Introduction to Breast Care

by

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Preface

As a former breast care nurse and now as a community nurse, I have seen first-hand what a devastating effect a breast cancer diagnosis has on a woman and her family. One in nine women in the UK will be diagnosed with this disease and some will die from it despite advances in research and technology. It is vital that the patient receives holistic, sensitive care from diagnosis through to outcome from a committed multidisciplinary team. The breast care nurse is a vital part of this team as often she is the health care professional with whom the patient will have the most contact. She is the person to whom the patient turns for support and information. The breast care nurse is often privy to confidences and private thoughts.

This book is intended to help student and qualified nurses, and newly appointed breast care nurses to care for patients with breast cancer from screening and diagnosis through to outcome. A chapter on benign breast disease is included as these patients too require sensitive, holistic care.

The impact of a breast cancer diagnosis affects all patients and their families differently. This book will endeavour to give straightforward, evidence-based factual information. Recent studies have been included so that information is as up to date as possible.

The book commences with the anatomy and physiology of the breast, risk factors for breast cancer and genetics. The chapters move in a logical order through diagnosis and surgical treatments, adjuvant therapies and psychological care. National government strategies relating to breast cancer are discussed. The Breast Screening Programme and the importance of breast awareness are also covered. Chapters relating to lymphoedema, prosthetics and complementary therapies are included as are chapters on fungating wounds and advanced breast cancer. However, palliative care is a vast, specialized subject in its own right and it is beyond the scope of this book to include much detail. Chapter 15 concentrates on areas relevant to advanced breast cancer, but symptom control, hospice care and loss and grief can be found in texts devoted to palliative care.

In breast cancer, as in other fields in medicine and nursing, there are constant developments and advances in research and treatments. Therefore although every effort has been made to keep the text as up to date as possible, it is impossible to include all new developments especially those in areas such as chemotherapy and endocrine therapies.

The role of the nurse is emphasised throughout. It is also, however, beyond the scope of this book to discuss in depth financial aspects and employment and benefit issues but, where applicable, the appropriate agency or professional through which information can be accessed is suggested.

This book is intended to be useful to all nurses who meet and care for patients with breast problems. I hope that it will broaden the reader's knowledge about breast cancer and ability to help the patients and families to cope with this disease.

I also hope that this book will encourage the reader's interest and enthusiasm for breast care nursing, which although challenging is extremely rewarding. If the reader wishes to learn more about breast care in the future it will have achieved its goal. I feel very privileged to have been given the chance to care for women with breast cancer and for their families.

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Thank you to my hugely supportive and long-suffering husband, daughters, friends and my colleagues and friends at Morecambe Health Centre.

Lastly, thank you to the women I have cared for with breast problems. They are all, without exception, very special.

CHAPTER ONE

Physiology of the breast

Anatomy and physiology

The two normal female adult breasts contain mammary glands which are modified sweat glands that produce milk. The breasts lie over the pectoralis major and serratus anterior muscles. They are attached to these by a layer of fascia (irregular, dense connective tissue) called the ligaments of Cooper. The size of the breast is determined by the amount of fat around the glandular or milk-secreting tissue rather than by the amount of glandular tissue itself. The mammary glands are structurally related to the skin but functionally related to the reproductive system as they produce milk to nourish offspring.

The breast is composed of two separate functional parts. The first part is the epithelial component and is concerned with production, secretion and ejection of breast milk. These functions are known as lactation and are associated with pregnancy and childbirth. The second part consists of all the other tissues making up and supporting the breast. These tissues include fat, fascia and muscles. In non-pregnant women and men the mammary glands are relatively underdeveloped. The Cooper's ligaments supporting the breast become looser with age or with stress caused by long-term vigorous exercise.

In each breast are 15–20 divisions of glandular tissue called lobes, which are arranged radially. Each lobe is separated by adipose tissue and is further divided into lobules that are separated and supported by fibrous tissue. Each lobule contains small, sac-like alveoli that produce and hold breast milk. The alveoli are embedded in connective tissue and are surrounded by spindle-shaped cells called myoepithelial cells, which are muscular and contract to propel milk towards the nipple during lactation. Milk collects in small ducts called terminal ducts, which then lead to the mammary ducts. These drain the alveoli and open onto the surface of the nipple, converging towards the nipple like the spokes of a wheel. There are

about 20 of these mammary ducts. Each duct drains milk from a different lobe of the breast. Close to the nipple the mammary ducts expand and form lactiferous sinuses. Some milk may be stored here before draining into a lactiferous duct, which then carries milk to the exterior.

It is important that this arrangement is understood when exploring cancer development. Most breast cancers form in the ducts of the breast. When the disease is confined to the ducts it is non-invasive and does not spread initially. This is known as ductal carcinoma *in situ* and is often classed as a pre-cancerous condition. It is always treated to reduce the chance of invasive cancer developing. The upper outer quadrant of the breast has the most ducts and therefore this is where most breast cancers occur. When the cancer cells break out of the duct it is known as invasive or infiltrating ductal carcinoma. This is the most common type of breast cancer.

