

DICER1 syndrome

Description

DICER1 syndrome is an inherited disorder that increases the risk of a variety of cancerous and noncancerous (benign) tumors, most commonly certain types of tumors that occur in the lungs, kidneys, ovaries, and thyroid (a butterfly-shaped gland in the lower neck). Affected individuals can develop one or more types of tumors, and members of the same family can have different types. However, the risk of tumor formation in individuals with *DICER1* syndrome is only moderately increased compared with tumor risk in the general population; most individuals with genetic changes associated with this condition never develop tumors.

People with *DICER1* syndrome who develop tumors most commonly develop pleuropulmonary blastoma, which is characterized by tumors that grow in lung tissue or in the outer covering of the lungs (the pleura). These tumors occur in infants and young children and are rare in adults. Pleuropulmonary blastoma is classified as one of three types on the basis of tumor characteristics: in type I, the growths are composed of air-filled pockets called cysts; in type II, the growths contain both cysts and solid tumors (or nodules); and in type III, the growth is a solid tumor that can fill a large portion of the chest. Pleuropulmonary blastoma is considered cancerous, and types II and III can spread (metastasize), often to the brain, liver, or bones. Individuals with pleuropulmonary blastoma may also develop an abnormal accumulation of air in the chest cavity that can lead to the collapse of a lung (pneumothorax).

Cystic nephroma, which involves multiple benign fluid-filled cysts in the kidneys, can also occur; in people with *DICER1* syndrome, the cysts develop early in childhood.

DICER1 syndrome is also associated with tumors in the ovaries known as Sertoli-Leydig cell tumors, which typically develop in affected women in their teens or twenties. Some Sertoli-Leydig cell tumors release the male sex hormone testosterone; in these cases, affected women may develop facial hair, a deep voice, and other male characteristics. Some affected women have irregular menstrual cycles. Sertoli-Leydig cell tumors usually do not metastasize.

People with *DICER1* syndrome are also at risk of multinodular goiter, which is enlargement of the thyroid gland caused by the growth of multiple fluid-filled or solid tumors (both referred to as nodules). The nodules are generally slow-growing and benign. Despite the growths, the thyroid's function is often normal. Rarely, individuals with *DICER1* syndrome develop thyroid cancer (thyroid carcinoma).

Frequency

DICER1 syndrome is a rare condition; its prevalence is unknown.

Causes

DICER1 syndrome is caused by mutations in the *DICER1* gene. This gene provides instructions for making a protein that is involved in the production of molecules called microRNA (miRNA). MicroRNA is a type of RNA, a chemical cousin of DNA, that attaches to a protein's blueprint (a molecule called messenger RNA) and blocks the production of proteins from it. Through this role in regulating the activity (expression) of genes, the Dicer protein is involved in many processes, including cell growth and division (proliferation) and the maturation of cells to take on specialized functions (differentiation).

Most of the gene mutations involved in *DICER1* syndrome lead to an abnormally short Dicer protein that is unable to aid in the production of miRNA. Without appropriate regulation by miRNA, genes are likely expressed abnormally, which could cause cells to grow and divide uncontrollably and lead to tumor formation.

[Learn more about the gene associated with *DICER1* syndrome](#)

- *DICER1*

Inheritance

DICER1 syndrome is inherited in an autosomal dominant pattern, which means one copy of the altered gene is sufficient to cause the disorder. It is important to note that people inherit an increased risk of tumors; many people who have mutations in the *DICER1* gene do not develop abnormal growths.

Other Names for This Condition

- *DICER1*-related pleuropulmonary blastoma cancer predisposition syndrome
- Pleuropulmonary blastoma familial tumor and dysplasia syndrome
- Pleuropulmonary blastoma family tumor susceptibility syndrome

Additional Information & Resources

Genetic Testing Information

- Genetic Testing Registry: Pleuropulmonary blastoma (<https://www.ncbi.nlm.nih.gov/gtr/conditions/C1266144/>)

[Genetic and Rare Diseases Information Center](#)

- Pleuropulmonary blastoma familial tumor susceptibility syndrome (<https://rarediseases.info.nih.gov/diseases/10734/index>)

Patient Support and Advocacy Resources

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

Clinical Trials

- ClinicalTrials.gov ([https://clinicaltrials.gov/search?cond=%22DICER1 syndrome%22](https://clinicaltrials.gov/search?cond=%22DICER1+syndrome%22))

Catalog of Genes and Diseases from OMIM

- GOITER, MULTINODULAR 1, WITH OR WITHOUT SERTOLI-LEYDIG CELL TUMORS; MNG1 (<https://omim.org/entry/138800>)
- PLEUROPULMONARY BLASTOMA; PPB (<https://omim.org/entry/601200>)

