Contralateral risk-reducing mastectomy in sporadic breast cancer

John A Murphy, Thomas D Milner, Joseph M O’Donoghue

Recent studies have shown that the number of women undergoing risk-reducing mastectomy has increased rapidly in the USA in the past 15 years. Although a small rise in the number of bilateral risk-reducing procedures has been noted in high-risk gene mutation carriers who have never had breast cancer, this number does not account for the overall increase in procedures undertaken. In patients who have been treated for a primary cancer and are judged to be at high risk of a contralateral breast cancer, contralateral risk-reducing mastectomy is often, but not universally, indicated. However, many patients undergoing contralateral risk-reducing mastectomy might not be categorised as high risk and therefore any potential benefit from this procedure is unproven. At a time when breast-conserving surgery has become more widely used, this sharp increase in contralateral risk-reducing mastectomy is surprising. We have reviewed the literature in an attempt to establish what is driving the increase in this procedure in moderate-to-low-risk populations and to assess its justification in terms of risk–benefit analysis.

Introduction

During the past decade, the use of contralateral risk-reducing mastectomy has increased substantially in the USA, despite the fact that contralateral breast cancer rates have actually decreased in the past two decades, probably because of adjuvant therapy. The reported increases in contralateral risk-reducing mastectomy might be partly related to screening and to improved overall long-term survival. The rate of diagnosis of bilateral synchronous cancers has not increased in the past decade, even with wider availability of high-quality imaging. Rates of contralateral risk-reducing mastectomy in the UK have not been assessed accurately, but an increase in the numbers of women undergoing the procedure can be expected to follow the trend reported in the USA because of convergence in the ways that we manage at-risk patients, such as wider use of breast screening, increased use of MRI, wider availability of high-quality reconstruction, and improved patient education, all combined with falling mortality rates. But is the perceived increase in long-term risk of contralateral breast cancer sufficient to justify contralateral risk-reducing mastectomy in patients who are not in high-risk groups? Several doubts persist about the benefits of the procedure, yet the referral pattern and number of procedures being done continues to rise. Patients seeking contralateral risk-reducing mastectomy range from those judged to be at high risk of developing a contralateral breast cancer because of genetic and familial risk factors, to those at lower risk who have developed a sporadic primary cancer with no other family history and a minimum annual risk of developing a contralateral breast cancer.

Accurate assessment of patients’ risks of contralateral breast cancer is becoming increasingly important because patients should not be offered contralateral risk-reducing mastectomy when the risk of systemic disease from the primary cancer outweighs the risk of a new contralateral breast cancer. This is a point that might not be accurately conveyed to, or assimilated by, the patient during an emotionally challenging period when they have to cope with the psychological stress caused by the diagnosis of the primary breast cancer. Indeed, the patient may substantially overestimate the risk and effect that a possible contralateral cancer might have in comparison to the primary cancer, which might ultimately affect their decision. With the wider availability of breast reconstruction surgery, non-reconstructive surgery clinicians such as non-oncoplastic breast surgeons, breast physicians, geneticists, and general practitioners might be more likely to offer contralateral risk-reducing mastectomy. These clinicians might not fully understand the inherent risks in terms of the patient’s physical health, psychology, and the financial burden associated with such surgery.

Even if contralateral risk-reducing mastectomy is not offered to patients at the time of diagnosis of the primary cancer, it might be discussed as a delayed procedure when the primary cancer has been treated. This trend has increased during the past decade in the USA, as seen in several major institutions; contributing factors include age, profession, and insurance status. In the UK, patients’ decisions can also be hastened and influenced by clinicians who are under pressure to meet national cancer targets.

This Review does not focus on bilateral risk-reducing mastectomy in high-risk groups. Rather, the focus is on the increasing use of mastectomy to remove a healthy breast in patients who have had, or who are about to undergo, mastectomy for a primary cancer, when the risk of cancer developing in the healthy breast in the future is low to moderate. The increasing use of contralateral risk-reducing mastectomy in patients judged to be high risk—ie, BRCA mutation carriers or those with very strong family history, in whom a primary cancer has been diagnosed—does not account for the overall increasing use of the procedure. Indeed, numbers in this patient group have remained static for the past two decades. Patients in this high-risk group, in whom the primary breast cancer is usually diagnosed at an early age, seem to have a heightened risk of developing contralateral breast cancer because of their  


c262
inherent genetic predisposition and their number of remaining life-years.7,8 However, some of these patients will undergo breast-conserving therapy with whole-breast radiation and surveillance of the contralateral breast, despite the increased risk of developing a contralateral cancer. Therefore, the fact that the patient group in whom there is a lower risk of dying from contralateral breast cancer is where the increase in the use of contralateral risk-reducing mastectomy has been recorded is surprising, especially in the era of early screening detection and the increasing use of oncoplastic breast-conserving surgical techniques for sporadic cancers.9

