

the morning temperature. The patient does not show any tendency for the worse but rather a slow, gradual improvement, with indications of greater nerve involvement. Patient has held weight.

(To be continued.)

## SKELETAL CANCER.

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THE subject of skeletal cancer or bone metastases following operations, particularly for breast cancer, assumes a place of importance when we are considering prognosis and the limit of time to be set on what may be called a cure after radical operation.

The discovery of two late recurrences or metastatic growths in patients operated on for breast cancer, the one in the skull seven years after operation, and the second in the vertebral column nine years after radical operation, has led the author to try to set down in as brief and concise a way as possible the essential facts in regard to skeletal metastatic growths.

Such instances as the above make one skeptical in putting one's faith in any time-limit of cure and very guarded in one's own mind in making a prognosis, even after the most thorough and radical operative procedure.

The literature contains no extensive, thorough or detailed paper on this subject, probably because of its comparative rarity and the fact that many cases are discovered only at the autopsy table.

Von Recklinghausen in 1891 made the first careful study of skeletal carcinoma. This was done in the course of studies on cancer of the prostate. He was surprised at the frequency of bone metastases in prostatic malignancy. Since Von Recklinghausen, Handley is the only author who has published anything of distinct value on the subject. He devotes an entire chapter to bone metastases and theories of invasion in his most excellent book on "Breast Cancer and Its Operative Treatment."

*Route of Metastatic Spread.* There are two distinct theories in regard to the mode of invasion. The older and more common one being that of emboli in the blood stream. The second, that of centrifugal extension via the lymphatic plexus of the fascia. Handley sets this forth so convincingly that reference will be often made to his excellent exposition of the subject in discussing this question.

I think, however, that Handley's theory explains satisfactorily bone metastases from breast cancer only and that it may or may not apply to cancer metastasizing to other organs or from other organs.

Handley's theory, while accounting satisfactorily for bone metastases in the humerus and

femur is hardly convincing when applied to the lung, brain and possibly vertebrae and liver. In these we must give credit to the embolic theory.

His belief, however, asserts that metastases to the liver are via the lymphatic plexus of the abdominal wall down to and by way of the suspensory ligament of the liver to the liver substance itself.

To quote from Handley: "There is one fact with reference to secondary growths of the femur and humerus which seems at first sight strongly to suggest their origin from emboli carried along the blood vessels. Bone deposits in an early stage involve the upper third of the femur, but the lower half of the humerus. They then occur mostly in that district of the bone towards which the nutrient artery of the shaft is directed. More closely examined, this contention loses much of its force. The seat of election for cancer of the femur is the great trochanter; of the humerus it is at the deltoid insertion. One would rather imagine, if the process were embolic, that the seat of election in the femur should be in the neck near the epiphyseal line, and not at a point distinctly lower down. Again in the humerus, when the nutrient artery enters below the mid-point of the bone, the line at which fracture is most often found—the deltoid insertion—lies above the nutrient foramen and not below it, as would be required in the embolic theory.

"If bone deposits are disseminated by the blood stream it seems reasonable to argue that cases in which they occur should show pulmonary metastases with especial frequency. As a matter of fact deposits in the lungs were only present in 4% of 37 cases showing extensive bone deposits, while pulmonary metastases are recorded in 26% of an entire series of 329 cases.

"The weightiest argument against blood infection as a cause of bone deposits lies in the entire escape from metastases of the tibia, fibula, radius, ulna and bones of the hands and feet. These bones are just as liable to embolism as the femur or humerus, probably more so, on account of their greater nearness to the periphery of the circulation, and yet metastases in them are of the rarest occurrence."

Observation has proved that the growth does not spread primarily along the skeleton by continuity and does seem to indicate that the extension is by way of the fascial planes through the delicate network of lymphatics which are known even to accompany blood vessels.

When we consider the process of invasion of the humerus and femur, granted they are invaded via the lymphatic plexus of the deep fascia, the first attack should be directed on that point at which the bone lies nearest to the deep fascial lymphatics, and therefore on that point at which the bone comes nearest to the cutaneous surface. Moreover, in the case where a bone is provided with two or more subcutaneous areas, the seat of first attack, according to the

view of centrifugal spread, must be that area nearest the trunk. Thus the point of invasion on the femur should be, and in point of fact is, the base of the great trochanter and the adjoining part of the linea aspera. The point of invasion of the humerus should be, and actually is, relatively much lower down, at the deltoid insertion, since the whole of the upper half of the humerus is well clothed with muscles.

