Our results suggest that PR status indeed provides very useful predictive information. The purpose of the study was to refine the evaluation of hormone receptor status by applying a quantified rather than dichotomized assessment. This approach has the disadvantage of rendering smaller subgroups and, consequently, loss of statistical power. Therefore, our results need to be confirmed in additional studies. However, they are

promising in that a fractioned evaluation of immunohistochemical hormone receptor expression could easily be adopted and incorporated into clinical practice and clinical trials.

Acknowledgments

We thank Elise Nilsson for excellent technical assistance

References

- Early Breast Cancer Trialists' Collaborative Group. Tamoxifen for early breast cancer: an overview of the randomised trials. Lancet 1998;351:1451 – 67.
- Baum M, Budzar AU, Cuzick J, et al. Anastrozole alone or in combination with tamoxifen versus tamoxifen alone for adjuvant treatment of postmenopausal women with early breast cancer: first results of the ATAC randomised trial. Lancet 2002;359: 3131-9.
- Goss PE, Ingle JN, Martino S, et al. A randomized trial of letrozole in postmenopausal women after five years of tamoxifen therapy for early-stage breast cancer. N Engl J Med 2003;349:1793–802.
- Coombes RC, Hall E, Gibson LJ, et al. A randomized trial of exemestane after two to three years of tamoxifen therapy in postmenopausal women with primary breast cancer. N Engl J Med 2004;351:1081–92.
- Howell A, Cuzick J, Baum M, et al. Results of the ATAC (Arimidex, Tamoxifen, Alone, or in Combination) trial after completion of 5 years' adjuvant treatment for breast cancer. Lancet 2005;365:60 – 2.
- 6. Reiner A, Spona J, Reiner G, et al. Estrogen receptor analysis on biopsies and fine-needle aspirates from human breast carcinoma. Correlation of biochemical and immunohistochemical methods using monoclonal antireceptor antibodies. Am J Pathol 1986:125:443-9.
- Allred DC, Bustmante MA, Daniel CO, Gaskill HV, Cruz AB, Jr. Immunocytochemical analysis of estrogen receptors in human breast carcinomas. Evaluation of 130 cases and review of the literature regarding concordance with biochemical assay and clinical relevance. Arch Surg 1990;125:107 – 13.
- 8. Stierer M, Rosen H, Weber R, Hanak H, Spona J, Tuchler H. Immunohistochemical and biochemical measurement of estrogen and progesterone receptors

- in primary breast cancer. Correlation of histopathology and prognostic factors. Ann Surg 1993;218:13 21.
- Barnes DM, Harris WH, Smith P, Millis RR, Rubens RD. Immunohistochemical determination of oestrogen receptor: comparison of different methods of assessment of staining and correlation with clinical outcome of breast cancer patients. Br J Cancer 1996;74:1329–30.
- Molino A, Micciolo R, Turazza M, et al. Prognostic significance of estrogen receptors in 405 primary breast cancers: a comparison of immunohistochemical and biochemical methods. Breast Cancer Res Treat 1997:45:241 – 9.
- Harvey JM, Clark GM, Osborne CK, Allred DC. Estrogen receptor status by immunohistochemistry is superior to the ligand-binding assay for predicting response to adjuvant endocrine therapy in breast cancer. J Clin Oncol 1999;17:1474–81.
- Mohsin SK, Weiss H, Havighurst T, et al. Progesterone receptor by immunohistochemistry and clinical outcome in breast cancer: a validation study. Mod Pathol 2004:17:1545–54.
- 13. Fischer ER, Anderson S, Dean S, et al. Solving the dilemma of the immunohistochemical and other methods used for scoring estrogen receptor and progesterone receptor in patients with invasive breast carcinoma. Cancer 2005;103:164–73.
- 14. Ravdin PM, Green S, Dorr TM, et al. Prognostic significance of progesterone receptor levels in estrogen receptor-positive patients with metastatic breast cancer treated with tamoxifen: results of a prospective Southwest Oncology Group study. J Clin Oncol 1992; 10:1284 – 91.
- 15. Elledge RM, Green S, Pugh R, et al. Estrogen receptor (ER) and progesterone receptor (PgR), by ligand-binding assay compared with ER, PgR, and pS2, by immuno-histochemistry in predicting response to

- tamoxifen in metastatic breast cancer: a Southwest Oncology Group study. Int J Cancer 2000;89:111 7.
- 16. Fernö M, Stål O, Baldetorp B, et al. Result of two or five years of tamoxifen correlated to steroid receptor and S-phase levels. Breast Cancer Res Treat 2000; 59:69 – 76.
- Lamy PJ, Pujol P, Thezenas S, et al. Progesterone receptor quantification as a strong prognostic determinant in postmenopausal breast cancer women under tamoxifen therapy. Breast Cancer Res Treat 2002; 76:65 – 71.
- 18. Bardou VJ, Arpino G, Elledge RM, et al. Progesterone receptor status significantly improves outcome prediction over estrogen receptor status alone for adjuvant endocrine therapy in two large breast cancer databases. J Clin Oncol 2003;21:1973 – 9.
- 19. Rydén L, Jönsson PE, Chebil G, et al. Two years of adjuvant tamoxifen in premenopausal patients with breast cancer: a randomised, controlled trial with long-term follow-up. Eur J Cancer 2005;41: 256-64.
- 20. Dowsett M, Cuzick J, Wale C, Howell T, Houghton J, Baum M. Retrospective analysis of time to recurrence in the ATAC trial according to hormone receptor status: an hypothesis-generating study. J Clin Oncol 2005;23:7512-7.
- 21. Rydén L, Chebil G, Dufmats M, et al. Adjuvant tamoxifen to premenopausal women reduces contralateral breast cancer. Results from a prospective randomized multicenter study with long-time follow-up. Breast Cancer Res Treat 2003;82:S30.
- 22. Arpino G, Weiss H, Lee AV, et al. Estrogen receptorpositive, progesterone receptor-negative breast cancer: association with growth factor receptor expression and tamoxifen resistance. J Natl Cancer Inst 2005;97:1254–61.