**Evidence for the increase in contralateral risk-reducing mastectomy**

Evidence, mainly obtained from the Surveillance Epidemiology and End Results registry, indicates a 150% increase in the use of contralateral risk-reducing mastectomy in all patients treated for a unilateral invasive breast cancer.26,31,33,36 UK NICE guidelines suggest that bilateral risk-reducing mastectomy should only be offered to high-risk patients—ie, gene mutation carriers, or those with a strong positive family history of breast cancer but who are negative for a known genetic mutation.7 NICE does not offer guidance to clinicians for patients in whom a primary breast cancer has been diagnosed and who seek contralateral risk-reducing mastectomy. However, those patients who have had a previous breast cancer and are judged as being at high risk of developing a contralateral breast cancer7 (but who might actually only be at low to moderate risk) are the group in which contralateral risk-reducing mastectomy has increased in the past decade. This absence of specific guidance for the treating clinicians could have contributed to the increase in contralateral risk-reducing mastectomy recorded in the past decade. Other possible reasons include surgeon advice, patient anxiety, desire for symmetry, and a combination of these factors.8,9 Evidence also suggests that the age and sex of the clinician could affect the recommendation, with female or young clinicians being more likely to offer contralateral risk-reducing mastectomy than older or male clinicians.10 Invasive lobular carcinoma is thought by some clinicians to increase the risk of contralateral breast cancer, but this theory has not been proven and again raises the question of clinicians’ accurate assessment of risk.8,10

**Benefits of contralateral risk-reducing mastectomy**

The primary aim of contralateral risk-reducing mastectomy is to benefit the patient by preventing contralateral breast cancer and the presumed reduction in life expectancy, and reducing negative personal effects and the health-care costs (financial) associated with treatment of a new malignancy. After a diagnosis of malignancy in one breast, historical data indicate a two- to six-times increase in the risk of developing a contralateral breast cancer at 10 years.6,9 This increased risk is highest in women with BRCA1 or BRCA2 mutations, who have a 19% and 12% increased risk at 5 years, and a 15-year actuarial risk of 36–5% and 28–5%, respectively.20,21 Smaller increases in risk are associated with a positive family history in the absence of a BRCA mutation, younger age at primary diagnosis, and previous exposure to radiation.22 Although contralateral risk-reducing mastectomy lessens the risk of development of contralateral breast cancer,21,24 no convincing evidence suggests that it reduces overall breast cancer mortality or increases overall survival in women with sporadic breast cancer.6,10,11 The absence of definitive clinical evidence is especially relevant for patients with early-stage sporadic breast cancer who have a low (0.5–0.75%) annual risk for developing contralateral breast cancer, with lifetime risks of 13% for women aged younger than 50 years and 3·5% for those older than 50 years at diagnosis.6 However, these annual risks obtained from historical data could be exaggerated compared with the actual current risks, owing to improvements in modern treatment.8 More recent follow-up data obtained from well-designed studies in which disease recurrence rates were compared in patients undergoing various endocrine treatments after a diagnosis of sporadic breast cancer showed contralateral breast cancer rates as low as 2·6% at 10 years in post-menopausal, oestrogen receptor-positive patients.6,22

Compared with primary breast cancer, contralateral breast cancer tends to present at an earlier stage with a lower risk of metastasis and better overall 5-year survival,26,27 probably due to increased patient awareness, and more frequent surveillance imaging and clinical examination. Risk factors for contralateral breast cancer such as BRCA mutations, young age, familial or genetic predisposition, or high-risk primary histology could potentially change this balance, particularly when several factors coexist.8,27 However, a recent Cochrane report concluded that in terms of mortality, evidence only supports contralateral risk-reducing mastectomy for those at the highest risk.31,12 UK guidelines for familial breast cancer recommend risk-reducing mastectomy for patients at high risk and surveillance for those at moderate risk.7 With extrapolation of an estimated overall lifetime risk of roughly 11% for breast cancer and the age-dependent standardised incidence ratios for contralateral breast cancer of 1·4–5·0, most people seeking contralateral risk-reducing mastectomy would fall into the moderate-risk or low-risk category, with the potential exception of the youngest patients.6–11 Therefore, patient selection on the basis of contralateral breast cancer risk alone supports contralateral risk-reducing mastectomy being offered only to those at the highest risk. Patients who are BRCA positive fall into this category, but even in this cohort little gain in life-years occurs in BRCA-positive patients who undergo contralateral risk-reducing mastectomy after the age of...
50 years, and the benefit is negligible in patients older than 35 years if comorbidities are present. For most other patients, evidence suggests that the risk of death from ipsilateral cancer metastases is higher than that of death from contralateral breast cancer. However, patients with early-stage disease who are young (18-49 years) with oestrogen receptor-negative tumours could have a small 5-year survival benefit, as might those who have a strong history of familial breast cancer or who have had previous mantle radiotherapy before the age of 25 years.

