

Appendix

Case selection process for Medicare intertrochanteric femur fractures

Physician Claims Files (Carrier) 2000-2002

Select on:

1. One of two Current Procedural Terminology (CPT) codes from the physician claim files⁵²:

27244: treatment of inter/per/subtrochanteric femoral fracture; with plate-and-screw type implant, **or**

27245: treatment of inter/per/subtrochanteric femoral fracture; with intramedullary implant

and

2. One of the following line ICD-9-CM diagnosis codes⁵³:

820.2	perthrochanteric fracture, closed
820.20	closed fracture, trochanteric section, unspecified
820.21	closed fracture, intertrochanteric section
820.22	closed fracture, subtrochanteric section
820.3	perthrochanteric fracture, open
820.30	open fracture, trochanteric section, unspecified
820.31	open fracture, intertrochanteric section
820.32	open fracture, subtrochanteric section
820.8	unspecified part of neck of femur, closed
820.9	unspecified part of neck of femur, open

From those cases, exclude the following:

- denied claims
- denied line items
- claims paid to physicians assistants
- provider facility (surgeon's) state code outside of the fifty United States or District of Columbia
- cases with procedure code modifiers (either modifier field):
 - 50: bilateral procedure
 - 53: discontinued procedure
 - 55: postoperative management only

- 56: preoperative management only
- 58: staged or related procedure by same surgeon during the postoperative period
- 62: two surgeons
- 78: return to operating room for related procedure during the postoperative period
- 79: unrelated procedure by the same surgeon during the postoperative period
- 80: assistant surgeon
- 81: minimal assistant surgeon
- 82: assistant surgeon when qualified resident surgeon not available
- AS: physicians assistant claim

3. For each patient: If more than one hip surgery date met selection criteria, we kept only the physician claim for the first (earliest) hip surgery date.

Beneficiary Enrollment Files (Denominator) 2000-2002

Exclude the following:

- race listed as *unknown*
- patients with any managed care enrollment
- Medicare status code 20,21,31 (non-elderly disabled [or not] with or without end-stage renal disease)
- non-United States residents

Hospital Claims Files (MEDPAR) 2000-2002

Select on:

1. One of two ICD-9-CM procedure codes from the hospital file⁵⁴:

- 79.15 closed reduction of femur fracture with internal fixation, **or**
- 79.35 open reduction of femur fracture with internal fixation

and

2. One of the following line ICD-9 diagnosis codes: limit to fractures of the proximal part of the femur⁵³:

820.2	pertrochanteric fracture, closed
820.20	closed fracture, trochanteric section, unspecified
820.21	closed fracture, intertrochanteric section
820.22	closed fracture, subtrochanteric section
820.3	pertrochanteric fracture, open
820.30	open fracture, trochanteric section, unspecified
820.31	open fracture, intertrochanteric section
820.32	open fracture, subtrochanteric section
820.8	unspecified part of neck of femur, closed
820.9	unspecified part of neck of femur, open

Case exclusions:

Exclude claim if any of the following diagnoses are present, any diagnosis field (1-10):

- Osteomyelitis:

730.0	Osteomyelitis, unspecified site
730.00	Acute osteomyelitis, unspecified site
730.05	Acute osteomyelitis, pelvic region and thigh
730.10	Chronic osteomyelitis, unspecified site
730.15	Chronic osteomyelitis, pelvic region and thigh
730.20	Unspecified osteomyelitis, unspecified site
730.25	Unspecified osteomyelitis, pelvic region and thigh
730.30	Periostitis without mention of osteomyelitis, unspecified site
730.35	Periostitis without mention of osteomyelitis, pelvic region and thigh
730.90	Unspecified infection of bone, unspecified site
730.95	Unspecified infection of bone, pelvic region and thigh
- Pathologic fracture: delete only if accompanied by a cancer-related or V10 code, or if not accompanied by an osteoporosis code (see Neoplasms below):

733.1	Pathologic fracture
733.10	Pathologic fracture, unspecified site
733.14	Pathologic fracture of neck of femur
733.15	Pathologic fracture of other specified part of femur