The coloured area around the nipple is known as the areola. In lactation, there is a lactiferous sinus just below the areola where milk accumulates.

Blood supply

The breast receives its blood supply from two main sources. The internal mammary artery runs down on either side behind the sternum. The artery gives off perforating branches to the breast that enter under its surface between the ribs. The lateral thoracic artery is a branch of the axillary artery. This reaches the breast from under the arm up in the armpit. The acromiothoracic and intercostal arteries supply further blood to the breast.

When trying to understand breast cancer and how it spreads, knowledge of the blood supply is very important. The most common method of cancer spread in the case of the breast is by direct invasion and via the lymphatics (see 'Lymphatic drainage' section later in this chapter). Lymph vessels draining an organ run alongside the arteries which supply that organ with blood. The lymph drainage from the breast will be along the lymph vessels running with the internal mammary and lateral thoracic arteries. However, spread via blood vessels (haematogenous spread) also occurs. Breast cancer can spread to other organs by this route including brain, liver, lungs and ovaries.

Blood drains from the breast via the veins that run with the arteries mentioned above. This is important in the case of the intercostals veins as these connect with the azygos veins deep in the chest and therefore allow cancer to spread to the spinal column – a site to which breast cancer can spread.

The spread of breast cancer is dependent also on establishment of a blood supply to the tumour. This is accomplished by the extension of existing blood vessels into the tumour mass by the growth of the cells that line

the intruding blood vessels. Highly vascular tumours are large and more likely to spread to other organs.

Development and function

Oestrogens produced in the ovary and circulated by follicular cells are important as they promote development and maintenance of female reproductive structures including the breasts (Tortora and Grabowski 1996). These oestrogens cause the breast to develop rapidly at puberty. During a woman's life the breast is constantly under the influence of hormonal stimulation and does not enter a resting phase until after the menopause. Then oestrogen output virtually ceases and the size of the breasts may reduce.

The discrepancy between glandular and adipose tissue in the breast allows the lobes to be felt on breast palpation. The difference in density is the basis for mammographic imaging. The ducts of the breast are not usually palpable unless they contain tumour or are inflamed or engorged with milk.

Young women's breasts are mostly composed of glandular tissue and are firm. As women age the lobes involute (shrivel) due to loss of density and are replaced by fat. Therefore they become softer and easier to examine and image with mammography.

Glandular tissue is very sensitive and many changes take place in the breast during the menstrual cycle. These changes are most evident prior to menstruation when oestrogen and progesterone are peaking. The breast glandular tissue may enlarge and become tender and painful in some women. After the menopause hormone levels are low and the breast becomes less tender and is easier to examine.

Considerable changes are also undergone during lactation. Milk formation after pregnancy is under hormonal control. In pregnancy high oestrogen and progesterone levels prepare the alveolar glands for the production of milk. The synthesis of milk after pregnancy is caused by prolactin from the anterior pituitary gland. Prolactin is a principal hormone in promoting lactation. It is released in response to prolactin releasing hormone, which is secreted by the hypothalamus. During pregnancy the high progesterone levels inhibits prolactin so no milk is secreted. After delivery the oestrogen and progesterone levels in the blood reduce and the inhibition is removed.

The sucking action initiates nerve impulses to the posterior pituitary gland via the hypothalamus. These stimulate oxytocin release, which causes the myoepithelial cells around the walls of the alveoli to contract therefore ejecting milk. Milk moves from the alveoli of the mammary glands into the ducts where it can be suckled from the nipple.

Congenital problems and variations on normal are often seen. Up to five per cent of the population present with aberrant breast tissue and supernumerary and accessory nipples. Breast asymmetry and hypoplasia are often caused by defects in the pectoral muscles. Unilateral enlargement of the breast or general uncontrolled overgrowth of breast tissue in adolescent girls can cause concern especially if pain and discomfort are also present.

Uncontrolled overgrowth of the breast tissue can be seen in adolescent girls who have a normal hormonal profile and can be severe enough to require breast reduction surgery for cosmetic and social reasons (Leinster et al. 2000).

Lymphatic drainage

A knowledge of the lymphatic drainage of the breast is necessary because cancerous cells from tumours often spread to other parts of the body via the lymphatic system.

The circulatory system brings many substances to cells and then removes waste products accumulated as a result of metabolism. Many additional substances including excess fluid and protein molecules are returned to the blood as lymph. This is a specialized fluid formed in the tissue spaces that is transported via specialized lymphatic vessels to re-enter the circulatory system. The lymphatic system also includes lymph nodes and lymphatic organs such as the spleen and thymus.