Centrifugal extension, therefore, explains in the humerus and femur the peculiar seats of metastases better than embolic infection via the blood stream.

Bones distal to the elbow and knee escape simply because the patient dies, almost invariably, before the growth has spread along the deep fascia far enough to reach them.

*Regions Affected.* A fact of particular interest is that bone metastases rarely ever occur in areas not commonly invaded by subcutaneous nodules. These occur in all areas of the body proximal to the elbows and knee joints.

In relation to this phase of the subject the following table is of interest:—

	Bone.	No. Cases	Per-centage
Bones lying wholly or partly within the area liable to subcutaneous invasion.	Sternum .....	30	9
	Ribs .....	28	8
	Clavicle .....	5	1.5
	Spine .....	12	3.6
	Cranial bones....	9	2.7
	Scapula* .....	1	.3
	Femur .....	14	4.2
	Os inominatum..	0	0
Bones lying below the area liable to subcutaneous nodules.	Humerus .....	9	2.7
	Radius .....	0	0
	Ulna .....	0	0
	Tibia .....	1†	.3
	Fibula .....	0	0
	Patella .....	1†	.3
	Bones of hand... 1	1	.3
Bones of foot....	0	0	

From 1872-1901 at the Middlesex Hospital there were 329 autopsies on cases of mammary cancer. Excluding cases where the only bones to which cancer had extended were the sternum and ribs, there were 37 cases in which the bones were the seat of secondary deposits or spontaneous fracture. When the cases of sternum and rib involvement are included, there were 73 cases, or a percentage of bone involvement of 4.5.

In general, autopsy records give reliable information only in regard to frequency of metastases in those bones which are subject to spontaneous fracture, with the exception of the vertebral column. Other bones are rarely examined as a routine. Hence statistics of recurrence may show too low a percentage. For this reason it is probable that the escape of the scapula and pelvic bones is almost certainly apparent only. The absence of records of spontaneous fracture in the distal bones shows that the escape from

\* This bone is seldom the seat of spontaneous fracture and is, therefore, overlooked at autopsy.

† This was a rare case in which there was ankylosis of the knee and continuous extension of the process downward from the femur.

cancerous invasion is real and not merely apparent.

*Bones Most Commonly Affected.* The liability of a bone to cancerous metastases increases with its proximity to the site of primary growth; thus the sternum and ribs are affected in about the same number of cases and more frequently than any of the other bones. The spine, femur, humerus, and cranial bones come next, the clavicle forming an exception to the general rule. Bones distal to the knee and elbow escape invasion except in the rarest instances. Halstead had no cases of involvement below the knee in his large series.

In the femur the deposit is usually present in the upper third of the bone, most often a little below the base of the great trochanter. Thus the point of election for spontaneous fracture in breast cancer does not coincide with the usual position of senile fracture of the femur, which is across the neck, nor with the point of the entry of the nutrient artery. There is strong clinical evidence that the great trochanter is the point of first invasion. Of eight cases showing unilateral fracture of the femur, the fracture was on the same side as the primary growth in six cases, and on the opposite side in only two cases. In 329 autopsied cases there were found 6 in which one or both humeri were the seat of deposits. In five of these cases attention was directed to the bone by the presence of fracture. The deltoid insertion was the site most often involved; the process extending upward and downward from this point by the medullary canal.

The infection may occur months or years after the removal of the primary growth, as instanced in the first part of this paper.

The character of the secondary tumor always corresponds to that of the primary growth. The bone lesion is never primary.

*Histo-Pathology.* Carcinomatous infiltration of bone causes diffuse lacunar absorption, rendering the bone soft and easily bent or broken. There may also be present at the seat of infiltration a tendency to the development of new bone tissue. This condition has been described as osteopathic carcinosis. The invasion of the marrow, in other words, leads to a low grade osteoporosis, called by Von Recklinghausen "osteomalacia carcinomatosa," which practically never penetrates or extends into soft parts or joints. There is gradual softening and thinning of bone, but rarely an osseous tumor large enough to be detected clinically. Tumors are more often found in the skull than elsewhere. Skeletal deformities other than local changes are rare. Unlike sarcoma, it is not the tumor which first calls attention to the disease. Spontaneous fractures are not as common as might be expected.

The radiographic literature on this subject is meagre. There appears no systematic report on these cases, there being only scattered mention of individual cases.

