Panel of SEREX-defined antigens for breast cancer autoantibodies profile detection

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Abstract

© 2016 Informa UK Limited, trading as Taylor & Francis Group. Content: Identification of panel of SEREX-defined antigens for breast cancer autoantibodies profile detection. Objective: To create panel of antigens that can differentiate breast cancer patients and healthy individuals. Methods: SEREX (serological analysis of cDNA expression libraries) method, ELISA (enzyme-linked immunosorbent assay), qPCR (quantitative polymerase chain reaction). Results: In large-scale screening of 16 SEREX-antigens by sera of breast cancer patients and healthy donors, a combination of six antigens (RAD50, PARD3, SPP1, SAP30BP, NY-BR-62 and NY-CO-58) was identified, which can differentiate breast cancer patients and healthy donors with 70% sensitivity and 91% specificity. Elevated mRNA expression of SPP1 gene was revealed in breast tumors (2–7-fold) that correlated with SPP1 antigen immunoreactivity in autologous patients' sera. Conclusions: The new panel of six SEREX-antigens was proposed, which enables creation of serological assay for breast cancer diagnostics and/or prognosis.

Keywords

antigenic panel, autoantibody, breast cancer, Tumor-associated antigens

References

[1] Anderson, K.S., and LaBaer, J., 2005. The sentinel within:exploiting the immune system for cancer biomarkers. Journal of proteome research, 4, 1123–1133.

[2] Anderson K.S., et al., 2011. Protein microarray signature of autoantibody biomarkers for the early detection of breast cancer. Journal of proteome research, 10, 85–96.

[3] Bartkova, J., et al., 2008. Aberrations of the MRE11-RAD50-NBS1DNA damage sensor complex in human breast cancer:MRE11 as a candidate familial cancer-predisposing gene. Molecular oncology, 2, 296–316.

[4] Boyle, P., et al., 2011. Clinical validation of an autoantibody test for lung cancer. Annals of Oncology, 22, 383–389.

[5] Chakraborty, G., et al., 2008. Down-regulation of osteopontin attenuates breast tumour progression in vivo. Journal of cellular molecular medicine, 12, 2305–2318.

[6] Chan, C.C., et al., 2010. Multiple serological biomarkers for colorectal cancer detection. International journal of cancer, 126, 1683–1690.

[7] Chapman, C., et al., 2007. Autoantibodies in breast cancer:their use as an aid to early diagnosis. Annals of oncology, 18, 868–873.

[8] Chomczynski. P., and Sacchi, N., 1987. Single-step method of RNA isolation by acid guanidinium thiocyanate-phenol-chloroform extraction. Analytical biochemistry, 162, 156–159.

[9] Collett, K., et al., 2005. A basal epithelial phenotype is more frequent in interval breast cancers compared with screen detected tumors. Cancer epidemiology, biomarkers and prevention, 14, 1108–1112.

[10] Cowell, I.G., et al., 2000. Human topoisomerase IIalpha and IIbeta interact with the C-terminal region of p53. Experimental cell research, 255, 86–94.

[11] Desmetz, C., et al., 2011. Autoantibody signatures:progress and perspectives for early cancer detection. Journal of cellular and molecular medicine, 15, 2013–2024.

[12] Dolganov, G.M., et al., 1996. Human Rad50 is physically associated with human Mre11:identification of a conserved multiprotein complex implicated in recombinational DNA repair. Molecular and cellular biology, 16, 4832–4841.

[13] Dong, X., et al., 2013. Combined measurement of CA 15-3 with novel autoantibodies improves diagnostic accuracy for breast cancer. OncoTargets and therapy, 6, 273–279.

[14] Elston, C.W., and Ellis, I.O., 1991. Pathological prognostic factors in breast cancer. I. The value of histological grade in breast cancer:experience from a large study with long-term follow-up. Histopathology, 19, 403–410.

[15] Evans, R.L., Pottala, J.V., and Egland, K.A., 2014. Classifying patients for breast cancer by detection of autoantibodies against a panel of conformation-carrying antigens. Cancer prevention research (Phila), 7, 545–555.

[16] Frkovic-Grazio, S., and Bracko, M., 2002. Long term prognostic value of Nottingham histological grade and its components in early (pT1N0M0) breast carcinoma. Journal of clinical pathology, 55, 88–92.

[17] Fedarko, N.S., et al., 2001. Elevated serum bone sialoprotein and osteopontin in colon, breast, prostate, and lung cancer. Clinical cancer research, 7, 4060–4066.

[18] Gnjatic, S., et al., 2010. NY-CO 58/KIF2C is overexpressed in a variety of solid tumors and induces frequent T cell responses in patients with colorectal cancer. International journal of cancer, 127, 381–93.

[19] Gnjatic, S., et al., 2010. Seromic profiling of ovarian and pancreatic cancer. Proceedings of national academy of science USA, 107, 5088–5093.

[20] Jäger, D., et al., 2001. Identification of a tissue-specific putative transcription factor in breast tissue by serological screening of a breast cancer library. Cancer research, 61, 2055–2061.

[21] Kim, S., et al., 2010. Autoantibodies against stress-induced phosphoprotein-1 as a novel biomarker candidate for ovarian cancer. Genes chromosomes cancer, 49, 585–595.

[22] Kiyamova, R., et al., 2010. Identification of tumor-associated antigens from medullary breast carcinoma by a modified SEREX approach. Molecular biotechnology, 46, 105–112.

[23] Kostianets, O., et al., 2012. Serological analysis of SEREX-defined medullary breast carcinoma-associated antigens. Cancer investigation, 30, 519–527.

[24] Koziol, J.A., et al., 2003. Recursive partitioning as an approach to selection of immune markers for tumor diagnosis. Clinical cancer research, 9, 5120–5126.

