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# Prostate Cancer History and Total Hip Arthroplasty: A Matched Cohort Analysis Investigating Venous Thromboembolism and Anticoagulation

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ABSTRACT

*Background:* Prostate cancer (PCa) is a common cancer among men in the United States. While malignancy is a known cause of venous thromboembolism (VTE), little is known about the effect of PCa history on postoperative complications after elective total hip arthroplasty (THA). This study aimed to evaluate the risk of hematologic complications in patients with a history of PCa taking common postoperative anticoagulants.

*Methods:* THA patients were identified through the PearlDiver Mariner database. Patients with a history of PCa were placed in one of the following cohorts based on postoperative anticoagulant prescription: aspirin, warfarin, low-molecular-weight heparin, direct Xa inhibitor, or any anticoagulant. PCa cohorts were matched 1:3 to patients without a history of PCa with the same anticoagulant prescription based on age, gender, and Charlson Comorbidity Index. Postoperative complications were evaluated using multivariable logistic regression.

*Results:* A total of 74,744 patients that underwent THA were included. PCa patients taking any anticoagulant were found to have increased risk of postoperative deep vein thrombosis (DVT) (odds ratio: 1.25, lower 99% confidence interval: 1.09, upper 99% confidence interval: 1.43, *P* value <.001). PCa patients taking warfarin, low-molecular-weight heparin, and direct Xa inhibitors additionally showed increased risk of postoperative DVT. Patients taking aspirin did not have an increased risk of postoperative DVT.

*Conclusions:* Our results suggest postoperative aspirin prophylaxis may not increase VTE complication risk when compared to other anticoagulants. Surgeons should be aware that PCa history may be an independent risk factor for VTE, and these patients may benefit from medical optimization.



## Introduction

Worldwide, prostate cancer (PCa) is the most prevalent cancer affecting men, with approximately 12.5% of men diagnosed with PCa at some point over their lifetimes [1,2]. When localized, it is potentially curable; however, it remains the second leading cancer cause of death in men. Cancer-associated thrombosis, most commonly a deep vein thrombosis (DVT), is a significant cause of mortality in cancer patients [3]. Current estimate of venous thromboembolism (VTE) incidence for patients with cancer is 0.5%, compared to 0.1% in the general population [4]. Furthermore, of all VTE events, active cancer is the cause in 20% of cases [5].

Cancer patients have many established risk factors for VTE including immobilization, hospital admissions, and surgery. Additionally, malignancy itself induces a hypercoagulable state, mediated by inflammatory cytokines and tissue factor [6]. Pharmacological maintenance agents, including hormonal therapies and chemotherapy, also have a synergistic effect in increasing VTE risk [7]. These findings are reflected in PCa research which has reported that, although all men with PCa have increased incidence of VTE complications, those on hormonal treatment have an increased risk [8].

While active cancer is an established risk factor for VTE, history of cancer is also an important consideration. A prior study of total

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knee arthroplasty patients found that a history of PCa tripled their odds of developing a pulmonary embolism (PE) following surgery [9]. To our knowledge, a history of PCa has not been assessed as an identifiable risk factor for VTE complications following total hip arthroplasty (THA). This is significant due to the increasing prevalence of both PCa and THA with age and the projected rise in THA worldwide with an increasingly older population [10,11]. Therefore, the aim of this study was to assess VTE risk for patients with a prior history of PCa, who subsequently underwent THA, and compare them to a matched cohort.

## Material and methods

The PearlDiver Mariner database was queried for this analysis between the years 2010 and 2020. PearlDiver is a fee-based database containing patient data from all payer types including Medicare, Medicaid, private insurance, and self-pay. At the time of this query, a total of 144 million patients were recorded in the PearlDiver Mariner Database. This included billing data in the form of Current Procedural Terminology codes as well as International Classification of Diseases 9th Revision (ICD-9-CM) and 10th Revision (ICD-10-CM). All data are deidentified and in compliance with the Health Insurance Portability and Accountability Act.

Patients were identified for this analysis with ICD-9-CM, ICD-10-CM, and Current Procedural Terminology codes for THA (Supplementary Table 1). Patients who did not have active records for at least 1 year preoperatively and 1 year postoperatively were excluded. A PCa cohort was created using ICD-9-CM and ICD-10-CM codes to identify patients with a preoperative record of PCa. PCa-free controls were identified without any record of PCa. PCa patients were matched to controls on a 1:3 basis based on age, gender, and Charlson Comorbidity Index (CCI). Specific anticoagulant PCa cohorts were then created by identifying patients in the PCa cohort with one of the following postoperative anticoagulant prescriptions: aspirin, warfarin, low-molecular-weight heparin (enoxaparin, dalteparin), and direct factor Xa inhibitors (apixaban, rivaroxaban). Similarly, anticoagulant control cohorts were created by identifying patients with an anticoagulant prescription in the PCa-free control cohort.

Data on patient demographics and medications were collected including age, CCI, medical comorbidities, preoperative PCa medications within 1 year preoperatively, and any anticoagulant medication within 1 year postoperatively. The following preoperative PCa medications were included in this analysis: tamoxifen, antiandrogens (abiraterone, finasteride, flutamide, bicalutamide, ketoconazole), nonsteroidal androgen receptor inhibitors (enzalutamide, apalutamide, darolutamide), taxane-based chemotherapy (docetaxel, cabazitaxel), Gonadotropin-releasing hormone (GNRH) analogs (leuprolide, goserelin, nafarelin, histrelin), and GNRH antagonists (degarelix). Medical comorbidities were selected based on their association with poor postoperative outcomes from prior work by Elixhauser et al [12]. The primary outcome of interest was the likelihood of any hematologic complication within 1 year postoperatively including DVT, PE, and need for transfusion. Secondary outcomes of interest included the following 1-year surgical complications: all-cause revision, aseptic loosening, dislocation, osteolysis, periprosthetic fracture, joint infection, and wound disruption.

Patient data were compared among cohorts using the R software incorporated into the PearlDiver database. Statistical analyses were performed on the PCa and control cohorts to compare age, demographics, and medications using the Pearson Chi-Squared test for categorical variables or T-test for continuous variables where appropriate. Postoperative outcomes were evaluated using multivariable logistic regression. Any comorbidity or anticoagulant that was shown to have difference between cohorts on univariate analysis with $P < .2$ was included as a predictive variable in multivariable regression for outcome analysis to control for potential confounding variables. The Bonferroni correction was applied by dividing 0.05 by the number of cohort comparisons included in this analysis resulting in a statistical significance level of $P < .01$ and 99% confidence intervals.