Alternatives to contralateral risk-reducing mastectomy

Surveillance and chemoprophylaxis are alternatives to contralateral risk-reducing mastectomy. Surveillance with regular clinical examination, mammography, and MRI might detect contralateral breast cancer at an early stage. The hazard ratio for death from cancer detected in this way is half that for cancer detected in patients with symptoms. However, mammography might have limitations in screening young patients who have an increased risk of developing contralateral breast cancer, and those with lobular carcinoma. MRI has a higher sensitivity but lower specificity than mammography, resulting in higher detection of contralateral breast cancers but also more unnecessary additional investigations and follow-up. MRI is not sufficiently cost effective for use as a population-wide method of screening but has been advocated in contralateral breast cancer surveillance because this patient group is smaller and at higher cancer risk than is the general population. However, its low specificity could result in additional unnecessary stress in a group of cancer survivors who might already have high levels of anxiety.

The effects of tamoxifen on breast cancer prevention have been assessed in the National Surgical Adjuvant Breast and Bowel Project's Study of Tamoxifen and Raloxifene (STAR). Results suggest a 50% decrease in risk in 19747 women who were at least 35 years of age, postmenopausal, or both. Tamoxifen seemed to be slightly more effective than raloxifene, but was associated with higher risks of endometrial carcinoma and thromboembolic events. This trial led to the licensing of both drugs by the US Food and Drug Administration for the prevention of breast cancer in women at high risk, including those with previous malignant breast pathology—ie, all women at risk of contralateral breast cancer. The size of the effect could reduce the risk in many patients to the point where contralateral risk-reducing mastectomy is of questionable benefit. In the UK, hormonal contralateral breast cancer prophylaxis is not recommended but occurs coincidentally as a result of adjuvant treatment for the primary cancer. Alkner and colleagues reported that 2 years of adjuvant tamoxifen treatment reduced contralateral breast cancer incidence by 50% in premenopausal women and by 90% in postmenopausal women. The International Breast Cancer Intervention I study (IBIS I) and UK, Australia and New Zealand Ductal Carcinoma In Situ study again confirmed substantial risk reduction of contralateral breast cancer. However, IBIS I also reported an unacceptable risk of thromboembolism with the use of tamoxifen for chemoprophylaxis and as such the drug is not licensed for this indication. The aromatase inhibitors are being assessed for chemoprophylaxis in the IBIS II prevention study (NCT0072462).

Other adjuvant trials were not specifically designed to assess prophylactic effects but do provide some data for the reduction in risk of developing a contralateral breast cancer. The Early Breast Cancer Trialist's Collaborative Group did a meta-analysis of 194 randomised controlled trials and concluded that administration of tamoxifen for a median of 5 years reduced the risk of contralateral breast cancer in women who originally had oestrogen receptor-positive or oestrogen receptor-unknown disease (hazard ratio 0.61) but had no effect on women who originally had oestrogen receptor-poor disease. Recent data have suggested that aromatase inhibitors could have a greater effect than tamoxifen. In the Arimidex, Tamoxifen, Alone or in Combination (ATAC) trial, anastrozole reduced the prevalence of contralateral breast cancer at 9 years to 2-5%, compared with 4-2% for tamoxifen. Extended adjuvant treatment with aromatase inhibitors might also decrease contralateral breast cancer risk.