[25] Kubista, M., et al., 2006. The real-time polymerase chain reaction. Molecular aspects of medicine, 27, 95–125.

[26] Lacombe, J., et al., 2014. A multiparametric serum marker panel as a complementary test to mammography for the diagnosis of node-negative early-stage breast cancer and DCIS in young women. Cancer epidemiology, biomarkers and prevention, 23, 1834–1842.

[27] Lacombe, J., et al., 2013. Identification and validation of new autoantibodies for the diagnosis of DCIS and node negative early-stage breast cancers. International journal of cancer, 132, 1105–1113.

[28] Lacombe, J., Mangé, A., and Jarlier, M., 2014. Use of autoantibodies to detect the onset of breast cancer. Journal of immunology research, 2014, 574981.

[29] Ladd, J.J., et al., 2013. Autoantibody signatures involving glycolysis and splicesome proteins precede a diagnosis of breast cancer among postmenopausal women. Cancer research, 73, 1502–1513.

[30] Liang, Y., et al., 2011. Elevated circulating levels of osteopontin are associated with metastasis in advanced non-small cell lung cancer. Chinese journal of cancer research, 23, 64–68.

[31] Liu, W., et al., 2015. Detection of autoantibodies to multiple tumor-associated antigens (TAAs) in the immunodiagnosis of breast cancer. Tumour biology, 36, 1307–1312.

[32] Lu, H., Goodell, V., and Disis, M.L., 2008. Humoral immunity directed against tumor-associated antigens as potential biomarkers for the early diagnosis of cancer. Journal of proteome research, 7, 1388–1394.

[33] Mangé, A., et al., 2012. Serum autoantibody signature of ductal carcinoma in situ progression to invasive breast cancer. Clinical cancer research, 18, 1992–2000.

[34] Pedersen, J.W., et al., 2011. Seromic profiling of colorectal cancer patients with novel glycopeptide microarray. International journal of cancer, 128, 1860–1871.

[35] Piura, E., and Piura, B., 2010. Autoantibodies to tumor-associated antigens in breast carcinoma. Journal of oncology, 2010, 264926.

[36] Piura, E., and Piura, B., 2011. Autoantibodies to tailor-made panels of tumor-associated antigens in breast carcinoma. Journal of oncology, 2011, 982425.

[37] Rodrigues, L.R., et al., 2007. The role of osteopontin in tumor progression and metastasis in breast cancer. Cancer epidemiology, biomarkers and prevention, 16, 1087–1097.

[38] Scanlan, M.J., et al., 2001. Humoral immunity to human breast cancer:antigen definition and quantitative analysis of mRNA expression. Cancer immunology, 1. 4.

[39] Scanlan, M.J., et al., 2002. Cancer-related serological recognition of human colon cancer:identification of potential diagnostic and immunotherapeutic targets. Cancer research, 62, 4041–4047.

[40] Shimo, A., et al., 2008. Involvement of kinesin family member 2C/mitotic centromere-associated kinesin overexpression in mammary carcinogenesis. Cancer science, 99, 62–70.

[41] Sueishi, M., Takagi, M., and Yoneda, Y., 2000. The forkhead-associated domain of Ki-67 antigen interacts with the novel kinesin-like protein Hklp2. Journal of biological chemistry, 275, 28888–28892.

[42] Tilli, T.M., et al., 2011. Osteopontin is a tumor autoantigen in prostate cancer patients. Oncology letters, 2, 109–114.

[43] Tommiska, J., et al., 2006. Evaluation of RAD50 in familial breast cancer predisposition. International journal of cancer, 118, 2911–2916.

[44] Tuck, A.B., Chambers, A.F., and Allan, A.L., 2007. Osteopontin overexpression in breast cancer:knowledge gained and possible implications for clinical management. Journal of cellular biochemistry, 102, 859–868.

[45] Wai, P.Y., and Kuo, P.C., 2004. The role of Osteopontin in tumor metastasis. Journal of surgical research, 121, 228–241.

[46] Wang, J.C., 1996. DNA topoisomerases. Annual review of biochemistry, 65, 635–692.

[47] Wang, X., et al., 2008. Mutational analysis of thirty-two double-strand DNA break repair genes in breast and pancreatic cancers. Cancer research, 68, 971–975.

[48] Yahalom, G., et al., 2013. An antibody-based blood test utilizing a panel of biomarkers as a new method for improved breast cancer diagnosis. Biomarkers in cancer, 5, 71–80.

[49] Yang, X.A., et al., 2004. Purification and refolding of a novel cancer/testis antigen BJ-HCC-2 expressed in the inclusion bodies of Escherichia coli. Protein expression and purification, 33, 332–338.

[50] Ye, H., et al., 2013. Mini-array of multiple tumor-associated antigens (TAAs) in the immunodiagnosis of breast cancer. Oncology letter, 5, 663–668.

[51] Zayakin, P., et al., 2013. Tumor-associated autoantibody signature for the early detection of gastric cancer. International journal of cancer, 132, 137–147.

[52] Zen, K., et al., 2009. Defective expression of polarity protein PAR-3 gene (PARD3) in esophageal squamous cell carcinoma. Oncogene, 28, 2910–2918.

[53] Zhang, J.Y., et al., 2003. Enhancement of antibody detection in cancer using panel of recombinant tumor-associated antigens. Cancer epidemiology, biomarkers and prevention, 12, 136–143.

[54] Zhang, J.Y., and Tan, E.M., 2010. Autoantibodies to tumor-associated antigens as diagnostic biomarkers in hepatocellular carcinoma and other solid tumors. Expert review of molecular diagnostics, 10, 321–328.

[55] Zhong, L., et al., 2008. Autoantibodies as potential biomarkers for breast cancer. Breast cancer research, 10, R40.