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A METHOD FOR IDENTIFYING PERIPHERAL INTRAVENOUS (PIV) CATHETER-RELATED COMPLICATIONS IN A U.S. HOSPITAL DISCHARGE DATABASE

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INTRODUCTION

- Nearly 200 million peripheral intravenous (PIV) catheters are used annually in the US.[1]
- The burden of peripheral intravenous (PIV) related bloodstream infections (BSI) is currently under-evaluated.[2]
- Identifying PIV-related complications in real-world data is challenging due to the broad use, inconsistent coding, and voluntary reporting of these devices.[3,4,5]

OBJECTIVE

- To evaluate the feasibility of identifying patients with peripheral intravenous lines (PIV) in real-world data and, if possible, estimate the rate of PIV-related complications.

METHODS

Study Design

- Retrospective analysis studying hospital admissions between 7/1/2013-6/30/2015 using the Premier Perspective® Database of US hospital discharge records.
- The Premier Perspective® Database covers 20% of U.S. hospital discharges. It contains deidentified data including clinical coding, hospital cost, and patient billing from more than 600 hospitals (45 million discharges) throughout the United States.
- Identifying PIV with dedicated procedure codes found significant underreporting. Therefore, based on interviews with expert clinicians, we identified admission diagnoses for which PIV catheter use could be assumed but that were unlikely themselves to cause a complication that would be mistaken as PIV-related.
  - We selected admissions having 1 of the following 7 primary diagnoses: pneumonia, chronic obstructive pulmonary disease (COPD), myocardial infarction (MI), congestive heart failure (CHF), chronic kidney disease (CKD), diabetes with complications, and major trauma (i.e., hip, spinal, and cranial fractures).
- All admissions were assumed to include PIV catheter use.
- Admissions with potential non-PIV-related causes of complications such as dialysis, surgery, and central line use excluded.

Study Measures

We examined the following measures within each primary diagnosis group and among all groups combined:

- Baseline measures included patient age, sex, and race; insurance plan type; admission type; hospital geographic region, location, teaching load, and size.
- Evidence of a PIV-related complication was defined as the presence of an ICD-9-CM code in the admission record for at least one of the following selected complications:
  - ***Bloodstream infection***, including: septicemia, sepsis, severe sepsis, septic shock, septicemic, bacteremia, disseminated fungal infection, disseminated candida infection, disseminated fungal endocarditis.
  - ***Upper extremity cellulitis and abscess*** at the following sites: upper arm and forearm; hand except fingers and thumb; and unspecified sites.
  - ***Upper extremity superficial phlebitis and thrombophlebitis*** at the following sites: upper extremity superficial vein; upper extremity, unspecified; and unspecified site.
  - ***Infections, not elsewhere classified (NEC)***, including: acute infection following transfusion, infusion, or injection of blood and blood products; infection following other infusion, injection, transfusion, or vaccination; and infection and inflammatory reaction due to vascular device, implant, and graft (includes peripheral venous vascular catheter).
  - ***Extravasation***, including: extravasation (infiltration) of other vesicant chemotherapy or agent.

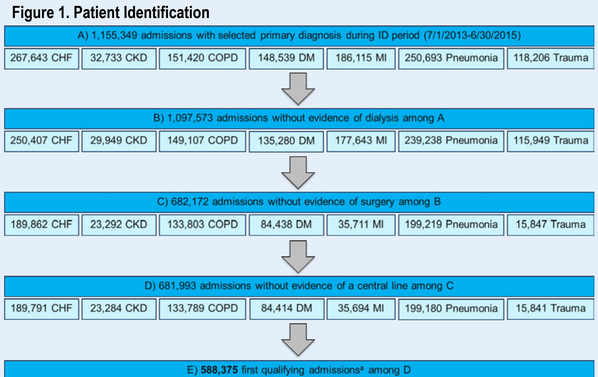
Statistical Analysis

- Descriptive statistics were generated for all patient demographic, payer, and admitting hospital characteristics and for rates of PIV-related complications of interest during the index hospitalization.
  - Means and standard deviations (SD) were reported for continuous variables, and percentages for categorical variables.
- All results were reported for each primary diagnosis group and for the overall combined group.

