that Huxley's contributions added but little to fill in the gaps in Darwin's knowledge, is all the more remarkable when it is remembered that in 1863 Richard Owen was 59 years old, that St. George Jackson Mivart was 36, and that the one was a master of the comparative anatomy of the vertebrates and the other a leading authority on the anatomy of the mammals and especially of the primates. But Owen had the misfortune to challenge Huxley's knowledge of primate anatomy on a point upon which his own knowledge was deficient. Owen, though the supreme authority on comparative anatomy, was defeated in a particularly stupid argument, and thereafter his weight as a critic of the ape origin of man thesis declined.

Mivart's book *Man and Apes* fell dead in 1873, two years after the publication of the *Descent of Man*. It fell dead not because the facts of primate anatomy so cogently brought forward by Mivart were proved incorrect but because they were ignored. They were ignored because a belief had been created that Darwin and Huxley had said the last word on the structural affinities between man and the rest of the primates. Unfortunately this belief persisted after the euphoria of nineteenth century scientific thought had, for many sciences, passed away. With some it seems to persist even to-day, and as a consequence the whole subject of comparative primate anatomy has failed to receive that re-examination that is so long overdue and that has already been carried out in so many other branches of science. Not until the complete anatomy of a wide series of members of the primates is recorded shall we be in a position to determine the interrelations of the different groups and to place the subject of man's place among the primates on a perfectly sound basis.

It is safe to prophesy that, as knowledge of the anatomy of the primates increases, the complexities of the problem will increase, and much work will have to be accomplished before ultimate clarity is achieved. It is satisfactory that the period of dogmatism is passing, but it will not be until anatomists regain their lost faith in the importance of morphological studies that the new era in our knowledge of primate anatomy dawns.

CARCINOMA OF THE BREAST AND ITS TREATMENT*

BY

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It may be thought that carcinoma of the breast is a common and hackneyed subject and one of little interest to the medical practitioner, yet it must be acknowledged that breast cancer is one of the main killing diseases in women. There can be no doubt that the incidence of this disease is steadily rising, and it behoves the medical profession to instruct and advise the public about the importance of its early diagnosis and treatment. Every year some 7,500 women die of cancer of the breast, this situation being the commonest site for cancer in women, accounting for 20% of female cancer deaths.

All clinicians will agree that the breast is a very favourable site for malignant disease, and that in early cases operative treatment gives excellent results. Even in cases

in which no treatment whatever is given the patient may be expected to live for three years; this is a fact that the medical profession does not realize.

The two common factors for causing patients to seek medical advice are pain and the presence of a lump. Only the second of these is present in early cases; this in itself is the main factor in the poor results which are obtained in the treatment of this condition.

Spread of Mammary Cancer

Cancer of the breast begins in the acini or ducts and at first is a very limited condition; soon, however, there is spread of cancer cells up and down the ducts and then through the duct wall. From here the extension is via the lymphatics of the breast, and, lastly, via the blood stream. There can be little doubt that the condition of the stroma of the breast together with its lymphatic and blood connexions plays an important part in the spread of the disease. In girls and young women the vascularity of the breast is very pronounced, and if cancer develops the prognosis is hopeless. It is also very bad in cases of cancer developing during pregnancy and lactation; while in women over 80 the condition of the breast and its stroma is so fibrotic that the disease may last many years without any real extension. I have watched a woman aged 88 with a carcinoma of the breast for 15 years; she has refused every kind of treatment that has been advocated.

To understand the lymphatic spread of mammary cancer it is important that a true conception of the connexions of the lymphatic vessels should be forthcoming.

The Lymphatics of the Breast

Our knowledge of the lymphatic drainage of the breast has increased during the last 40 years. As a student I often watched the late Sir Watson Cheyne perform a radical excision of the breast, divide the clavicle, and remove the supraclavicular glands. These patients rarely survived six months but died of general metastases and recurrence in the supraclavicular regions. It was thought and taught at that time (1909) that the lymphatics of the breast passed under and over the clavicle to the supraclavicular glands. It was also taught that the lymphatics of the axilla passed upwards into the supraclavicular glands. These ideas of lymphatic spread have been greatly modified during the last 20 years as the pathology of mammary cancer has been placed on a more sound foundation.

