2157delG: a frequent mutation in BRCA2 missed by PTT

Complete BRCA1 and BRCA2 mutation analysis is a time consuming and expensive process. Many laboratories have chosen to screen only those parts of the genes with a high yield of mutations: exons 2, 11, and 20 in BRCA1 and exons 10 and 11 in BRCA2. While this may be a valid approach in optimising use of scarce resources, it is a somewhat self fulfilling prophecy on the location of most mutations. Furthermore, most institutions use the protein truncation test (PTT) to analyse the large exon 11 in both genes and exon 10 in BRCA2. PTT will not detect missense mutations (possibly a blessing given the difficulty in establishing their effect), but also mutations at the extreme of each exon will be missed, as they will not produce a recognisably different signal. Our initial strategy has been to screen all exons in both genes to offer a complete gene screen, but also to ascertain whether any founder mutation exists in our local population. In BRCA2, we initially analysed 60 samples from affected subjects in families with four or more breast cancers diagnosed <60 years, and/or families containing male as well as female breast cancer, as well as a subset of 22 breast cancer cases aged <30 years with a family history of breast cancer.

We undertook a combined approach of single strand conformation polymorphism (SSCP) for the smaller exons and each end of exons 10 and 11 and PTT of the two large exons. In these initial panels, we detected 15 truncating mutations (25%) of which three (5%) were in segment 11A on SSCP, but were not detected in segment 1 on PTT. On DNA sequencing, these were all found to be the result of a single base deletion (G) at position 2157. All three families contained early onset breast cancer cases with two containing a male breast cancer, one patient being diagnosed at <30 years. A further patient diagnosed aged 32 years with three affected relatives with breast cancer <40 years of age was sent to Myriad Genetic Laboratories Inc for full gene sequencing. She too was detected as having the 2157delG mutation. While samples from other families have been sent to Myriad, they did not meet the above criteria, although two families with breast and ovarian cancer have had different BRCA2 mutations identified.

This high detection rate of 2157delG prompted us to develop a PCR-ARMSSTM test to screen a larger set of high risk families. We used this assay to test 46 families with four female breast cancers <60 years and 154 families with three breast cancers <60 years. These families did not contain male breast cancer or ovarian cancer patients. The ARMS test detected three further 2157delG mutations which were confirmed on sequencing.

The overall detection rate was 1.5% for the sample set, but <8% (0-28%) of these families would be expected to harbour a BRCA2 mutation.1 Our data suggest that 10-20% of BRCA2 mutations in the north west of England will be accounted for by a single mutation. 2157delG has been reported 10 times on the Breast Cancer Information Core database,2 mainly by Myriad Genetics Inc (probably including one of our families), which undertakes whole gene sequencing. To our knowledge, the mutation has not been reported in a UK laboratory. This is probably because of the failure of most UK laboratories to undertake more than PTT for exon 11. We would strongly advise all UK laboratories (and those populations with migration from the UK, for example, North America) to screen for 2157delG, possibly as an initial screen for BRCA2. Our frequencies suggest that it will be more frequent than the exon 13 duplication in BRCA1,3 but not as frequent as the founder Jewish mutations in our own north west population4 or some other non-UK founder mutations in BRCA2.5 We are currently undertaking haplotype analysis to ascertain if 2157delG represents a significant founder mutation.

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