Scientific Articles on PubMed

- PubMed (<https://pubmed.ncbi.nlm.nih.gov/?term=%28%28dicer1+syndrome%29+OR+%28pleuropulmonary+blastoma+familial+tumor+and+dysplasia+syndrome%29+OR+%28pleuropulmonary+blastoma+family+tumor+susceptibility+syndrome%29+OR+%28dicer1-related+pleuropulmonary+blastoma+cancer+predisposition+syndrome%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+1440+days%22%5Bdp%5D>)

References

- Bahubeshi A, Bal N, Rio Frio T, Hamel N, Pouchet C, Yilmaz A, Bouron-DalSoglio D, Williams GM, Tischkowitz M, Priest JR, Foulkes WD. Germline DICER1 mutations and familial cystic nephroma. *J Med Genet*. 2010 Dec;47(12):863-6. doi:10.1136/jmg.2010.081216. Epub 2010 Oct 29. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/21036787>)
- Durieux E, Descotes F, Mauduit C, Decaussin M, Guyetant S, Devouassoux-Shisheboran M. The co-occurrence of an ovarian Sertoli-Leydig cell tumor with a thyroid carcinoma is highly suggestive of a DICER1 syndrome. *Virchows Arch*. 2016 May;468(5):631-6. doi: 10.1007/s00428-016-1922-0. Epub 2016 Mar 16. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/26983701>)
- Foulkes WD, Bahubeshi A, Hamel N, Pasini B, Asioli S, Baynam G, Choong CS, Charles A, Frieder RP, Dishop MK, Graf N, Ekim M, Bouron-Dal Soglio D, Arseneau J, Young RH, Sabbaghian N, Srivastava A, Tischkowitz MD, Priest JR.

Extending the phenotypes associated with DICER1 mutations. *Hum Mutat.* 2011 Dec;32(12):1381-4. doi: 10.1002/humu.21600. Epub 2011 Oct 11. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/21882293>)

- Hill DA, Ivanovich J, Priest JR, Gurnett CA, Dehner LP, Desruisseau D, Jarzembowski JA, Wikenheiser-Brokamp KA, Suarez BK, Whelan AJ, Williams G, Bracamontes D, Messinger Y, Goodfellow PJ. DICER1 mutations in familial pleuropulmonary blastoma. *Science.* 2009 Aug 21;325(5943):965. doi:10.1126/science.1174334. Epub 2009 Jun 25. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/19556464>) or Free article on PubMed Central (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3098036/>)
- Rio Frio T, Bahubeshi A, Kanellopoulou C, Hamel N, Niedziela M, Sabbaghian N, Pouchet C, Gilbert L, O'Brien PK, Serfas K, Broderick P, Houlston RS, Lesueur F, Bonora E, Muljo S, Schimke RN, Bouron-Dal Soglio D, Arseneau J, Schultz KA, Priest JR, Nguyen VH, Harach HR, Livingston DM, Foulkes WD, Tischkowitz M. DICER1 mutations in familial multinodular goiter with and without ovarian Sertoli-Leydig cell tumors. *JAMA.* 2011 Jan 5;305(1):68-77. doi: 10.1001/jama.2010.1910. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/21205968>) or Free article on PubMed Central (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3406486/>)
- Schultz KA, Pacheco MC, Yang J, Williams GM, Messinger Y, Hill DA, Dehner LP, Priest JR. Ovarian sex cord-stromal tumors, pleuropulmonary blastoma and DICER1 mutations: a report from the International Pleuropulmonary Blastoma Registry. *Gynecol Oncol.* 2011 Aug;122(2):246-50. doi: 10.1016/j.ygyno.2011.03.024. Epub 2011 Apr 17. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/21501861>) or Free article on PubMed Central (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3138876/>)
- Slade I, Bacchelli C, Davies H, Murray A, Abbaszadeh F, Hanks S, Barfoot R, Burke A, Chisholm J, Hewitt M, Jenkinson H, King D, Morland B, Pizer B, Prescott K, Sagar A, Side L, Traunecker H, Vaidya S, Ward P, Futreal PA, Vujanec G, Nicholson AG, Sebire N, Turnbull C, Priest JR, Pritchard-Jones K, Houlston R, Stiller C, Stratton MR, Douglas J, Rahman N. DICER1 syndrome: clarifying the diagnosis, clinical features and management implications of a pleiotropic tumour predisposition syndrome. *J Med Genet.* 2011 Apr;48(4):273-8. doi:10.1136/jmg.2010.083790. Epub 2011 Jan 25. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/21266384>)
- Yin Y, Castro AM, Hoekstra M, Yan TJ, Kanakamedala AC, Dehner LP, Hill DA, Ornitz DM. Fibroblast Growth Factor 9 Regulation by MicroRNAs Controls Lung Development and Links DICER1 Loss to the Pathogenesis of Pleuropulmonary Blastoma. *PLoS Genet.* 2015 May 15;11(5):e1005242. doi:10.1371/journal.pgen.1005242. eCollection 2015 May. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/25978641>) or Free article on PubMed Central (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4433140/>)

Last updated May 1, 2016