I believe, but not every surgeon will agree with me, that there is no lymphatic connexion between the breast and the supraclavicular glands except via the upper intercostal spaces and the internal mammary glands. In my opinion there is no connexion between the axilla and the supraclavicular glands. On this belief hangs the modern conception of radical mastectomy. The conservation of the clavicular head of the pectoralis major muscle implies that no lymphatic vessels pass from the breast to the supraclavicular glands in front of or behind the clavicle.

Involvement of the supraclavicular glands therefore means that intrathoracic extension of the disease has taken place and the condition is therefore inoperable.

Although the lymphatics of the breast are numerous, there are very definite pathways which determine the spread of the disease. The lymphatics from the upper and outer quadrant drain into the axillary glands. Those from the lower and outer quadrant drain for the most part into the axilla, but a few may drain to the lymphatics of the abdominal wall to the umbilicus and so via the ligamentum teres to the liver. The lymphatics of the inner quadrants of the breast drain via the intercostal spaces into the

*Read in opening a discussion in the Section of Surgery at the Annual Meeting of the British Medical Association, Cambridge, 1948.

internal mammary glands and the anterior mediastinum and so into the supraclavicular glands (Fig. 1).

Some lymphatics may pass across the middle line to the opposite breast, while a few may pass to the parmammary glands and to the abdominal lymphatics.

FIG. 1.—Drawing showing the lymphatic drainage of the breast.

Early Diagnosis

It is essential that early diagnosis should be made if better results are to be obtained in the treatment of carcinoma of the breast. There are several factors which have in the past prevented early diagnosis and these should be entirely eliminated to-day. The patient who discovers a lump in her breast often decides to tell no one, as it might be cancer and she might die as some of her friends or relatives have done. This fear of cancer is very real and must be tackled by the profession on proper lines. The laity must be convinced that cancer of the breast can be cured in the early stages of the disease. I have found that the average time taken by my patients before they report the presence of a lump in the breast is six months, while in some cases it is double that time. Another factor is the treatment of carcinoma of the breast by quacks and herbalists and the like. This is a free country and patients may seek advice from anyone, but it is a pity that some sort of propaganda should not be used to reveal the real danger to which the public at large are subjected.

Early diagnosis by the practitioner has in the past been hampered by the fact that nearly every textbook on surgery reveals the late stages of the disease as diagnostic factors of importance. It must be acknowledged that there is only one early sign of carcinoma of the breast and that is the presence of a lump. This lump is in the substance of the breast, is usually hard, and can often be felt by the flat of the hand. Cancer is the commonest cause of a lump in the breast, and this must not be forgotten. The lump is closely united to, if not absolutely incorporated with, the breast substance, and on careful digital examination its

margin is quite indefinite. In the early stages it is entirely distinct from the skin, which moves freely over its surface, but as growth proceeds the stroma contracts and, by dragging on the suspensory ligaments of Cooper passing from the glandular substance to the skin, the latter structure becomes more or less fixed, and hence, on attempting to move it upon the tumour, an appearance of dimpling results.

In investigating any case of a lump in the breast the practitioner must never arrive at a hasty conclusion, but give an opinion of its nature only after careful and detailed examination. Thus, the age and previous history of the patient and the family history should be considered. Simple tumours generally arise at an earlier date than the malignant, while sarcomata usually affect younger individuals than carcinomata. There can be little doubt, moreover, about the occasional tendency of tumours to run in families. The length of time for which the swelling has been observed, and whether or not it varies in size at the menstrual periods, should be ascertained. The general appearance of the patient should be noted, and also the fact whether local or neuralgic pain is experienced. It is not unusual for pain to be referred to that part of the shoulder supplied by the posterior division of the second intercostal nerve, the anterior branch of which goes to the breast.

A careful inspection of the organ should be made with the patient sitting and lying down, comparing it with the opposite breast so that any signs of asymmetry may be noted. Dimpling of the skin, projection of the tumour or of the whole gland, and the situation and condition of the nipple are the chief points to which the practitioner's attention should be directed. Examination with the flat of the hand, accompanied by gentle pressure of the fingertips, must then be undertaken; it is not enough to pick up the breast substance between the fingers, as thereby false impressions are obtained.

