If bacterial infection is present, this method at the moment cannot claim any great diagnostic value, but in the absence of such infection its great help in affording a diagnosis between malignant disease and gastric or intestinal ulcers, non-malignant strictures, aneurysms, non-malignant conditions of the bladder (such as stone), or non-malignant pelvic conditions in the female, is apparent. The negative evidence afforded by a normal antitryptic index is also of very great value in excluding malignant disease.

My thanks are due to Dr. Lunn and Dr. Roper, of the St. Marylebone Infirmary; Dr. Potter, of the Kensington Infirmary; and Dr. Coulson, of the St. George's (Hanover Square) Infirmary, for their kindness in giving me access to their cases.

REFERENCES.

¹ *Lancet*, April 3rd, 1909. ² *Clinical Journal*, April, 1909.

AN INVESTIGATION OF SERRATUS MAGNUS INFECTION IN CANCER OF THE BREAST.

By T. BONHÔTE HENDERSON, M.A., M.B.,

B.Ch.Oxon., F.R.C.S.Eng.,

SURGICAL REGISTRAR TO THE CANCER HOSPITAL, BROMPTON.

It has been my misfortune during a period of more than two and a half years to record the notes of 75 cases of recurrent mammary cancers. The unhappy victims have come from well-known hospitals in London and the provinces, and many of them have been operated upon by surgeons of the very highest reputation, yet recurrence has taken place quickly or slowly in a diffuse "cuirasse" or discrete nodular form. Granted that a certain number of these cases were, at the time of operation, not very advanced, it becomes evident that in some way or other the "radical" operation was not radical enough.

The observance of a number of cases which presented nodular recurrences about the lower half of the scar led me to believe that in certain instances such recurrences might be due to the almost invariable practice of leaving intact the serratus magnus muscle, perhaps already infected by outlying extensions of growth.

Whilst removal of the pectoralis major is now an accepted routine, and removal of the pectoralis minor is a debatable point, scant attention has been paid to the serratus magnus, a muscle which from its anatomical relation to the breast demands the closest investigation. Both Sir Henry Morris¹ and Handley² advocate occasional removal of portions of this muscle, not, however, with quite that emphasis which on anatomical grounds would appear imperative. So far as I am aware, no microscopical evidence has been adduced as to the infection or non-infection of this muscle in certain cases of mammary cancer, and it was to gain evidence on this point that this research was carried out.

It is an anatomical fact that normally one-third of the female breast lies on the fascia over the serratus magnus. This corresponds, in the main, to the lower and outer third of the breast, and to the digitations of the muscle arising from the fifth and sixth ribs.

It is uncommon for the lower limit of the breast to reach below the level of the sixth costal arch. The four lowest digitations of the muscle at their origin are covered only by fascia and skin, and in the female the fifth and sixth digitations are covered also directly by the normally developed breast. Above this level the breast lies almost entirely upon the pectoralis major. It is not unusual for the breast to have more extensive margins than is apparent, and to have outlying isolated portions; but it is probable that, in the very large majority of cases, no portion of the organ lies directly upon the upper serrations of the muscle. The field of inquiry was thus limited to the lower serrations, especially those directly underlying the breast—namely, those arising from the fifth and sixth ribs. The muscle is naturally divisible into three portions:

1. A muscular bundle from the first and second costal arches, which is inserted into the ventral aspect of the upper angle of the scapula.

2. A bundle from the second, third, and fourth ribs, which is inserted into the whole of the ventral aspect of the vertebral border of the scapula between the upper and lower angles.

3. A bundle from the fifth, sixth, seventh, and eighth ribs is inserted into the ventral aspect of the inferior angle.

The innervation of the muscle follows also this muscular and anatomical division, the three bundles being supplied, subject to occasional variation, by the fifth, sixth, and seventh cervical nerves respectively. I have proved to my own entire satisfaction that removal of the lowest bundle (from the fifth, sixth, seventh, and eighth ribs) does not impair the functional activity of the arm, nor the nervous supply of the upper two segments of the muscle, and it would appear that these two segments, with their extensive origin and insertion, are fully capable of carrying out the necessary scapular movements. Such removal is only a step further than the recognized routine of removal of the serratus fascia; it adds nothing to the difficulties of the operation, and takes but a minute or two to perform. The serrations can be detached from their origin, stripped back and divided close to their insertion. The lowest fasciculus of the pectoralis minor is a guide to the fifth rib.