## Results

A total of 74,744 patients that underwent THA between 2010 and 2020 were included in this analysis. This included 18,687 (25%) patients with a history of PCa and 56,057 (75%) control patients with no history of PCa. Comparison of age range, gender, and CCI showed no statistically significant difference between cohorts (Table 1). When comorbidities were compared between cohorts, patients with a history of PCa were shown to have higher rates of cardiac arrhythmias (PCa: 8351 [45%], controls: 23,950 [43%], $P < .001$), hypothyroidism (PCa: 4056 [22%], controls: 11,731 [21%], $P = .0247$), fluid and electrolyte disorders (PCa: 7713 [41%], controls: 22,668 [40%], $P = .0445$), and deficiency anemia (PCa: 4183 [22%], controls: 11,084 [20%], $P < .001$) (Table 2). The control group had a higher number of patients with chronic pulmonary disease (PCa: 7034 [38%], controls: 23,642 [42%], $P < .001$), diabetes (PCa: 9182 [49%], controls: 29,888 [53%], $P < .001$), obesity (PCa: 7274 [39%], controls: 25,215 [45%], $P < .001$), and liver disease (PCa: 3355 [18%], controls: 10,765 [19%], $P < .001$). No difference was noted between cohorts for hypertension, renal failure, hereditary hypercoagulability, or hereditary hemophilia.

Further analysis of anticoagulant medications between cohorts showed that among PCa-free controls, an increased number of patients used aspirin postoperatively (PCa: 1339 [7%], controls: 4570 [8%], $P < .001$). No difference was noted between cohorts for postoperative prescription of warfarin, heparin, low molecular weight heparin (LMWH), fondaparinux, direct thrombin inhibitors, or direct Xa inhibitors ($P > .05$). Evaluation of chemotherapy medications in the PCa cohort showed the most common preoperatively prescribed PCa medications were antiandrogens (2728 [15%]) (Table 3). Less than 1% of patients with a history of PCa received tamoxifen (11), nonsteroidal androgen receptor inhibitors (33), GNRH analogs (60), GNRH antagonists (<11), or taxane-based chemotherapy (<11) within 1 year preoperatively.

When 1-year postoperative outcomes were evaluated between patients with PCa history and controls using multivariable logistic regression, the PCa cohort showed increased odds of DVT (odds ratio [OR] 1.25, lower 99% confidence interval [LCL] 1.09, upper 99% confidence interval [UCL] 1.43, $P < .0001$) and decreased odds of wound disruption (OR 0.79, LCL 0.63, UCL 0.97, $P = .0045$) (Table 4). No difference was noted between PCa cohort and controls for PE, need for transfusion, hematoma formation, joint infection, revision, aseptic loosening, dislocation, osteolysis, or periprosthetic fracture.

When 1-year postoperative outcomes were compared between PCa patients taking aspirin and PCa-free controls on aspirin, PCa patients showed higher risk of transfusion (OR 1.45, LCL 1.00, UCL 2.04, $P = .0077$). No increase in odds for DVT, PE, wound disruption, joint infection, revision, aseptic loosening, dislocation, osteolysis, or

**Table 1**
Comparison of age, gender, and CCI between PCa cohort and controls.

| Variables | History of prostate cancer | % | Controls with no history of prostate cancer | % | *P* value |
|---|---|---|---|---|---|
| Total | 18,687 | 100% | 56,057 | 100% | |
| Age range | | | | | |
| 40-44 | 40 | 0% | 120 | 0% | 1 |
| 45-49 | 174 | 1% | 522 | 1% | |
| 50-54 | 680 | 4% | 2040 | 4% | |
| 55-59 | 1760 | 9% | 5280 | 9% | |
| 60-64 | 3166 | 17% | 9498 | 17% | |
| 65-69 | 4158 | 22% | 12,474 | 22% | |
| 70-74 | 6994 | 37% | 20,980 | 37% | |
| 75-79 | 1652 | 9% | 4956 | 9% | |
| 80+ | 56 | 0% | 168 | 0% | |
| Gender | 18,634 | 100% | 55,898 | 100% | 1 |
| Average CCI score | 3.26 | | 2.4 | | 1 |
| Median CCI score | 3 | | 2 | | |
| Standard deviation for CCI score | 2.84 | | 1.87 | | |

periprosthetic fracture was observed for PCa patients on aspirin compared to controls (Table 5).

When outcomes were compared between PCa patients on warfarin vs controls, PCa patients showed higher odds of DVT (OR 1.31, LCL 1.00, UCL 1.69, $P = .0042$). PCa patients on warfarin did not show increased risk of PE, wound disruption, need for transfusion, joint infection, revision, aseptic loosening, dislocation, osteolysis, or periprosthetic fracture compared to controls.

When outcomes for PCa patients on direct LMWH were compared to those for controls, PCa patients showed higher odds of DVT (OR 1.39, LCL 1.00, UCL 1.89, $P = .00929$). No increase in odds was observed for PE, wound disruption, need for transfusion, joint infection, revision, aseptic loosening, dislocation, osteolysis, or periprosthetic fracture for PCa patients on LMWH compared to controls.

When outcomes for PCa patients on direct Xa inhibitors were compared to those for controls, PCa patients showed higher odds of DVT (OR 2.10, LCL 1.28, UCL 3.22, $P < .0001$). No increase in risk was observed for PE, wound disruption, need for transfusion, joint infection, revision, aseptic loosening, dislocation, osteolysis, or periprosthetic fracture for PCa patients on LMWH compared to controls.

When outcomes were evaluated and compared between patients taking any anticoagulant, aspirin, warfarin, LMWH, and direct Xa inhibitors and respective matched controls, no statistically significant difference in risk was noted for any hematologic or infectious complication included in this analysis (Fig. 1).

## Discussion

The optimal postoperative anticoagulant for THA patients with a history of PCa remains unclear. The current AAOS practice guidelines recommend postoperative pharmacotherapy and mechanical compression devices to prevent VTE both in patients without an increased risk other than surgery itself as well as in patients with a prior VTE [13]. However, there are no recommendations on VTE prophylaxis for patients with cancer as a risk factor. These guidelines additionally do not specify which anticoagulant is preferable.

**Table 2**
Comparison of comorbidities and anticoagulant prescriptions within 1 year postoperatively between PCa cohort and controls.

| Variables | History of prostate cancer | % | Controls with no history of prostate cancer | % | *P* value |
|---|---|---|---|---|---|
| Total | 18,687 | 100% | 56,057 | 100% | |
| Comorbidity | | | | | |
| Cardiac arrhythmias | 8351 | 45% | 23,950 | 43% | <.001 |
| Hypertension | 16,881 | 90% | 50,731 | 90% | .5195 |
| Chronic pulmonary disease | 7034 | 38% | 23,642 | 42% | <.001 |
| Diabetes | 9182 | 49% | 29,888 | 53% | <.001 |
| Hypothyroidism | 4056 | 22% | 11,731 | 21% | .02469 |
| Fluid and electrolyte disorders | 7713 | 41% | 22,668 | 40% | .04449 |
| Deficiency anemia | 4183 | 22% | 11,084 | 20% | <.001 |
| Obesity | 7274 | 39% | 25,215 | 45% | <.001 |
| Renal failure | 3424 | 18% | 10,250 | 18% | .9162 |
| Liver disease | 3355 | 18% | 10,765 | 19% | <.001 |
| Hereditary hypercoagulability | 342 | 2% | 1027 | 2% | 1 |
| Hereditary hemophilia | 144 | 1% | 477 | 1% | .3168 |
| Postoperative anticoagulant | | 0% | | 0% | |
| Aspirin | 1339 | 7% | 4570 | 8% | <.001 |
| Warfarin | 1786 | 10% | 5586 | 10% | .1088 |
| Heparin | 24 | 0% | 50 | 0% | .1794 |
| Low-molecular-weight Heparin | 768 | 4% | 2386 | 4% | .3997 |
| Fondaparinux | 18 | 0% | 64 | 0% | .6096 |
| Direct thrombin inhibitor | 180 | 1% | 647 | 1% | .2336 |
| Direct Xa inhibitor | 2903 | 16% | 8761 | 16% | .7683 |