The relation of the tumour to the gland, its shape, its consistency, whether fluctuating or not, its mobility on superficial, deep, and surrounding parts should be investigated. To this end the breast must also be examined with the patient's hand pressed to the hip, so as to put the fibres of the pectoralis major muscle into action; transverse movement of the organ across the fibres is always possible unless the growth is fixed to the thoracic wall; movement in the direction of the fibres is at once limited if the tumour has invaded the muscle or even if the overlying fascia is seriously involved. Finally, the lymphatic glands in the axilla, the supraclavicular glands, and the opposite breast and axilla must be carefully examined. After such a detailed examination, if the practitioner is still in doubt about the nature of a tumour of the breast, then local excision of the *whole* lump and not part of it should be undertaken and a histological examination of the tissue removed should be made. If the condition is benign, then the patient will be completely satisfied and relieved; if on the other hand the condition is malignant, adequate treatment can be forthcoming.

It is important to classify the clinical manifestations of carcinoma of the breast before any decision is made about the form of treatment. The clinical classification can be divided into the following stages:

Stage I.—Tumour of the breast only.

Stage II.—Tumour of the breast and skin changes and/or axillary glands.

Stage III.—Tumour of the breast and supraclavicular glands or glands in opposite axilla, and/or fixation of the breast to the pectoral fascia.

Stage IV.—Skeletal and visceral metastases.

Treatment

The surgeon to-day has the choice of radical surgery alone or combined with radiotherapy, local excision and radiotherapy, or radiotherapy alone. After thirty years' experience during which I have operated upon over 500 women and nine men for this condition my ideas have become definitely crystallized.

Stage I.—I am convinced that in these cases radical mastectomy is the method of choice and offers the best chance of eradicating the disease completely. However, in those cases in which the woman is slight, the breast is small, and the tumour is in the inner quadrants I perform a local excision of the breast and follow this with radiotherapy. Cancer of the breast occurring in the inner quadrants is apt to extend into the intercostal spaces without any clinical evidence whatever, and this is why the prognosis is bad in these cases. A radical amputation in a small woman with a small breast would involve extensive skin grafting of the chest wall to close the defect left behind after the amputation, and this in itself would delay any post-operative radiotherapy. It has been said that radical amputation is a mutilating operation, but so is local excision, and from the patient's point of view the psychological effect is better, for they realize that everything has been removed and are much happier.

The operative mortality from radical mastectomy is not more than 1%, and this is due to the rare case of embolism or the very occasional anaesthetic death. With careful pre-operative preparation and the use of blood transfusion in selected cases the mortality could easily be lowered. I am not in favour of post-operative x-ray therapy in Stage I cases. I employed it for some 10 years and found from my follow-up that the results did not justify its use. There can be no doubt that x-ray treatment does produce some anaemia, and some fibrosis of the lungs always follows its application. In my "follow-up" I have obtained an 81% five-year cure and a 65% ten-year cure. Of course it is quite fallacious to talk about cures in carcinoma of the breast, as I have had 12 cases in which recurrence took place 10 years after operation, the longest being that of a woman who died of recurrence 22 years after radical mastectomy.

Stage II.—These cases give poor results with surgery alone, and in my series I can record only a 25% five-year survival rate. This is distressing, as Stage II cases so often form the greater proportion of cases seen in our hospitals at the present time. It behoves us to take stock of our results and to consider in what way they can be improved. Stage II cases mean lymphatic extension beyond the confines of the breast, and, this being so, pre-operative x-ray treatment should be given to eliminate the lymphatic vessels which are loaded with cancer cells. Pre-operative irradiation means a delay in removal of the breast for some two months, but the surgeon can arrange his cases so that irradiation is given immediately after the patient is seen for the first time and the date of admission can be fixed. In quite a number of cases the primary tumour becomes smaller, also the axillary glands, and the risks of dissemination are considerably reduced. Why, then, it may be asked, should not x-ray therapy be given and no operative measures be undertaken? The answer to this question is that the results are not as good as when pre-operative x-ray therapy is followed by radical mastectomy. Post-operative irradiation should be reserved for those cases in which there is recurrence.