Cytotoxic chemotherapy for primary disease might also decrease the risk of contralateral breast cancer. In a meta-analysis, the Early Breast Cancer Trialist's Collaborative Group reported a decreased risk of contralateral breast cancer (hazard ratio 0.66) in patients who received chemotherapy when younger than 50 years. An effect lasting up to 10 years has also been reported. Some evidence also suggests that new targeted treatments such as trastuzumab could also reduce contralateral breast cancer rates. Therefore, existing and previously delivered adjuvant treatments should be considered in discussions with any patient seeking contralateral risk-reducing mastectomy to provide patients with a realistic perception of their contralateral breast cancer risk.

Risks associated with contralateral risk-reducing mastectomy

Contralateral risk-reducing mastectomy is not 100% effective or risk-free and is irreversible. The procedure does not have a clear overall survival advantage in patients diagnosed with sporadic breast cancer. Even without reconstruction, the procedure can take several hours, and necessitate a prolonged inpatient hospital stay followed by several weeks of recovery. The National Mastectomy and Breast Reconstruction Audit (NMBRA 2010) shows that the median length of hospital stay after a mastectomy in the UK is 4 days, which is...
1 day shorter than in the preceding decade. Recent evidence in the UK suggests that up to 12–6% of patients undergoing straightforward mastectomy will experience a complication, such as infection, wound dehiscence, or skin flap necrosis, necessitating a further inpatient stay within the first 30 days of the postoperative period, again with a median length of stay of 4 days. In the USA, up to 15% of patients will have a wound complication from a mastectomy.\textsuperscript{47} Up to 6% of patients will also experience severe pain after a mastectomy, and the risk of return to theatre during admission has been estimated at 1.85%.\textsuperscript{47}

In patients who have undergone an immediate or a delayed reconstruction, length of inpatient hospital stay is longer than for a simple mastectomy, but varies depending on which type of reconstruction is done. Sporadic data from individual units in the UK suggest a length of stay of about 4 days for implant-based reconstruction, or up to 9–11 days for the more complex autologous tissue-based reconstructions—ie, latissimus dorsi, transverse rectus abdominis myocutaneous, or deep inferior epigastric artery perforator flaps. 15–18% of patients will suffer a complication in the immediate postoperative period in the UK and up to 23% will do so after immediate reconstruction in the USA.\textsuperscript{46} Overall, risk of return to theatre in the immediate postoperative period is 4–6% for immediate reconstruction and 5–6% for delayed reconstruction, with flap viability inspection being a major contributor.\textsuperscript{46} Overall flap failure rates are low in the UK—only 0.2% of pedicled flaps and 1.98% of free flaps fail in the immediate postoperative period. Postoperative severe pain is not managed well in the short term, with 16–21% of patients experiencing such pain in the immediate postoperative period. Overall, 20% of simple mastectomy patients and 25% of immediate reconstruction patients will need at least one episode of seroma drainage in the postoperative period.\textsuperscript{46,47}

In the longer term, reoperation has been reported in up to 49% of patients, mostly for implant-related problems.\textsuperscript{11,15,46} Reoperation rates seem to be substantially higher in women undergoing subcutaneous mastectomy and reconstruction than in women undergoing straightforward mastectomy alone (44% vs 30%).\textsuperscript{46}

**Potential drivers for contralateral risk-reducing mastectomy**

Psychological factors substantially affect a patient’s decision to undergo contralateral risk-reducing mastectomy and can greatly affect perceptions of outcome. The decision necessitates weighing up the risk of a future primary cancer and related mortality against the loss of a breast, and the associated psychological implications. Provision of the necessary information for women to make this decision is crucial, as they can easily perceive the contralateral breast as a genetically identical twin, with equal exposure to environmental factors such as hormones that have already culminated in the primary breast cancer. Many patients will need a lot of information before contralateral risk-reducing mastectomy, especially regarding issues surrounding reconstruction, the possibility of negative feelings post surgery, and recurrence.\textsuperscript{46,51}

Women who choose contralateral risk-reducing mastectomy over surveillance tend to be younger, more highly educated, and more likely to have a family history of cancer than are those who do not choose to have the procedure.\textsuperscript{8,13–15,52} However, surveillance itself can have a negative effect on patients’ anxiety. With the increasing use of MRI, more needle biopsies might be needed on lesions not identified with conventional imaging techniques.\textsuperscript{8} Indeed, the rate of contralateral risk-reducing mastectomy has increased in the past decade in line with increasing use of MRI as a surveillance method.\textsuperscript{8} Other factors affecting a woman’s decision about contralateral risk-reducing mastectomy include clinician recommendation, anticipation of regret, high anxiety, a perceived increased risk of cancer, and avoidance of treatments such as chemotherapy if a contralateral breast cancer is subsequently diagnosed.\textsuperscript{8,13–15}