**Table 3**
Prostate cancer medications prescribed within 1 year prior to THA.

| Variables | History of prostate cancer | % |
|---|---|---|
| Total | 18,687 | 100% |
| Active prostate cancer treatment | | |
| Tamoxifen | 11 | 0% |
| Antiandrogen | 2728 | 15% |
| Nonsteroidal androgen receptor inhibitor | 33 | 0% |
| GNRH analog | 60 | 0% |
| GNRH antagonist | [a] | [a] |
| Taxane-based chemotherapy | [a] | [a] |

[a] The number of patients in a cohort of size <11 is not reportable per Health Insurance Portability and Accountability Act (HIPAA).

Several tools have been developed to stratify VTE risk to aid in postoperative risk reduction. One tool is the Caprini score which stratifies patients based on several risk factors including prior malignancy [14]. However, patients who undergo "major lower extremity arthroplasty" are automatically classified as "high risk," and therefore, the clinical utility of this risk-stratifying tool for THA is limited. One systematic review by Kunutsor et al. evaluated several risk assessment tools including the Caprini score and found limited validation, inadequate reporting, and unknown impact on patient outcomes with all currently available VTE risk-stratifying tools for total joint arthroplasty [15]. Therefore, more research is needed to determine the impact of VTE risk factors, such as PCa history, on total joint arthroplasty outcomes to improve clinical guidelines on minimizing VTE risk.

Our results demonstrated a strong relationship between PCa history and increased risk of VTE. Specifically, patients were found to have an OR of 1.25 for DVT which was statistically significant with 99% confidence intervals. When patients on specific anticoagulants were evaluated, patients taking warfarin, LMWH, and direct Xa inhibitors were all found to have elevated ORs for DVT. However, patients taking aspirin were not found to have increased DVT risk. Additionally, no statistically significant increase in OR was observed for PE among PCa patients in any cohort.

While the effect of prior PCa history on VTE risk in THA is not completely understood, several prior studies have evaluated the history of malignancy on total joint arthroplasty outcomes. However, these studies have shown conflicting results. A meta-analysis by Zeng et al. analyzed 5 studies evaluating VTE risk among patients with cancer and found no difference in incidence between VTE among patients with and those without cancer. [16] A more recent database study by Rosas et al. analyzed 2,381,706 Medicare patients who underwent total knee arthroplasty and found an increased risk of PE and a clinically insignificant increased risk of DVT among patients with a history of PCa. [9] Our study builds on this prior work by analyzing PCa among all-paying patients to evaluate VTE risk on specific anticoagulants.

There are several limitations to this study. This analysis relies on billing codes from an insurance claims database which has known disadvantages. Insurance billing codes may not always accurately represent conditions or procedures and additionally rely on codes to be recorded accurately and consistently. Therefore, it is possible some codes may be misrepresented or even omitted in the database. These codes also lack clinically important granularity. For example, ICD-9 and ICD-10 codes do not specify the method of diagnosis or location of DVT which could impact treatment. Furthermore, this analysis was limited by the use of ICD-9 and ICD-10 codes to identify patients with a history of PCa. This study used diagnosis codes to identify patients with a history of PCa as there was no billing code available in this data set for active PCa. Therefore, the results presented in this study have limited generalizability to patients actively treated for PCa. However, we sought to address this by describing the number of patients in each PCa cohort with a prescription of hormone therapy within 1 year preoperatively. Finally, this analysis is limited by a retrospective study design preventing drawing conclusions regarding causation of outcomes based on PCa history or anticoagulant prescription.

## Conclusions

To our knowledge, this is the first study to show increased DVT risk among THA patients with PCa and a decreased risk when receiving aspirin for postoperative VTE prophylaxis. Specifically, patients with PCa were shown to have an OR of 1.25 with a 99% confidence interval of 1.09 to 1.43 for DVT within 1 year. This increase in risk was also observed for all anticoagulants included in this study except aspirin suggesting a noninferiority of aspirin as a postoperative anticoagulant in PCa patients. Surgeons should be aware that patients with PCa history may be at increased risk of DVT when evaluating VTE risk assessment. These patients may benefit from risk-reduction strategies such as early mobilization and pneumatic compression devices. A future randomized control trial should seek

**Table 4**
Comparison of 1-year complication rates between PCa cohort and controls using multivariable logistic regression controlled for comorbidities and postoperative anticoagulant.

| Variables | History of prostate cancer | % | Controls with no history of prostate cancer | % | Odds ratio | Lower 99% CI | Upper 99% CI | *P* value |
|---|---|---|---|---|---|---|---|---|
| 1-Y complications | | | | | | | | |
| Total | 18,687 | 100.0% | 56,057 | 100.0% | | | | |
| Deep vein thrombosis | 559 | 3.0% | 1403 | 2.5% | 1.25 | 1.09 | 1.43 | **<.0001** |
| Pulmonary embolism | 186 | 1.0% | 513 | 0.9% | 1.14 | 0.90 | 1.41 | .14136 |
| Wound disruption | 185 | 1.0% | 718 | 1.3% | 0.79 | 0.63 | 0.97 | **.0045** |
| Hematoma | 207 | 1.1 | 667 | 1.2 | 0.93 | 0.75 | 1.14 | .3682 |
| Need for transfusion | 645 | 3.5% | 1670 | 3.0% | 1.12 | 0.98 | 1.27 | .020478 |
| Joint infection | 84 | 0.4% | 334 | 0.6% | 0.77 | 0.55 | 1.04 | .031393 |
| Revision | 243 | 1.3% | 805 | 1.4% | 0.93 | 0.76 | 1.12 | .309333 |
| Aseptic loosening | 155 | 0.8% | 490 | 0.9% | 0.98 | 0.76 | 1.23 | .814119 |
| Dislocation | 147 | 0.8% | 563 | 1.0% | 0.79 | 0.62 | 1.00 | .013514 |
| Osteolysis | 102 | 0.5% | 407 | 0.7% | 0.77 | 0.57 | 1.02 | .02083 |
| Periprosthetic fracture | 177 | 0.9% | 545 | 1.0% | 0.95 | 0.75 | 1.18 | .550931 |

CI, confidence interval.
Bold values indicate significance $P < .01$.

