Inpatient Outcomes of Colorectal Cancer Patients with and without Concomitant Osteoporosis: A Population Based Propensity-Score Matched Analysis

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Introduction & Aim

- Low serum calcium and vitamin D levels elevate the risk of colorectal cancer (CRC) and may be a prognostic factor for CRC patients
- Calcium metabolism and vitamin D levels are key factors in osteoporosis (OP) for which bisphosphonates are the standard treatment.
- While OP in CRC patients is common, the impact of concomitant disease on inpatient outcomes is poorly understood.
- Aim: To use a propensity-matched analysis to examine inpatient outcomes in CRC patients with OP.

Methods

Data & Cohort
- 2001 – 2014 National Inpatient Sample (NIS)
- Primary/Secondary diagnosis of malignant CRC with and without diagnosis of OP (ICD-9 codes)

Baseline Characteristics Observed
- Patient Demographics: Age, Race, Sex, Income, Payer
- Hospital Characteristics: Teaching Status, Size, Region,
- Clinical Features: Elixhauser Comorbidities, Admission Status, Admission Year
- Assessed with Rao-Scott Chi-Squared and Mann-Whitney tests

Propensity Score Matching
- Cases of OP propensity score matched to non-OP cases
- 1:1 case to control matching ratio, caliper = 0.2
- Nearest neighbor greedy match algorithm
- Matching Covariates: baseline characteristics
- Match Criteria: Standardized Mean Differences (SMD), <0.1 - Covariates added to outcomes regressions

Outcomes Assessment
- Primary Outcomes: Length of stay (LOS), Total In-hospital charges, routine vs non-routine disposition, mortality
- Secondary Outcomes: in-hospital complications and procedures performed
- Assessed with adjusted multivariable Poisson, gamma, and logistic regression

Results

Table 1: Baseline Characteristics Of the Study Cohort Pre and Post Propensity Score Matching

Variable	Raw Cohort				Propensity Matched Cohort[2]		
	No Osteoporosis N = 2,591,147	Osteoporosis N = 69,154	Pvalue	StdMeanDiff	No Osteoporosis N = 56,792	Osteoporosis N = 56,770	StdMeanDiff
Age	68 (57 - 78)	79 (72 - 85)	<0.001 *	0.76	79 (72 - 85)	79 (72 - 85)	0.02
Sex							
Female	48.7%	91.5%	<0.001 *	0.85	90.9%	91.3%	0.01
Male	51.2%	8.5%		-0.85	9.1%	8.7%	-0.01
Race							
White	60.0%	71.5%	<0.001 *	0.25	85.2%	85.3%	0.00
Hispanic	6.1%	4.2%		-0.10	5.2%	4.9%	-0.01
Black	9.9%	3.4%		-0.26	4.2%	4.0%	-0.01
Asian/Pac Islander	2.3%	3.0%		0.05	3.4%	3.5%	0.01
Elixhauser Comorb Index	17 (7 - 22)	16 (7 - 23)	<0.001 *	-0.02	17 (7 - 23)	16 (7 - 23)	0.00
Admission Type							
Elective	51.4%	51.2%	0.69	0.00	50.6%	50.9%	0.00
Non-Elective	48.3%	48.6%		0.00	49.4%	49.1%	0.00
Hospital Teaching Status							
Urban Nonteach	40.1%	43.2%	<0.001 *	0.06	44.4%	44.5%	0.00
Urban Teaching	46.4%	42.9%		-0.08	43.3%	43.4%	0.00
Rural	13.2%	13.6%		0.02	12.3%	12.0%	0.00
Hospital Region							
South	38.6%	32.2%	<0.001 *	-0.14	33.8%	33.7%	0.00
Midwest	23.9%	26.2%		0.07	19.6%	19.7%	0.01
Northeast	20.6%	22.7%		0.03	26.3%	26.3%	0.00
West	16.9%	19.0%		0.08	20.3%	20.3%	0.00

1. Median (Interquartile Range) | 2. Counts weighted by NIS trends weights post propensity matching
* Pvalue < 0.05

Table 2: Primary Outcomes and Complication Rates - Estimates and Adjusted Regression Coefficients

Variable	Outcome	No Osteoporosis	Osteoporosis	Coefficient[1]	95% Conf Interval	Pvalue
Primary Outcomes	Total Charges[2]	$39,189 ($22,133 - $68,852)	$38,262 ($21,898 - $65,896)	0.95	(0.93 - 0.98)	<0.001 *
	Routine Disposition	49.2%	47.9%	0.96	(0.9 - 1.01)	0.13
	Length Of Stay[2]	6 (4 - 10)	6 (4 - 9)	0.96	(0.94 - 0.98)	<0.001 *
	Mortality	3.9%	2.7%	0.71	(0.61 - 0.83)	<0.001 *
Complications & Procedures	Acute Kidney Injury	5.7%	4.0%	0.66	(0.57 - 0.75)	<0.001 *
	Blood Transfusion	23.8%	22.9%	0.93	(0.87 - 1)	0.048 *
	Gastrointestinal Hemorrhage	8.8%	8.6%	0.95	(0.87 - 1.05)	0.34
	Mechanical Ventilation	4.2%	3.0%	0.69	(0.6 - 0.8)	<0.001 *
	Peritonitis/Intestinal Abscess	2.4%	1.4%	0.58	(0.48 - 0.7)	<0.001 *
	Pneumonia	4.4%	3.9%	0.88	(0.77 - 1.01)	0.08
	Respiratory Failure	6.2%	5.1%	0.8	(0.71 - 0.9)	<0.001 *
	Septicemia	3.1%	2.1%	0.66	(0.56 - 0.78)	<0.001 *
	Total Colectomy	0.1%	0.1%	1.77	(0.75 - 4.21)	0.19
	Partial Colectomy	0.1%	0.2%	1.41	(0.7 - 2.87)	0.34

1. "No Osteoporosis" set as the reference group | 2. Median (Interquartile range)
* Pvalue < 0.05

Results

- 2,660,301 cases of CRC, 69,165 w/OP
- Pre-match, cases of CRC with OP were older (79 IQR: 72-85 vs 68 IQR: 57-78, P<0.001), more likely to be female (91.5% vs 48.7%, P < 0.001), white (71.5% vs 60%, P<0.001), and have uncomplicated hypertension (53.8% vs 42.5%, P<0.001)
- After matching to controls, cases of CRC with OP had lower hospital charges (-5%, 95% CI -7% to -2%, P<0.001), lower LOS (aIRR: 0.96, 95% CI 0.94-0.98, P<0.001), and lower mortality (aOR: 0.71, 95% CI 0.61–0.83, P<0.001). The overall mortality rate of CRC without OP was 3.9% versus 2.7% with OP (P<0.001).
- CRC with concomitant OP had lower rates of mechanical ventilation (aOR: 0.69, 95% CI 0.6-0.8, P<0.001), acute kidney injury (aOR: 0.66, 95% CI 0.57 – 0.75, P<0.001), peritonitis (aOR: 0.58, 95% CI 0.48-0.7, P<0.001), and septicemia (aOR: 0.66, 95% CI 0.56-0.78, P<0.001)

Conclusions

- Inpatients with CRC with OP have lower total charges, LOS, and overall mortality and complication rates
- . These favorable inpatient outcomes may be explained by OP treatment impacting CRC progression
- Future studies are needed to directly examine the potential impact and role of bisphosphonates and other OP treatments on CRC prognosis