- Avascular necrosis:
 - 733.4 Aseptic necrosis of bone
 - 733.40 Aseptic necrosis of bone, unspecified site
 - 733.42 Aseptic necrosis of bone, head and neck of femur
 - 733.49 Aseptic necrosis of bone, other
- Malunion and nonunion of fracture:
 - 733.8 Malunion and nonunion of fracture
 - 733.81 Malunion of fracture
 - 733.82 Nonunion of fracture
- Pelvis and/or multiple lower extremity fractures:
 - 808.0 Fractures of acetabulum, closed
 - 808.1 Fractures of acetabulum, open
 - 808.2 Pubis, closed
 - 808.3 Pubis, open
 - 808.4 Other pelvis, closed
 - 808.4x Other specified fracture of pelvis, closed
 - 808.5x Other specified fracture of pelvis, open
 - 808.8 Unspecified fracture of pelvis, closed
 - 808.9 Unspecified fracture of pelvis, open
 - 827.0 Other multiple and ill-defined fractures of lower limb, closed
 - 827.1 Other multiple and ill-defined fractures of lower limb, open
 - 828.0 Multiple fractures involving both lower limbs, closed
 - 828.1 Multiple fractures involving both lower limbs, open
- Late effects of musculoskeletal and connective tissue injuries:
 - 905.3 Late effect of fracture of neck of femur
 - 905.4 Late effect of lower extremity fracture
 - 905.5 Late effect of fracture of multiple and unspecified bones
- Mechanical complication of internal orthopaedic device, implant, and graft:
 - 996.4 Mechanical complication of internal orthopaedic device, implant, and graft
- Infection and inflammatory reaction due to internal prosthetic device, implant, and graft
 - 996.60 Due to unspecified device, implant, and graft

- 996.67 Due to internal orthopaedic device, implant, and graft
- Device complications: other complications of internal prosthetic device, implant, and graft
 - 996.70 Due to unspecified device, implant, and graft
 - 996.78 Due to other internal orthopaedic device, implant, and graft
- Postoperative infection:
 - 998.59 Other postoperative infection
- Other specified complications of procedures, not elsewhere classified:
 - 998.83 Nonhealing surgical wound
 - 998.89 Other specified complications
 - 998.9 Unspecified complication of procedure, not elsewhere classified
- Aftercare and rehabilitation:
 - V53.7 Fitting and adjustment of orthopaedic device
 - V54.0x Aftercare involving internal fixation device
 - V54.13 Aftercare for healing traumatic fracture of hip
 - V54.14 Aftercare for healing traumatic fracture of leg, unspecified
 - V54.15 Aftercare for healing traumatic fracture of upper leg
 - V54.16 Aftercare for healing traumatic fracture of lower leg
 - V54.17 Aftercare for healing traumatic fracture of vertebrae
 - V54.19 Aftercare for healing traumatic fracture of other bone
 - V54.2x Aftercare for healing pathologic fracture
 - V54.8x Other orthopaedic aftercare
 - V54.9 Unspecified orthopaedic aftercare
 - V57.89 Other specified rehabilitation procedure, other
 - V58.43 Aftercare following surgery for injury and trauma
 - V58.49 Other specified aftercare following surgery
- Evidence of high-energy trauma involving train, motor vehicle, bicycle, pedestrian hit, off-road vehicle, snow vehicle, animal riding, other:
 - E810 through E823, and E825 through E829
- Neoplasms:
 - 170.6 Malignant neoplasm of pelvic bones, sacrum and coccyx
 - 170.7 Malignant neoplasm of long bones of lower limb

170.9	Malignant neoplasm of bone and articular cartilage, site unspecified
195.x	Malignant neoplasm of other and ill-defined sites
198.5	Secondary malignant neoplasm of bone and bone marrow
196.x	Secondary and unspecified malignant neoplasm of lymph nodes
197.x	Secondary malignant neoplasm of respiratory and digestive systems
198.x	Secondary malignant neoplasm of other specified sites
199.0	Malignant neoplasm without specification of site, disseminated
199.1	Malignant neoplasm without specification of site, other
200.x	Lymphosarcoma and reticulosarcoma
201.x	Hodgkin disease
202.x	Other malignant neoplasms of lymphoid and histiocytic tissue
203.xx	Multiple myeloma and immunoproliferative neoplasms
204.xx	Lymphoid leukemia
205.xx	Myeloid leukemia
206.xx	Monocytic leukemia
207.xx	Other specified leukemia
208.xx	Leukemia of unspecified cell type
213.6	Benign neoplasm of pelvic bones, sacrum and coccyx
213.7	Benign neoplasm of long bones of lower limb
213.9	Benign neoplasm of bone and articular cartilage, site unspecified
238.0	Neoplasm of uncertain behavior, bone and articular cartilage
239.2	Neoplasm of unspecified nature of bone, soft tissue, and skin
V10.81	Personal history of malignant neoplasm of bone

Additional notes on patients with cancer-related diagnosis codes:

- We excluded cases coded as having a *pathologic fracture* if there was any accompanying neoplasm or history of cancer code (V10.xx).
 - From the remaining claims, we excluded cases coded as having a *pathologic fracture* without an accompanying *osteoporosis* code on the claim.
- [We therefore included cases with a *pathologic fracture* code only if there was an accompanying *osteoporosis* code (733.0x) and no neoplasm or history of cancer (V10.xx) code.]