**Table 5**
Comparison of 1-year complication rates between anticoagulant PCa cohorts and controls using multivariable logistic regression controlled for comorbidities.

| One-year complications for anticoagulant cohorts | History of prostate cancer | % | Controls with no history of prostate cancer | % | Odds ratio | Lower 99% CI | Upper 99% CI | *P* value |
|---|---|---|---|---|---|---|---|---|
| Aspirin | | | | | | | | |
| Total | 1339 | 100.0% | 4570 | 100.0% | | | | |
| Recent PCa therapy (within 1 y) | 211 | 15.8% | | | | | | |
| Deep vein thrombosis | 53 | 4.0% | 132 | 2.9% | 1.44 | 0.89 | 2.16 | .03255 |
| Pulmonary embolism | 12 | 0.9% | 56 | 1.2% | 0.82 | 0.29 | 1.72 | .54933 |
| Wound disruption | 24 | 1.8% | 106 | 2.3% | 0.78 | 0.39 | 1.33 | .27728 |
| Hematoma | <11 | [a] | 91 | 2.0 | [a] | [a] | [a] | [a] |
| Need for transfusion | 83 | 6.2% | 196 | 4.3% | 1.45 | 1.00 | 2.04 | **.007729** |
| Joint infection | 13 | 1.0% | 43 | 0.9% | 1.09 | 0.39 | 2.27 | .78566 |
| Revision | 51 | 3.8% | 141 | 3.1% | 1.27 | 0.79 | 1.91 | .15046 |
| Aseptic loosening | 24 | 1.8% | 99 | 2.2% | 0.81 | 0.41 | 1.39 | .36365 |
| Dislocation | 21 | 1.6% | 93 | 2.0% | 0.78 | 0.37 | 1.37 | .3029 |
| Osteolysis | 19 | 1.4% | 61 | 1.3% | 1.09 | 0.48 | 2.02 | .75758 |
| Periprosthetic fracture | 17 | 1.3% | 90 | 2.0% | 0.62 | 0.27 | 1.15 | .0789 |
| Warfarin | | | | | | | | |
| Total | 1786 | 100.0% | 5586 | 100.0% | | | | |
| Recent PCa therapy (within 1 y) | 260 | 14.6% | | | | | | |
| Deep vein thrombosis | 180 | 10.1% | 448 | 8.0% | 1.31 | 1.02 | 1.66 | **.00422** |
| Pulmonary embolism | 96 | 5.4% | 270 | 4.8% | 1.12 | 0.80 | 1.52 | .344254 |
| Wound disruption | 27 | 1.5% | 129 | 2.3% | 0.65 | 0.35 | 1.08 | .04646 |
| Hematoma | <11 | [a] | 165 | 3.0 | [a] | [a] | [a] | [a] |
| Need for transfusion | 130 | 7.3% | 373 | 6.7% | 1.10 | 0.82 | 1.44 | .391774 |
| Joint infection | 18 | 1.0% | 88 | 1.6% | 0.66 | 0.30 | 1.20 | .1092 |
| Revision | 38 | 2.1% | 158 | 2.8% | 0.75 | 0.44 | 1.16 | .1182 |
| Aseptic loosening | 21 | 1.2% | 99 | 1.8% | 0.68 | 0.33 | 1.20 | .117983 |
| Dislocation | 23 | 1.3% | 88 | 1.6% | 0.85 | 0.42 | 1.49 | .5089 |
| Osteolysis | 19 | 1.1% | 103 | 1.8% | 0.60 | 0.28 | 1.06 | .039656 |
| Periprosthetic fracture | 25 | 1.4% | 93 | 1.7% | 0.84 | 0.43 | 1.44 | .44918 |
| LMWH | | | | | | | | |
| Total | 768 | 100.0% | 2386 | 100.0% | | | | |
| Recent PCa therapy (within 1 y) | 115 | 15.0% | | | | | | |
| Deep vein thrombosis | 111 | 14.5% | 270 | 11.3% | 1.39 | 1.00 | 1.89 | **.009289** |
| Pulmonary embolism | 56 | 7.3% | 150 | 6.3% | 1.22 | 0.76 | 1.83 | .237422 |
| Wound disruption | 14 | 1.8% | 90 | 3.8% | 0.49 | 0.19 | 1.00 | .01364 |
| Hematoma | <11 | [a] | 110 | 4.6% | [a] | [a] | [a] | [a] |
| Need for transfusion | 61 | 7.9% | 184 | 7.7% | 1.07 | 0.69 | 1.58 | .66945 |
| Joint infection | 18 | 2.3% | 66 | 2.8% | 0.92 | 0.40 | 1.73 | .7626 |
| Revision | 32 | 4.2% | 130 | 5.4% | 0.76 | 0.42 | 1.23 | .18013 |
| Aseptic loosening | 25 | 3.3% | 64 | 2.7% | 1.32 | 0.65 | 2.35 | .2467 |
| Dislocation | 11 | 1.4% | 77 | 3.2% | 0.46 | 0.16 | 0.96 | .0177 |
| Osteolysis | 14 | 1.8% | 62 | 2.6% | 0.73 | 0.28 | 1.46 | .302611 |
| Periprosthetic fracture | 17 | 2.2% | 70 | 2.9% | 0.76 | 0.32 | 1.44 | .316251 |
| Direct Xa inhibitor | | | | | | | | |
| Total | 2903 | 100.0% | 8761 | 100.0% | | | | |
| Recent PCa therapy (within 1 y) | 457 | 15.7% | | | | | | |
| Deep vein thrombosis | 271 | 9.3% | 677 | 7.7% | 2.10 | 1.28 | 3.22 | **<.0001** |
| Pulmonary embolism | 56 | 1.9% | 207 | 2.4% | 1.15 | 0.51 | 2.11 | .602903 |
| Wound disruption | 40 | 1.4% | 189 | 2.2% | 1.13 | 0.33 | 2.49 | .7264 |
| Hematoma | <11 | [a] | 89 | 1.0 | [a] | [a] | [a] | [a] |
| Need for transfusion | 137 | 4.7% | 392 | 4.5% | 1.11 | 0.53 | 1.97 | .66662 |
| Joint infection | <11 | [a] | 89 | 1.0% | [a] | [a] | [a] | [a] |
| Revision | 54 | 1.9% | 219 | 2.5% | 0.79 | 0.26 | 1.67 | .49294 |
| Aseptic loosening | 38 | 1.3% | 131 | 1.5% | 1.62 | 0.51 | 3.50 | .1629 |
| Dislocation | 29 | 1.0% | 152 | 1.7% | 0.91 | 0.17 | 2.27 | .8212 |
| Osteolysis | 21 | 0.7% | 116 | 1.3% | 0.66 | 0.05 | 1.95 | .434251 |
| Periprosthetic fracture | 37 | 1.3% | 124 | 1.4% | 0.76 | 0.11 | 2.04 | .56267 |

CI, confidence interval.
Bold values indicate significance $P < .01$.
[a] The number of patients in a cohort of size <11 is not reportable per Health Insurance Portability and Accountability Act (HIPAA).

to validate these results and compare VTE risk among PCa patients taking aspirin, warfarin, LMWH, and direct Xa inhibitors.

