

Supplementary Tables

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Supplementary Table 1: Objective response rate in metastatic anal cancer by RECIST v1.1

| Confirmed objective response | Pembrolizumab (n) (N=32) |
|-------------------------------------|----------------------------------|
| Complete response | 3.1% (95% CI: 0.1–16.2) (n=1) |
| Partial response | 6.3% (95% CI: 0.7–20.8%) (n=2) |
| Stable disease | 31.2% (95% CI: 16.1-50.0) (n=10) |
| Progressive disease | 43.8% (95% CI: 26.4-62.3) (n=14) |
| Inevaluable | 15.6% (95% CI: 5.3-32.8) (n=5) |
| ORR (PR + CR) | 9.4% (95% CI: 2.0–25.0) (n=3) |

Supplementary Table 2: Number of Tumors Analyzed by DFCI Immunoprofile According to Cancer Type

| DFCI Immunoprofile by Cancer Type | |
|---|----------------|
| Cancer Type | Total N |
| Lung Cancer | 347 |
| Colorectal Cancer | 140 |
| Bladder Cancer | 110 |
| Breast Cancer | 101 |
| Endometrial Cancer | 71 |
| Head & Neck Cancer | 71 |
| Melanoma | 69 |
| Renal Cancer | 57 |
| Gastroesophageal Adenocarcinoma | 50 |
| Ovarian Cancer | 50 |
| Pancreatic Cancer | 37 |
| Anal Cancer* | 24 |
| Biliary Tract Cancer | 15 |
| Cervical Cancer | 5 |
| Prostate Cancer | 5 |
| * All of the anal cancer patients included were part of the clinical trial. | |

Supplementary Table 3: HPV status by tumor tissue and peripheral blood

| Patient ID | P16/PCR result | Baseline TTMV-HPV DNA | HPV status determination |
|------------|------------------|-----------------------|--------------------------|
| 1 | Genotype 16 | 67544 | Positive |
| 2 | p16 positive | 590000 | Positive |
| 3 | ISH/p16 positive | 2462500 | Positive |
| 4 | unknown | 16818 | Positive |
| 5 | p16 positive | 1317 | Positive |
| 6 | PCR positive | 238889 | Positive |
| 7 | p16 positive | 20417 | Positive |
| 8 | p16 positive | 45076 | Positive |
| 9 | unknown | Unknown | Unknown |
| 10 | p16 positive | 141111 | Positive |
| 11 | unknown | 0 | Negative |
| 12 | p16 positive | 4387 | Positive |
| 13 | p16 positive | 1483333 | Positive |
| 14 | unknown | 116 | Positive |
| 15 | ISH/p16 positive | 4 | Positive |
| 16 | unknown | 117750 | Positive |
| 17 | NEGATIVE | 0 | Negative |
| 18 | p16 positive | 0 | Undetermined |
| 19 | ISH/p16 positive | 92 | Positive |
| 20 | ISH/p16 positive | 155 | Positive |
| 21 | ISH/p16 positive | 20000 | Positive |
| 22 | p16 positive | 731250 | Positive |
| 23 | unknown | 170052 | Positive |
| 24 | NEGATIVE | 0 | Negative |
| 25 | p16 positive | 6133 | Positive |
| 26 | p16 positive | 35046 | Positive |
| 27 | p16 positive | Unknown | Positive |
| 28 | p16 positive | 533 | Positive |
| 29 | p16 positive | Unknown | Positive |
| 30 | unknown | 10258 | Positive |
| 31 | Genotype 16 | 211 | Positive |
| 32 | unknown | 2000 | Positive |

ID: identification. ISH: in-situ hybridization. PCR: polymerase chain reaction. HPV: human papillomavirus. TTMV-HPV DNA: tumor tissue modified-HPV DNA.

Supplementary Table 4: Demographic table of patients exposed to PD1 inhibition at Dana-Farber Cancer Institute (Retrospective Cohort)

| | | n=18 (%) |
|--|----------------------|-----------------|
| Median Age (years) | | 57 |
| | Range (years) | 37-80 |
| Gender | | |
| | Male | 5 (28) |
| | Female | 13 (72) |
| Race | | |
| | White | 18 (100) |
| Smoking Status | | |
| | Never | 4 (22) |
| | Former | 12 (67) |
| | Current | 2 (11) |
| HIV status | | |
| | Positive | 1 (6) |
| | Negative | 17 (94) |
| Pathologic differentiation | | |
| | Well | 0 (0) |
| | Moderate | 8 (44) |
| | Poor | 5 (28) |
| | Not specified | 5 (28) |
| HPV status | | |
| | Positive | 14 (78) |
| | Negative | 1 (6) |
| | Not tested | 3 (17) |
| Clinical T stage at diagnosis | | |
| | T1 | 0 (0) |
| | T2 | 3 (17) |
| | T3 | 4 (22) |
| | T4 | 2 (11) |
| | Not specified | 9 (50) |
| Clinical node status at diagnosis | | |
| | N0 | 2 (11) |
| | N+ | 9 (50) |
| | Not specified | 7 (39) |
| M stage at diagnosis | | |
| | M0 | 11 (61) |
| | M1 | 7 (39) |
| Initial treatment for localized disease | | |
| | Chemoradiation | 11 (61) |
| | Excision | 0 (0) |
| Response to chemoradiation | | |
| | Complete Response | 7 (39) |
| | Incomplete Response | 4 (22) |

| | |
|---|---------|
| First line therapy in metastatic setting | |
| Cisplatin/5-fluorouracil (5-FU) | 7 (39) |
| Carboplatin/paclitaxel | 3 (17) |
| Folinic acid, 5-FU, oxaliplatin | 1 (6) |
| Pembrolizumab | 4 (22) |
| Nivolumab | 2 (11) |
| Other | 1 (6) |
| PD1 directed therapy | |
| Pembrolizumab monotherapy | 10 (55) |
| Nivolumab monotherapy | 7 (39) |
| Chemotherapy + nivolumab | 1 (6) |
| Site of metastases at time of anti-PD1 therapy | |
| Liver | 5 (28) |
| Lung | 10 (55) |
| Distant lymph nodes | 11 (61) |
| Other | 5 (28) |