

Predictive Value of ICD and CPT Codes for Identifying Osteonecrosis of the Jaw

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BACKGROUND

The definition of osteonecrosis of the jaw is exposed, necrotic bone in the maxillofacial region lasting longer than 8 weeks.¹ Examples of risk factors include radiation to the head or neck, bisphosphonate use, and age. Other factors, such as tooth extraction, may be a risk factor but alternatively may be a trigger for detection of osteonecrosis of the jaw (ONJ).

A number of claims-based studies have evaluated the incidence of ONJ and evaluated potential risk factors for ONJ among United States (US) medical claims, but very few have validated the outcome.²⁻⁵ In 2006, a specific ICD code for osteonecrosis of the jaw (733.45) was introduced.

OBJECTIVE

- To develop a claims-based algorithm and quantify the positive predictive value (PPV) for ascertainment of ONJ cases during the time period when the ONJ code was not available.

Study Cohorts Inclusion Criteria

Using a large commercially insured population in the US, the study cohorts were identified from individuals with the following:

- Complete medical claims
- Complete pharmacy claims
- Plan eligibility dated January 1, 2000 through March 31, 2007
- Claim(s) for a cohort index diagnosis associated with at least one of the following:
 - ≥ Two outpatient physician visits
 - One overnight emergency department claim
 - One inpatient hospital claim
- Enrollment ≥ 1 year before index diagnosis

Cancer Cohort

- Males and females aged ≥ 40 years with selected cancers (Table 1)

Osteoporosis Cohort

- Women aged ≥ 50 years and men ≥ 60 years with selected claims (Table 2)

Table 1. ICD Codes for Cancer Cohort Index Diagnosis

Diagnosis Description	ICD-9 Code
Breast cancer	
Malignant neoplasm of breast	174.xx
Breast carcinoma in situ	233.0x
Uncertain neoplasm of breast	238.3x
Breast neoplasm of uncertain nature	239.3x
Prostate cancer	
Malignant neoplasm of prostate	185.xx
Multiple myeloma	
Multiple myeloma, Kahler's disease, myelomatosis	203.0x

ICD-9 = International Classification of Diseases, 9th edition.

Table 2. ICD Codes for Osteoporosis Cohort Index Diagnosis

Diagnosis Description	ICD-9 Code
Osteoporosis	733.0x
Disorder of bone and cartilage, unspecified	733.90
Vertebral fractures	733.13, 805.xx
Hip fractures	733.14, 820.xx
Wrist fractures	733.12, 813.xx, 814.xx

Medical Chart Abstraction

We selected health care service for abstraction using the following criteria:

- Service occurred within 6 months of first potential ONJ claim date.
- Priority was given to the following specialties (if a patient visited more than one specialty office, we selected all of them):
 - Oral surgeon
 - Oral maxillofacial surgeon
 - Oral medicine
 - ENT surgeon
 - Dentist
 - Otolaryngology.
- For those who did not visit any specialties of interest, we selected the most visited provider who was associated with potential ONJ codes.

Abstracted data included the following:

- Mention of exposed bone and location
- Lesions in the oral cavity
- Duration of exposed bone
- Symptoms, such as pain, pus, sudden loosening of teeth, numbness of the jaw
- Diagnosis by radiologist
- Treatments applied, such as excision of bone, antibiotic, debridement, antiseptic rinse
- Diagnosis by oral or dental medicine clinician
- Radiation to the head and neck (for exclusion purposes)
- Diagnosis by pathologist.

Without knowledge of bisphosphonate exposure, a maxillofacial surgeon [CL] and an oral medicine research clinician [AZ] reviewed abstracted data and the available claims history. They independently categorized each potential case as probable ONJ, possible ONJ, or not ONJ. Differences between the two reviewers were discussed and resolved.

Lower PPV (LPPV) and upper (UPPV) were derived as follows:

$$LPPV = \frac{\# \text{ of probable ONJ cases}}{\text{Total \# abstracted potential ONJ cases}}$$

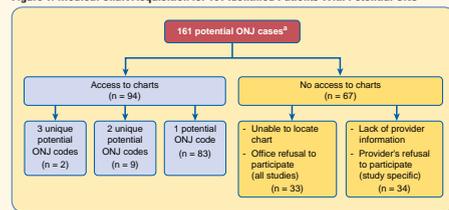
$$UPPV = \frac{\# \text{ of possible ONJ cases} + \# \text{ probable ONJ cases}}{\text{Total \# abstracted potential ONJ cases}}$$

$$\text{Sensitivity for an ICD code} = \frac{\# \text{ of possible/probable ONJ cases for ICD code}}{\text{Total \# possible/probable ONJ identified over all codes}}$$

RESULTS

- There were 161 potential ONJ cases without claims for radiation therapy of the head or neck or jaw metastasis within 30 days after the potential ONJ diagnosis.
- For 21 abstracted potential cases, copies of charts with redacted identifying information were used when abstraction yielded insufficient information for classification.