Pfahler reports a marked absorption of lime salts, that the areas are more sharply defined

than in syphilis, osteomyelitis or tuberculosis, but more irregular in outline than bone cysts. There is no marked periostitis.

Union after fracture has been reported in 2 cases.

The most remarkable feature of multiple metastases is that they have been known to undergo spontaneous involution.

*Frequency.* Kaufmann finds that bone cancer is most common after cancer of the breast, thyroid and prostate. The occurrence in prostatic cases being about 16%. Cabot believes that the frequency may even be greater than this.

In cases of elderly men with unexplained pain in the back or legs the prostate should be examined for malignancy. Cabot (in a personal interview) mentions several instances of this kind. The bone involvement in malignant disease of the prostate is early and must be reckoned with in estimating the chances of cure, even if the neoplasm is entirely extirpated.

Fischer-Defag found metastases in the spine or femur in 25% of post mortems on cases of cancer of the prostate in the Dresden Hospital.

After breast amputation metastases in the spine are quite common, especially when the disease is the atrophic scirrhus type.

Kaufmann's figures are interesting. In 138 cases he found the lumbar vertebrae involved in 27, the dorsal in 19, femur in 23, ilium 4, ribs 19, sternum 12, and skull in 11. It is not uncommon for more than one bone to be involved, sometimes as many as six or seven.

Leutinger's cases showed 14.5% in the spine, 7.6% in the extremities and 2% in the skull. More modern statistics show as high as 25% in the vertebrae, 20% in the femur and 18% in the ribs. Blumer found 90% of thyroid metastases in women. A peculiarity of this form of the disease being that the thyroid resembled the ordinary goitre without exophthalmus and in no way suggested malignancy. No obvious thyroid enlargement is found in at least 25% of the cases; 38% of thyroid metastases occur in bones of the face and cranium, 10% in the vertebrae, 10% in the femur, 9% in the pelvic bones, 7% in the sternum and 5% in the humerus. Of course all these figures are relative but tend to give, by their practical uniformity, a very good general idea of the relative frequency of these metastases in different regions.

Blumer, analyzing 45 cases, found spontaneous fracture in 24% and spinal symptoms in 13%. Blumer also, contrary to Handley's rule, found as many as 1.4% in the hand and foot. An analysis of his cases reported fails, however, to discover the case histories of any in which such metastases occurred. We know that such metastases are very rare. Paget found no such metastases in 650 cases. Osler reports 1 case of fusiform metastases in the right thumb, followed shortly by involvement of the right clavicle and then the left tibia and ankle. But this was one of the unusual cases of widespread generaliza-

tion mentioned in their report by Brunon and Firbut.

*Symptomatology.* There may be none. The only characteristic symptom of this disease is pain, generally rather continuous, very severe, generally described and diagnosed as, or mistaken for, myalgia, lumbago, sciatica or rheumatism. Local tenderness over the site of the growth may be present, but is the exception rather than the rule. Spinal paralyses are rare, considering the frequency of involvement of the vertebrae; this is probably so because the disease attacks the bodies first. Skeletal cancer may offer the first evidence of primary neoplasm elsewhere, many cases of cancer of the breast and prostate not being discovered till x-ray shows tumor formation when submitted for diagnosis of a spontaneous fracture. This is well illustrated by one of Wharton's cases. A woman while walking in her room felt her left leg give way under her. Examination showed fracture and tumor of the middle third of the left femur and unsuspected and inoperable cancer of the left breast. Cases of this kind could be multiplied many times.

Wharton cites one case of metastases in the left clavicle 5 months after removal of the left breast. The clavicle was fractured while the patient was turning in bed. A marked tumor developed at the site of fracture before death, which occurred two months later. Also another case in which both femora were fractured while in bed six months after removal of the breast. This patient also later developed a tumor in the right humerus and one in the left parietal bone. Multiple tumors are, however, rare, as the patient more generally succumbs to the ravages of the disease before many metastases have developed. Cabot instances many cases where unexplained pain in the back was cleared up by rectal examination showing malignancy of the prostate. Brackett, seeing many cases of obscure back pain, often finds malignancy primary in the breast or prostate. Bony involvement, where there is tumor formation or acute localizing pain, may be mistaken for aneurysm, especially when it is located in the sternum or cranium. In the latter situation there may be signs of cerebral compression demanding surgical relief.