Lymph nodes are located in clusters along the pathway of lymphatic vessels. Some are the size of a pinhead; others are larger. Lymph nodes perform biological filtration of bacteria and other abnormal cells. Knowledge of lymph node location is vital when surgery for breast cancer is being performed. Lymph passes through the node and is filtered so that cancer cells are removed and prevented from entering the blood. Axillary nodes are removed during breast cancer surgery as they may contain cancer cells filtered out of the lymph drained from the breast.

Unfortunately cancer cells from a single breast tumour can often spread to other areas of the body via the lymph system. Swollen but pain-free lymph nodes can be a result of cancer spreading via the lymph system and infiltrating the nodes (Hubbard and Mechan 1997). Knowledge of the location of nodes and flow of lymph is important when diagnosing metastatic spread. Secondary tumour sites are predictable by the direction of lymph flow from the organ primarily involved (Tortora and Grabowski 1996).

Following lymph node removal a patient may suffer from lymphoedema (swelling of the arm), which will be discussed in Chapter 12.

Pathology of breast tumours

How a tumour develops

A cancerous tumour is an expanding mass of disorganized tissue produced by the multiplication of abnormal cells. A tumour may develop when exposed to a carcinogen (Richardson 1995). External agents such as a chemical or virus, or further genetic alterations can promote tumour development by causing irreversible changes to the DNA. These agents do not change the structure of DNA but stimulate normal growth-controlling genes (proto-oncogenes) into abnormal expression as oncogenes (tumour causing genes). The resulting changes may progress to malignancy first as a pre-invasive lesion then as invasive cancer. The malignant tumour will invade adjacent tissue, destroying it and metastasizing via the lymph and blood (Mera 1997). A tumour can also develop a blood supply of its own and will sometimes outgrow it causing necrosis in the middle.

Most malignant breast tumours originate in epithelial cells in the undifferentiated terminal structures of the mammary gland, an area called Lob 1, and are classified as carcinomas. Lob 1 is particularly sensitive to carcinogens. Pregnancy and breastfeeding reduce the amount of Lob 1 in the breast (Brashers 1998).

The tumour cells infiltrating the tissue are surrounded by dense connective tissue, which is produced by the body in response to the tumour. This dense tissue pulls on the adjacent tissue causing skin puckering and nipple retraction, which are typical signs of a malignant lesion. The tumour feels firm on palpation and does not have sharp margins as it infiltrates into surrounding tissue (Damjanov 1996).

Malignant breast tumours can be divided into *in situ* and invasive cancers.

In situ carcinomas

There are three types of *in situ* carcinomas – ductal carcinoma *in situ* (DCIS), lobular carcinoma *in situ* (LCIS) and Paget's disease. Although generally classed as pre-invasive, each has the potential to progress to invasive carcinoma.

DCIS (Ductal carcinoma in situ or intraduct carcinoma)

In pure DCIS malignant cells are confined to the ducts of the lobules and there is no invasion of surrounding tissue. The tumour cells cannot metastasize to other areas of the body as the ducts do not contain blood or lymphatic vessels. Up to 20 per cent of screening cancers are pure DCIS but sometimes it may present as a palpable mass, Paget's disease or nipple

discharge. There is a proliferation of cells with cytological features of malignancy within the ducts. Several patterns can frequently be seen in the same lesion, so whereas previously DCIS was classified according to the architectural pattern (for example comedo, cribriform, solid) now more emphasis is placed on nuclear grade. Currently DCIS is divided into three grades: high, intermediate and low based on size and pleomorphism of the nuclei.

DCIS can progress to invasive carcinoma if not completely excised. It is not clear how long it takes to progress or how many cancers do become invasive, although some studies suggest 30–40 per cent. Low grade DCIS is less likely to progress than high and intermediate. If excision is inadequate DCIS or invasive carcinoma may recur.

LCIS (Lobular carcinoma in situ)

In LCIS the lobules at the end of the mammary ducts are filled with a uniform population of regular tumour cells which may spread along adjacent ducts. These cells distort the ducts and may often undergo necrosis (Kumar et al. 1997).

As LCIS usually does not produce a mass and is not usually found on a mammogram, it is generally an incidental finding. There may be a slight association with adjacent calcification. It tends to be multifocal and bilateral, complicating the approach to treatment. It is generally regarded as a risk indication for the development of carcinoma – about 10 times that of the general population and carrying a 20 per cent risk of developing cancer in 10–15 years time.

Paget's disease

This is a manifestation of high-grade comedo DCIS in which the malignant cells (Paget cells) extend from the subareolar ducts to the epidermis of the nipple. Here they can be seen lying either singly or in groups between the squamous cells. Between a third and a half of cases have an associated invasive cancer. Women affected are usually in a slightly older age group than those who experience the usual invasive ductal carcinoma (Kumar et al. 1997). There may be a palpable mass in the breast. Involved areolar skin tends to be fissured and ulcerated.

Invasive carcinomas

It is important that pathologists recognize that there are a number of differing types of invasive breast carcinoma, based on the cell morphology and histological pattern. They may have different prognoses and therefore choice of treatment will be affected.

