Changes in BMI According to Urinary Diversion Type Following Radical Cystectomy

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BACKGROUND

For patients facing a diagnosis of a locally advanced bladder malignancy, radical cystectomy (RC) with urinary diversion, preceded by neoadjuvant platinum-based chemotherapy (NC) is considered the gold standard in treatment.[1,2] Following RC, continent (e.g. neobladder) or incontinent (e.g. ileal conduit) urinary diversion is completed. Previous research has shown both diversion methods can result in acute and chronic metabolic abnormalities including bone density, electrolyte imbalance, impaired drug metabolism, abnormal acid-base balance, and malabsorption.[3,4] While the acute and chronic metabolic changes of urinary diversion have been explored, the current study seeks to improve the understanding of urinary diversion on lean muscle mass and adipose burden over time. Previous research examining body composition across a range of cancer types has shown correlations among lean and fat mass levels and resulting patient related survival outcomes, performance status, and pharmaceutical toxicities.[5,6]

Specific Aim 1: Quantify and compare changes in lean muscle mass among patients who received continent and incontinent diversions following RC to patients treated with bladder sparing protocols (BSP) retaining their native bladder over a period of 1 year.

Specific Aim 2: Quantify and compare changes in adipose tissue (including subcutaneous and visceral fat) among patients who received continent and incontinent diversions following RC to patients treated with BSP retaining their native bladder over a period of 1 year.

METHODS

Clinicopathologic and radiographic data was retrospectively collected for all consecutive patients undergoing treatment for locally advanced bladder cancer between 2000 and 2018 (N=654). The clinical cohort for this study included patients undergoing radical cystectomy and either incontinent (N=105) or continent diversion (N=35) and patients undergoing BPS (N=5) who functioned as controls as they retained their native bladder.. Patients were excluded under the following criteria: unavailable imaging within 30-60 days of initiation of chemotherapy and unavailable follow-up imaging (1-year s/p RC). After exclusion, 145 patients were included in the current analysis.

Axial CT images at the level of third lumbar (L3) were collected at baseline and one year post treatment dates. Analysis of imaging was conducted by a team of radiologists at Massachusetts General Hospital in which axial images were segmented by tissue density into lean muscle, subcutaneous and visceral adipose tissue using artificial intelligence-based algorithms.

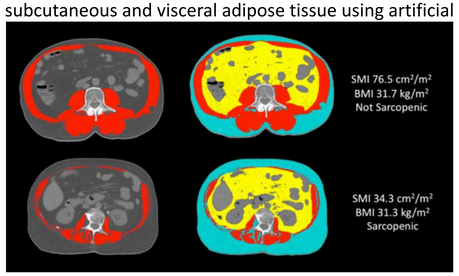

Figure 1. Example of Slice-O-Matic software analysis of axial CT images at the level of L3 among two patients with similar BMI and differing levels of lean and adipose tissue (image adopted from Psutka et al., 2014)

Statistical analysis: Comparison of body composition over 1 year following treatment among patients who received RC with urinary diversion (continent vs. incontinent) and patients who received trimodal therapy (retained their native bladder). Medians and IQR were used for comparison among groups. **At the time of this poster printing, body composition analysis is ongoing, therefore change in BMI is presented**.

