



Supplementary Material

10.1302/2046-3758.99.BJR-2020-0023.R1

Table i. Search string run in both MEDLINE and Embase for study identification.

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|---|
| 1. hip fracture/ or exp femur intertrochanteric fracture/ or exp femur neck fracture/ or exp femur pertrochanteric fracture/ or exp femur subtrochanteric fracture/ or exp femur trochanteric fracture/ |
| 2. *hip fracture/ or exp *femur intertrochanteric fracture/ or exp *femur neck fracture/ or exp *femur pertrochanteric fracture/ or exp *femur subtrochanteric fracture/ or exp *femur trochanteric fracture/ |
| 3. (hip* adj9 fractu*).ti,ab. |
| 4. (hip* adj9 break*).ti,ab. |
| 5. (proximal femur* adj9 fractur*).ti,ab. |
| 6. (proximal femur* adj9 break*).ti,ab. |
| 7. 2 or 3 or 4 or 5 or 6 |
| 8. 1 or 3 or 4 or 5 or 6 |
| 9. hip surgery/ |
| 10. *hip surgery/ |
| 11. surg*.ti,ab. |
| 12. operat*.ti,ab. |
| 13. proced*.ti,ab. |
| 14. replacement arthroplasty/ or hip replacement/ or total arthroplasty/ |
| 15. *replacement arthroplasty/ or *hemiarthroplasty/ or *total arthroplasty/ |
| 16. fracture fixation/ or intramedullary nailing/ or plate fixation/ |
| 17. *fracture fixation/ or *intramedullary nailing/ or *plate fixation/ |
| 18. orthopedic fixation device/ or bone plate/ or femoral fixation device/ |
| 19. *orthopedic fixation device/ or *bone plate/ or *femoral fixation device/ |
| 20. fixation*.ti,ab. |
| 21. 10 or 11 or 12 or 13 or 15 or 17 or 19 or 20 |
| 22. 9 or 11 or 12 or 13 or 14 or 16 or 18 or 20 |
| 23. infection rate/ |
| 24. *infection rate/ |
| 25. (rate* adj3 infection*).ti,ab. |
| 26. infect*.ti,ab. |
| 27. *infection/ or *"bone and joint infections"/ or *device infection/ or *healthcare associated infection/ or *infection complication/ or *infection rate/ |
| 28. infection/ or "bone and joint infections"/ or device infection/ or healthcare associated infection/ or infection complication/ or infection rate/ |
| 29. surgical infection/ or "infections associated with other infections or conditions"/ or infectious complication/ or postoperative complication/ |
| 30. *surgical infection/ or *"infections associated with other infections or conditions"/ or *infectious complication/ or *postoperative complication/ |
| 31. 23 or 25 or 26 or 28 or 29 |
| 32. 24 or 26 or 27 or 30 |
| 33. 8 and 22 and 31 |

Table ii. Summary of modified Newcastle-Ottawa Scales.

| Study author | Selection | Outcome | Global rating* |
|---------------------|------------------|----------------|-----------------------|
| Ahmed | ★★ | ★★ | Fair |
| Barr | ★★ | ★★ | Fair |
| Chandran | ★ | ★★ | Poor |
| Chaplin | ★ | ★★★★ | Poor |
| Chapman | ★★ | ★★ | Fair |
| Duckworth | ★★ | ★★ | Fair |
| Edwards | ★★ | ★★ | Fair |
| Findlay | ★★ | ★★ | Fair |
| Hargrove | ★★ | ★★ | Fair |
| Harrison | ★★ | ★★ | Fair |
| Jettoo | ★★ | ★★ | Fair |
| Mackay | ★★ | ★★ | Fair |
| Mamarelis | ★★ | ★★ | Fair |
| Morgan | ★★ | ★ | Poor |
| Reilly | ★★ | ★ | Poor |
| Robinson | ★★ | ★★ | Fair |
| Shewale | ★★ | ★★ | Fair |
| Sprowson | ★★ | ★★★★ | Fair |
| Theodorides | ★★ | ★★ | Fair |
| Wright | ★★ | ★★ | Fair |

*Good quality: Three or four stars in selection domain AND one or two stars in comparability domain AND two or three stars in outcome/exposure domain. Fair quality: two stars in selection domain AND one or two stars in comparability domain AND two or three stars in outcome/exposure domain. Poor quality: zero or one star in selection domain OR zero stars in comparability domain OR zero or one star in outcome/exposure domain.