Invasive ductal carcinoma

This is the commonest type, accounting for 50–70 per cent of invasive cancers. They usually have an irregular stellate outline, are firm to palpate and are gritty when cut. They often accompany DCIS.

Invasive lobular carcinoma

This accounts for 10–15 per cent of invasive cancers. These cancers may be bilateral or multifocal. They consist of small regular tumour cells, which infiltrate in a diffuse manner. Contralateral disease is more common in patients with infiltrating lobular carcinoma. Patients who have had treatment for breast cancer should have regular follow-ups to detect cancer in the second breast (Orel et al. 1992). Development of contralateral disease is associated with the risk of distant recurrence (Heron et al. 2000).

Tubular carcinoma

This accounts for two per cent of symptomatic cancers but up to 15 per cent of screen detected. Tubular structures form a well-differentiated carcinoma. Little cell activity is displayed and the prognosis is good.

Mucinous carcinoma

This is commoner in older women and will form two per cent of invasive cancers. Nests of tumour cells compose well-differentiated gelatinous masses. The prognosis is better than the usual invasive cancers (Kumar et al. 1997).

Medullary carcinoma

This represents one per cent of invasive cancers. It is usually found in postmenopausal women. Again, the prognosis is good.

Inflammatory breast cancer

This is a rare form of breast cancer which affects a small number of women. The cancer cells block the lymph vessels in the skin of the breast giving the breast an acutely inflamed appearance. The lymph nodes may be swollen. Inflammatory breast cancer grows rapidly and often spreads to other sites. It can be mistaken for an infection so treatment may be delayed. Systemic treatment and then surgery are usually necessary. The prognosis is poor but as treatment methods improve the prognosis improves slightly.

Staging

Staging is used to determine the extent of the disease beyond the primary site, therefore the need for adjuvant treatment can be determined. The stage may determine whether or not the patient will undergo surgery. It is also important to determine the prognosis. A small, early, localized tumour is likely to carry a good prognosis whereas an advanced tumour with metastases will have a poor prognosis.

Tumour differentiation

Prognostic information can be gained by grading the degree of differentiation of the tumour. The degree of tubule formation, nuclear pleomorphism and frequency of cell division are graded from one to three (Sainsbury et al. 2000). These are added and the tumour is given a final grade of 1, 2 or 3. A grade 3 tumour will show no glandular formation and its cells will have large pleomorphic nuclei and show frequent mitoses. A grade 1 tumour will show many glands and will be composed of small tumour cells with few mitoses. Therefore, a grade 3 tumour will show an aggressive nature and suggest a poorer prognosis. This histological grade is an important predictor of disease free and overall survival.

Other features in a tumour are of value in predicting local recurrence and prognosis.

Vascular or lymphatic invasion

Any cancer cells in the lymphatic or blood vessels are an indicator of more aggressive disease. The number of lymph nodes involved and the level of axillary involvement is important. A patient with this feature is at risk from local and systemic recurrence (Sainsbury et al. 2000). Ten-year survival drops to 25–30 per cent for patients with positive nodes from 70 per cent for patients with negative nodes.

Extensive *in situ* component

If more than 25 per cent of the main tumour consists of non-invasive disease and there is *in situ* cancer in the surrounding tissue, the cancer is classified as having an extensive *in situ* component. Local recurrence is more likely following breast conservation surgery (Sainsbury et al. 2000).

Staging of invasive breast cancers

On diagnosis of a breast cancer the extent of disease is assessed and the

tumour staged in order for the most appropriate treatment to be established. This is performed on the basis of the gross appearance of the tumour and how it has spread to lymph nodes and distant organs. There appear to be three major classification systems.

The 4 stage system

Stage 1 – early disease – the tumour less than 2.5cm and confined to the breast; 5-year survival rate is 80 per cent.
Stage 2 – early disease – the tumour is 2–5cm; there is some spread to the axillary lymph nodes; 5-year survival rate is 65 per cent.
Stage 3 – locally advanced disease – the tumour is more than 5cm; it has spread to chest wall; there is involvement of supraclavicular or internal mammary nodes; 5-year survival rate is 40 per cent.
Stage 4 – advanced disease – the tumour is any size; metastases are present at distant sites, for example bone, brain, liver, lungs; 5-year survival rate is 10 per cent (Damjanov 1996).

Stages 1 and 2 are potentially curable with surgery and chemotherapy and/or radiotherapy and anti-hormone drugs. Stages 3 and 4 are advanced where symptom control is a priority.

This system may also be known as the Manchester Staging System (Denton 1996).

