**Supplement**

**S1 Table.** Information for 40 tumor-adjacent normal pairs of HNSCC patients downloaded from TCGA.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No.** | **Bc patient barcode** | **Clinical stage** | **Form completion date** | **Anatomic neoplasm subdivision** | **Gender** |
| 1 | TCGA-CV-7091 | Stage I | 2011/10/11 | Oral Cavity | MALE |
| 2 | TCGA-CV-7177 | Stage I | 2011/10/11 | Larynx | FEMALE |
| 3 | TCGA-CV-6938 | Stage II | 2011/9/13 | Oral Cavity | MALE |
| 4 | TCGA-CV-6961 | Stage II | 2011/9/12 | Oral Tongue | MALE |
| 5 | TCGA-CV-6955 | Stage II | 2011/10/11 | Oral Cavity | FEMALE |
| 6 | TCGA-CV-7101 | Stage II | 2011/10/6 | Larynx | MALE |
| 7 | TCGA-CV-7103 | Stage II | 2011/10/11 | Oral Tongue | MALE |
| 8 | TCGA-CV-7183 | Stage II | 2011/10/11 | Oral Cavity | MALE |
| 9 | TCGA-CV-7238 | Stage II | 2011/12/5 | Oral Tongue | FEMALE |
| 10 | TCGA-CV-7255 | Stage II | 2011/12/5 | Oral Tongue | FEMALE |
| 11 | TCGA-CV-7406 | Stage II | 2012/4/9 | Base of tongue | MALE |
| 12 | TCGA-CV-7423 | Stage II | 2012/2/13 | Oral Cavity | MALE |
| 13 | TCGA-CV-7437 | Stage II | 2012/4/9 | Larynx | MALE |
| 14 | TCGA-CV-7438 | Stage II | 2012/2/13 | Oral Tongue | FEMALE |
| 15 | TCGA-CV-7440 | Stage II | 2012/4/9 | Larynx | MALE |
| 16 | TCGA-CV-6935 | Stage III | 2011/9/9 | Larynx | MALE |
| 17 | TCGA-CV-6943 | Stage III | 2011/9/9 | Base of tongue | MALE |
| 18 | TCGA-CV-6959 | Stage III | 2011/9/8 | Oral Tongue | MALE |
| 19 | TCGA-CV-6962 | Stage III | 2011/8/25 | Larynx | MALE |
| 20 | TCGA-CV-6960 | Stage III | 2011/9/8 | Oral Cavity | MALE |
| 21 | TCGA-CV-7097 | Stage III | 2011/10/5 | Oral Cavity | MALE |
| 22 | TCGA-CV-7235 | Stage III | 2011/12/12 | Floor of mouth | MALE |
| 23 | TCGA-CV-7242 | Stage III | 2011/12/2 | Larynx | FEMALE |
| 24 | TCGA-CV-7245 | Stage III | 2011/12/2 | Larynx | MALE |
| 25 | TCGA-CV-7250 | Stage III | 2011/12/5 | Larynx | MALE |
| 26 | TCGA-CV-7252 | Stage III | 2011/12/2 | Oral Cavity | FEMALE |
| 27 | TCGA-CV-7261 | Stage III | 2011/12/2 | Larynx | MALE |
| 28 | TCGA-CV-7425 | Stage III | 2012/2/13 | Oral Cavity | FEMALE |
| 29 | TCGA-CV-7432 | Stage III | 2012/2/13 | Oral Cavity | MALE |
| 30 | TCGA-CV-7434 | Stage III | 2012/2/13 | Oral Cavity | MALE |
| 31 | TCGA-HD-8635 | Stage III | 2012/12/28 | Oral Tongue | FEMALE |
| 32 | TCGA-HD-A6I0 | Stage III | 2013/9/20 | Oral Cavity | MALE |
| 33 | TCGA-CV-6933 | Stage IVA | 2011/9/9 | Oral Tongue | MALE |
| 34 | TCGA-CV-6934 | Stage IVA | 2011/9/13 | Oral Tongue | FEMALE |
| 35 | TCGA-CV-6936 | Stage IVA | 2011/9/13 | Floor of mouth | MALE |
| 36 | TCGA-CV-6939 | Stage IVA | 2011/9/13 | Oral Tongue | MALE |
| 37 | TCGA-CV-6956 | Stage IVA | 2011/10/11 | Oral Tongue | MALE |
| 38 | TCGA-CV-7178 | Stage IVA | 2011/10/11 | Oral Cavity | FEMALE |
| 39 | TCGA-CV-7416 | Stage IVA | 2012/1/31 | Oral Cavity | FEMALE |
| 40 | TCGA-CV-7424 | Stage IVA | 2012/2/7 | Larynx | MALE |