Figure 1. Medical Chart Acquisition for 161 Identified Patients With Potential ONJ



*No history of radiation therapy of the head or neck or jaw metastasis within 30 days after the potential ONJ diagnosis.

Among 161 identified potential ONJ cases, the percentage of potential cases that were abstracted were consistent across the most frequent claims codes, approximately 60% for each (Table 3).

Table 3. Number of Potential Cases Abstracted, Stratified by Each Claim Code Used to Identify Potential ONJ Cases

Code	Code Text	Abstracted		Not Abstracted	
		Number (n = 94)	Code-Specific Percentage	Number (n = 67)	Code-Specific Percentage
5227	Periapical abscess with sinus	3	60	2	40
5264	Inflammatory conditions of jaw	53	58	39	42
5265	Alveolitis of jaw	3	60	2	40
21025	Excision, bone; mandible	6	60	4	40
21045	Excision, malignant tumor, mandible; radical resection	1	50	1	50
21047	Excision, benign tumor or cyst, mandible; extra-oral osteotomy and partial mandibulectomy	1	100	0	0
21127	Augmentation, mandibular body or angle; with bone graft, onlay, or interpositional (includes obtaining autograft)	1	100	0	0
21210	Graft, bone; nasal, maxillary or malar areas (includes obtaining graft)	12	67	6	33
21215	Graft, bone; mandible (includes obtaining graft)	0	0	1	100
41800	Drainage, abscess, cyst, hematoma, dentoalveolar structures	1	100	0	0
41830	Alveolectomy, with curettage, osteitis, or sequestrectomy	2	67	1	33
42120	Resection, palate or extensive resection, lesion	2	40	3	60
21081	Impression and custom preparation; mandibular resection prosthesis	2	100	0	0
21193	Reconstruction, mandibular rami, horizontal, vertical, "C"/"L" osteotomy	0	0	1	100
52689	Other specified diseases of the jaws	15	56	12	44
	Total claims	102^a	NA	72^a	NA

NA = not available.

^aPatients could have more than one eligible code; thus these are not unique patients.

Age distribution and history of bisphosphonate use was similar among abstracted potential ONJ cases compared with those not abstracted (Table 4).

Table 4. Distribution of Age and Previous Bisphosphonate Use, by Potential Cases Abstracted and Not Abstracted

Characteristic	Abstracted		Not Abstracted	
	Number	Percentage	Number	Percentage
Age (years)				
≤ 49	5	5	0	0
50-59	30	32	23	34
60-69	32	34	19	28
70-79	18	19	16	24
80+	9	10	9	13
Total	94	100	67	100
Prior bisphosphonate use				
Yes	39	41	25	37
No	55	59	42	63
Total	94	100	67	100
Cancer cohort	52	55	50	75
Osteoporosis cohort	42	45	17	25
Total	94	100	67	100

Frequency of Abstraction by Cohort

- Cancer cohort: 51% (52/102)
- Osteoporosis cohort: 71% (42/59)
- Difference between cohorts: (% in osteoporosis - % in cancer) = 20.2% (95% CI: 5.1 35.3%)

Among All Abstracted Potential ONJ Cases

- Percentage of possible/probable ONJ cases: 41% (39/94)
- Percentage of probable ONJ cases: 22% (21/94)
- Possible cases made up 46% (18/39) of the probable and possible cases.
- Inflammatory Conditions of the Jaw (526.4)**
 - Among probable ONJ cases: 81% had claims for inflammatory conditions of the jaw (Table 5).
 - Among probable and possible ONJ cases: 79% had claims for inflammatory conditions of the jaw (Table 5).
 - UPPV for a claim for inflammatory conditions of the jaw: 0.58 (95% CI: 0.45-0.71) (Table 6).

If ONJ case ascertainment were limited to use of this ICD code (526.4) without confirmation in medical records:

- We would miss 19% (4/21) of probable ONJ cases.
- We would miss 20% (8/39) of probable and possible ONJ cases.
- We would overestimate the number of probable and possible ONJ cases associated with this code by 71% (22/31).

Other Codes

- Inclusion of codes other than inflammatory conditions of the jaw identified an additional 20% (8/39) of probable and possible cases.
- Without chart abstraction, inclusion of potential cases with these ICD codes would have overestimated the number of probable and possible ONJ cases by 140% (55/39).