The TNM system

The International Union against Cancer details this system (Tumour, Node, Metastasis) as given below:

T – Tumour stage
Tx – Cannot be assessed
T0 – No evidence of primary tumour
Tis – Carcinoma *in situ*
T1 – Tumour 2cm or less in its greatest dimension
T2 – Tumour greater than 2cm but less than 5cm
T3 – Tumour greater than 5cm
T4 – Tumour of any size with direct extension to chest wall or skin

N – Lymph node stage
Nx – Cannot be assessed
N0 – No nodal metastases detected
N1 – Metastasis to mobile nodes on same side
N2 – Metastasis to nodes on the same side that are fixed to each other or another structure
N3 – Metastasis to internal mammary nodes on the same side

M – Metastasis stage
Mx – Cannot be assessed
M0 – No distant metastasis present
M1 – Distant metastasis present (Sobin and Wittekind 1997).

The Nottingham prognostic index (NPI)

This is often used as a prognostic tool. It gives an accurate prediction of survival for women with breast cancer and aids the decision regarding adjuvant therapy. An equation is used:

The size of the tumour (cm) by 0.2 + the grade (1–3) + the nodal status (1–3).
1 = no nodes involved.
2 = 1–3 nodes involved.
3 = > 3 nodes involved.

The higher the final figure the worse the prognosis.

A NPI of < 3 = 90 per cent 15-year survival rate and no adjuvant therapy.
A NPI of 3.01–3.4 = 80 per cent 15-year survival rate and no adjuvant therapy.
A NPI of 3.41-4.4 = 50 per cent 15-year survival rate. If the patient is ER+ = endocrine therapy. If ER- = chemotherapy.
A NPI of 4.41–5.3 = 30 per cent 15-year survival rate. Adjuvant therapy as above.
A NPI of >5.4 = 8 per cent 15-year survival rate. Adjuvant therapy as above but administer chemotherapy only if the patient is fit enough (Galea et al. 1992).

Hormone receptors

Oestrogen receptors are proteins present on the cell surface of breast cells and on breast tumours. Oestrogen binds to these receptors and stimulates growth factor production. This results in uncontrolled cell proliferation in malignant cells. Oestrogen and progesterone status can be assessed where labelled antibodies against the receptors are applied to tissue sections. Sixty per cent of tumours are considered ER positive. These tend to have a better prognosis. Many tumours also have progesterone receptors (PR). These also carry a better prognosis. Receptor status provides information as to the likely response to adjuvant therapies (Brashers 1998). More information on oestrogen receptors can be found in Chapter 9.

Other prognostic markers

Other markers of prognosis are constantly being sought. These include angiogenesis (a high density of new vessels indicates a worse prognosis),

peptide growth factors and receptors such as epidermal growth factor (EGF) and its receptor (EGFR – this is associated with a poor prognosis), proliferation markers, for example Ki 67 or PCNA, c-erbB-2 and oncogenes and tumour suppressor genes.

Epidemiology

Breast cancer is the most common female cancer in westernized countries, responsible for 20 per cent of all female cancers. In the UK one in five cancers in women are breast cancers and it is estimated that one in nine women will develop breast cancer at some point in their life (Cancer Research Campaign 2001). Mortality from breast cancer in this country is among the highest in the world (Evans et al. 1998). Each year there are 14,000 deaths and 38,000 new cases. The incidence appears to be higher in the upper socio-economic groups. Breast cancer is also the commonest cancer in minority ethnic groups in the UK (Cancer Research Campaign 1996).

There is a regional variation in England and Wales – more cases occur in the south in post-menopausal women. However, post-menopausal women account anyway for 80 per cent of breast cancers. Breast cancer does occur in men but is rare, accounting for about 300 cases per year.

Risk factors

Age is the strongest risk factor – the older woman is at greater risk. Although 80 per cent of cases are post-menopausal, nearly 7000 cases per year are pre-menopausal. In addition, one in five cases in women of child bearing age occur when the woman is pregnant or lactating, or in the first year following the birth. Over 1000 women per year are diagnosed in the age group 35–39 years. The rate of increase prior to the menopause suggests that hormonal status is a link (Cancer Research Campaign 1996).

Reproductive factors play a part. The greater the exposure to oestrogen the higher the risk. In countries such as Japan, China, Arabia and Africa where women have an average age of 17 years at menarche, the risk is low. An early age at menarche appears to increase the risk – in the USA the average age is 12.8 years and one in nine women will face breast cancer in their life (Tortora and Grabowski 1996). A late menopause (after 55 years) approximately doubles the risk compared to undergoing the menopause before 45 years. Having a child after the age of 30 years and nulliparity doubles the risk in comparison to the risk of a woman who had a child before the age of 20 years.

A woman who has had benign breast disease proven on biopsy, especially atypical hyperplasia will have an increased risk of malignancy

occurring. However, this will only account for 10 per cent of benign biopsy specimens. If a woman has already had cancer in the other breast her risk will be quadrupled.

Ionizing radiation in large quantities is a risk factor but is unlikely to occur under modern clinical conditions (Cancer Research Campaign 1996). Research suggests that young girls who have had thoracic radiotherapy for Hodgkin's disease in the past may be at increased risk of breast cancer. The breast at puberty is very sensitive and it has been suggested that girls under 21 years who have undergone this treatment should be identified and screened. Radiation doses are now lower and radiotherapists try to exclude breast tissue from the radiation field.

