Bellino MJ. Gluteus Minimus Debridement During Acetabular Fracture Surgery Does Not Prevent Heterotopic Ossification - A Comparative Study. J Orthop Trauma. 2021 Jan 18 [Epub ahead of print].

38. Leucht P, Castillo AB, Bellino MJ. Comparison of tricalcium phosphate cement and cancellous autograft as bone void filler in acetabular fractures with marginal impaction. Injury. 2013;44(7):969-974.

39. D'Heurle A, Archdeacon MT, Hiratzka S, Casstevens C, Finnan R, McCoy B. Do Surrogates of Injury Severity Influence the Occurrence of Heterotopic Ossification in Fractures of the Acetabulum? J Orthop Trauma. 2016;30(4):213-216.

40. Elhassan Y, Abdelhaq A, Piggott RP, Osman M, McElwain JP, Leonard M. Heterotopic Ossification following acetabular fixation:

Incidence and risk factors: 10-year experience of a tertiary centre. Injury. 2016;47(6):1332-1336.

41. Ghalambor N, Matta JM, Bernstein L. Heterotopic ossification following operative treatment of acetabular fracture. An analysis of risk factors. Clin Orthop Relat Res. 1994;305:96-105.

42. Karunakar MA, Shah SN, Jerabek S. Body mass index as a predictor of complications after operative treatment of acetabular fractures. J Bone Joint Surg Am. 2005;87(7):1498-1502.

43. Mourad WF, Packianathan S, Shourbaji RA, Zhang Z, Graves M, Khan MA, Baird MC, Russell G, Vijayakumar S. The impact of body mass index on heterotopic ossification. Int J Radiat Oncol Biol Phys. 2012;82(5):e831-e836.

44. Alonso JE, Davila R, Bradley E. Extended iliofemoral versus triradiate approaches in management of associated acetabular fractures. Clin Orthop Relat Res. 1994;305:81-87.

45. Childs HA, Cole T, Falkenberg E, Smith JT, Alonso JE, Stannard JP, Spencer SA, Fiveash J, Raben D, Bonner JA, Westfall AO, Kim RY. A prospective evaluation of the timing of postoperative radiotherapy for preventing heterotopic ossification following traumatic acetabular fractures. Int J Radiat Oncol Biol Phys. 2000;47(5):1347-1352.

46. Mathew M, Maheshwari N, Juliano J, Varlotto J, Ferenci M, Liao J, Wagner H, Mackley H. Can Radiation Wait Until Monday After a Friday Surgery? Time Interval Between Hip Surgery and Radiation Therapy and the Risk of Subsequent Heterotopic Ossification(HO). Presented as an oral presentation at the Proceedings of the 24th Annual Meeting of the American College of Radiation Oncology; 2014 Feb 27-Mar 1; Orlando, FL. Abstract no. 8.

47. Donabedian A. Evaluating the quality of medical care. Milbank Q. 2005;83(4):691-729.

48. Sheehan KJ, Sobolev B, Guy P. Mortality by Timing of Hip Fracture Surgery. J Bone Joint Surg Am. 2017;99(20):e106.

49. Zychowicz ME. Pathophysiology of heterotopic ossification. Orthop Nurs. 2013;32(3):173-177.

50. Balboni TA, Gobezie R, Mamon HJ. Heterotopic ossification: Pathophysiology, clinical features, and the role of radiotherapy for prophylaxis. Int J Radiat Oncol Biol Phys. 2006;65(5):1289-1299.

51. Łęgosz P, Drela K, Pulik Ł, Sarzyńska S, Małdyk P. Challenges of heterotopic ossification-Molecular background and current treatment strategies. Clin Exp Pharmacol Physiol. 2018;45(12):1229-1235.

52. Kraft CT, Agarwal S, Ranganathan K, Wong VW, Loder S, Li J, Delano MJ, Levi B. Trauma-induced heterotopic bone formation and the role of the immune system: A review. J Trauma Acute Care Surg. 2016;80(1):156-165.

53. Lord JM, Midwinter MJ, Chen YF, Belli A, Brohi K, Kovacs EJ, Koenderman L, Kubes P, Lilford RJ. The systemic immune response to

trauma: An overview of pathophysiology and treatment. Lancet. 2014;384(9952):1455-1465.

54. Balogh ZJ, Varga E, Tomka J, Süveges G, Tóth L, Simonka JA. The new injury severity score is a better predictor of extended hospitalization and intensive care unit admission than the injury severity score in patients with multiple orthopaedic injuries. J Orthop Trauma. 2003;17(7):508-512.

55. Fern KT, Smith JT, Zee B, Lee A, Borschneck D, Pichora DR. Trauma patients with multiple extremity injuries: Resource utilization and long-term outcome in relation to injury severity scores. J Trauma - Inj Infect Crit Care. 1998;45(3):489-494.

56. Cipriano CA, Pill SG, Keenan MA. Heterotopic ossification following traumatic brain injury and spinal cord injury. J Am Acad Orthop Surg. 2009;17(11):689-697.

57. Sullivan MP, Torres SJ, Mehta S, Ahn J. Heterotopic ossification after central nervous system trauma. Bone Joint Res. 2013;2(3):51-57.

58. Huang H, Cheng WX, Hu YP, Chen JH, Zheng ZT, Zhang P. Relationship between heterotopic ossification and traumatic brain injury: Why severe traumatic brain injury increases the risk of heterotopic ossification. J Orthop Transl. 2018;12:16-25.

59. Cadosch D, Gautschi OP, Thyer M, Song S, Skirving AP, Filgueira L, Zellweger R. Humoral factors enhance fracture-healing and callus formation in patients with traumatic brain injury. J Bone Joint Surg Am. 2009;91(2):282-288.

60. Dawson-Amoah K, Raszewski J, Duplantier N, Waddell BS. Dislocation of the hip: A review of types, causes, and treatment. Ochsner J. 2018;18(3):242-252.

61. Eggli S, Woo A. Risk factors for heterotopic ossification in total hip arthroplasty. Arch Orthop Trauma Surg. 2001;121(9):531-535.

62. Pavlou G, Salhab M, Murugesan L, Jallad S, Petsatodis G, West R, Tsiridis E. Risk factors for heterotopic ossification in primary total hip arthroplasty. HIP Int. 2012;22(1):50-55.

63. Bischoff R, Dunlap J, Carpenter L, DeMouy E, Barrack R. Heterotopic ossification following uncemented total hip arthroplasty. Effect of the operative approach. J Arthroplasty. 1994;9(6):641-644.

64. Pai VS. Heterotopic ossification in total hip arthroplasty. The influence of the approach. J Arthroplasty. 1994;9(2):199-202.

65. Ziran N, Soles GLS, Matta JM. Outcomes after surgical treatment of acetabular fractures: A review. Patient Saf Surg. 2019;13(1):16.

66. Tannast M, Najibi S, Matta JM. Two to Twenty-Year Survivorship of the Hip in 810 Patients with Operatively Treated Acetabular Fractures. J Bone Joint Surg Am. 2012;94(17):1559-1567.

67. Pascarella R, Cerbasi S, Politano R, Balato G, Fantasia R, Orabona G, Mariconda M. Surgical results and factors influencing outcome in

patients with posterior wall acetabular fracture. Injury. 2017;48(8):1819-1824.

68. Pearl J. Causal diagrams for empirical research. Biometrika. 1995;82(4):669-688.

69. Plaisier BR, Meldon SW, Super DM, Malangoni MA. Improved outcome after early fixation of acetabular fractures. Injury. 2000;31(2):81-84.