Bladder cancer

Description

Bladder cancer is a disease in which certain cells in the bladder become abnormal and multiply uncontrollably to form a tumor. The bladder is a muscular organ in the lower abdomen that stores urine until it can be removed (excreted) from the body.

Bladder cancer may cause blood in the urine, pain during urination, frequent urination, the feeling of needing to urinate without being able to, or lower back pain. Many of these signs and symptoms are nonspecific, which means they may occur in multiple disorders. People who have one or more of these nonspecific health problems often do not have bladder cancer, but have another condition such as an infection.

Bladder cancer develops when tumors form in the tissue that lines the bladder. There are several types of bladder cancer, categorized by the type of cell in the tissue that becomes cancerous. The most common type is transitional cell carcinoma (also known as urothelial carcinoma); others include squamous cell carcinoma and adenocarcinoma. If the tumor spreads (metastasizes) beyond the lining of the bladder into nearby tissues or organs, it is known as invasive bladder cancer.

Frequency

In the United States, bladder cancer is the fourth most common type of cancer in men. Bladder cancer occurs four times more often in men than in women, with about 60,000 men and 18,000 women diagnosed with the condition each year.

Causes

Cancers occur when genetic mutations build up in critical genes, specifically those that control cell growth and division (proliferation) or the repair of damaged DNA. These changes allow cells to grow and divide uncontrollably to form a tumor. In nearly all cases of bladder cancer, these genetic changes are acquired during a person's lifetime and are present only in certain cells in the bladder. These changes, which are called somatic mutations, are not inherited. Somatic mutations in many different genes have been found in bladder cancer cells. It is unclear whether genetic changes that are inherited and present in all of the body's cells (germline mutations) play a significant role in causing bladder cancer.

Somatic mutations in the *FGFR3*, *PIK3CA*, *KDM6A*, and *TP53* genes are common in

bladder cancers. Each of these genes plays a critical role in regulating gene activity and cell growth, ensuring cells do not grow and divide too rapidly or uncontrollably. It is likely that mutations in these genes disrupt normal gene regulation, contributing to the uncontrolled cell growth that can lead to tumor formation in bladder cancer. Mutations in many other genes have been found to be associated with bladder cancer; each of these additional genes is associated with a small percentage of cases. Most of these genes are also involved in regulating the normal activity of genes and the growth of cells.

Additionally, deletions of part or all of chromosome 9 are commonly found in bladder cancer. Research shows that several genes that control cell growth and division are located on chromosome 9. It is likely that a loss of one or more of these genes plays a role in the early development and progression of bladder cancer.

Researchers have identified many lifestyle and environmental factors that expose individuals to cancer-causing compounds (carcinogens), which increase the rate at which somatic mutations occur, contributing to a person's risk of developing bladder cancer. The greatest risk factor is long-term tobacco smoking. It is estimated that half of people with bladder cancer have a history of tobacco smoking. Other environmental risk factors include chronic bladder inflammation, exposure to certain industrial chemicals, certain herbal medicines common in Asia, a parasitic infection called schistosomiasis, and long-term use of urinary catheters.

Learn more about the genes and chromosome associated with Bladder cancer

- ARID1A
- ATM
- CDKN2A
- CREBBP
- EP300
- FGFR3
- HRAS
- KDM6A
- KMT2D
- PIK3CA
- PTEN
- RAF1
- RB1
- TP53
- chromosome 9

Additional Information from NCBI Gene:

- CCNE1

- CDKN1A
- ELF3
- ERBB2
- FAT1
- KMT2A
- KMT2B
- KMT2C
- MDM2
- RAC1
- RHOB
- SPTAN1
- STAG2

Inheritance

Bladder cancer is typically not inherited. It is usually associated with somatic mutations that occur in certain cells in the bladder during a person's lifetime.

In rare families, the risk of bladder cancer is inherited. In these cases, the cancer risk follows an autosomal dominant pattern, which means one copy of the altered gene in each cell is sufficient to increase a person's chance of developing the disease. It is important to note that people inherit an increased risk of cancer, not the disease itself. Not all people who inherit mutations in these genes will develop bladder cancer.

Other Names for This Condition

- Bladder carcinoma urinary
- Bladder tumor
- Cancer of the urinary bladder
- Cancer, bladder
- Cancer, urinary bladder
- Malignant bladder neoplasm
- Malignant bladder tumor
- Neoplasm of the bladder
- Neoplasm of the urinary bladder
- Tumor of the urinary bladder
- Urinary bladder carcinoma
- Urinary bladder neoplasm

Additional Information & Resources

Genetic Testing Information

- Genetic Testing Registry: Urinary bladder carcinoma (https://www.ncbi.nlm.nih.gov/gtr/conditions/C0699885/)

Genetic and Rare Diseases Information Center

- Bladder cancer (https://rarediseases.info.nih.gov/diseases/12210/index)

Patient Support and Advocacy Resources

- National Organization for Rare Disorders (NORD) (https://rarediseases.org/)

Clinical Trials

- ClinicalTrials.gov (https://clinicaltrials.gov/search?cond=%22Bladder cancer%22)

Catalog of Genes and Diseases from OMIM

- BLADDER CANCER (https://omim.org/entry/109800)

Scientific Articles on PubMed

- PubMed (https://pubmed.ncbi.nlm.nih.gov/?term=%28Bladder+Neoplasms%5BMAJR%5D%29+AND+%28bladder+cancer%5BTI%5D%29+AND+review%5Bpt%5D+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+1080+days%22%5Bdp%5D)