**S2 Fig**

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**S2 Fig.** Principal component analysis (PCA) of the GINS2 level in 40 tumor-adjacent normal pairs of HNSCC based upon the consensus clustering. Samples were divided into 3 groups: stage I+ II, stage III, stage IV. Normal (N) and Cancer(C) samples were clearly separated, proving that the data of different batches of samples were highly stable and could be used for subsequent analysis.

**S3 Table.** Relevant information of 61 differential expression target genes based on TCGA

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **NO** | **Gene ID** | **Name of gene** | **Number of transcripts** | **Number of articles on pubmed** | **Novoseek disease relationships for the gene** | **MalaCards disease relationships for the gene** |
| 1 | 11332 | ACOT7 | 4 | 34 | 0 | 10 |
| 2 | 200810 | ALG1L | 2 | 4 | 0 | 0 |
| 3 | 64411 | ARAP3 | 1 | 34 | 0 | 4 |
| 4 | 9824 | ARHGAP11A | 2 | 17 | 0 | 6 |
| 5 | 55723 | ASF1B | 1 | 45 | 0 | 2 |
| 6 | 483 | ATP1B3 | 1 | 28 | 0 | 7 |
| 7 | 114904 | C1QTNF6 | 2 | 16 | 0 | 9 |
| 8 | 55038 | CDCA4 | 2 | 27 | 0 | 12 |
| 9 | 91687 | CENPL | 3 | 17 | 0 | 4 |
| 10 | 93979 | CPA5 | 3 | 13 | 0 | 2 |
| 11 | 144402 | CPNE8 | 1 | 26 | 0 | 6 |
| 12 | 53336 | CPXCR1 | 2 | 8 | 0 | 5 |
| 13 | 55454 | CSGALNACT2 | 1 | 12 | 0 | 5 |
| 14 | 80174 | DBF4B | 2 | 19 | 0 | 0 |
| 15 | 285761 | DCBLD1 | 1 | 18 | 0 | 4 |
| 16 | 55601 | DDX60 | 1 | 9 | 0 | 11 |
| 17 | 55635 | DEPDC1 | 2 | 15 | 0 | 0 |
| 18 | 81624 | DIAPH3 | 2 | 39 | 0 | 11 |
| 19 | 116093 | DIRC1 | 1 | 7 | 0 | 7 |
| 20 | 9787 | DLGAP5 | 2 | 51 | 3 | 6 |
| 21 | 8632 | DNAH17 | 1 | 11 | 0 | 5 |
| 22 | 79075 | DSCC1 | 1 | 16 | 0 | 1 |
| 23 | 199221 | DZIP1L | 2 | 8 | 0 | 1 |
| 24 | 146956 | EME1 | 2 | 38 | 0 | 13 |
| 25 | 54821 | ERCC6L | 1 | 31 | 0 | 9 |
| 26 | 84691 | FAM71F1 | 1 | 5 | 0 | 6 |
| 27 | 55785 | FGD6 | 1 | 14 | 0 | 1 |
| 28 | 23768 | FLRT2 | 1 | 24 | 0 | 6 |
| 29 | 2307 | FOXS1 | 1 | 8 | 0 | 1 |
| 30 | 51659 | GINS2 | 1 | 32 | 0 | 4 |
| 31 | 84296 | GINS4 | 1 | 19 | 0 | 3 |
| 32 | 2983 | GUCY1B3 | 1 | 27 | 0 | 4 |
| 33 | 55355 | HJURP | 1 | 39 | 0 | 3 |
| 34 | 3149 | HMGB3 | 1 | 25 | 0 | 1 |
| 35 | 56300 | IL1F9 | 1 | 30 | 0 | 9 |
| 36 | 3833 | KIFC1 | 1 | 39 | 0 | 6 |
| 37 | 79888 | LPCAT1 | 1 | 27 | 0 | 4 |
| 38 | 131578 | LRRC15 | 2 | 10 | 0 | 1 |
| 39 | 84057 | MND1 | 1 | 14 | 0 | 6 |
| 40 | 51203 | NUSAP1 | 3 | 33 | 0 | 8 |
| 41 | 285848 | PNPLA1 | 3 | 9 | 0 | 9 |
| 42 | 5558 | PRIM2 | 1 | 44 | 0 | 1 |
| 43 | 26064 | RAI14 | 6 | 35 | 0 | 3 |
| 44 | 201299 | RDM1 | 8 | 9 | 0 | 3 |
| 45 | 84957 | RELT | 2 | 11 | 0 | 1 |
| 46 | 8601 | RGS20 | 2 | 22 | 0 | 4 |
| 47 | 116832 | RPL39L | 1 | 5 | 0 | 3 |
| 48 | 83546 | RTBDN | 2 | 11 | 0 | 3 |
| 49 | 222663 | SCUBE3 | 1 | 10 | 0 | 3 |
| 50 | 79801 | SHCBP1 | 1 | 33 | 0 | 4 |
| 51 | 10615 | SPAG5 | 1 | 41 | 0 | 11 |
| 52 | 404203 | SPINK6 | 2 | 13 | 0 | 3 |
| 53 | 56164 | STK31 | 3 | 16 | 0 | 0 |
| 54 | 9015 | TAF1A | 2 | 34 | 0 | 1 |
| 55 | 8577 | TMEFF1 | 1 | 10 | 0 | 4 |
| 56 | 126282 | TNFAIP8L1 | 2 | 9 | 0 | 0 |
| 57 | 84969 | TOX2 | 4 | 12 | 0 | 3 |
| 58 | 54209 | TREM2 | 1 | 36 | 4 | 10 |
| 59 | 29089 | UBE2T | 1 | 39 | 0 | 5 |
| 60 | 11274 | USP18 | 1 | 42 | 0 | 12 |
| 61 | 27033 | ZBTB32 | 1 | 20 | 0 | 10 |

