Differential expression of NPDC1 in cancer of the vulva.

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In these brief notes we document work using published microarray data (1, 2) to pioneer integrative transcriptome analysis comparing vulvar carcinoma to its tissue of origin, the vulva. We report the differential expression of neural proliferation, differentiation and control 1, encoded by NPDC1, in cancer of the vulva. NPDC1 may be of pertinence to understanding transformation and disease progression in vulvar cancer (3).

Keywords: vulvar cancer, vulvar carcinoma, NPDC1, neural proliferation, differentiation and control 1.

Gynecologic cancers include cervical cancer, ovarian cancer, endometrial (uterine) cancer, and vulvar cancer (4, 3). Vulvar cancer is thought to be the least prevalent of these, with 6190 cases reported in the United States in 2018 (5). We integrated separate published microarray datasets to understand, at the systems level, the transcriptional landscape of vulvar carcinoma.

Methods

We utilized microarray datasets GSE63678 (1) and GSE38228 (2) for this integrated, transcriptome-level differential gene expression analysis of human vulvar cancers in conjunction with GEO2R. GSE63678 was generated using Affymetrix Human Genome U133A 2.0 Array technology with $n=7$ normal vulvar tissues and $n=6$ vulvar carcinoma tissues; analysis was performed using platform GPL571. GSE38228 was generated using Illumina HumanHT-12 V4.0 expression beadchip technology with $n=5$ normal vulvar tissues and $n=13$ vulvar SCC (squamous cell carcinoma) tissues; analysis was performed using platform GPL10558. The Benjamini and Hochberg method of p -value adjustment was used for ranking of differential expression but raw p -values were used to assess statistical significance of global differential expression. Log-transformation of data was auto-detected, and the NCBI generated category of platform annotation was used. A statistical test was performed to evaluate whether NPDC1 expression was significantly different between normal vulva and vulvar cancer using a two-tailed t -test.

Results

We mined published microarray data (1, 2) to understand the most significant transcriptional changes between the normal vulva and cancer of the vulva.

NPDC1 is differentially expressed in vulvar cancer.

We found that neural proliferation, differentiation and control 1, encoded by NPDC1, was among the most differentially expressed genes, transcriptome-wide, in cancer of the vulva (1). When sorting each transcript whose expression was measured across the transcriptome based on significance of change between the normal vulva and vulvar cancer tissues, NPDC1 ranked 92 out of 22277 total transcripts, equating to 99.6% differential expression (Chart 1) (1). Differential expression of NPDC1 was statistically significant (Chart 1; $p=1.04E-05$).

We validated our findings by performing this same analysis using a second published microarray dataset (2). When sorting each transcript whose expression was measured across the transcriptome based on significance of change between the normal vulva and vulvar cancer tissues, NPDC1 ranked 2037 out of 47323 total transcripts, equating to 95.7% differential expression (Chart 2) (2). Differential expression of NPDC1 was again statistically significant (Chart 2; $p=4.74E-04$).

NPDC1 expression is higher in cancer tissue as compared to the vulva.

We obtained exact mRNA expression data from the first microarray dataset we mined to directly compare expression levels between control and cancer tissues. NPDC1 was expressed at significantly higher levels in cancer of the vulva as compared to normal vulva. NPDC1 was expressed at 9.15 ± 0.35 arbitrary units (A.U.) in normal vulva, but at 7.65 ± 0.45 A.U. in vulvar cancer tissues (Figure 1). We

1 calculated a mean fold change of 0.84 in NPDC1 expression when comparing vulvar carcinoma to vulva.
2

3 **Discussion**

4 We documented here that NPDC1 is differentially expressed at the transcriptome level in cancer of
5 the human vulva (1, 2). NPDC1 is a candidate gene of interest in understanding the transcriptional
6 biology of vulvar cancer.
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Rank: 92
Probe ID: 218086_at
p-value: 1.04E-05
t: 6.811673
B: 3.75333
Gene: NPDC1
Gene name: neural proliferation, differentiation and control 1

Chart 1: Differential expression of NPDC1 in vulvar cancer.

Rank of differential expression, probe ID, *p*-value of global differential expression, *t*, a moderated *t*-statistic, *B*, the log-odds of differential expression between the groups compared, gene and gene name are listed in this chart.

Rank: 2037
Probe ID: ILMN_2199313
p-value: 4.74E-04
t: 4.2413149
B: -0.28581
Gene: NPDC1
Gene name: neural proliferation, differentiation and control 1

Chart 2: Differential expression of NPDC1 in vulvar cancer.

Rank of differential expression, probe ID, *p*-value of global differential expression, *t*, a moderated *t*-statistic, *B*, the log-odds of differential expression between the groups compared, gene and gene name are listed in this chart.

Figure 1: NPDC1 is expressed at significantly higher levels in vulvar cancer as compared to normal vulva.

The mRNA expression level of NPDC1 in the normal vulva (left) and in vulvar carcinoma (right) is graphically depicted with the result of a statistical test evaluating significance of difference in NPDC1 expression between the two groups, a *p*-value, listed above.