References

- American Cancer Society: What Are the Key Statistics for Bladder Cancer? (https://www.cancer.org/cancer/bladder-cancer/about/key-statistics.html)
- Audenet F, Attalla K, Sfakianos JP. The evolution of bladder cancer genomics:What have we learned and how can we use it? Urol Oncol. 2018 Jul;36(7):313-320.doi: 10.1016/j.urolonc.2018.02.017. Epub 2018 Mar 21. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/29573965)
- Cancer Genome Atlas Research Network. Comprehensive molecular characterizationof urothelial bladder carcinoma. Nature. 2014 Mar 20;507(7492):315-22. doi:10.1038/nature12965. Epub 2014 Jan 29. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/24476821) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3962515/)

- Dinney CP, McConkey DJ, Millikan RE, Wu X, Bar-Eli M, Adam L, Kamat AM, Siefker-Radtke AO, Tuziak T, Sabichi AL, Grossman HB, Benedict WF, Czerniak B. Focus on bladder cancer. Cancer Cell. 2004 Aug;6(2):111-6. doi:10.1016/j.ccr.2004.08.002. No abstract available. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/15324694)
- Flaig TW, Spiess PE, Agarwal N, Bangs R, Boorjian SA, Buyyounouski MK, DownsTM, Efstathiou JA, Friedlander T, Greenberg RE, Guru KA, Hahn N, Herr HW, HoimesC, Inman BA, Jimbo M, Kader AK, Lele SM, Meeks JJ, Michalski J, Montgomery JS,Pagliaro LC, Pal SK, Patterson A, Petrylak DP, Plimack ER, Pohar KS, Porter MP,Preston MA, Sexton WJ, Siefker-Radtke AO, Tward J, Wile G, Johnson-Chilla A,Dwyer MA, Gurski LA. NCCN Guidelines Insights: Bladder Cancer, Version 5.2018. JNatl Compr Canc Netw. 2018 Sep;16(9):1041-1053. doi: 10.6004/jnccn.2018.0072. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/30181416)
- Flaig TW. NCCN Guidelines Updates: Management of Muscle-Invasive BladderCancer. J Natl Compr Canc Netw. 2019 May 1;17(5.5):591-593. doi:10.6004/jnccn.2019.5017. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/31117036)
- Lindgren D, Liedberg F, Andersson A, Chebil G, Gudjonsson S, Borg A, ManssonW, Fioretos T, Hoglund M. Molecular characterization of early-stage bladdercarcinomas by expression profiles, FGFR3 mutation status, and loss of 9q.Oncogene. 2006 Apr 27;25(18):2685-96. doi: 10.1038/sj.onc.1209249. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/16532037)
- McConkey DJ, Lerner SP. SIU-ICUD consultation on bladder cancer: basicscience. World J Urol. 2019 Jan;37(1):15-29. doi: 10.1007/s00345-018-2594-y. Epub2018 Dec 13. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/30547196)
- Oxford G, Theodorescu D. The role of Ras superfamily proteins in bladdercancer progression. J Urol. 2003 Nov;170(5):1987-93. doi:10.1097/01.ju.0000088670.02905.78. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/14532839)
- Robertson AG, Kim J, Al-Ahmadie H, Bellmunt J, Guo G, Cherniack AD, Hinoue T, Laird PW, Hoadley KA, Akbani R, Castro MAA, Gibb EA, Kanchi RS, Gordenin DA, Shukla SA, Sanchez-Vega F, Hansel DE, Czerniak BA, Reuter VE, Su X, de SaCarvalho B, Chagas VS, Mungall KL, Sadeghi S, Pedamallu CS, Lu Y, Klimczak LJ,Zhang J, Choo C, Ojesina AI, Bullman S, Leraas KM, Lichtenberg TM, Wu CJ, SchultzN, Getz G, Meyerson M, Mills GB, McConkey DJ; TCGA Research Network; WeinsteinJN, Kwiatkowski DJ, Lerner SP. Comprehensive Molecular Characterization ofMuscle-Invasive Bladder Cancer. Cell. 2017 Oct 19;171(3):540-556.e25. doi:10.1016/j.cell.2017.09.007. Epub 2017 Oct 5. Erratum In: Cell. 2018 Aug9;174(4):1033. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/28988769) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5687509/)
- Smith ND, Rubenstein JN, Eggener SE, Kozlowski JM. The p53 tumor suppressorgene and nuclear protein: basic science review and relevance in the management ofbladder cancer. J Urol. 2003 Apr;169(4):1219-28. doi:10.1097/01.ju.0000056085.58221.80. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/12629332)
- Spiess PE, Agarwal N, Bangs R, Boorjian SA, Buyyounouski MK, Clark PE,

DownsTM, Efstathiou JA, Flaig TW, Friedlander T, Greenberg RE, Guru KA, Hahn N, HerrHW, Hoimes C, Inman BA, Jimbo M, Kader AK, Lele SM, Meeks JJ, Michalski J, Montgomery JS, Pagliaro LC, Pal SK, Patterson A, Plimack ER, Pohar KS, Porter MP,Preston MA, Sexton WJ, Siefker-Radtke AO, Sonpavde G, Tward J, Wile G, Dwyer MA,Gurski LA. Bladder Cancer, Version 5.2017, NCCN Clinical Practice Guidelines inOncology. J Natl Compr Canc Netw. 2017 Oct;15(10):1240-1267. doi: 10.6004/jnccn.2017.0156. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/28982750)

- Woldu SL, Bagrodia A, Lotan Y. Guideline of guidelines: non-muscle-invasivebladder cancer. BJU Int. 2017 Mar;119(3):371-380. doi: 10.1111/bju.13760. Epub2017 Jan 24. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/28058776) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5315602/)
- Wolff EM, Liang G, Jones PA. Mechanisms of Disease: genetic and epigeneticalterations that drive bladder cancer. Nat Clin Pract Urol. 2005Oct;2(10):502-10. doi: 10.1038/ncpuro0318. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/16474624)

Last updated January 25, 2021