In the USA, the increasing incidence of obesity can also potentially promote the choice of contralateral risk-reducing mastectomy to achieve symmetry because obese patients might be left with gross asymmetry and have difficulty using an external prosthesis after a unilateral mastectomy.\textsuperscript{9} Although no UK study has addressed this idea, this factor might also play an increasingly important part in decision making in view of the fact that the incidence of obesity is rising steadily in the UK.\textsuperscript{9}

However, the greatest benefit of surgery seems to be a reduction in breast cancer-related concerns and anxiety, and most women are satisfied with their decision to undergo contralateral risk-reducing mastectomy.\textsuperscript{46,54–56,58} However, the negative consequences can be substantial. Roughly a third of women experience difficulties with body image, feminine identity, and sexual intimacy after surgery.\textsuperscript{9,59} Reconstruction might mitigate these concerns, and has a crucial role in the decision-making process, but whether the choice to have contralateral risk-reducing mastectomy as a psychological coping strategy is rational is disputed.\textsuperscript{8} The implications of psychological factors for patient selection are wide-ranging. The clinician should be aware of patient expectations and assess for high anxiety, since this will be more common in those seeking contralateral risk-reducing mastectomy, and might indicate potential dissatisfaction with the outcome, particularly in patients undergoing reconstructive surgery. Before surgery, the patient should be given both surgical and psychological counselling and the opportunity to speak to a patient who has already had the procedure. Patients’ own perception of their contralateral breast cancer risk might also need adjustment and should be
assessed in detail by the clinician, since women can overestimate their risk of a contralateral breast cancer by a factor of 5 to 10.62 Patients should be advised that contralateral risk-reducing mastectomy can decrease anxiety, but possibly at the expense of a negative body image and feelings of femininity.60,63

Reconstruction post-contralateral risk-reducing mastectomy

Reconstruction could play a key part in patients’ requests for contralateral risk-reducing mastectomy. Previous studies have found that 53–78% of women opt for reconstruction after contralateral risk-reducing mastectomy, with most choosing immediate reconstruction.60,63 Three subgroups can be identified. First, those undergoing reconstruction in the asynchronous setting pose unique challenges because of inherent asymmetries in the therapeutic and risk-reducing defects. The mastectomy will not be therapeutic, postoperative radiotherapy is highly unlikely, and reconstructive donor sites such as the abdomen might have been used previously for the primary reconstruction. Second, those undergoing bilateral risk-reducing mastectomies, including a simultaneous contralateral risk-reducing mastectomy after previous breast conservation and radiotherapy, also pose unique challenges because of the effect of radiotherapy on the breast envelope where the primary cancer was originally treated.44 Finally, bilateral simultaneous mastectomies including contralateral risk-reducing mastectomy with immediate reconstructions are less frequent but can offer unrivalled reconstructive options. As is the case for any breast reconstruction, comorbidities must be taken into account. After bilateral reconstruction, the number of secondary procedures increases exponentially with the number of comorbid risk factors (radiotherapy, smoking, obesity, hypertension, and diabetes mellitus).45

Satisfaction with reconstruction after both bilateral and contralateral risk-reducing mastectomies has been reported and the procedure can be completed without decision regret.61,64,68 However, in contralateral risk-reducing mastectomy, overall general satisfaction is substantially greater than is aesthetic satisfaction.61,64,67

Overall general positive satisfaction correlates are found with information provision, complications, and diminution in the amounts of cancer concern. Conversely, the aesthetic correlates with body image, sexuality, and feelings of femininity are most often adversely affected.64,68 Little is understood about the differences (if any) between the three subgroups of patients identified who seek contralateral risk-reducing mastectomy and reconstruction.

By comparison with reconstruction after a therapeutic mastectomy, contralateral risk-reducing mastectomy reconstruction often has superior aesthetic results and lower complication rates.68 Shape and size symmetry after secondary mastectomy is best achieved when similar reconstructions are done on both sides.64 Change from predominantly implant-based to autologous tissue reconstruction also has the potential to increase aesthetic satisfaction, since autologous reconstruction can provide superior long-term results.60,69 Excellent results can be achieved and every effort should be made to optimise the reconstruction and maximise patients’ satisfaction with the aesthetic outcome.

