UNDERSTANDING PATTERNS OF 30-DAY READMISSION IN PATIENTS WITH CARDIAC AMYLOIDOSIS

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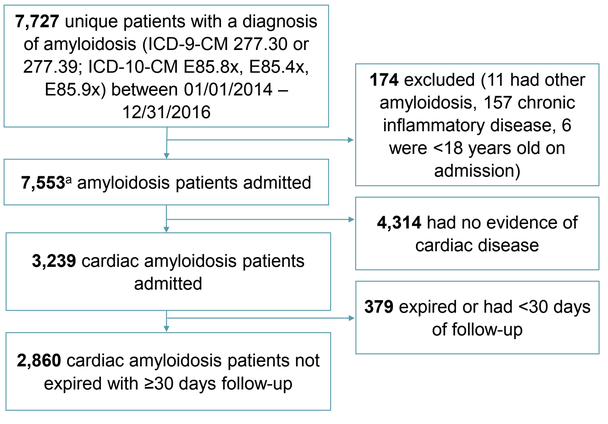
Objective

- Cardiac amyloidosis is a rare, progressive, and typically fatal form of cardiomyopathy mostly found in patients with light chain (AL) amyloidosis and transthyretin (ATTR) amyloidosis.[1]
- Patients with cardiac amyloidosis tend to have extremely poor prognosis and require frequent hospital care. Improved detection and new treatments over the past several years have improved outcomes, but survival remains poor.[2]
- The objective of this study was to examine 30-day readmission characteristics in patients with cardiac amyloidosis.

Methods

- Study design and data source
  - Retrospective, cross-sectional analysis using the 2014-2016 Premier Healthcare Database
    - Contains complete deidentified clinical coding, hospital costs, and patient billing data from >600 hospitals across the US
    - Covers 20% of US hospital discharges, including all billed items (medications, laboratory, diagnostic and therapeutic services, and primary and secondary diagnoses) for each patient's hospitalization
- Patient population and timeframe (**Figure 1**)
  - Hospitalized patients ≥18 years old with cardiac amyloidosis were identified if they:
    - Had ≥1 inpatient claims consistent with amyloidosis [International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) codes: 277.30 or 277.39; ICD-10-CM: E85.4x, E85.8x, or E85.9x] in any diagnosis field AND
    - Had cardiac involvement (≥1 code for heart failure, syncope, postural/orthostatic hypotension, tricuspid/mitral regurgitation murmur, sudden cardiac death, dyspnea, edema, or ascites)
    - Were discharged alive and had ≥30 days of follow-up
  - If there were multiple qualifying hospitalizations, only the first was included.
  - Patients diagnosed with other types of amyloidosis or chronic inflammatory diseases were excluded.
- Study measures
  - Patient demographics (e.g. age, gender, race, payment source) and comorbidities [e.g.) Charlson Comorbidity Index (CCI), multiple myeloma, monoclonal gammopathy of undetermined significance (MGUS)]
  - Hospital admission type (elective vs. non-elective)
  - 30-day all-cause readmission rate, cost [2016$ (USD)], length of stay (LOS), and in-hospital mortality
- Statistical analysis
  - Descriptive statistics (means, standard deviations, relative frequencies for continuous data, and percentages for categorical data) reported
  - Data transformations and analyses performed using SAS© version 9.4

Figure 1. Patient identification flowchart



[a] Only the first qualified hospitalization for each patient was included in the study.

Table 1. Demographics of readmitted vs. non-readmitted cardiac amyloidosis patients

	Readmitted within 30 days	Not readmitted within 30 days	p-value
N	481	2,379	
Age, mean (SD)	71.1 (12.4)	73.0 (11.7)	**0.001**
Age group, no. (%)			**0.025**
18-34	2 (0.4)	9 (0.4)	
35-54	50 (10.4)	161 (6.8)	
55-64	78 (16.2)	346 (14.5)	
65 or older	351 (73.0)	1,863 (78.3)	
Sex, no. (%)			0.346
Female	184 (38.3)	965 (40.6)	
Male	297 (61.7)	1,414 (59.4)	
Race, no. (%)			0.412
White	302 (62.8)	1,522 (64.0)	
African American	108 (22.5)	558 (23.5)	
Other	67 (13.9)	271 (11.4)	
Unknown	4 (0.8)	28 (1.2)	
Marital status, no. (%)			0.233
Single or divorced	170 (35.3)	923 (38.8)	
Married	239 (49.7)	1,118 (47.0)	
Other	72 (15.0)	328 (13.8)	
Unknown	0 (0)	10 (0.4)	
Primary payer type, no. (%)			0.464
Medicare	366 (76.1)	1,858 (78.1)	
Medicaid	31 (6.4)	127 (5.3)	
Commercial	14 (2.9)	67 (2.8)	
Self-pay	2 (0.4)	28 (1.2)	
Managed care	59 (12.3)	249 (10.5)	
Other	9 (1.9)	50 (2.1)	
Year of hospitalization, no. (%)			0.257
2014	172 (35.8)	819 (34.4)	
2015	153 (31.8)	848 (35.6)	
2016	156 (32.4)	712 (29.9)	

SD: standard deviation; p-values in **bold**: statistically significant at 0.05 level

Table 2. Comorbidities and disease manifestations among readmitted vs. non-readmitted cardiac amyloidosis patients