Table 5. Number and Percentage of Confirmed ONJ Cases and of Noncases Associated With Each ICD/CPT Code

Diagnosis or Procedure	Code	Number and Percentage of Each ONJ Classification Category		
		Probable Cases (Total = 21)	Probable and Possible Cases (Total = 39)	Not an ONJ Case (Total = 55)
Inflammatory conditions of jaw	526.4	17 (81%)	31 (79%)	22 (40%)
Graft, bone; nasal, maxillary, or malar areas (includes obtaining graft)	21210	1 (5%)	3 (7%)	9 (17%)
Other specified diseases of the jaws	526.89	1 (5%)	1 (3%)	13 (24%)
Periapical abscess with sinus	522.7	1 (4%)	1 (2%)	2 (4%)
Excision, bone; mandible	21025	0 (0%)	0 (0%)	1 (2%)
Alveolitis of jaw	526.5	1 (4%)	2 (5%)	1 (2%)
All other codes	21045, 21047, 21047, 21127, 21081, 21193, 41800, 41830, or 42120	0 (0%)	1 (2%)	7 (13%)

Table 6. LPPV and UPPV by ICD or CPT Code

Description	Probable ONJ	Possible ONJ	Not ONJ	Sum	LPPV (95% CI)	UPPV (95% CI)
Inflammatory conditions of jaw (526.4)	17	14	22	53	0.32 (0.20-0.46)	0.58 (0.44-0.72)
Graft, bone; nasal, maxillary/malar areas (includes obtaining graft) (21210)	1	2	9	12	0.08 (0.002-0.38)	0.25 (0.05-0.57)
Other specified diseases of the jaws (526.89)	1	0	13	14	0.07 (0.004-0.30)	0.07 (0.002-0.34)
Periapical abscess with sinus (522.7)	1	0	2	3	0.33 (0.01-0.93)	0.33 (0.01-0.91)
Excision, bone; mandible (21025)	0 ^a	0 ^a	1 ^b	1	0.00	0.00
Alveolitis of jaw (526.5)	1	1	1	3	0.33 (0.01-0.91)	0.67 (0.09-0.99)
All other codes ^c	0 ^d	1	7 ^e	8	0.00	0.13 (0.003-0.53)
Unique patients	21	18	55	94	0.22 (0.14-0.32)	0.41 (0.31-0.52)
Cancer cohort	14	12	26	52	0.27 (0.16-0.41)	0.50 (0.36-0.64)
Osteoporosis cohort	7	6	29	42	0.17 (0.07-0.31)	0.31 (0.18-0.47)

^a Three additional patients were also coded as 526.4 and therefore classified as 526.4.

^b One additional patient was also coded as 526.4 and therefore classified as 526.4.

^c 21045, 21047, 21127, 21215, 21081, 21193, 41800, 41830, or 42120.

^d One additional patient was also coded as 526.5 and therefore is classified as 526.5.

^e One additional patient with code 21127 was also coded as 526.89 and therefore classified as 526.89.

Patients from the cancer cohort made up the larger proportion of probable/possible ONJ cases.

UPPV Among All Abstracted Potential ONJ Cases

- Overall: 41% (39/94)
- Cancer cohort: 50% (26/52)
- Osteoporosis Cohort: 31% (13/42)
- Difference for cancer vs. osteoporosis cohorts: 19% (95% CI: -0.4%-39%)

Table 7. Number of Potential Cases Abstracted and Final Case Classification Among Those Abstracted, by Cohort

Cohort	Abstracted				Not Abstracted
	Probable ONJ	Possible ONJ	Not ONJ	Total	Total
Cancer	14	12	26	52	50
Osteoporosis	7	6	29	42	17
Total	21	18	55	94	67

DISCUSSION

- For this study period, use of claims to ascertain ONJ cases was relatively poor, and for other studies covering this time period (January 2000-March 2007), medical record abstraction to validate classification of potential ONJ cases is recommended.
- Even with medical record abstraction, the lack of detail around exposed bone or duration of exposed bone made it challenging for reviewers to classify 22% (21/94) of abstracted potential ONJ cases.
- Without medical record abstraction, the number of false positive potential ONJ cases identified via claims algorithm based solely on ICD codes may be as large as the number of true potential ONJ cases (i.e., the PPV may be < 50%).
- During the period including and before 2006, in the situation where a study based on claims and without medical record abstraction is planned, use of the ICD code with the highest PPV (ICD 526.4) would overestimate the total number of cases by approximately 70%. Therefore, we do not recommend this approach. However, introduction of the new ICD code for aseptic osteonecrosis of the jaw (733.45) in 2006 may facilitate future research in this area.

STRENGTHS AND LIMITATIONS

- For this study, abstraction percentage (58%) was not optimal. This was partially related to lack of historical contact information for selected health care providers.
- Among abstracted and nonabstracted potential ONJ cases, the distributions by age and bisphosphonate use were not different, suggesting that the abstracted cases were relatively representative of all potential ONJ cases identified. Subsequent chart abstraction studies using this claims data source have resulted in a substantially higher abstraction rate.
- This study did not evaluate missed potential cases among codes not related to ONJ. Because ONJ is so rare, the number of patients needed to evaluate the occurrence of false negative ONJ cases would have been prohibitive.

CONCLUSIONS

- For identification and assessment of risk factors, where covariates and timing of ONJ cases must be identified, medical record abstraction is essential.
- When abstraction of charts is not feasible, the overall PPV (LPPV = 0.22; UPPV = 0.41) can be used to reduce the total number of identified potential ONJ cases based solely on claims to an estimate of the total number of possible and probable ONJ cases.

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CONFLICT OF INTEREST STATEMENT

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