**S4 Fig**

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**S4 Fig.** Effects of 40 highly expressed genes knockdown on CNE-2Z cell proliferation in vitro. The proliferation ability was verified through Cellomics ArrayScan Infinity in CNE-2Z cells.

**S5 Fig**

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**S5 Fig.** Effects of 5 representative genes knockdown on CNE-2Z cell proliferation in vitro. CSGALNACT2, IL1F9, TMEFF1, SPINK6, and GINS2 were knocked down in CNE-2Z cells. Knockdown of GINS2 inhibited proliferation most obviously.

**S6 Table.** Expression of GINS2 in cancer and in benign tumors and inflammatory tissue of HNSCC patients by tissue chip quantitative analysis.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Cancer** | | | | | **Benign tumor and**  **inflammatory tissue** | | | | | **Cancer *vs.* Benign tumor and inflammatory tissue** | | | |
|  |  | | |  |  |  | | |  |  |  |  |  |
| **No.** | | **Type of organization** | **IHC score** | | **No.** | | **Type of organization** | **IHC score** | | **Significance level** | | **Fold change** | |
| A1 | | Cancer | 12 | | E5 | | Benign tumor | 2 | | 0.010428 | | 1.552508 | |
| A2 | | Cancer | 12 | | E6 | | Benign tumor | 2 | |  | |  | |
| A3 | | Cancer | 0 | | E7 | | Benign tumor | 4 | |  | |  | |
| A4 | | Cancer | 0 | | E8 | | Benign tumor | 4 | |  | |  | |
| A5 | | Cancer | 6 | | E9 | | Benign tumor | 8 | |  | |  | |
| A6 | | Cancer | 4 | | E10 | | Benign tumor | 6 | |  | |  | |
| A7 | | Cancer | 1 | | F1 | | Benign tumor | 6 | |  | |  | |
| A8 | | Cancer | 8 | | F2 | | Benign tumor | 4 | |  | |  | |
| A9 | | Cancer | 1 | | F3 | | Benign tumor | 1 | |  | |  | |
| A10 | | Cancer | 1 | | F4 | | Benign tumor | 0 | |  | |  | |
| B1 | | Cancer | 8 | | F5 | | Benign tumor | 6 | |  | |  | |
| B2 | | Cancer | 4 | | F6 | | Benign tumor | 6 | |  | |  | |
| B3 | | Cancer | 0 | | F7 | | Benign tumor | 9 | |  | |  | |
| B4 | | Cancer | 1 | | F8 | | Benign tumor | 6 | |  | |  | |
| B5 | | Cancer | 4 | | F9 | | Benign tumor | 12 | |  | |  | |
| B6 | | Cancer | 4 | | F10 | | Benign tumor | 12 | |  | |  | |
| B7 | | Cancer | 8 | | G1 | | Benign tumor | 1 | |  | |  | |
| B8 | | Cancer | 8 | | G2 | | Benign tumor | 1 | |  | |  | |
| B9 | | Cancer | 8 | | G3 | | Benign tumor | 4 | |  | |  | |
| B10 | | Cancer | 4 | | G4 | | Benign tumor | 4 | |  | |  | |
| C1 | | Cancer | 12 | | G5 | | Benign tumor | 4 | |  | |  | |
