ROLE FOR A BARD1 SNP IN BREAST CANCER SUSCEPTIBILITY

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Visit Report

1.1 Introduction
Breast cancer is the most frequent malignancy in women. Most breast cancer cases occur in a small percentage of the population that is at increased risk due to genetic factors (Pharoah et al., 2002). The known breast cancer predisposing genes, including BRCA1 and BRCA2, account for only 20-25% of this effect (Easton DG, 1999). Current models suggest that the remaining risk is more probably attributable to a polygenic effect reflecting the random combination of multiple alleles relatively common in the population, each with a small effect on breast cancer risk (Antoniou et al., 2002). The simplest approach to select candidate alleles is biological plausibility. Genes involved in the same cellular processes than BRCA1 are obvious candidates to be investigated. In this context, BARD1 appears to be especially relevant, as growing evidence suggests that in vivo, BRCA1 and BARD1 physically interact and cooperate in a myriad of different biological processes. Co-immunoprecipitation analysis indicates that most (>75%) of the cellular pool of endogenous BRCA1 exists in vivo in the form of BRCA1/BARD1 heterodimer. This interaction is essential for the ubiquitin E3 ligase activity of BRCA1 (Baer and Ludwig, 2002).

The role of BARD1 in cancer susceptibility is still unclear. Thai et al. (1998) have described one somatic mutation in BARD1 associated with sporadic breast cancer (V695L) and one germline mutation associated with ovarian cancer (Q564H). Ghameti et al. (2002) have found four different mutations in breast or breast/ovarian families negative for BRCA1 and BRCA2 mutations (K312N, C557S, N295S and 1144del21bp). Several polymorphisms have been reported in BARD1 but only two have been suggested as possible responsible for breast cancer susceptibility: Ishitobi et al. (2003) proposed V507M to be associated with increased risk of breast cancer in postmenopausal women, and Karpinnen et al. (2004) proposed C575S to be associated with familial breast cancer, specially in families whose history did not include ovarian cancer. These data supports a role for BARD1 in breast cancer susceptibility. However, the extent and nature of this risk is far from clear.

1.2 Patients and Methods
DNA from 682 controls (healthy blood donors) and 888 breast cancer cases have participated in our study. Breast cancer cases were either sporadic (679 breast cancer cases not selected by family history) or familial (the index case from 209 high risk breast ovarian families). The index cases of the 209 families included in this analysis were women diagnosed of breast cancer in which a complete screening of BRCA1 and BRCA2 germ-line mutations had been performed previously. This analysis was performed by a combination of techniques: DGGE, SSCP, CSGE and by HPLC.

Genotyping of the P24S SNP was performed by the 5’ nuclease assay in an ABI-7700 (APPLIED BIOSYSTEMS) with TaqMan probes. Genotyping of the V507M SNP was performed by direct sequencing.

1.3 Results and Discussion
We performed a case-control study to investigate the possible association of the BARD1 P24S SNP (C143T) with breast cancer susceptibility but the frequencies found by our group resembles those of other Caucasian populations (Thai et al., 1998), so the data indicates a lack of association between the BARD1 P24S polymorphism and breast cancer risk in Spanish population.

Afterwards, we tried to know if there was any connection among the P24S SNP (C143T) from our study and V507M SNP (A1592G) from the Ishitobi et al study (2003). With this aim, we genotyped the V507M polymorphism in those samples homozygous for the P24S SNP so that we were able to unambiguously characterize four haplotypes.

The frequency of C-G and C-A haplotypes were similar in controls, sporadic breast cancer and familial breast cancer (irrespectively of the mutation status). The data suggests that these haplotypes do not influence breast cancer risk. Interestingly, we observed the T-G haplotype was over represented in all breast cancer subgroups. Frequencies were as follow: 13% in controls (N=116), 22% in sporadic cases (N=134), 23% in BRCA unrelated familial cases (N=24), 25% in BRCA1 related cases (N=12) and 43% in BRCA2 related cases (n=14). The highest frequency was therefore observed in the subgroup of BRCA2 related cases. In the remaining subgroups (sporadic, BRCA1 related and BRCA unrelated familial cases) the frequency was similar and for the purpose of statistical analysis they were considered collectively as non BRCA2 breast
cancer cases. The over-representation of the T-G haplotype in non-BRCA2 cases (22% vs. 13%, OR=1.94, p=0.04) and BRCA2 related c
gases (43% vs 13%, OR=5.05, p=0.01) were significative findings. The relevant data is summarized in the table.

Collectively, the data suggests a role for the T-G haplotypes in breast cancer risk, especially in those cases related to BRCA2 germ-line mutations

<table>
<thead>
<tr>
<th>Haplotypes</th>
<th>Controls</th>
<th>BC&lt;sup&gt;a&lt;/sup&gt;</th>
<th>OR (95%CI)</th>
<th>p</th>
<th>BC&lt;sup&gt;b&lt;/sup&gt;</th>
<th>OR (95%CI)</th>
<th>p</th>
<th>Non-BRCA2</th>
<th>OR (95%CI)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC</td>
<td>86</td>
<td>210</td>
<td>22</td>
<td></td>
<td>188</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-C-G</td>
<td>80 (93)</td>
<td>188 (90)</td>
<td>1.56 (0.6-4.5)</td>
<td></td>
<td>19 (66)</td>
<td>1.5 (0.5-4.5)</td>
<td></td>
<td>169 (90)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-C-A</td>
<td>6 (7)</td>
<td>22 (10)</td>
<td>3 (14)</td>
<td></td>
<td>21 (11)</td>
<td>3 (14)</td>
<td></td>
<td>19 (10)</td>
<td>1.5 (0.5-4.5)</td>
<td></td>
</tr>
<tr>
<td>TT</td>
<td>116</td>
<td>184</td>
<td>14</td>
<td></td>
<td>170</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-T-A</td>
<td>101 (87)</td>
<td>140 (76)</td>
<td>44 (24)</td>
<td></td>
<td>8 (57)</td>
<td>38 (22)</td>
<td></td>
<td>132 (78)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-T-G</td>
<td>15 (13)</td>
<td>6 (43)</td>
<td>2 (1.1-4.2)</td>
<td></td>
<td>0.01</td>
<td>3 (1.3-19)</td>
<td></td>
<td>1.9 (1-3.9)</td>
<td>0.04</td>
<td></td>
</tr>
</tbody>
</table>

1 All BC cases included in our study. 2 BC related to a germ-line BRCA2 defect. 3 sporadic, BRCA1 and BRCA unrelated BC cases.
* Fisher exact test.

References