Stage III.—Surgery can be of little avail in these cases, as the condition is essentially inoperable. X-ray therapy is the treatment of choice. The surgeon may be asked to remove a fungating tumour so as to make the life of the patient more tolerable or as an ancillary to the x-ray therapy. It is curious to note that some of the worst cases survive the five-year period when the prognosis from the start of treatment seemed hopeless.

Stage IV.—These cases are the bane of the practitioner's life, for there is little that can be done for them. Irradiation is only palliative, but may be useful in controlling some bone metastases and giving some relief from pain. It may well be that the extended use of endocrines in Stage IV cases will prove of real value. I have been impressed with the value of testosterone in large doses (1,000 mg.) in these cases, and I consider

that it gives results comparable to those obtained by stilboestrol in cases of carcinoma of the prostate. The use of testosterone should have a much more extended trial in these advanced cases. I know of no more difficult and trying surgical case than that of advanced mammary cancer. It is useless for the practitioner or surgeon to say that nothing else can be done, for the relatives will immediately fly off to some quack, who will promise a cure with some highly coloured injection of excessive cost which must be given at a certain time each day. Such treatments go on for at least a year. When the patient dies the relatives are told that if only the patient had come for treatment a little sooner a cure would have resulted. We are all familiar with such cases and they do not do the profession any good. I therefore advise the extended use of testosterone for these patients. Human nature demands some treatment in the advanced mammary cancer case, and therefore let us as medical men and women see to it that the treatment given has a scientific basis.

Radiotherapy

The question of radium or x-ray treatment in mammary cancer is one that has interested surgeons for several years, and I am quite definite in my sole advocacy for x-ray therapy with or without surgery rather than radium therapy. My reasons are that, although radium has been used in Stage II cases with some success, the primary tumour still persists in the breast, although it may simply be composed of a mass of hard fibrous tissue. This in itself has a bad psychological effect on the patient, because she imagines that the growth still persists and that it may eventually spread. I have often been asked to excise such a mass several years after radium treatment, and I realize the peace of mind removal of the mass brings to the patient. Radium is more local in its action than x rays, and the outlying lymphatic vessels are more likely to come within the barrage of the x-ray tube than the radium needles.

It is essential to keep an eye on the patient's blood picture during the time she is undergoing x-ray therapy, and should this show a reduction in the red cells steps must be taken to bring the blood picture back to normal. As a rule a good iron tonic with a liberal amount of vitamins will effect this.

Radical Mastectomy

Although it is some 50 years since Halsted advocated his radical operation for carcinoma of the breast, this treatment is still performed to-day. Yet there are certain details that I consider worth while bringing to your notice. It is important to conserve the clavicular head of the pectoralis major muscle, as this protects the axillary vessels and prevents the skin from becoming adherent to them. I have twice seen this distressing condition in cases in which the whole of the muscle was excised. Also, in my opinion, oedema of the arm is more likely to follow, as the lymphatics are compressed by the skin crossing the axillary vessels and nerves. I have never seen or heard of a patient who developed a secondary deposit in the clavicular portion of the pectoralis major, nor do I believe that there is any lymphatic connexion between the breast and the supraclavicular glands except via the mediastinum.

In dissection of the axilla it is most important to remove all fat and glands below and to the inner side of the axillary vein. On no account should any attempt be made to remove fat from the axillary artery or brachial nerve cords, because after such a course is adopted brachial neuralgia is very likely to ensue. In my student days it was a common procedure for the surgeon to display the axillary vessels and brachial plexus and remove every particle of fat from the axilla, and a large number of these cases developed brachial neuralgia which caused much pain and misery.

The radical operation itself should be definitely planned and the patient should be in hospital several days before operation. To-day there is too great a tendency for the patient to arrive in hospital late one day and to be operated upon the next. This cannot be condemned too strongly; it leaves no time for any pre-operative examination, blood count, or x-ray picture of the chest to see if any secondary deposits have developed.

The technique that I use is as follows.