## Conflicts of interest

Matthew E. Deren has stock or stock options in RomTech and is in the editorial or governing board of JBJS Social Media Advisory Committee. Alan H. Daniels receives royalties from Medicrea and Spineart; is a paid consultant for Medtronic, Stryker, Spineart, and Orthofix; receives research support from Orthofix and Stryker; and receives financial or material support from Springer. All other authors declare no potential conflicts of interest.

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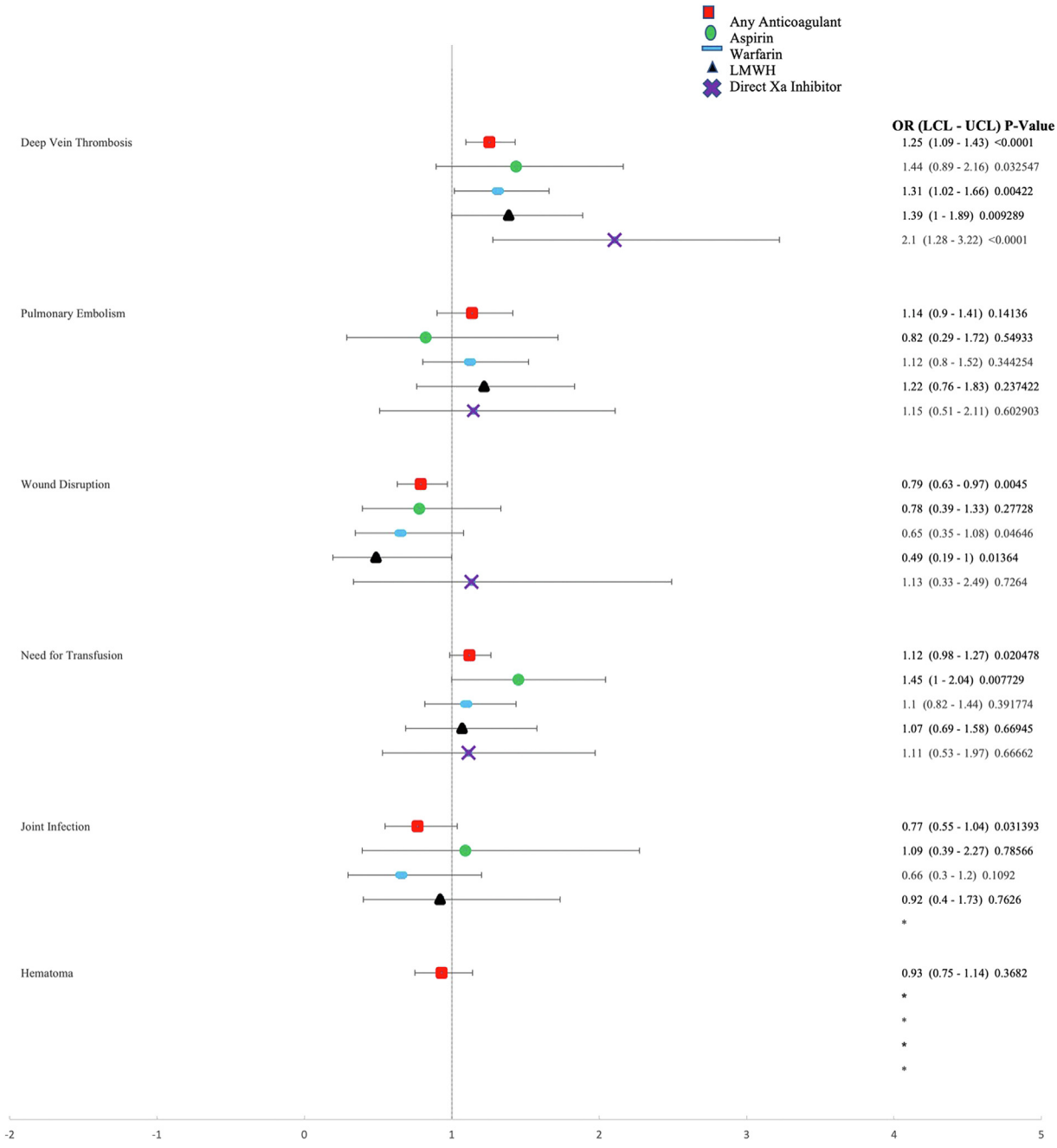


**Figure 1.** Odds ratios for hematologic complications comparing PCa patients on any anticoagulant, aspirin, warfarin, LMWH, and direct Xa inhibitors to controls. *The number patients in a cohort size <11 are not reportable per Health Insurance Portability and Accountability Act (HIPAA).