	Readmitted within 30 days	Not readmitted within 30 days	p-value
N	481	2,379	
Charlson comorbidity index, mean (SD) [median]	4.1 (2.2) [4.0]	3.8 (2.2) [4.0]	**0.007**
Charlson comorbidity index (categories), no. (%)			0.352
0	9 (1.9)	48 (2.0)	
1	43 (8.9)	268 (11.3)	
2	63 (13.1)	342 (14.4)	
3+	366 (76.1)	1,721 (72.3)	
Individual Charlson comorbidities, no. (%)			
Myocardial Infarction	84 (17.5)	359 (15.1)	0.189
Congestive Heart Failure	377 (78.4)	1,848 (77.7)	0.737
Peripheral Vascular Disease	58 (12.1)	255 (10.7)	0.391
Cerebrovascular Disease	112 (23.3)	627 (26.4)	0.161
Dementia	22 (4.6)	172 (7.2)	**0.035**
Chronic Pulmonary Disease	123 (25.6)	525 (22.1)	0.094
Rheumatologic Disease	13 (2.7)	60 (2.5)	0.819
Peptic Ulcer Disease	14 (2.9)	40 (1.7)	0.071
Mild Liver Disease	22 (4.6)	102 (4.3)	0.779
Diabetes-Mild to Moderate	81 (16.8)	446 (18.7)	0.325
Diabetes with Chronic Complications	55 (11.4)	184 (7.7)	**0.007**
Paraplegia or Hemiplegia	24 (5.0)	97 (4.1)	0.365
Renal Disease	277 (57.6)	1,236 (52.0)	**0.024**
Any Malignancy/Lymphoma/Leukemia	95 (19.8)	422 (17.7)	0.296
Moderate or Severe Liver Disease	49 (10.2)	213 (9.0)	0.392
Metastatic Solid Tumor	30 (1.3)	6 (1.2)	0.980
AIDS	0 (0.0)	3 (0.1)	0.436
Other comorbidities, and disease manifestations, no. (%)			
Multiple Myeloma	79 (16.4)	312 (13.1)	0.054
MGUS	27 (5.6)	77 (3.2)	**0.011**
Hypothyroidism	103 (21.4)	471 (19.8)	0.420
WM	5 (1.0)	17 (0.7)	0.457
Hypotension	105 (21.8)	510 (21.4)	0.849
Hyperlipidemia	250 (52.0)	1,201 (50.5)	0.551
Carpal Tunnel Syndrome	2 (0.4)	7 (0.3)	0.664
Hepatomegaly	6 (1.2)	18 (0.8)	0.282
Purpura	57 (11.9)	284 (11.9)	0.957
Claudication	37 (7.7)	140 (5.9)	0.133
Stroke	52 (10.8)	279 (11.7)	0.566
Peripheral Neuropathy	11 (2.3)	72 (3.0)	0.378

SD: standard deviation; AIDS: acquired immunodeficiency syndrome;
MGUS: monoclonal gammopathy of undetermined significance;
WM: Waldenstrom macroglobulinemia; p-values in **bold**: statistically significant at 0.05 level

Results

- Patient demographic and clinical characteristics
  - 2,860 patients with cardiac amyloidosis and ≥30 days of follow-up were included and 481 (16.8%) were readmitted within 30 days (**Table 1**).
  - Mean (SD) age of readmitted patients was 71.1 (12.4) years vs. 73.0 (11.7) (p=0.001) for non-readmitted patients (**Table 1**).
  - 76.1% of readmitted patients had Medicare as their primary payer vs. 78.1% of non-readmitted patients (p=0.464) (**Table 1**).
  - Readmitted patients had higher overall CCI and other comorbidity burden than non-readmitted patients [mean (SD) CCI 4.1 (2.2) vs. 3.8 (2.2), p=0.007], including a higher percentage of diabetes with chronic complications (11.4% vs. 7.7%, p=0.007), renal disease (57.6% vs. 52.0%, p=0.024), and MGUS (5.6% vs. 3.2%, p=0.011) (**Table 2**).
- Hospital admission characteristics
  - 439 (91.3%) of readmitted patients had a non-elective readmission.
- Health outcomes
  - Mean (SD) cost of readmission was $18,536 (39,415)
  - Mean (SD) readmission LOS was 8.5 (9.3) days
  - 11.2% died in the hospital during readmission

Conclusions

- Limitations
  - Cardiac disease and amyloidosis were identified using coded data, not clinical records, which are designed for billing, not research. We could not differentiate different types of cardiac amyloidosis, such as AL and ATTR, in claims.
  - Findings may not be generalizable to patients discharged from types of hospitals not included in this data source (e.g., federally-funded or closed-panel HMO facilities).
- One in 6 patients who are admitted with cardiac amyloidosis is readmitted within 30-days; more than 1 in 10 patients die during readmission.
- This readmission rate is similar to that for other conditions (e.g., acute myocardial infarction, heart failure) targeted in the CMS Hospital Readmissions Reduction Program.[3]
- Quality improvement programs, along with awareness of readmission risks and better outpatient disease management might improve care and reduce costs.

References

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3. Boccuti C, et al. Aiming for Fewer Hospital U-turns: The Medicare Hospital Readmission Reduction Program [Internet]. Kaiser Family Foundation. 2017.

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