

Current Screening Practice: Implications for the Introduction of CAD

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Abstract. The UK National Health Service Breast Screening Programme (NHSBSP) provides free mammographic screening for all women between the ages of 50 and 69. This paper examines in detail the way in which the programme is implemented in one of the busiest breast screening centres, discussing the implications of current practice for the introduction of computer aided detection systems. The paper also investigates the different types of abnormality that arise in older and younger women within the screening age group, and discusses how this is likely to affect prompting systems.

1 Breast Cancer Screening

The National Health Service Breast Screening Programme (NHSBSP) was established in England and Wales in 1988 [1] and achieved national coverage in 1995. Initially, women between 50 and 64 were invited for screening every three years, with two view mammography at their first visit and single view mammography thereafter. Recently, the programme has been extended to include women up to the age of 69, with two view mammography at every visit [2]. The gold standard for film reading is double reading with arbitration by a third reader [3]. All screening centres in the UK are carefully monitored to ensure that the standard of screening offered to women is consistently high, but within the programme there is considerable variation in local practice.

The screening process involves two view mammography, carried out either in a mobile unit or at a hospital base. Women with a normal screening outcome are notified within two weeks. If a significant abnormality is detected, the woman is recalled for further assessment combining clinical examination with further imaging (mammography and ultrasound) and proceeding to needle biopsy where indicated. It is predicted that the programme will save 1250 lives per year by 2010 [2].

Quality assurance and monitoring play an important role in maintaining the effectiveness of screening. A number of factors including cancer detection rates and positive predictive values are recorded for each Breast Screening Unit. Both regional and

national systems are involved in monitoring these criteria and in taking action if required. Although the NHSBSP criteria are based on single reading only, double reading of mammograms is a well-established practice in the UK; by 2003, more than three quarters of mammograms were being double read [4]. Reading regimes vary from centre to centre, with the final decision to recall made by consensus, by arbitration, or if either reader recommends it.

The national programme has responded positively but cautiously to the advent of new technology such as digital acquisition, soft copy reading and CAD. In this paper we examine the way in which a busy screening centre within the NHSBSP operates in practice, and discuss the implications of our findings for the introduction of new technology such as computer-aided detection (CAD).

2 Current Practice

2.1 The Film Reading Process

The current practice in one busy breast screening centre is, where possible, double reading by a radiologist and a radiographer trained in film reading. At this stage the readers score cases, with 1 being a recommendation for return to routine screening, and a score of 2 or more requiring a discussion with the other reader (consensus). Following this, a decision is made to either return the woman to routine screening, refer the case for arbitration, request previous films, request a technical recall, or recall the woman for further assessment.

Analysis of 1174 screening mammograms read in the screening centre over 15 consecutive working days showed that 98.5% of those were double read by a consultant radiologist and a radiographer trained in film reading. Of these, 218 women were recommended for a consensus discussion by one or both readers. Overall, radiographers identified 155 of these cases and radiologists 141, with an overlap of 78 cases recommended by both readers. This difference between radiologists and radiographers was not significant ($p=0.272$) but radiographers were more likely to request a recall on technical grounds.

Of the 218 sets of films that were subject to consensus discussion by the radiographer and radiologist, 154 (70.6%) were identified as requiring: further assessment, arbitration, technical recall or requests for previous films. The remaining 64 women were returned to routine screening.

During the consensus discussion, of the 33 women recommended for recall by radiographers but not radiologists, 5 women (15.2%) went to arbitration, but of the 32 women recommended for recall by the radiologist but not the radiographer 18 women (56.3%) actually went to arbitration indicating that the radiologists were more influential in the consensus process. Of the 33 sets of mammograms that went to arbitration following consensus 11 (33%) were recalled for further assessment, whilst the remaining 22 were returned to routine screening.

2.2 Implications for the Introduction of CAD

CAD systems are used to aid image interpretation; they are intended to draw the reader's attention to suspicious regions that have been identified by detection