Operative Technique

Previous to operation the axilla should be shaved and the skin purified over an extensive area including the back. The patient then lies on the back with the head directed towards the opposite side and the arm raised and held to a little more than a right angle. The field of the operation is protected from the patient's face and the anaesthetist by sterile towels. The incisions employed vary with the size and position of the tumour. The primary object is to remove the growth, together with the whole gland and all its accessible lymphatic connexions; the question of being able to close the wound subsequently is of secondary importance. As a rule, sufficiently wide undercutting will allow very extensive wounds to be closed; but when this is impossible skin grafting can be adopted, and no lengthy convalescence need ensue.

In planning the incision the growth should be taken as the centre of a circle with a diameter 4 to 5 in. (10 to 12.5 cm.). It is convenient to prolong the upper and lower portions upwards towards the axilla and downwards towards the epigastrium so as to secure a straight line for the final suture (Fig. 2). The upper incision is prolonged towards the axilla, and runs up and curves down towards the insertion of the pectoralis major to the humerus.

The dissection of the axilla is started first in order to avoid an unnecessarily prolonged exposure of the chest wall. The skin flaps are undercut and retracted; a transverse incision in the fascia at the level of the insertion of the pectoralis major

FIG. 2.—Skin incision for removal of the breast in cases of carcinoma.

is made, the cephalic vein identified, and the anterior border of the latissimus dorsi exposed. The upper, lower, and lateral limits of the axillary dissection are thus identified. The costo-sternal portion of the pectoralis major is divided close to its insertion and retracted inwards (Fig. 3). The axillary fascia is incised so as to expose the axillary vein, and the dissection is then carried upwards and inwards towards the clavicle. The interval between the two parts of the pectoralis major is opened up and the costo-sternal portion retracted downwards, thus exposing the pectoralis minor muscle. By retracting the clavicular head of the pectoralis major upwards the insertion of the pectoralis minor into the coracoid process can be seen and divided close to the bone. It is important to divide the tendon of the minor pectoral muscle close to the bone, as no vessels are cut and no bleeding takes place. The two pectoral muscles are then retracted downwards and the axillary fat and lymphatics can be dissected away from the axillary vein. Care is taken to identify and preserve the nerve to the latissimus dorsi and the nerve of Bell, both of which are exposed in the posterior part of the wound. Hot saline packs are placed in the axillary wound.

The lateral flap is then undercut and the whole breast and axillary contents are drawn over towards the middle line; the dissection is carried forwards and inwards, starting from the outer border of the latissimus dorsi. The inner aspect of this muscle is cleared as well as the axillary surface of the sub-

scapularis. The subscapular nerves are identified and protected, and some branches of the subscapular vessels will need ligation. The serratus magnus can then be denuded of the overlying fascia, care being taken to secure branches of the intercostals,

FIG. 3.—Division of the pectoralis minor muscle.

and finally the attachments of the pectoral muscles to the ribs and sternum are divided from below, anterior and lateral penetrating branches of the internal mammary vessels being ligated. The midline of the sternum is thus reached, a portion of the rectus sheath being included in the dissection. The breast is then turned back to its original position and the medial skin-flap is dissected up across the middle line, the advantage of doing this step last being that the vessels have already been secured in the deep dissection. A few strokes with the scalpel then separate the fascia in the sternal midline, and the breast and axillary contents are removed (Fig. 4). Great care is taken with haemostasis, as there is considerable oozing from such a large raw area. The diathermy cautery proves an excellent coagulating point and saves much time. Through a stab-wound a drain is introduced into the axilla for 24 to 36 hours. The skin-flaps are drawn together with tension sutures and the wound is closed. In dressing the case it is advisable to place extra pads of wool in the axilla and under the clavicle so that their presence may assist in the prevention of oozing. The arm is placed close to the side for 24 hours so as to obliterate the axillary space as much as possible and prevent a haematoma forming in that situation. After this the arm should be kept at an angle of 45 degrees away from the trunk so as to allow the skin-flap to fall against the chest wall; this does not interfere with the subsequent free movement of the arm.

The after-treatment consists in making the patient perform deep-breathing exercises each day to prevent any pulmonary complications. The patient can often get up for a few hours on the third post-operative day. Early rehabilitation is important in these cases and prevents the occurrence of thrombosis and pulmonary embolism.