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## Appendix

**Supplementary Table 1**
ICD and CPT codes used to define cohorts, risk factors, and postoperative complications.

| Events | ICD and CPT codes |
|---|---|
| Total hip arthroplasty | ICD-9-P-8151, ICD-10-P-0SR90J9, ICD-10-P-0SR90JA, ICD-10-P-0SR90JZ, ICD-10-P-0SRB0J9, ICD-10-P-0SRB0JA, ICD-10-P-0SRB0JZ, CPT-27130 |
| Prostate cancer | ICD-9-D-185, ICD-9-D-V1046, ICD-9-D-2334, ICD-10-D-C61, ICD-10-D-Z8546, ICD-10-D-D075 |
| Comorbidities | |
| Cardiac arrhythmias | ICD-9-D-4260, ICD-9-D-42613, ICD-9-D-4267, ICD-9-D-4269, ICD-9-D-42610, ICD-9-D-42612, ICD-9-D-4270:ICD-9-D-4274, ICD-9-D-4276ICD-9-D-4279, ICD-9-D-7850, ICD-9-D-99601, ICD-9-D-99604, ICD-9-D-V450, ICD-9-D-V533, ICD-10-D-I441:ICD-10-D-I4435, ICD-10-D-I456, ICD-10-D-I459, ICD-10-D-I470:ICD-10-D-I499, ICD-10-D-ROOO, ICD-10-D-ROO1, ICD-10-D-ROO8, ICD-10-D-T82100:ICD-10-D-T82199S, ICD-10-D-Z4501:ICD-10-D-Z4509, ICD-10-D-Z950 |
| Hypertension | ICD-9-D-4010:ICD-9-D-4059, ICD-10-D-I10:ICD-10-D-I159 |
| Chronic pulmonary disease | ICD-9-D-4168, ICD-9-D-4169, ICD-9-D-4900:ICD-9-D-5059, ICD-9-D-5064, ICD-9-D-5081, ICD-9-D-5088, ICD-10-D-I2781:ICD-10-D-I279, ICD-10-D-J400:ICD-10-D-J479, ICD-10-D-J600:ICD-10-D-J679, ICD-10-D-J684, ICD-10-D-J701, ICD-10-D-J703 |
| Diabetes | ICD-9-D-24900:ICD-9-D-25099, ICD-9-D-7902, ICD-9-D-79021, ICD-9-D-79022, ICD-9-D-79029, ICD-9-D-7915, ICD-9-D-7916, ICD-10-D-E080:ICD-10-D-E139 |
| Hypothyroidism | ICD-9-D-2409, ICD-9-D-2430:ICD-9-D-2449, ICD-9-D-2461, ICD-9-D-2468, ICD-10-D-E000:ICD-10-D-E039, ICD-10-D-E890 |
| Fluid and electrolyte disorders | ICD-9-D-2536, ICD-9-D-2760:ICD-9-D-2769, ICD-10-D-E222, ICD-10-D-E860:ICD-10-D-E878 |
| Deficiency anemia | ICD-9-D-2801:ICD-9-D-2819, ICD-10-D-D508, ICD-10-D-D509, ICD-10-D-D510:ICD-10-D-D539 |
| Obesity | ICD-9-D-2780, ICD-9-D-27800, ICD-9-D-27801, ICD-9-D-27802, ICD-9-D-27803, ICD-10-D-E660:ICD-10-D-E669 |
| Renal failure | ICD-9-D-40301, ICD-9-D-40311, ICD-9-D-40391, ICD-9-D-40402, ICD-9-D-40403, ICD-9-D-40412, ICD-9-D-40413, ICD-9-D-40492, ICD-9-D-40493, ICD-9-D-5850:ICD-9-D-5869, ICD-9-D-5880, ICD-9-D-V420, ICD-9-D-V451, ICD-9-D-V560:ICD-9-D-V569, ICD-10-D-I120, ICD-10-D-I1311, ICD-10-D-N180:ICD-10-D- NI9, ICD-10-D-N250, ICD-10-D-Z4901:ICD-10-D-Z4902, ICD-10-D-Z940, ICD-10-D-Z992 |
| Liver disease | ICD-9-D-07022, ICD-9-D-07023, ICD-9-D-07032, ICD-9-D-07033, ICD-9-D-07044, ICD-9-D-07054, ICD-9-D-0706, ICD-9-D-0709, ICD-9-D-4560:ICD-9-D-4562, ICD-9-D-5700:ICD-9-D-5719, ICD-9-D-5722:ICD-9-D-5728, ICD-9-D-5733, ICD-9-D-5734, ICD-9-D-5738, ICD-9-D-5739, ICD-9-D-V427, ICD-10-D-B180:ICD-10-D-B189, ICD-10-D-I850:ICD-10-D-I859, ICD-10-D-I864, ICD-10-D-I982, ICD-10-D-K700:ICD-10-D-K709, ICD-10-D-K7110:ICD-10-D-K7111, ICD-10-D-K713:ICD-10-D-K7151, ICD-10-D-K717, ICD-10-D-K7200:ICD-10-D-K7469, ICD-10-D-K760, ICD-10-D-K762:ICD-10-D-K769Z944 |
| Coagulopathy | ICD-9-D-2860:ICD-9-D-2871, ICD-9-D-2873:ICD-9-D-2875, ICD-10-D-D65:ICD-10-D-D689, ICD-10-D-D691, ICD-10-D-D693:ICD-10-D-D696 |
| Hematologic complications | |
| Cerebral vascular disease | ICD-9-D-36234, ICD-9-D-430:ICD-9-D-43899, ICD-10-D-G45:ICD-10-D-G4599, ICD-10-D-G46:ICD-10-D-G4699, ICD-10-D-H340, ICD-10-D-I60:ICD-10-D-I6999 |
