BCAT1

BCAT1 refers to the branched-chain amino acid transaminase 1 gene. This gene encodes an enzyme called cytosolic branched-chain aminotransferase (BCATc), which is involved in the catabolism of branched-chain amino acids (BCAAs) such as leucine, isoleucine, and valine. BCAT1 catalyzes the reversible transfer of an amino group from one amino acid to another, playing a role in the interconversion of BCAAs.

Branched-chain amino acids are essential amino acids, meaning that the body cannot produce them on its own, and they must be obtained through the diet. These amino acids are important for protein synthesis and serve as precursors for the synthesis of neurotransmitters.

The BCAT1 gene has been studied in various contexts, including its role in cancer. Altered expression of BCAT1 has been observed in certain cancers, and it has been investigated as a potential therapeutic target. Additionally, research on BCAT1 is ongoing to understand its involvement in metabolic processes and its potential implications for various health conditions.

IDH mutation is an important prognostic factor of diffuse astrocytomas. Although the majority of IDH mutations could be identified by immunohistochemical (IHC) stain for R132H-mutant IDH1, DNA sequencing would be required for IHC negative cases to determine their IDH mutation status. This approach is not cost-effective for tumors with low IDH mutation rates.

OBJECTIVE: To investigate whether BCAT1 could be used as a surrogate marker for IDH mutations, because BCAT1 is an enzyme related to IDH genes.

METHODS: A group of 120 anaplastic astrocytomas were immunostained for BCAT1, ATRX, and R132H-mutant IDH1. Staining results correlated with the results of DNA sequencing of IDH1/IDH2.

RESULTS: DNA sequencing showed IDH1/2 mutations in 50.8% of cases of which 73.8% had IDH1 R132H mutation. Several IDH1 noncodon 132 mutations, ie, G97D, S122N, G123E, I130K, and G131S, which had uncertain prognostic significance, were identified. IHC stain for R132H-mutant IDH1 identified 93.3% of IDH1 R132H mutations and 70.5% of all IDH mutations. BCAT1 loss was seen in 65.8% of cases, its sensitivity to identify IDH mutations was 96.7%. The sensitivity reached 100% for IDH1 codon 132 and IDH2 codon 172 mutations.

CONCLUSION: Positive BCAT1 stain could be used to exclude diffuse gliomas with IDH1 codon 132 and IDH2 codon 172 mutations. Selecting cases with negative BCAT1 and R132H-mutant IDH1 staining for DNA sequencing of IDH1/2 genes could improve the cost-effectiveness of detecting IDH mutations particularly in tumors with low IDH mutation rates, and confine the need of 1p/19q assay in IDH-mutant tumors [1)].

1)
Chen YY, Ho HL, Lin SC, Hsu CY, Ho DM. Loss of BCAT1 Expression is a Sensitive Marker for IDH-Mutant Diffuse Glioma. Neurosurgery. 2018 Aug 3. doi: 10.1093/neuros/nyy338. [Epub ahead of print] PubMed PMID: 30113684.