The risk of breast cancer occurring due to taking the oral contraceptive and HRT has been studied. There is a small increase in risk of contracting breast cancer during use of the combined oral contraceptive and for 10 years afterwards, but the excess disappears 10 years after the cessation of use (Collaborative Group on Hormonal Factors in Breast Cancer 1996).

Combined HRT (oestrogen and progesterone) is now more common. At present the health benefits of HRT outweigh the disadvantages, but some studies show an increase in risk after more than 10 years of use of unopposed oestrogen. Other evidence suggests that there is an increased risk of about 50 per cent for use of HRT for more than five years (Colditz et al. 1995). However, most studies show that shorter term use is not associated with increased risk. HRT reduces CHD and osteoporosis, which possibly gives an advantage in terms of years of life (Mera 1997). Due to the possibility that oestrogens stimulate the production of growth factors by cancer cells, women who have had breast cancer or who have a family history may be advised to avoid HRT. HRT is discussed in more detail in Chapter 9.

Dietary factors may play a part but this is still unclear. A high fat diet may be a risk but this appears to be inconclusive. Fat intake in an individual's early years may be more significant than during middle age (Hunter and Willett 1996). However, obesity may be a risk factor in postmenopausal women. This may be because oestrogen is stored in adipose tissue and may be released over a longer period than in non-obese women. High alcohol consumption has also been implicated possibly because high alcohol levels can lead to obesity and raise oestrogen levels. Migrants who move from low incidence areas (for example Japan) to high incidence areas (such as the USA) are at greater risk of breast cancer than women who do not migrate. Incidence and mortality is five times higher in the USA than in Japan (Kumar et al. 1997). This difference would appear to be environmental and involve diet and reproductive patterns. The migrants tend to adopt the habits of the host country and vice versa.

Some factors may protect against breast cancer, for example high levels of exercise, breastfeeding and a high-fibre diet rich in fruit and vegetables

(Cancer Research Campaign 1996). Cigarette smoking has been implicated in the past but a recent study has shown that teenage girls who smoke have a 70 per cent greater risk of developing breast cancer in later life. The results showed that the effects of smoking were especially harmful during adolescence when breast tissue is most sensitive to environmental carcinogens. The study also showed that childless women who smoked 20 cigarettes a day for 20 years were also at similar risk (Breast Cancer Care 2002). These results suggest that there is a role for breast care nurses to undertake health promotion in schools to raise the awareness of young girls about the risks of smoking and breast cancer.

Although 11,340 women died of breast cancer in England and Wales in 2000, breast cancer survival rates continue to improve. Earlier diagnosis through breast screening and improved treatments contribute to this (National Institute for Clinical Excellence 2002). Survival rates have increased in recent years. Survival figures at the moment mean staying alive five years after diagnosis. As improvements in screening programmes and treatment are recent, 10-year survival rates are not yet available. If breast cancer is detected at its earliest stage there is a 92 per cent survival rate.

However, research undertaken nearly 10 years ago states that the 10-year survival rate for patients with non-palpable invasive breast cancer of 10mm or less in diameter is over 85 per cent, a better rate by 15–40 per cent than for patients with a palpable breast cancer (Rosen et al. 1993).

The survival rate for patients diagnosed between 1993 and 1995 was 93 per cent at one year and 76 per cent after five years. Five-year survival rates are highest among people aged 50–59 years at diagnosis. Younger and older have a lower survival rate. Survival rates vary with the characteristics of the tumour and the stage at which it was detected. About 50 per cent have early disease at initial diagnosis and have an excellent prognosis. Fewer than five per cent have metastatic disease at diagnosis although the likelihood of an initial advanced cancer diagnosis increases with age (National Institute for Clinical Excellence 2002).

Genetics

The genetic link to breast cancer is widely believed to be common. In actual fact only 5–10 per cent of women are at increased risk due to an inherited form of breast cancer occurring in women in their 30s and 40s. In some families, the high incidence of breast cancer is accompanied by clusters of ovarian cancer (Mera 1997).

Most cases of breast cancer are sporadic in which genetic changes occur only within the cancer cells. However, in a few cases a genetic change will have been inherited. This means that it is present in every cell and can be

passed down through the family in each generation. Carriers have a 50 per cent chance of passing the gene down to each of their children but although the risk is increased it does not mean that cancer will definitely develop (Eeles 1996).

BRCA1 and BRCA2

A number of different genes are involved. Since 1990 two highly penetrant autosomal dominant genes have been localized and cloned. (Penetrance is the likelihood of getting the disease.) These are BRCA1 and BRCA2. These account for five per cent of breast cancers showing a clear inherited pattern due to autosomal dominant inheritance (Miki et al. 1994).