RESULTS

- We identified 588,375 qualifying admissions (N=15,637–187,904 depending on condition) **(Figure 1)**.
- Within the overall cohort, mean (SD) age was 66.1 years (20.6) and 52.4% female. The majority were white (71.2%) and had mainly non-elective admission (95.2%) in urban hospital settings (83.5%) **(Table 1)**.
  - Medicare was the primary payment source (66.2%). Over one-third (39.5%) of admissions occurred in teaching hospitals and about one-quarter (24.3%) in hospitals with more than 500 beds.

Figure 1. Patient Identification



CHF: congestive heart failure; CKD: chronic kidney disease without dialysis; COPD: chronic obstructive pulmonary disease; DM: diabetes with complications; MI: myocardial infarction; Trauma: hip, spinal, or cranial fracture.

[a] Within each diagnosis group, we included only the first qualifying admission (index hospitalization) for all patients. Readmissions for the same condition were excluded.

RESULTS (continued)

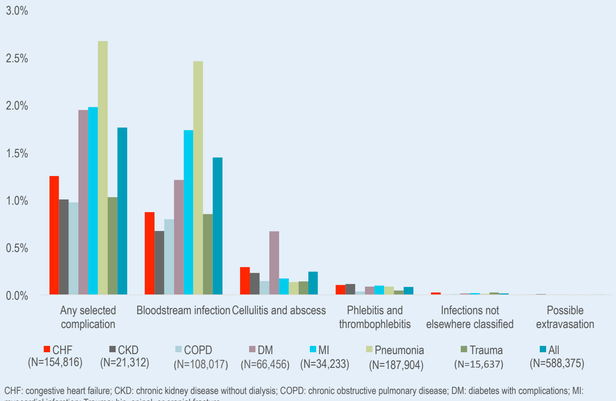
- There were 10,354 patients (1.8%) with at least one complication **(Table 2, Figure 2)**. Complication rates varied by cohort: from 0.98% of COPD cohort to 2.67% of pneumonia cohort **(Table 2)**.
- Overall, BSI accounted for 82.2% of complications, cellulitis for 13.9%, phlebitis for 4.6%, infections for 0.8%, and extravasation for 0.1% (results not shown). BSI was most commonly observed among patients with pneumonia (2.5%), MI (1.7%), and DM (1.2%) **(Table 2, Figure 2)**.

Table 1. Patient Demographics, Payer Characteristics, and Admitting Hospital Characteristics

	CHF N=154,816	CKD N=21,312	COPD N=108,017	DM N=66,456	MI N=34,233	Pneumonia N=187,904	Trauma N=15,637	All N=588,375
Age, year, mean (SD)	73.6 (13.8)	68.7 (16.2)	68.7 (12.0)	50.5 (20.7)	75.0 (13.6)	62.2 (25.3)	63.7 (27.3)	66.1 (20.6)
Female, %	51.1	48.4	56.0	47.8	50.6	53.5	55.2	52.4
Race, %								
White	69.8	52.8	78.8	57.6	74.2	73.7	77.7	71.2
Black	16.8	32.0	10.4	25.1	10.2	11.4	6.3	14.7
Other	13.4	15.1	10.9	17.4	15.6	14.9	16.0	14.1
Payment Source, %								
Managed care/commercial	9.9	12.8	11.6	24.8	11.9	17.5	16.8	14.7
Medicaid/charity	3.8	5.8	5.6	11.5	3.1	7.2	6.2	6.2
Medicare	77.7	68.6	71.3	38.2	76.9	61.8	60.7	66.2
Other	8.6	12.8	11.5	25.5	8.1	13.5	16.3	12.9
Admission type, %								
Emergent (vs. elective)	95.2	95.7	95.2	96.1	96.5	94.7	96.1	95.2
Hospital region,%								
Northeast	19.3	21.2	17.3	18.2	21.7	16.7	22.4	18.3
Midwest	21.5	19.2	21.5	19.4	20.7	21.9	18.9	21.2
West	11.3	10.6	8.7	12.0	12.9	11.4	15.3	11.1
South	47.9	49.0	52.5	50.5	44.6	50.1	43.4	49.4
Teaching hospital, %	41.2	46.3	35.7	43.0	39.4	37.3	50.9	39.5
Location of hospital, %								
Urban (vs. rural)	84.3	89.3	80.9	87.1	81.7	82.1	89.0	83.5
Number of beds, %								
501+ (vs. ≤ 500)	25.9	30.9	20.6	27.3	22.4	22.8	35.7	24.3