| Peripheral vascular disease | ICD-9-D-093, ICD-9-D-4373, ICD-9-D-440:ICD-9-D-44099, ICD-9-D-441:ICD-9-D-44199, ICD-9-D-4431:ICD-9-D-4439, ICD-9-D-4471, ICD-9-D-5571, ICD-9-D-5579, ICD-9-D-V434, ICD-10-D-I70:ICD-10-D-I7099, ICD-10-D-I71:ICD-10-D-I7199, ICD-10-D-I731, ICD-10-D-I738, ICD-10-D-I739, ICD-10-D-I771, ICD-10-D-I790, ICD-10-D-I792, ICD-10-D-K551, ICD-10-D-K558, ICD-10-D-K559, ICD-10-Z958, ICD-10-D-Z959 |
| Deep vein thrombosis | ICD-9-D-4532, ICD-9-D-4533, ICD-9-D-4534, ICD-9-D-45382, ICD-9-D-45384, ICD-9-D-45385, ICD-9-D-45386, ICD-10-D-I26:ICD-10-D-I2699 |
| Hematoma | ICD-9-D-99811, ICD-9-D-99812, ICD-9-D-99813, ICD-10-D-D7801, ICD-10-D-D7802, ICD-10-D-D7821, ICD-10-D-D7822, ICD-10-D-E3601, ICD-10-D-E3602, ICD-10-D-E89810, ICD-10-D-E89811, ICD-10-D-G9731, ICD-10-D-G9732, ICD-10-D-G9751, ICD-10-D-G9752, ICD-10-D-H59111, ICD-10-D-H59112, ICD-10-D-H59113, ICD-10-D-H59119, ICD-10-D-H59121, ICD-10-D-H59122, ICD-10-D-H59123, ICD-10-D-H59129, ICD-10-D-H59311, ICD-10-D-H59312, ICD-10-D-H59313, ICD-10-D-H59319, ICD-10-D-H59321, ICD-10-D-H59322, ICD-10-D-H59323, ICD-10-D-H59329, ICD-10-D-H9521, ICD-10-D-H9522, ICD-10-D-H9541, ICD-10-D-H9542, ICD-10-D-I97410, ICD-10-D-I97411, ICD-10-D-I97418, ICD-10-D-I9742, ICD-10-D-I97610, ICD-10-D-I97611, ICD-10-D-I97618, ICD-10-D-I97620, ICD-10-D-J9561, ICD-10-D-J9562, ICD-10-D-J95830, ICD-10-D-J95831, ICD-10-D-K9161, ICD-10-D-K9162, ICD-10-D-K91840, ICD-10-D-K91841, ICD-10-D-L7601, ICD-10-D-L7602, ICD-10-D-L7621, ICD-10-D-L7622, ICD-10-D-M96810, ICD-10-D-M96811, ICD-10-D-M96830, ICD-10-D-M96831, ICD-10-D-N9961, ICD-10-D-N9962, ICD-10-D-N99820, ICD-10-D-N99821, ICD-10-D-T888XXA |
| Pulmonary embolism | ICD-9-D-4151:ICD-9-D-4159, ICD-10-D-I26:ICD-10-D-I269 |
| Need for transfusion | ICD-9-P-9904, ICD-10-P-3023, ICD-10-P-30230AZ, ICD-10-P-30230G0, ICD-10-P-30230G2, ICD-10-P-30230G3, ICD-10-P-30230G4, ICD-10-P-30230H0, ICD-10-P-30230H1, ICD-10-P-30230J0, ICD-10-P-30230J1, ICD-10-P-30230K0, ICD-10-P-30230K1, ICD-10-P-30230L0, ICD-10-P-30230L1, ICD-10-P-30230M0, ICD-10-P-30230M1, ICD-10-P-30230N0, ICD-10-P-30230N1, ICD-10-P-30230P0, ICD-10-P-30230P1, ICD-10-P-30230Q0, ICD-10-P-30230Q1, ICD-10-P-30230R0, ICD-10-P-30230R1, ICD-10-P-30230S0, ICD-10-P-30230S1, ICD-10-P-30230T0, ICD-10-P-30230T1, ICD-10-P-30230V0, ICD-10-P-30230V1, ICD-10-P-30230W0, ICD-10-P-30230W1, ICD-10-P-30230X0, ICD-10-P-30230X2, ICD-10-P-30230X3, ICD-10-P-30230X4, ICD-10-P-30230Y0, ICD-10-P-30230Y2, ICD-10-P-30230Y3, ICD-10-P-30230Y4, ICD-10-P-30233AZ, ICD-10-P-30233G0, ICD-10-P-30233G2, ICD-10-P-30233G3, ICD-10-P-30233G4, ICD-10-P-30233H0, ICD-10-P-30233H1, ICD-10-P-30233J0, ICD-10-P-30233J1, ICD-10-P-30233K0, ICD-10-P-30233K1, ICD-10-P-30233L0, ICD-10-P-30233L1, ICD-10-P-30233M0, ICD-10-P-30233M1, ICD-10-P-30233N0, ICD-10-P-30233N1, ICD-10-P-30233P0, ICD-10-P-30233P1, ICD-10-P-30233Q0, ICD-10-P-30233Q1, ICD-10-P-30233R0, ICD-10-P-30233R1, ICD-10-P-30233S0, ICD-10-P-30233S1, ICD-10-P-30233T0, ICD-10-P-30233T1, ICD-10-P-30233V0, ICD-10-P-30233V1, ICD-10-P-30233W0, ICD-10-P-30233W1, ICD-10-P-30233X0, ICD-10-P-30233X2, ICD-10-P-30233X3, ICD-10-P-30233X4, ICD-10-P-30233Y0, ICD-10-P-30233Y2, ICD-10-P-30233Y3, ICD-10-P-30233Y4, ICD-10-P-30240AZ, ICD-10-P-30240G0, ICD-10-P-30240G2, ICD-10-P-30240G3, ICD-10-P-30240G4, ICD-10-P-30240H0, ICD-10-P-30240H1, ICD-10-P-30240J0, ICD-10-P-30240J1, ICD-10-P-30240K0, ICD-10-P-30240K1, ICD- |