Mammary Carcinoma in the Male

Although cancer of the breast in the male is about a hundred times less common than in the female, every surgeon is faced with these cases. In 30 years of surgical practice I have met with it nine times, and in every case

the patient had been a keen boxer in his youth. It seems to me that trauma may play a more important part in the causation of carcinoma of the breast in the male than is usually thought. In my series of nine cases the ages ranged

FIG. 4.—The operation area after removal of the breast for carcinoma.

from 36 to 56 years: two were officers in the Navy, two were officers in Commando units in the Army, three were in the Police Force, and two were naval petty officers.

The prognosis of cancer in the male breast is very poor; the small undeveloped breast allows early lymphatic spread before the condition is diagnosed. In all my cases axillary lymphatic glands were present, and in the four cases in which I performed a radical excision the glands were infiltrated with growth. In my series of nine cases the average duration of life after operation was 30 months, all the cases dying of mediastinal metastases.

My experience of these cases has taught me that the correct treatment should be excision of the breast with the tumour, followed by x-ray treatment. But even when this has been done the prognosis is very poor in comparison with carcinoma of the breast in the female.

Results of Treatment

It must be acknowledged that in the main the results of treatment of mammary cancer are poor. The prime factor is the delay of the patient in coming for treatment, and this can be improved only by a definite line of propaganda. The Ministry of Health should take steps to improve this situation.

The second factor is inadequate treatment. I would like to associate myself with my friend Sir Stanford Cade, who has stressed so often the fact that the commonest error in treatment is to underestimate the extent of the disease and under-operate or under-irradiate.

One of the biggest problems which faces the profession to-day is the standardization of deep x-ray therapy. At the present time x-ray therapy varies in different centres and

in different hospitals. How can we compare results under these conditions? Confidence is an important factor in everyone's life, and the surgeon's confidence in the radio-therapeutic treatment is a weighty one. How can some surgeons be satisfied if they have no trust in the x-ray therapy equipment in their hospitals or centres? To my mind the standardization of good x-ray therapy establishments throughout the country is long overdue, and the lack of it is in no small way responsible for the poor results of x-ray therapy in mammary cancer.

Those hospitals that are fortunate enough to possess modern high-voltage plants get better results and give confidence to the surgeons attached to them. If a surgeon or practitioner has no confidence in his hospital x-ray therapy unit how can he be expected to advise his patients to undergo treatment? To my mind under-irradiation is often worse than no therapy at all.

Can we hope to have a better service under the National Health Service, or will the practitioner, surgeon, and patient be overwhelmed with the forms to fill in, red tape, and inefficiency which characterize the other services that have been nationalized during the last three years? It will be the duty of the medical profession to try to correct this tendency as soon as possible.

EARLY DIAGNOSIS AND TREATMENT OF CARCINOMA OF THE BREAST*

BY

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Cancer of the breast is responsible for the death of more than 7,000 women a year in England and Wales alone, and this figure is rising rather than falling. Two-thirds (67%) of the patients operated upon in this series of 170 radical mastectomies already had metastases in the axillary glands. The main reason for this state of affairs is delay, by the patient, by the general practitioner, by the consultant, and by the hospital.

To avoid the errors responsible for delay by the profession the following vital considerations should be borne in mind:

1. *The Fallibility of Clinical Diagnosis.*—However experienced we are, we cannot differentiate with certainty on clinical grounds alone between the non-malignant and the early malignant swelling. If exploration is not adopted as a guiding principle many a patient with early carcinoma will be placed upon the waiting list as suffering from a non-malignant condition, and all hope of cure may have been cast away.

2. *The Fatal Period of Observation.*—A period of observation is no longer justifiable in the treatment of the doubtful breast lesion. Exploration of the swelling is the only proper procedure if there is the slightest uncertainty.

The practice in some hospitals when a patient is suspected of carcinoma of the breast is for her name to be placed upon a general waiting list to await her turn for a vacant bed. This procedure must be wrong. By such an arrangement the "carcinoma" patient may wait a varying number of weeks while others with non-urgent, non-malignant conditions are admitted in rotation. The names of all cancer patients should be placed upon a special waiting list and arrangements should be made to admit doubtful or early cases immediately. The exploration of a swelling in the breast is an emergency operation.

*Extracts from a Hunterian Lecture delivered at the Royal College of Surgeons of England on Feb. 9, 1948.