Cost-effectiveness of contralateral risk-reducing mastectomy

In high-risk patients, bilateral risk-reducing mastectomy has been shown to be cost effective compared with breast cancer surveillance. However, no such studies have been undertaken in patients undergoing delayed contralateral risk-reducing mastectomy after a previous sporadic breast cancer. This fact might be of further importance because the initial and potential ongoing cost of reconstruction in these patients is also a notable factor when compared with mastectomy alone, both in terms of financial cost and patient morbidity.62 In the UK, the tariff for an implant-only reconstruction has been assessed at roughly £3427.25 For more complex reconstructions, such as autologous latissimus dorsi or abdominal free flap reconstructions, tariffs such as £6654 and £10 388, respectively, are charged.3 Such figures do not include the costs associated with management of complications and revisions, which occur in up to 49% of patients.61,62 However, indirect costs might be lower in those undergoing contralateral risk-reducing mastectomy, and productivity might be increased in patients who have the procedure because of reduced anxiety as assessed in quality-adjusted life-years.61,62 This fact again emphasises the need for clinicians to provide accurate information about the risk of contralateral breast cancer in comparison to risk of metastases and the risks from surgery and subsequent revisions associated with reconstruction to patients with sporadic breast cancer. If contralateral risk-reducing mastectomy is to be done on the basis of anxiety relief, as is the case for most patients in the low-to-moderate risk group, then patient education is crucial.60,62 Clinical commissioning groups should decide whether surgery is an appropriate use of resources when other interventions such as cognitive behavioural therapy could be a more appropriate and more cost-effective way to manage patients without the associated surgical morbidity.

Conclusions

From a cancer management perspective, the increasing use of contralateral risk-reducing mastectomy in sporadic breast cancer is almost certainly unjustified.67 Many variables affect patient selection for contralateral risk-reducing mastectomy. Logically, overall mortality should be considered first, followed by the risk of contralateral breast cancer—a point that is often not portrayed accurately to the patient by the treating clinician. Patient counselling should follow the same sequence and include detailed information about the patient’s true risk, with consideration of adjuvant
treatment and the potential for surveillance and breast-conserving treatment.\textsuperscript{1} Epidemiological studies investigating the value of contralateral risk-reducing mastectomy have substantial limitations—ie, small patient numbers, insufficient long-term follow-up data, unknown adjuvant treatments used, and an absence of important prognostic information such as tumour grade, oestrogen receptor status, and HER2 status, among others. On this background can the physical and psychological risks and benefits of contralateral risk-reducing mastectomy be presented accurately. Use of online survival prediction tools such as Adjuvant! Online and PREDICT might help the clinician to predict future risk from the primary cancer and can form the basis of the overall risk reduction benefit of contralateral risk-reducing mastectomy.\textsuperscript{7,24} The patient should also be educated about the characteristics of a contralateral breast cancer, should this occur. The contralateral breast cancer will typically be a less relevant cancer—ie, cancer detected during surveillance is likely to be smaller, less likely to have metastasised to the lymph nodes and, therefore, have an excellent prognosis with no or little effect on patient mortality.\textsuperscript{16,17} Reconstruction, especially with autologous tissue, might mitigate some of the psychological effects at the cost of more extensive surgery, but can never restore a completely natural breast and is associated with a substantial increase in financial cost and patient morbidity. Young, anxious patients who are recommended for contralateral risk-reducing mastectomy by the treating clinician are more likely to be dissatisfied with the aesthetic outcome than older patients who seek contralateral risk-reducing mastectomy themselves.\textsuperscript{18} To avoid dissatisfaction, the surgeon should clarify the patients’ reasons for requesting contralateral mastectomy and have a high threshold for offering surgery. Multidisciplinary input from clinical geneticists, clinical psychologists, breast care nurses, and reconstructive nurses to ensure patients have adequate information is mandatory. Furthermore, comprehensive studies of patient-reported outcomes could also aid decision making, and could help to assess the economic consequences of contralateral risk-reducing mastectomy in patients with sporadic breast cancer.

**Contributors**

JAM and TDM contributed to the writing and preparation of this manuscript. JMO’D is the senior author who oversaw the preparation of the manuscript and reviewed the final version.

**Search strategy and selection criteria**

We did a literature search of the OVID, PubMed, Cochrane Library, NHS evidence, and Embase/Medline databases with the key search terms: “contralateral breast cancer”, “risk reducing mastectomy”, “prophylactic mastectomy”, and “sporadic breast cancer”. The search was then exploded using the “related articles” term in PubMed. Only articles published in English between 1990 and 2013 were included.

**Conflicts of interest**

We declare that we have no conflicts of interest.

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