RESULTS

Table 1. Patient demographics and clinicopathological data

Variable	Incontinent Urinary Diversion N=105	Continent Urinary Diversion N=35	Bladder Sparing N=5	Total Median (IQR) or n (%)
Median age at RC (years)	68.6 (59.8-75.7)	57.9 (51.3-64.1)	76.2 (59.1-77.4)	65.6 (57.9-73.3)
Sex (%)				
Male	79 (75)	32 (91)	4 (80)	115 (79)
Female	26 (25)	3 (9)	1 (20)	30 (21)
Race				
Caucasian	98 (93)	32 (91)	5 (100)	136 (93)
Other	7 (7)	3 (9)	0 (0)	10 (7)
ECOG performance status, no. (%)				
Missing	25 (24)	9 (26)	1 (20)	35 (24)
0	39 (37)	16 (46)	1 (20)	56 (39)
1	35 (33)	10 (29)	2 (40)	47 (32)
≥2	4 (4)	0 (0)	1 (20)	5 (3)
Median ASA				
1	7 (7)	4 (11)	NA	11 (8)
2	27 (26)	11 (31)	NA	38 (26)
≥3	71 (68)	20 (57)	NA	91 (63)
Smoker				
Past	55 (52)	15 (43)	3 (60)	73 (50)
Current	13 (12)	8 (23)	0 (0)	21 (14)
Median preoperative hemoglobin, g/dL (IQR)	11.6 (10.75-13.2)	12.6 (11.75-13.525)	12 (11.55-12.45)	11.8 (10.9-13.4)
Median preoperative albumin, g/dL (IQR)	4 (3.7-4.2)	4 (3.8-4.2)	3.75 (3.625-3.825)	4 (3.7-4.2)
Clinical Tumor Stage				
T2	39 (37)	13 (37)	3 (60)	55 (38)
≥T3	53 (50)	18 (51)	1 (20)	72 (49)
N1	17 (16)	7 (20)	2 (40)	26 (18)
Lymphovascular invasion, no. (%)	28 (27)	10 (29)	0 (0)	15 (10)
Median no. of lymph nodes dissected (IQR)	18 (13-25)	22 (15-28.75)	NA	19 (13-26)
Positive peripheral tumor margin, no. (%)	9 (9)	1 (3)	NA	10 (7)

Table 2. Comparison of Body Mass Index at baseline and 1-year post intervention

Nutritional Characteristic	Incontinent Urinary Diversion N=105		Continent Urinary Diversion N=35		Bladder Sparing N=5		Total Median (IQR) or n (%)	
	Pre-surgical	1-year post intervention (RC)	Pre-surgical	1-year post intervention (RC)	Baseline	1-year post intervention (BSP)	Baseline	Post intervention (RC) and (BSP)
Body Mass Index (kg/m2)	27.1 (24.3-31.1)	26.7 (23.87-30.79)	27.7 (25.4-30.8)	27.1 (24.35-29.42)	25.1 (23.5-31.2)	28.1 (27.93-29.68)	27.3 (24.7-31.1)	26.9 (24.2-30.5)
BMI Category (WHO Classification) no. (%)								
Underweight (BMI < 18.5 kg/m)	1 (1)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)	1 (1)
Normal weight (BMI 18.5–24.9 kg/m)	30 (29)	33 (31)	6 (17)	12 (34)	2 (40)	1 (20)	38 (26)	46 (32)
Overweight (BMI 25.0–29.9 kg/mg)	40 (38)	39 (37)	18 (51)	15 (43)	1 (20)	3 (60)	59 (41)	57 (39)
Class I Obesity (BMI 30.0–34.9 kg/m)	29 (28)	27 (26)	9 (26)	7 (20)	2 (40)	0 (0)	40 (28)	34 (23)
Class II Obesity (BMI 35–39.9 kg/m)	4 (4)	4 (4)	2 (6)	1 (3)	0 (0)	1 (20)	6 (4)	6 (4)
Class III Obesity (BMI > 40 kg/m)	1 (1)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)	1 (1)