Table iii. Summary of studies included in systematic review and meta-analysis. Italicized studies were only reported and not analyzed in the quantitative synthesis.

| Author (year) | Journal | Hospital | Years represented | Prospective or retrospective | Patient cohort | Cases, n | Study specified follow-up, months | Diagnostic criteria for infection | Total infections (any) | Surgical infections (incidence proportion) | Superficial infection only, n (%) | Deep infection only, n (%) | Reoperation for infection, n (%) | Summary | Mean age of cohort | M:F ratio of cohort per 100 patients |
|------------------|--|---------------------------|-------------------|------------------------------|--|----------|-----------------------------------|--|------------------------|--|-----------------------------------|----------------------------|----------------------------------|---|--------------------|--------------------------------------|
| Ahmed (2016) | European Journal of Orthopaedic Surgery and Traumatology | Hull | 2010 to 2013 | Retrospective | All hip fracture | 1,500 | 1 | Reoperation for infection | 27 | 1.80 | N/A | N/A | 27 (1.80) | Historical comparison of two different antibiotic regimens | 81.3 | 25.6:74.4 |
| Barr (2015) | Injury | Cambridge (Addenbrooke's) | 2011 to 2013 | "Prospective" | All hip fracture > 60 | 841 | 12 | Reoperation or readmission for SSI | 13 | 1.55 | 9 (1.1) | 4 (0.5) | N/A | Comparison of hip fracture care and outcomes after MTC introduction | 83 | 28:72 |
| Chandran (2006) | Acta Orthop Belg | Scarborough | 1989 to 2000 | Retrospective | Hemiarthroplasty only-specific implant | 103 | 48 | Revision for infection | 1 | 0.97 | N/A | 1 (0.97) | 1 (0.97) | Case series Furlong | 77.5 | N/A |
| Chaplin (2013) | Annals of the Royal College of Surgeons | Redditch | 2004 to 2009 | Prospective-database | Hemiarthroplasty only | 110 | 36 | None given | 11 | 10.00 | 3 (2.7) | 8 (7.3) | 5 (4.5) | Case series with selective follow up of Austin Moore in DGH | 80 | 25:75 |
| Chapman (2016) | Clinical Biochemistry | Oxford | 2012 to 2013 | Retrospective | All hip fracture | 684 | 1 | Study's own: Wound cellulitis, persistent ooze treatment with antibiotics, return to theatre and positive wound microbiology | 22 | 2.05 | N/A | N/A | N/A | Cohort of operatively managed hip fractures followed up to explore utility of CRP | 81.4 | 25:75 |
| Duckworth (2012) | Injury | Edinburgh | 2005 to 2008 | Prospective-database | All hip fractures | 2,718 | 1 | Positive microbiology from wound sample-superficial infections excluded | 43 | 1.43 | N/A | 43 (1.43) | 43 (1.43) | Cohort of infected cases examined for risk factors | 73 | N/A |

| | | | | | | | | | | | | | | | | |
|------------------|---|----------------------------|--------------|----------------------|--|--------|------------|---|-----|-------|----------|-----------|-----------|---|-------|-----------|
| Edwards (2008) | JBJS Br | Nottingham | 1999 to 2004 | Prospective-database | All hip fracture | 3,563 | > 5 months | Study's own: Deep to fascia = deep. Antibiotic only = superficial | 80 | 2.25 | 39 (1.1) | 41 (1.2) | 41 (1.2) | Single centre cohort looking at numbers of infections | 80.1 | 20.1:79.9 |
| Findlay (2011) | JBJS Br | Nottingham | 2007 to 2009 | Prospective-database | All hip fracture | 1,578 | 12 | None given | 41 | 2.60 | 25 (1.6) | 16 (1.0) | N/A | Within centre cohort study reporting complications in the context of service redesign | 80.2 | 26:74 |
| Hargrove (2006) | JBJS Br | 4 different centres | Pre-2006 | Prospective | All hip hemiarthroplasty across 4 centres | 356 | 1 | The Nosocomial Infection National Surveillance System (99) | 39 | 10.96 | 26 (7.3) | 13 (3.7) | N/A | RCT comparing pulsed lavage to control in hemiarthroplasty | N/A | N/A |
| Harrison (2012) | JBJS Br | Peterborough | 1986 to 2010 | Prospective-database | All hip fracture (exclude THA) | 6,905 | 12 | CDC | 50 | 0.72 | N/A | 50 (0.7) | N/A | Single centre cohort of all but THA cases | 80.6 | 22:78 |
| Jattoo (2016) | Journal of Orthopaedic Surgery | Multicentre UK | 2007 to 2013 | Administrative data | Internally fixed intracapsular hip fracture cannulated screws or SHS | 52,884 | 3 | ICD codes | 215 | 0.41 | N/A | N/A | N/A | Large cohort from national data of internally fixed intracapsular hip fractures | N/A | N/A |
| Mackay (2000) | J R Coll Surg Ed | Newcastle | 1997 | Retrospective | All proximal femoral fractures | 357 | 3 | Surgical Infection Study Group (100) | 8 | 2.24 | N/A | 8 (2.24) | 7 (2.0) | Single centre audit of infection rate before and after guideline implementation | 80 | 17:83 |
| Mamarelis (2017) | BJJ | Harlow | 2010 to 2015 | Retrospective | All hemiarthroplasty for intracapsular hip fractures | 705 | 3 | Positive microbiology and return to theatre | 13 | 1.84 | N/A | 13 (1.84) | 13 (1.84) | Retrospective review of return to theatre in hemiarthroplasty | 83.74 | 25:75 |
| Morgan (2005) | J Hospital Infection | Multicentre | Unknown | Prospective | Internal fixation or hemiarthroplasty | 1,127 | 12 | CDC | 33 | 2.93 | N/A | N/A | N/A | Multicentre prospective study of CDC infection primary hip/knee and hip fracture. Only assessed as inpatients | N/A | N/A |
| Reilly (2006) | Infection Control and Hospital Epidemiology | 32 centres across Scotland | 2002 to 2004 | Prospective | Repair fracture neck of femur | 2,303 | 1 | CDC | 74 | 3.21 | N/A | N/A | N/A | Investigation of SSI diagnosis after repair of neck of femur | N/A | N/A |