(*continued on next page*)

**Supplementary Table 1** (*continued*)

| Events | ICD and CPT codes |
|---|---|
| | 10-P-30240L0, ICD-10-P-30240L1, ICD-10-P-30240M0, ICD-10-P-30240M1, ICD-10-P-30240N0, ICD-10-P-30240N1, ICD-10-P-30240P0, ICD-10-P-30240P1, ICD-10-P-30240Q0, ICD-10-P-30240Q1, ICD-10-P-30240R0, ICD-10-P-30240R1, ICD-10-P-30240S0, ICD-10-P-30240S1, ICD-10-P-30240T0, ICD-10-P-30240T1, ICD-10-P-30240V0, ICD-10-P-30240V1, ICD-10-P-30240W0, ICD-10-P-30240W1, ICD-10-P-30240X0, ICD-10-P-30240X2, ICD-10-P-30240X3, ICD-10-P-30240X4, ICD-10-P-30240Y0, ICD-10-P-30240Y2, ICD-10-P-30240Y3, ICD-10-P-30240Y4, ICD-10-P-30243AZ, ICD-10-P-30243G0, ICD-10-P-30243G2, ICD-10-P-30243G3, ICD-10-P-30243G4, ICD-10-P-30243H0, ICD-10-P-30243H1, ICD-10-P-30243J0, ICD-10-P-30243J1, ICD-10-P-30243K0, ICD-10-P-30243K1, ICD-10-P-30243L0, ICD-10-P-30243L1, ICD-10-P-30243M0, ICD-10-P-30243M1, ICD-10-P-30243N0, ICD-10-P-30243N1, ICD-10-P-30243P0, ICD-10-P-30243P1, ICD-10-P-30243Q0, ICD-10-P-30243Q1, ICD-10-P-30243R0, ICD-10-P-30243R1, ICD-10-P-30243S0, ICD-10-P-30243S1, ICD-10-P-30243T0, ICD-10-P-30243T1, ICD-10-P-30243V0, ICD-10-P-30243V1, ICD-10-P-30243W0, ICD-10-P-30243W1, ICD-10-P-30243X0, ICD-10-P-30243X2, ICD-10-P-30243X3, ICD-10-P-30243X4, ICD-10-P-30243Y0, ICD-10-P-30243Y2, ICD-10-P-30243Y3, ICD-10-P-30243Y4, ICD-10-P-30250G0, ICD-10-P-30250G1, ICD-10-P-30250H0, ICD-10-P-30250H1, ICD-10-P-30250J0, ICD-10-P-30250J1, ICD-10-P-30250K0, ICD-10-P-30250K1, ICD-10-P-30250L0, ICD-10-P-30250L1, ICD-10-P-30250M0, ICD-10-P-30250M1, ICD-10-P-30250N0, ICD-10-P-30250N1, ICD-10-P-30250P0, ICD-10-P-30250P1, ICD-10-P-30250Q0, ICD-10-P-30250Q1, ICD-10-P-30250R0, ICD-10-P-30250R1, ICD-10-P-30250S0, ICD-10-P-30250S1, ICD-10-P-30250T0, ICD-10-P-30250T1, ICD-10-P-30250V0, ICD-10-P-30250V1, ICD-10-P-30250W0, ICD-10-P-30250W1, ICD-10-P-30250X0, ICD-10-P-30250X1, ICD-10-P-30250Y0, ICD-10-P-30250Y1, ICD-10-P-30253G0, ICD-10-P-30253G1, ICD-10-P-30253H0, ICD-10-P-30253H1, ICD-10-P-30253J0, ICD-10-P-30253J1, ICD-10-P-30253K0, ICD-10-P-30253K1, ICD-10-P-30253L0, ICD-10-P-30253L1, ICD-10-P-30253M0, ICD-10-P-30253M1, ICD-10-P-30253N0, ICD-10-P-30253N1, ICD-10-P-30253P0, ICD-10-P-30253P1, ICD-10-P-30253Q0, ICD-10-P-30253Q1, ICD-10-P-30253R0, ICD-10-P-30253R1, ICD-10-P-30253S0, ICD-10-P-30253S1, ICD-10-P-30253T0, ICD-10-P-30253T1, ICD-10-P-30253V0, ICD-10-P-30253V1, ICD-10-P-30253W0, ICD-10-P-30253W1, ICD-10-P-30253X0, ICD-10-P-30253X1, ICD-10-P-30253Y0, ICD-10-P-30253Y1, ICD-10-P-30260G0, ICD-10-P-30260G1, ICD-10-P-30260H0, ICD-10-P-30260H1, ICD-10-P-30260J0, ICD-10-P-30260J1, ICD-10-P-30260K0, ICD-10-P-30260K1, ICD-10-P-30260L0, ICD-10-P-30260L1, ICD-10-P-30260M0, ICD-10-P-30260M1, ICD-10-P-30260N0, ICD-10-P-30260N1, ICD-10-P-30260P0, ICD-10-P-30260P1, ICD-10-P-30260Q0, ICD-10-P-30260Q1, ICD-10-P-30260R0, ICD-10-P-30260R1, ICD-10-P-30260S0, ICD-10-P-30260S1, ICD-10-P-30260T0, ICD-10-P-30260T1, ICD-10-P-30260V0, ICD-10-P-30260V1, ICD-10-P-30260W0, ICD-10-P-30260W1, ICD-10-P-30260X0, ICD-10-P-30260X1, ICD-10-P-30260Y0, ICD-10-P-30260Y1, ICD-10-P-30263G0, ICD-10-P-30263G1, ICD-10-P-30263H0, ICD-10-P-30263H1, ICD-10-P-30263J0, ICD-10-P-30263J1, ICD-10-P-30263K0, ICD-10-P-30263K1, ICD-10-P-30263L0, ICD-10-P-30263L1, ICD-10-P-30263M0, ICD-10-P-30263M1, ICD-10-P-30263N0, ICD-10-P-30263N1, ICD-10-P-30263P0, ICD-10-P-30263P1, ICD-10-P-30263Q0, ICD-10-P-30263Q1, ICD-10-P-30263R0, ICD-10-P-30263R1, ICD-10-P-30263S0, ICD-10-P-30263S1, ICD-10-P-30263T0, ICD-10-P-30263T1, ICD-10-P-30263V0, ICD-10-P-30263V1, ICD-10-P-30263W0, ICD-10-P-30263W1, ICD-10-P-30263X0, ICD-10-P-30263X1, ICD-10-P-30263Y0, ICD-10-P-30263Y1, ICD-10-P-30273H1, ICD-10-P-30273J1, ICD-10-P-30273K1, ICD-10-P-30273L1, ICD-10-P-30273M1, ICD-10-P-30273N1, ICD-10-P-30273P1, ICD-10-P-30273Q1, ICD-10-P-30273R1, ICD-10-P-30273S1, ICD-10-P-30273T1, ICD-10-P-30273V1, ICD-10-P-30273W1, ICD-10-P-30277H1, ICD-10-P-30277J1, ICD-10-P-30277K1, ICD-10-P-30277L1, ICD-10-P-30277M1, ICD-10-P-30277N1, ICD-10-P-30277P1, ICD-10-P-30277Q1, ICD-10-P-30277R1, ICD-10-P-30277S1, ICD-10-P-30277T1, ICD-10-P-30277V1, ICD-10-P-30277W1, ICD-10-P-30280B1, ICD-10-P-30283B1 |
| Surgical complications | |
| Revision hip arthroplasty | CPT-27134, CPT-27137, CPT-27138, ICD-9-P-0070, ICD-9-P-0072, ICD-9-P-0073, ICD-9-P-0071, ICD-9-P-8153, ICD-10-P-0SWBXJZ, ICD-10-P-0SW9XJZ, ICD-10-P-0SW90JZ, ICD-10-P-0SWB0JZ, ICD-10-P-0SWRXJZ, ICD-10-P-0SWSXJZ, ICD-10-P-0SWS0JZ, ICD-10-P-0SWR0JZ, ICD-10-P-0SWA0JZ, ICD-10-P-0SWE0JZ, ICD-10-P-0SW909Z, ICD-10-P-0SWB09Z, ICD-10-P-0SWEXJZ, ICD-10-P-0SWAXJZ |
| Aseptic loosening | ICD-9-D-99641, ICD-10-D-T84030A, ICD-10-D-T84031A |
| Dislocation | ICD-9-D-99642, ICD-10-D-T84020A, ICD-10-D-T84021A |
| Osteolysis | ICD-9-D-99641, ICD-9-D-99645, ICD-9-D-99646, ICD-9-D-99647, ICD-10-D-T84030, ICD-10-D-T84031, ICD-10-D-T84050, ICD-10-D-T84051, ICD-10-D-T84060, ICD-10-D-T84061 |
| Periprosthetic fracture | ICD-9-D-99644, ICD-10-D-M9701XA, ICD-10-D-M9701XD, ICD-10-D-M9701XS, ICD-10-D-M9702XA, ICD-10-D-M9702XD, ICD-10-D-M9702XS, ICD-10-D-M971, ICD-10-D-M9711XA, ICD-10-D-M9711XD, ICD-10-D-M9711XS, ICD-10-D-M9712XA, ICD-10-D-M9712XD, ICD-10-D-M9712XS, ICD-10-D-M9721XA, ICD-10-D-M9721XD, ICD-10-D-M9721XS, ICD-10-D-M9722XA, ICD-10-D-M9722XD, ICD-10-D-M9722XS, ICD-10-D-M9731XA, ICD-10-D-M9731XD, ICD-10-D-M9731XS, ICD-10-D-M9732XA, ICD-10-D-M9732XD, ICD-10-D-M9732XS, ICD-10-D-M9741XA, ICD-10-D-M9741XD, ICD-10-D-M9742XA, ICD-10-D-M9742XD, ICD-10-D-M9742XS, ICD-10-D-M978XXA, ICD-10-D-M978XXD, ICD-10-D-M978XXS, ICD-10-D-M979, ICD-10-D-M979XXA, ICD-10-D-M979XXD, ICD-10-D-M979XXS |
| Joint infection | ICD-9-D-99666, ICD-9-D-99667, ICD-10-D-T8451, ICD-10-D-T8452 |
| Wound disruption | ICD-9-D-99830, ICD-9-D-99831, ICD-9-D-99832, ICD-9-D-99833, ICD-10-D-T8130XA, ICD-10-D-T8130XD, ICD-10-D-T8130XS, ICD-10-D-T8131XA, ICD-10-D-T8131XD, ICD-10-D-T8131XS, ICD-10-D-T8132XA, ICD-10-D-T8132XD, ICD-10-D-T8132XS, ICD-10-D-T8133XA, ICD-10-D-T8133XD, ICD-10-D-T8133XS |