- Following the above case exclusions, we divided the remaining cases with any MEDPAR ICD-9 cancer-related code(s) into three categories (none were listed as having pathologic fractures):
 1. cases with any one of five cancers that most commonly metastasize to bone:
thyroid, breast, prostate, kidney, or lung
 2. cases with other cancers, not previously excluded
 3. cases with a V10.x code only, other than V10.81 (previously excluded)

-If a claim had both a V10 and an ICD-9 cancer code (#1 or #2 above), the patient was categorized in the appropriate cancer category.

-If a claim had both types of cancer codes (#1 and #2), they were included in category #1 above.

We added these remaining cases with a cancer-related diagnosis (categories #1-#3 above) as three dummy-coded predictors in logistic regression, modeling intramedullary nail use (0/1) as a function of state, year, and the other standard patient predictors. None of the coefficients on the above three cancer-related predictors were significant for device; therefore we included these patients in our analysis.

Final steps: (all patients had a CPT procedure code of 27244 or 27245):

- Merged files, first by year (Carrier+MEDPAR+enrollment), then all three years together
- Kept the first hip surgery date by patient identifier across all three years
- Limited cases to a diagnosis and procedure date match (MEDPAR and Carrier files) within a ± 7 -day window around the Carrier hip surgery date
- Limited cases to Medicare (Parts A+B enrollment) or (Parts A+B with Medicaid-administered assistance) during the hospital stay of interest
- Calculated patient age on the date of surgery with use of the hip surgery date from the Carrier claim and each patient's date of birth listed in the enrollment file. Kept case if age was sixty-five years or greater on the date of surgery.

TABLE E-1 2000 Adjusted Odds Ratios and Rates of Intramedullary Nail Use for Intertrochanteric Fractures in Medicare Beneficiaries

State	Adjusted Odds Ratio ¹ Compared with Wyoming	95% Confidence Interval for Odds Ratio	Adjusted Intramedullary Nail Rate ^{1,2}
Alabama	0.704	0.350-1.416	5.62
Alaska	0.222	0.027-1.811	1.96
Arizona	2.339	1.179-4.639	14.86
Arkansas	0.656	0.319-1.349	4.97
California	1.475	0.756-2.877	10.36
Colorado	1.316	0.645-2.687	8.97
Connecticut	0.872	0.429-1.773	6.07
Delaware	1.028	0.444-2.378	7.08
District of Columbia	0.647	0.189-2.217	6.06
Florida	1.928	0.991-3.752	12.20
Georgia	0.750	0.377-1.492	5.75
Hawaii	0.422	0.136-1.307	4.00
Idaho	1.068	0.479-2.379	7.42
Illinois	2.139	1.096-4.172	13.21
Indiana	1.013	0.512-2.003	7.14
Iowa	0.363	0.173-0.760	2.76
Kansas	1.011	0.500-2.047	7.43
Kentucky	0.792	0.392-1.598	5.57
Louisiana	0.509	0.245-1.059	3.89
Maine	0.463	0.205-1.044	3.59
Maryland	0.930	0.463-1.867	6.94
Massachusetts	0.532	0.264-1.074	3.81
Michigan	1.292	0.659-2.533	8.91
Minnesota	0.720	0.355-1.459	5.48