BRCA1 is an inherited susceptibility gene present on the long arm of chromosome 17. BRCA1 is a tumour suppressor gene, which plays a part in regulating cell growth and repairing DNA. However, when one copy of BRCA1 is inherited in a defective or mutant form the woman is predisposed to breast or ovarian cancer. More than 100 different types of mutation have been found in BRCA1. Many of these are confined to a very small number of families. It is a large gene and screening for mutations is difficult. Screening is undertaken on samples from affected family members. The test is very difficult technically and takes many months. If a faulty gene is not found it is not possible for subsequent relatives to be tested. If the patient is tested and does not carry a faulty gene the chance of developing breast cancer is the same as the general population.

If the number of breast/ovarian cancer cases within a family increases the probability of detecting a BRCA1 mutation also increases. The lifetime risk of breast cancer if mutations in BRCA1 are detected is 85 per cent and ovarian cancer 30–50 per cent. There is also an increased risk of prostate cancer 8 per cent and bowel cancer 10 per cent (Evans et al. unpublished notes). BRCA1 is associated with medullary cancers in some cases. A high proportion of BRCA1 cancers is grade 3 with a high mitotic frequency and lymphocytic infiltration. They also tend to be oestrogen/progesterone receptor negative and the prognosis may be worse than that of patients who do not have the gene.

BRCA2 is found on the long arm of chromosome 13. Mutations in this area can account for as many inherited breast cancer cases as BRCA1 but probably not as many ovarian cancers. The lifetime risk of breast cancer is 85 per cent and ovarian cancer 20 per cent. This gene is also associated with an increase in male breast cancer and also prostate and bowel cancer (Wooster et al. 1995).

A pattern of malignancies within a pedigree determines which gene is most likely to have a mutation present. Specific mutations occur with

increasing frequency. Three mutations – two in BRCA1 and one in BRCA2 – occur frequently in Ashkenazi Jewish women. An estimated 20 per cent of these women affected by breast cancer before the age of 40 years will show a mutation (Eeles 1996). Breast cancers caused by BRCA1 and BRCA2 are generally of early onset (before 40 years). Both breasts may be affected and another woman within the family may also be affected.

Other genetic alterations in breast cancer involve a mutation in oncogenes. When this occurs, the control of cell growth is lost.

P53

P53 is the most common tumour suppressor gene that is mutated in breast cancer. Tumour suppressor genes are part of the normal mechanism that controls the cell cycle. Normal p53 is activated when abnormalities occur in DNA transcription. The cell cycle is arrested and the cell undergoes programmed cell death, therefore the abnormal DNA is prevented from replicating. When mutant p53 replaces the normal, the DNA continues to replicate giving rise to cancer tumours. A tumour containing p53 will have a worse prognosis than one that does not (Leinster et al. 2000).

Li-Fraumeni syndrome is due to an autosomal dominant germline mutation in p53. This is a rare syndrome causing brain tumours, soft tissue and bone sarcomas, adrenocortical carcinomas and early onset breast cancer. Most of these occur early, breast cancer presents before the age of 40 years. Early mammography is recommended.

ErbB, c-erbB-2, and erbB-3

Amplification of erbB, c-erbB-2 and erbB-3 oncogenes is seen in approximately two-thirds of breast cancer patients. Over expression of erbB-2 appears to be linked with a poor prognosis. The c-erbB-2 gene product has been found in post-menopausal patients with a family history of breast cancer, whereas the BRCA1 mutation is generally found in younger women (Leinster et al. 2000).

Cowden's disease

PTEN is the gene involved in Cowden's disease, a rare syndrome of multiple hamartomas of the skin, thyroid, mucous membranes and breast. There is an increased risk of breast cancer associated with the syndrome, possibly occurring in 50 per cent of affected females; 33 per cent are bilateral. The onset can be very young but the average age is 38 years (Hodgson and Maher 1999).

Risk assessment and genetic counselling

Genetic counselling is increasingly in demand to determine risk and measures to reduce it among women with a family history of breast cancer. Counselling requires an initial assessment of the lifetime risk of developing breast cancer on the basis of data obtained by taking a thorough family history. This would include information about types of cancer in the family, ages at onset, bilateral breast diseases and multiple cases. This includes all first- and second-degree relatives and as many distant relatives as possible (Hodgson and Maher 1999).

Currently regional genetics services are able to offer genetic testing and counselling to a small number of these women at the Family History Clinics. Also some local breast units are able to offer risk assessment to low and moderate risk women. Some breast care nurses have undergone training and are running clinics for these women.

Women with a family history of breast cancer are advised to visit their GP who will advise on increased risk or will refer to a cancer genetics clinic or cancer specialist. Information and counselling will be provided and the patient informed whether they are at low, medium or increased risk. If there is a strong family history and the woman is at moderate risk she may be asked to take part in a study which is looking at ways to monitor people at moderate risk, and will include regular screening (Cancer Bacup 2001).