| | | | | | | | | | | | | | | | | |
|--------------------|------------------------|------------------|---|----------------------|--|--------|-------------|--|-----|-------|-----------|------------|------------|---|-------|---------------------------------|
| Robinson (2005) | JBJS Am | Edinburgh | 1994 to 2001 | Retrospective | Subtrochanteric fractures | 302 | 12 | Superficial & deep needed signs and culture-study's own | 42 | 13.91 | 37 (12.3) | 5 (1.7) | 6 (1.9) | Case series of long cephalomedullary nails | 78.5 | N/A |
| Shewale (2004) | Hip International | Southampton | Pre-2004 | Retrospective | Patients undergoing hemiarthroplasty | 200 | > 12 months | None given | 11 | 5.50 | 4 (2.0) | 7 (3.5) | N/A | Single centre review of change from uncemented Austin Moore to cemented Thompson. | 84.9 | 10:90 |
| Spowson (2016) | Bone and Joint Journal | Northumbria | 2008-2012 | Prospective | Patients undergoing hemiarthroplasty | 848 | 12 months | HPA SSI | 17 | 2.00 | 0 | 17 | N/A | RCT comparing single vs dual antibiotic cement | 82.65 | |
| Theodorides (2011) | Injury | Leeds and Oxford | Leeds-2004 to 2010 Oxford-1998 to 2008 | Prospective-database | All patients treated surgically for hip fracture | 10,061 | > 1 | Deep = reoperation and positive culture in sample deep to fascia | 105 | 1.04 | N/A | 105 (1.04) | 105 (1.04) | Review of treatment of deep infection at two centres | 83 | Not reported for overall cohort |
| Wright (2008) | Injury | Warrington | 2002 to 2003 | Prospective | All hip fracture | 230 | 1 | None given | 28 | 12.17 | N/A | N/A | N/A | Single centre review of POSSUM scoring system for predicting outcome in surgically treated hip fracture | 80 | N/A |

CDC, Centers for Disease Control and Prevention; DGH, District General Hospital; HPA, Health Protection Agency; ICD, International Classification of Diseases; MTC, major trauma centre; N/A, not available; POSSUM, Physiological and Operative Severity Score for the enUmeration of Mortality and morbidity; RCT, randomized controlled trial; SHS, sliding hip screw; SSI, surgical site infection; THA, total hip arthroplasty.

Table iv. Summary of historical studies identified by search, which met inclusion criteria but were published before 2000.

| Study author (year) | Journal | Hospital | Years represented | Prospective or retrospective | Patient cohort | Patients/cases, n | Mean follow up, months | Diagnostic criteria for infection | Total infections (any) |
|----------------------------|------------------------------|---|--------------------------|-------------------------------------|--|--------------------------|-------------------------------|--|-------------------------------|
| Christie (1988) | JBJS Br | Edinburgh | Pre-1988 | Prospective | RCT-displaced subcapital hip fractures | 127 | 12 | None given | 6 |
| D'Arcy (1976) | JBJS Br | Hastings | 1966 to 1972 | Retrospective | Hemiarthroplasty only-specific implant | 354 | Not specified | None given | 17 |
| Hunter (1969) | BJS | Oxford | 1963 to 1967 | Retrospective | Hemiarthroplasty and internal fixation | 186 | Not specified | None given | 24 |
| Keene (1993) | Injury | Peterborough and Birmingham Accident Hospital | Pre-1993 | Prospective | Hemiarthroplasty | 531 | Not Specified | None given | 32 |
| McQueen (1990) | Injury | Edinburgh | 1986 to 1986 | Prospective | All hip fracture | 502 | 1 | None given | 69 |
| Parker (1994) | International Orthopaedics | Peterborough and Birmingham Accident Hospital | Pre-1993 | Prospective | All hip fracture | 1722 | Unknown | None given | 20 |
| Robinson (1994) | Clin Orthop Related Research | Livingstone | 1989 to 1991 | Prospective | Intracapsular hip fractures | 166 | 21 | None given | 8 |
| Skinner (1986) | JBJS Br | King's College London | 1980 to 1983 | Retrospective | Displaced subcapital fracture | 107 | 22 | None given | 5 |
| Wood (1980) | Injury | Black Notley Hospital Essex | 1972 to 1977 | Retrospective | Displaced fracture | 235 | Unknown | Positive culture from wound | 18 |