The relative obscurity of the spinal type demands further analysis. Spontaneous fracture and well marked kyphos may be present. Certain of these cases before fracture have the excruciating pain characteristic of nerve root pressure and are the most distressing of all types. This may later develop into a paraplegia, called by Cruveilhier years ago "para plegia dolorosa." The dorso-lumbar region is the part most commonly affected. The lesion may be high up in the cervical region and a quadruplegia result. There may be herpes zoster at some stage of the process. During the neuralgic stage these unfortunate patients are often treated as neurasthenics. There have been instances in which the onset, instead of being gradual and suggesting

compression of the cord, is very sudden and is like an acute myelitis of degeneration or infectious origin. The most expert neurologists have been led astray by these acute cases. In the chronic cases a visible tumor or spinal deformity is the exception rather than the rule. Osler reports a case of recovery after a complete paraplegia. This is extremely rare.

*Summary.* A review of the foregoing facts reveals the following facts of importance in regard to metastatic bone cancer:—

1. Metastasis takes place probably by centrifugal spread along the lymphatic plexus of the deep fascia in most cases.

2. Bone metastases occur almost entirely in the areas of the body subject also to skin nodule metastases, *i.e.* everywhere proximal to the elbow and knee joints. Bones distal to these joints are very rarely involved.

3. Metastases are more common after cancer of the breast than any other organ. The prostate and thyroid being the next most common. (Hypernephroma of the kidney is not considered in this series.)

4. The liability of a bone to cancerous invasion increases with its proximity to the site of the primary focus. Thus the sternum and ribs are affected about equally and more frequently than any other bones. The spine, femur, humerus, pelvic and cranial bones come next.

5. The character of the secondary lesion always corresponds to that of the primary growth.

6. The frequency after cancer of the prostate may be as high as 25%.

7. The vertebrae are the favorite seats of attack in scirrhus of the breast.

8. The percentage of vertebral metastases is nearly 25%.

9. Spontaneous fracture is present in about 24%.

10. Pain is the only characteristic symptom.

11. Visible or palpable tumor is rare, while spontaneous fracture is quite common.

12. We may set down the following points as diagnostic aids: Any fracture of a long bone occurring as a result of trivial injury should immediately suggest the possibility of bone metastases and lead to careful search for the primary new growth. In all cases of painful paraplegia a neoplasm should be suspected.

A diagnosis of primary bone tumors should never be made without very careful examination of the abdomen, mammary glands, prostate, and thyroid for malignancy. It is rare that careful search will fail to reveal the primary focus.

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## CORSETS, PTOSIS, AND SACRO-ILIAC STRAIN.

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IN the issue of the JOURNAL for Jan. 2, 1913 (Vol. clxviii, p. 12), I published a brief paper<sup>1</sup> on "The Rôle of Ptosis in Gynecology." Much has been written, both before and since that time, on this most important topic. Of particular value is the recent work of Kellogg<sup>2</sup> and Williams.<sup>3</sup> Yet despite the contributions of many authors, the subject remains in large part neglected or not understood. Unrecognized or untreated ptosis is still the commonest cause of gynecologic failure.

The following observations represent the conclusions of my experience in the gynecologic clinic of the Boston City Hospital, and in private practise. If they seem too strongly stated, it is not because I am engaged in special pleading, but because I have been impressed with the frequency of improper corseting and consequent ptosis in women of all classes, and convinced of the importance to both practitioner and patient of recognizing and correcting this condition whenever it occurs. As vigorous an educational movement is needed among physicians and among the public on the subject of ptosis as on that of uterine carcinoma from neglected cervical laceration. The latter may cause death, but the former may cause lifelong discomfort and disability.

A majority of women, from various causes, suffer from ptosis of one or more of the abdominal viscera. Such ptosis may complicate and aggravate various pelvic diseases, or may simulate them with a variety of symptoms. As most such female abdominal ailments are referred to the pelvis, such cases usually come to the gynecologist, who may err lamentably in his diagnosis and treatment, if he is not alert to detect ptosis in its various forms. Many a patient has been treated in vain for supposed pelvic disease when ptosis was her sole ailment, and many another has failed of the full benefit from effective treatment of her pelvic condition when her coexistent ptosis has been unrecognized and untreated. Hence the subject of ptosis is of vast importance not only to the success of the practitioner but to the welfare of his patients.

Men do not often have ptosis. The principal causes of the preponderating occurrence of