CHF: congestive heart failure; CKD: chronic kidney disease without dialysis; COPD: chronic obstructive pulmonary disease; DM: diabetes with complications; MI: myocardial infarction; Trauma: hip, spinal, or cranial fracture.

Figure 2. Selected Complication Rates Related to PIV



CHF: congestive heart failure; CKD: chronic kidney disease without dialysis; COPD: chronic obstructive pulmonary disease; DM: diabetes with complications; MI: myocardial infarction; Trauma: hip, spinal, or cranial fracture.

Table 2. Selected Complication[a] Rates Related to Peripheral IV

	CHF N=154,816	CKD N=21,312	COPD N=108,017	DM N=66,456	MI N=34,233	Pneumonia N=187,904	Trauma N=15,637	All N=588,375
Patients with any complication[ab]								
no.	1,936	214	1,053	1,293	677	5,020	161	10,354
%	1.251	1.004	0.975	1.946	1.978	2.672	1.030	1.760
Selected complications among entire cohort								
Bloodstream infection, %	0.87	0.67	0.80	1.21	1.74	2.46	0.85	1.45
Cellulitis and abscess, %	0.29	0.23	0.15	0.67	0.17	0.13	0.14	0.24
Phlebitis and thrombophlebitis, %	0.10	0.11	0.04	0.09	0.10	0.09	0.05	0.08
Infections not elsewhere classified, %	0.03	0.01	0.01	0.01	0.02	0.01	0.03	0.01
Possible extravasation, %	<0.01	0.01	<0.01	<0.01	0.00	<0.01	0.00	<0.01

CHF: congestive heart failure; CKD: chronic kidney disease without dialysis; COPD: chronic obstructive pulmonary disease; DM: diabetes with complications; MI: myocardial infarction; Trauma: hip, spinal, or cranial fracture. [a] Complications include bloodstream infection, upper extremity cellulitis and abscess, upper extremity superficial phlebitis and thrombophlebitis, PIV-related infections not elsewhere classified (i.e., infection or inflammatory reaction following infusion, injection, transfusion, vaccination, vascular device, implant, or graft), or possible extravasation. [b] Patients might have more than one complication.

LIMITATIONS

- All patients in our sample were assumed to have received a PIV catheter upon admission to a U.S. hospital based on clinical expert input; to the degree this assumption does not hold, our sample may include patients not at risk for a PIV-related complication.
- We attempted to exclude admissions with evidence of factors that could have independently led to a PIV complication; however, we were unable to remove all potential confounders, due to coding or identification limitations, leading to possible over-reporting of PIV complication rates.

CONCLUSIONS

- Using a methodology based on clinical expert input, PIV-related complications were uncovered in hospital data at rates consistent with clinical research on PIV complications.[1]
- Future analyses will explore the clinical and economic impact of these complications in each of the conditions studied.

REFERENCES

1. Maki DG, et al. Mayo Clin Proc. 2006;81(9):1159-1171. doi:10.4065/81.9.1159.
2. Zingg W, et al. Int J Antimicrob Agents. 2009;34 Suppl 4:S38-42. doi:10.1016/S0924-8579(09)70565-5.
3. Trinh TT, et al. Infect Control Hosp Epidemiol. 2011;32(6):579-583. doi:10.1086/660099.
4. Morris AK, et al. J Hosp Infect. 2016;93(2):169-174. doi:10.1016/j.jhin.2016.03.003.
5. Pujol M, et al. J Hosp Infect. 2007;67(1):22-29. doi:10.1016/j.jhin.2007.06.017.

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