In view of the proved fact that the pectoralis major is frequently infected by the "lymphatic permeation" of Handley long before any clinical observations of the attachment of the growth to the muscle beneath it can be demonstrated, it appeared reasonable to conclude that a similar infection might be shown to be present in another directly underlying muscle, and that, moreover, such an investigation might give some clue to the problem of recurrence. Though the results have been negative, it has seemed right to record the investigation as far as it goes, in the hope that the subject may be more fully pursued by others who also see a large number of mammary cancers.

The cases selected were all carefully picked from amongst some 150 mammary tumours successively admitted to the Cancer Hospital. These picked cases are only 8 in number, but in these 8 cases either the growth was lying directly over the serratus magnus, or the whole breast was involved, including that portion lying over this muscle. All the cases were submitted to operation, and in all the tumour was proved microscopically to be carcinoma. No inoperable case was investigated, as it was desired to exclude as far as possible any case in which the muscle might have become directly infiltrated by coarse invasion in contradistinction to lymphatic permeation; my object being to determine the condition of the muscle as regards infection while the growth was still operable.

At first cases were selected which showed no clinical evidence that the growth was tacked on to the fascia beneath it, but later, as no muscular infection could be demonstrated in these cases, others were investigated in which the growth had only a limited mobility over the serratus fascia.

My colleagues in their own cases were most kind in removing such portions of muscle as I required in the manner I wished. The method adopted was, as far as possible, to peel off the pectoralis major, serratus fascia, and lowest segment of serratus muscle in a continuous sheet. The relative position of the tumour, fascia, and muscle was then reconstructed, a selected portion hardened in the natural position of the parts, and a number of sections in series cut and examined. At this stage Dr. Alex. Paine and Dr. Kettle, of the Cancer Research Department of the hospital, afforded me most valuable help, for which I wish to express my gratitude and indebtedness to them.

In not one of the cases could any trace of cancer cells be found in a numerous series of muscle sections, although processes of cells were visible extending in the fascia right up to the muscle margin; nor was there any evidence of the irritative round-celled infiltration surrounding a cancerous lymphatic, nor any sign of a degenerated cancer plug, obliterated by a perilymphatic fibrosis.

These results are surprising, but, I believe, are destined to be reversed in the future. If there are lymphatics in the pectoralis major which communicate at an angle with those in the pectoral fascia, the same arrangement is more than likely to hold good in the case of the serratus magnus, and it will be found in the future to be a routine necessity to remove the "exposed" portion of this muscle in the

surgical treatment of those mammary cancers which overlie it. A more perfect technique will produce microscopical proof. Below is a short clinical report of the investigated cases:

CASE I.

At the extreme outer side of the left breast there is a very marked dimpling of the skin. Beneath and below this is a very hard, solid tumour with indefinite margins shading off into normal tissue, roughly the size of a plum. The nipple is not retracted, and the growth is not attached to the underlying fascia; one definitely enlarged hard axillary gland.

CASE II.

In March, 1907, a large, hard mass, the size of a Tangerine orange, had been excised from the lower and outer extremity of the left breast. In October, 1908, recurrence took place at the site of the scar in the shape of a mass, the size of a walnut, not attached to the skin or deep fascia. It lay external to the outer border of the pectoralis major. A chain of three very distinct hard enlarged axillary glands can be felt.

CASE III.

The left breast is the seat of a large, hard, prominent tumour, distorting and enlarging the organ, and occupying its whole area. The nipple is slightly depressed, and its summit is commencing to ulcerate, and there is very marked dimpling of the skin. The mass does not appear to be at all fixed to the deep fascia. Enlarged glands are present in the axilla.

CASE IV.

Beneath the left nipple and areola is a large, hard tumour of rounded outline and with well-defined margins, at least 2 in. in diameter, lying mainly towards the outer part of the breast. The nipple and areola are thickened, hard, and infiltrated by growth. The tumour is tacked on to the pectoral fascia and to the serratus fascia. One infected axillary gland is felt.

CASE V.

The right breast is much distorted by an indefinite hard sub-areolar growth, about 2 in. in diameter, which has caused deep and irregular dimpling of the skin and retraction of the nipple. The main part of the skin infection extends towards the outer edge of the breast beyond the edge of the pectoralis major. Below and external to the nipple is a small patch of cutaneous ulceration, secreting some thin serous fluid. There is very definite attachment of the tumour to the deep fascia, and one infected axillary gland can be felt.

CASE VI.