Risk calculation

Where four first-degree relatives have early onset or bilateral breast cancer the risk of inheriting a gene is nearly 50 per cent (Evans et al. 1994). About 80 per cent of gene carriers will develop breast cancer in their lifetime. Therefore, the maximum risk counselled is 40–45 per cent unless there is significant family history on both sides. A dominant history on a father's side of the family would give at least a 20–25 per cent lifetime risk to daughters as breast cancer genes can be inherited through the father.

The daughter of a breast cancer gene carrier has a prior risk of 50 per cent of inheriting the susceptibility so her lifetime risk of developing breast cancer is about 40 per cent. However, if she remains unaffected after the age of 50 years her risk will fall because she has lived through a large amount of her risk period. Most hereditary breast cancers occur at a younger age (Evans et al. 1994). If she remains healthy the older she becomes it is less likely that she has inherited the susceptibility. The risk gradually equalizes to normal after the age of 60 years in those with a family history of breast cancer.

Women who have an identical twin sister with breast cancer are also at least three times more likely to develop breast cancer. Identical twins may gain their increased risk by inheriting the same set of genes. Non-identical twins are at much smaller risk.

If a family history shows an increased risk the woman could be offered a predictive test to ascertain if she carries a BRCA1 or BRCA2 mutation. Permission is requested to offer other at risk family members predictive testing and counselling (Hodgson and Maher 1999).

Criteria for referral to the Family History Clinic

The following criteria are suggested:

1 First-degree relative with breast cancer under 40 years.
2 First-degree relative or one first- and one second-degree relative with breast cancer under 60 years.
3 Three or more cases of breast/ovarian cancer, any age on the same side of the family.
4 One case of breast cancer at less than 50 years and one ovarian cancer on the same side of the family where one is the first-degree relative of the referred patient.
5 Double primary cancer involving breast and ovary, sarcoma or colon when the first occurred at less than 50 years.
6 Breast cancer in father or brother – any age.
7 History of related cancer in mother/father − any age.
8 BRCA1, BRCA2 or Cowden's disease confirmed.
9 Ashkenazi Jewish with breast cancer at less than 60 years or ovarian cancer any age in a close relative.

Women at moderate risk fit the following criteria:

1 First-degree relative with a breast cancer diagnosis at less than 40 years old.
2 First/second-degree relatives with breast cancer diagnosis under 60 years or ovarian cancer at any age.
3 First/second-degree relatives with breast/ovarian cancer at any age.
4 First-degree relative with bilateral breast cancer under 60 years.
5 First-degree male relative with breast cancer at any age.

The relative risk in this group is at least three times that of the general population. Below 30 years no mammogram would be carried out, the patient would be advised on breast awareness. At age 35–49 years annual mammography would be carried out. Screening may be done from five years prior to the age at diagnosis of the relative if this age is greater than 39 years. After 50 years mammograms would be carried out every 18 months (in between screening via the National Breast Screening Programme).

The difference between familial and non-familial breast cancer would be discussed with women at low risk and they would be reassured that their risk is not significantly raised. They would be encouraged to be breast aware and are entered into the screening programme at the appropriate age (British Association of Surgical Oncologists 1998).

Reducing the risk

For a young woman with a significantly increased risk the options are limited. She could be advised to plan her family early, avoid the oral contraceptive pill and HRT, stop smoking and maintain a good diet. She will also be advised to become breast aware and self-examine.

A study published recently suggests that the longer women breastfeed the more they are protected against breast cancer. The study found that the relative risk of breast cancer decreased by 4.3 per cent for every 12 months of breastfeeding in addition to a seven per cent decrease already for each birth. This may explain why breast cancer is less prevalent in countries where having large families and breastfeeding for longer is common (Collaborative Group on Hormonal Factors in Breast Cancer 2002).

Annual screening may identify over 60 per cent of cancers in younger women but the young breast is difficult to interpret as tissue is dense (Tabar et al. 1987). Women are eligible for annual screening from 35 years if at a lifetime risk of one in six (twice the national average) or greater. If breast cancer in a first-degree relative has occurred when the relative was less than 40 years, screening of the patient begins at five years before the age the relative was at diagnosis (for example, if the first-degree relative was 39 years at diagnosis, the patient will be screened from age 34 years). After 50 years mammograms are undertaken every 18 months.

Mammography can detect lesions in the 35–49 year age group especially. Although there is a small theoretical risk of repeated scans inducing a breast cancer, it is generally considered that the benefits of early detection outweigh any possible hazards (Law 1997).

The potential use of MRI (magnetic resonance imaging) for screening women aged 35–50 years at high risk is currently being evaluated. This uses IV contrast and therefore is a more invasive test than mammography but it gives more information on any tumour present. It is the most sensitive practical technique, although it will not detect a proportion of DCIS. Ideally it would be undertaken yearly in high-risk women, but MRI is also extremely expensive.

For some women at very high risk of breast cancer bilateral prophylactic mastectomy may be carried out. These women need to be made aware of the residual risk of cancer following mastectomy leaving the nipple – total mastectomy may be preferable (Hodgson and Maher 1999). Also patients