| C2 | | Cancer | 12 | | G6 | | Benign tumor | 4 | |  | |  | |
| C3 | | Cancer | 12 | | G7 | | Benign tumor | 12 | |  | |  | |
| C4 | | Cancer | 6 | | G8 | | Benign tumor | 12 | |  | |  | |
| C5 | | Cancer | 12 | | G9 | | Benign tumor | 12 | |  | |  | |
| C6 | | Cancer | 6 | | G10 | | Benign tumor | 12 | |  | |  | |
| C7 | | Cancer | 12 | | H1 | | Benign tumor | 9 | |  | |  | |
| C8 | | Cancer | 12 | | H2 | | Benign tumor | 6 | |  | |  | |
| C9 | | Cancer | 1 | | H3 | | Benign tumor | 8 | |  | |  | |
| C10 | | Cancer | 1 | | H4 | | Benign tumor | 1 | |  | |  | |
| D1 | | Cancer | 0 | | H5 | | Benign tumor | 0 | |  | |  | |
| D2 | | Cancer | 0 | | H6 | | Benign tumor | 0 | |  | |  | |
| D3 | | Cancer | 9 | | H7 | | Benign tumor | 0 | |  | |  | |
| D4 | | Cancer | 8 | | H8 | | Benign tumor | 0 | |  | |  | |
| D5 | | Cancer | 8 | | H9 | | Benign tumor | 0 | |  | |  | |
| D6 | | Cancer | 6 | | H10 | | Benign tumor | 8 | |  | |  | |
| D7 | | Cancer | 12 | | I1 | | Benign tumor | 0 | |  | |  | |
| D8 | | Cancer | 12 | | I2 | | Benign tumor | 2 | |  | |  | |
| D9 | | Cancer | 0 | | I3 | | Benign tumor | 6 | |  | |  | |
| D10 | | Cancer | 0 | | I4 | | Benign tumor | 6 | |  | |  | |
| E1 | | Cancer | 12 | | I5 | | Benign tumor | 0 | |  | |  | |
| E2 | | Cancer | 12 | | I6 | | Benign tumor | 0 | |  | |  | |
| E3 | | Cancer | 12 | | I7 | | Benign tumor | 4 | |  | |  | |
| E4 | | Cancer | 12 | | I8 | | Inflammatory tissue | 4 | |  | |  | |
|  | |  |  | | I9 | | Inflammatory tissue | 4 | |  | |  | |
|  | |  |  | | I10 | | Inflammatory tissue | 4 | |  | |  | |
|  | |  |  | | J1 | | Inflammatory tissue | 0 | |  | |  | |
|  | |  |  | | J2 | | Inflammatory tissue | 0 | |  | |  | |
|  | |  |  | | J3 | | Inflammatory tissue | 0 | |  | |  | |
|  | |  |  | | J4 | | Inflammatory tissue | 0 | |  | |  | |
|  | |  |  | | J5 | | Inflammatory tissue | 2 | |  | |  | |
|  | |  |  | | J6 | | Inflammatory tissue | 2 | |  | |  | |
|  | |  |  | | J7 | | Inflammatory tissue | 2 | |  | |  | |
|  | |  |  | | J8 | | Inflammatory tissue | 6 | |  | |  | |
|  | |  |  | | J9 | | Inflammatory tissue | 2 | |  | |  | |
|  | |  |  | | J10 | | Inflammatory tissue | 2 | |  | |  | |

**S7 Fig**

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**S7 Fig.** Quantitative analysis of the GINS2 expression in cancer and in benign tumors and inflammatory tissue. GINS2 gene expression was significantly increased in cancer.