Mississippi	0.646	0.311-1.341	5.22
Missouri	0.908	0.458-1.800	6.35
Montana	2.835	1.368-5.874	17.05
Nebraska	1.257	0.612-2.582	8.62
Nevada	2.786	1.347-5.765	17.70
New Hampshire	1.391	0.655-2.953	9.34
New Jersey	1.077	0.546-2.123	7.34
New Mexico	0.533	0.234-1.213	4.06
New York	0.699	0.356-1.372	4.80
North Carolina	0.553	0.278-1.100	4.27
North Dakota	0.387	0.147-1.020	3.00
Ohio	0.960	0.489-1.884	6.99
Oklahoma	0.564	0.273-1.163	4.14
Oregon	1.104	0.535-2.277	7.78
Pennsylvania	1.205	0.617-2.354	8.11
Rhode Island	0.277	0.102-0.755	2.10
South Carolina	1.715	0.865-3.402	11.93
South Dakota	0.573	0.244-1.345	3.99
Tennessee	1.270	0.644-2.505	8.85
Texas	1.452	0.745-2.829	9.84
Utah	2.608	1.273-5.341	15.82
Vermont	0.778	0.299-2.021	6.29
Virginia	0.631	0.315-1.262	4.86
Washington	0.804	0.397-1.628	5.81
West Virginia	5.247	2.650-10.390	27.63
Wisconsin	0.514	0.255-1.035	3.86
Wyoming	1.000	Reference state	7.52

¹Adjusted for patient age, sex, race, Charlson score, subtrochanteric fracture, and Medicaid-administered assistance. ²Rate per

100 Medicare patients with an intertrochanteric fracture treated with internal fixation; sixty-five years of age or older.

TABLE E-2 2002 Adjusted Odds Ratios and Rates of Intramedullary Nail Use for Intertrochanteric Fractures in Medicare Beneficiaries

State	Adjusted Odds Ratio ¹ Compared with Wyoming	95% Confidence Interval for Odds Ratio	Adjusted Intramedullary Nail Rate ^{1,2}
Alabama	0.902	0.486-1.677	9.63
Alaska	0.226	0.028-1.806	2.39
Arizona	3.465	1.884-6.372	27.79
Arkansas	1.718	0.925-3.189	15.99
California	1.987	1.093-3.613	18.78
Colorado	1.708	0.912-3.197	16.45
Connecticut	1.214	0.646-2.283	12.45
Delaware	0.922	0.418-2.035	9.41
District of Columbia	1.081	0.430-2.718	10.71
Florida	3.742	2.063-6.787	28.68
Georgia	1.338	0.728-2.457	13.53
Hawaii	1.238	0.567-2.701	14.39
Idaho	1.853	0.948-3.623	18.21
Illinois	2.441	1.342-4.441	21.18
Indiana	2.321	1.270-4.242	21.08
Iowa	0.843	0.451-1.578	8.87
Kansas	1.660	0.892-3.089	17.19
Kentucky	0.987	0.532-1.834	10.54
Louisiana	1.734	0.936-3.210	17.30
Maine	0.281	0.128-0.618	3.41
Maryland	0.964	0.518-1.797	9.85
Massachusetts	0.613	0.329-1.142	6.60
Michigan	2.587	1.420-4.710	22.78
Minnesota	1.032	0.546-1.950	11.43

Mississippi	3.647	1.957-6.796	28.26
Missouri	1.612	0.880-2.956	15.12
Montana	3.705	1.925-7.128	29.69
Nebraska	1.790	0.951-3.367	16.61
Nevada	2.910	1.522-5.563	26.28
New Hampshire	1.584	0.815-3.077	15.93
New Jersey	1.838	1.006-3.358	17.09
New Mexico	0.935	0.479-1.827	10.29
New York	1.520	0.835-2.765	14.17
North Carolina	1.003	0.546-1.840	10.36
North Dakota	0.799	0.377-1.691	9.29
Ohio	1.186	0.649-2.166	12.24
Oklahoma	2.598	1.409-4.787	22.71
Oregon	1.376	0.729-2.596	13.91
Pennsylvania	1.510	0.830-2.749	14.48
Rhode Island	0.677	0.290-1.577	8.05
South Carolina	3.158	1.720-5.801	26.05
South Dakota	1.017	0.512-2.018	10.89
Tennessee	2.093	1.144-3.828	19.30
Texas	2.005	1.104-3.642	18.71
Utah	3.105	1.636-5.891	25.34
Vermont	1.496	0.712-3.143	15.00
Virginia	1.403	0.762-2.582	14.30
Washington	0.934	0.501-1.741	10.31
West Virginia	6.317	3.416-11.683	40.13
Wisconsin	0.762	0.411-1.414	8.26
Wyoming	1.000	Reference state	10.92

¹Adjusted for patient age, sex, race, Charlson score, subtrochanteric fracture, and Medicaid-administered assistance. ²Rate per

100 Medicare patients with an intertrochanteric fracture treated with internal fixation; sixty-five years of age or older.