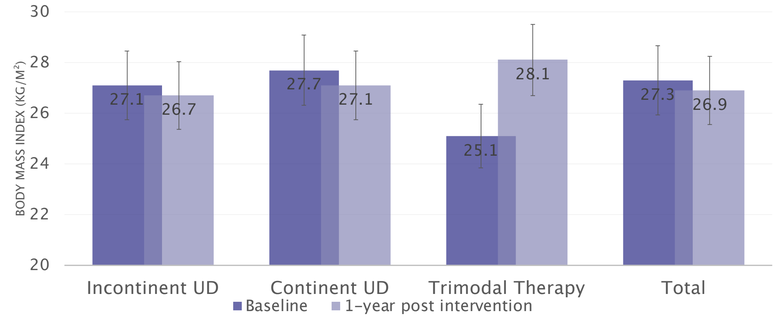

Figure 2. Demonstrates the change in BMI from baseline to 1-year post intervention for each clinical group as well as the total change in BMI among all study participants

CONCLUSIONS

Preliminary comparison demonstrated patients who underwent continent diversion had a greater BMI at baseline than those patients who underwent incontinent diversion or BSP. Both continent and incontinent diversion experienced a decline in BMI over a 1-year period following RC. Patients who underwent BSP saw an increase in BMI during the same 1-year post intervention period. Clinicopathological data showed many similarities among interventions groups except for median age which varied significantly among the three interventions. Because only the clinicopathological data and BMI can be compared at this time many limitations exist. As work on this project continues imaging analysis will allow for a comprehensive comparison among interventions and a foundational understanding of the implications that different methods of urinary diversion have on lean muscularity and adipose tissue. Finally, the goal of this project is to provide physicians with a resource that can aid in improving clinical outcomes, as well as educating patients on an array of treatment options.

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REFERENCES

1. Cahn, D., Handorf, E., Nordsiek, M., Churilla, T., Horwitz, E., & Ristau, B. et al. (2016). Contemporary use trends and survival outcomes in patients undergoing radical cystectomy or bladder-preservation therapy for muscle-invasive bladder cancer. The Journal Of Urology, 195(4), e649. doi: 10.1016/j.juro.2016.02.375
2. Aragon-Ching, J., Werntz, R., Zietman, A., & Steinberg, G. (2018). Multidisciplinary Management of Muscle-Invasive Bladder Cancer: Current Challenges and Future Directions. American Society Of Clinical Oncology Educational Book, (38), 307-318. doi: 10.1200/edbk_201227
3. Vasdev, N., Moon, A., & Thorpe, A. (2013). Metabolic complications of urinary intestinal diversion. *Indian Journal of Urology*, *29*(4), 310-315. doi: 10.4103/0970-1591.120112
4. Martini, A., Villari, D., & Nicita, G. (2017). Long-term complications arising from bowel interposition in the urinary tract. International Journal of Surgery, 44, 278-280. doi: 10.1016/j.ijsu.2017.07.030
5. Prado, C., Baracos, V., McCargar, L., Reiman, T., Mourtzakis, M., & Tonkin, K. et al. (2009). Sarcopenia as a Determinant of Chemotherapy Toxicity and Time to Tumor Progression in Metastatic Breast Cancer Patients Receiving Capecitabine Treatment. Clinical Cancer Research, 15(8), 2920-2926. doi: 10.1158/1078-0432.ccr-08-2242
6. Hilmi, M., Jouinot, A., Burns, R., Pigneur, F., Mounier, R., & Gondin, J. et al. (2018). Body composition and sarcopenia: The next-generation of personalized oncology and pharmacology?. *Pharmacology & Therapeutics*. doi: 10.1016/j.pharmthera
7. Arora, K., Hanson, K. T., Habermann, E. B., Tollefson, M. K., & Psutka, S. P. (2018). Early Complications and Mortality following Radical Cystectomy: Associations with Malnutrition and Obesity. *Bladder Cancer*, *4*(4), 377–388. https://doi.org/10.3233/BLC-180173
8. Psutka, S. P., Carrasco, A., Schmit, G. D., Moynagh, M. R., Boorjian, S. A., Frank, I., … Tollefson, M. K. (2014). Sarcopenia in patients with bladder cancer undergoing radical cystectomy: Impact on cancer-specific and all-cause mortality. *Cancer*. https://doi.org/10.1002/cncr.28798

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