The left breast has been totally destroyed in its whole area by a large, offensive, fungating growth, 4 in. in diameter, definitely attached to the deep fascia. There is a mass of hard, enlarged axillary glands.

CASE VII.

The left breast is very large, prominent, and projected forwards by a large, very hard tumour the size and shape of a "halfpenny bun." The nipple is indrawn, and the skin of the areola is reddened, infiltrated, and fixed to the growth beneath. The tumour has a very definite edge and occupies practically the whole breast area, fully one-third of the mass lying on the serratus magnus. The growth is definitely tacked to the pectoral fascia, but this cannot be clearly demonstrated as regards the serratus fascia. Several hard, enlarged discrete glands are present in the axilla.

In this case, on examination of the specimen removed, an enlarged gland was found lying on the lower segment of the serratus magnus. I believe this gland is known to anatomists, but I have not previously identified it in the examination of a large number of breasts removed for cancer. Microscopically it was not infected by cancer cells, and no such infection could be demonstrated in the muscle underlying it.

CASE VIII.

At the outer extremity of the right breast is a hard mass the size of a goose-egg, adherent to the skin over it and causing retraction of the nipple. There is definite attachment of the tumour to the deep fascia beneath, and a mass of enlarged axillary glands.

This patient died a month after operation from pulmonary complications. At the *post-mortem* examination a piece of chest wall underlying the site of the tumour was excised for further examination. No cancer infection could be found in a large number of microscopic sections.

REFERENCES.

¹ Mitchell Banks Lecture, 1908. ² *Cancer of the Breast*.

CANCER IN NEW ZEALAND.

BY

P. W. HISLOP, M.D. EDIN.,

GERALDINE, N.Z.,

AND

P. CLENNELL FENWICK, M.D.,

HONORARY SURGEON TO CHRISTCHURCH HOSPITAL, N.Z.

ALTHOUGH New Zealand has the lowest death-rate for the world, there is a persistent increase in the percentage of deaths from cancer.

In the year 1898 the deaths from cancer per 10,000 of living persons was 6.40, the percentage of total number of deaths due to cancer being 6.50. In 1907 the deaths from cancer per 10,000 of living persons was 7.33, the percentage of total number of deaths due to cancer was 6.70.

In the latter year, out of 10,066 deaths 674 cases were due to cancer, of which 361 were males and 313 females.

To show the increase in tabular form the following tables are taken from the report of the Public Health Department.

TABLE I.—Showing for each of the Ten Years 1898 to 1907 the Number of Persons Registered as having Died from Cancer, the Proportion of Deaths from Cancer per 10,000 Living, and the Percentage of all Deaths attributed to Cancer.

Year.	Estimated Mean Population.	Deaths from Cancer.	Total Deaths, all Causes.	Deaths from Cancer per 10,000 of Living Persons.	Percentage of Total Deaths due to Cancer.
1898	736,260	471	7,244	6.40	6.50
1899	749,984	468	7,680	6.24	6.09
1900	763,594	430	7,200	5.63	5.97
1901	777,968	515	7,634	6.62	6.75
1902	797,793	536	8,375	6.72	6.40
1903	820,217	582	8,528	7.10	6.82
1904	845,022	571	8,087	6.76	7.06
1905	870,000	566	8,061	6.51	7.02
1906	895,594	623	8,339	6.96	7.47
1907	919,105	674	10,066	7.33	6.70

The deaths from cancer in New Zealand and England are compared in Table II. The increase in the numbers for the sexes together for England and New Zealand is represented in the proportions below:

TABLE II.—Deaths from Cancer in every 10,000 Persons Living.

Year.	New Zealand.	England.	Year.	New Zealand.	England.
1881	2.69	5.20	1900	5.63	8.28
1886	3.68	5.90	1905	6.51	8.85
1891	4.68	6.92	1906	6.96	9.17
1896	5.50	7.64			

The relative percentage of deaths among males and females is shown by Table III.

TABLE III.—Deaths from Cancer in every 10,000 Persons of Each Sex Living in New Zealand.

Year.	Males.	Females.	Year.	Males.	Females.
1886	3.69	3.67	1903	7.51	6.63
1890	4.72	4.79	1904	7.23	6.23
1894	6.65	5.27	1905	6.79	6.18
1898	5.77	5.98	1906	7.10	6.79
1901	6.48	6.77	1907	7.41	7.25

To quote from the Departmental report:

The mortality was higher among the males than among the females (with the exception of 1890 and 1901), which is the reverse of English experience, where the rate was 7.94 per 10,000