celebrating the life and works of one of the greatest men who ever lived. If you accept as a standard of greatness the contribution he made as a benefactor of his fellow man, then Lord Lister is the greatest of all. His studies made possible all the advances of modern surgery and the extension of its beneficent effect to millions and millions of people. But in order that his great discoveries and the advances that have been based on them may be available to all the people we must train more surgeons and we must provide them with the means of carrying out their work. This calls for a degree of co-operation between the public and organized medicine that does not yet exist, and it calls for the support and guidance of this Association.

Some may doubt the possibility of creating the Utopia I have described. When one recalls, however, the success with which it was done in our armies where by efficient organization and by an adequate supply of consultants and of well trained young surgeons our soldiers were given a quality of surgical care never before thought possible, then there is no reason in the world why we cannot do the same thing in civilian life. With careful planning and with the use of radio, the aeroplane and the judicious placing of our medical centres I can see the benefits of modern surgery being carried not only to our towns and to our rural settlements but also to the farthest outposts of our country, where many of the best of our young people live and are doing the things that make our country great.

Medical Arts Building.

POST-TRAUMATIC GRANULOMA OF THE BONY ORBIT SIMULATING TUMOUR*

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TWO almost identical cases of cyst-like, expanding lesions of the bony orbit causing proptosis are presented. Each was originally thought to be a metastatic, malignant tumour, but postoperatively, on pathological examination, was found to be a chronic granuloma. To show that the lesion is not peculiar to the bony orbit, these cases are augmented by a case of a similar lesion in a rib. A study of both textbooks and literature brings to light only two references which bear any resemblance to this condition in the skull.[1, 2] W. E. Dandy,[3] in his textbook, lists orbital tumours as follows:

Character of tumour	*No.*	*%*
Inflammatory mass	1	3.2
Pure fibroma	1	3.2
Pure osteoma	2	6.5
Osteomatous cyst	1	3.2
Spindle-cell sarcoma	1	3.2
Round-cell sarcoma	1	3.2
Schüller-Christian's disease (probable)	5	16.2
Dural meningiomas of nerve sheath (bilateral)	1	3.2
Dural tumours without hyperostosis of skull (by x-ray)	2	6.5
Sarcoma with tremendous hyperostosis of skull	1	3.2
Dural meningioma with hyperostosis of skull	9	29.1
Periosteal sarcoma	1	3.2
Carcinoma	1	3.2
Glioma	4	12.9

It will be noticed that post-traumatic granuloma is conspicuous by its absence.

CASE 1

This was a 57-year old white labourer. In 1919 he had been struck by a flying spike over the right supra-orbital margin; this resulted in a painless, permanent, slight swelling posterior to the lateral third of the right eyebrow. On November 5, 1943, he was admitted to the Montreal General Hospital having been struck by an automobile. In addition to minor injuries, the right supraorbital region had struck the pavement, causing a swelling involving the right orbit and the superior orbital margin; this was compressible at certain points and crepitus was obtained on pressure over the superior orbital margin. There was proptosis of the right eye with upward limitation of movement. Since the fundi and fields of vision were normal, and there was no pulsation or bruit heard over the orbital area, the proptosis was attributed to dislocation of the eyeball due to an extra- and intra-orbital tumour. Family and personal history, further physical examination, urinalysis, and blood Wassermann were negative. X-rays showed a comminuted fracture of the lateral and superior margin of the right orbital fossa with some lateral displacement of the fragments.

On November 24, a biopsy was made on tissue removed through an opening in the right outer frontal plate; the material was soft, cellular, and brownish-pink (see pathology report below). The tumour seemed to extend outside the orbit* and complete removal would have required a very radical attack. At the patient's request, he was discharged on December 3, to be followed in the Neurological Out-patient Department.

He went back to work and felt perfectly well until about June 10, 1944, when the tumour mass began to increase rapidly in size, and he experienced dizziness on bending over or on moving his head from side to side. On July 19, he was admitted to the Montreal Neurological Institute. Physical examination revealed a firm, irregular, reddish, swelling in the right frontal region above and lateral to the right orbit and encroaching on

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* According to Dandy: "Byers (1901) and Hudson (1912) demonstrated by post mortem studies that 75 to 80% of all orbital tumours had intracranial extensions which subsequently caused death".

it (Figs. 1 and 2). This mass seemed to be fixed and continuous with the right frontal bone, and its anterior pole was soft. Ophthalmological examination showed the following: Vision: right = 6/20, left = 6/30; cycloplegic refraction, right + 2.00 sp. = 6/8, left + 3.00 sp. = 6/6;, there was marked proptosis (exophthalmometer readings, right = 19 mm., left = 12 mm.); left hyperphoria of 5 prism diopters; he complained of diplopia but none was demonstrable at the time of examination; the fundi were normal except for some light pigment changes near the right macula; the eye itself was not considered to be involved. X-ray report; "the appearance is that of a long continued expanding lesion in the neighbourhood of the right orbit; a mucocele is the most probable diagnosis" (Figs. 3 and 4).

On July 28, 1944, Dr. Wilder Penfield performed a right supraorbital craniotomy and removed the orbital tumour. The tumour was approximately 3 cm. in diameter; it occupied the lateral 2/3rds of the right supraorbital ridge, the zygomatic process of the right frontal bone, and was pushing the eyeball downward and medially. The tumour was partly cystic, and these

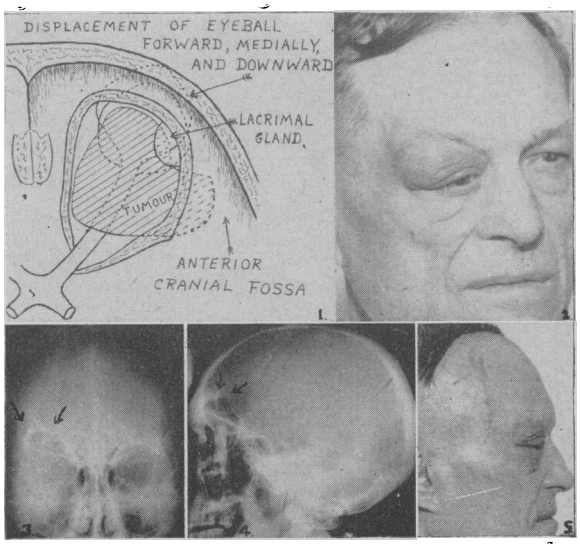

Fig. 1. (Case 1).—Superior aspect of right orbit redrawn by Dr. Laws from Dr. Penfield's operative sketch. **Fig. 2.** (Case 1).—Preoperatively. (Right eye). **Figs. 3 and 4.** (Case 1).—Antero-posterior and lateral views of expanding lesion. **Fig. 5.** (Case 1).—Postoperatively.

cysts contained yellowish, glistening, gelatinous material. It had caused rather marked thinning of the plates of the expanded bone. It consisted of soft, brownish material which was relatively avascular and which presented a fairly well-demarcated frontier. It was densely adherent to the lachrymal gland.

The postoperative course was uneventful (Fig. 5). This patient has not returned to the clinic despite several follow-up attempts to get him there, but as of August, 1947, three years after operation, he is known to be living and to be without any symptoms of recurrence.

Pathological report.—Biopsy of November 24, 1943. The sections consist of fragments of three types of tissue. One small fragment is composed of a periosteal type of fibrous tissue on one margin of which is incorporated a small fragment of "young" bone. Another small fragment consists of shattered, calcified bone with the periosteum attached in places. The periosteum is actively cellular; the bone fragment is in part compact and in part trabeculated. The third and largest fragment consists of a mass of cellular connective tissue in which there is a good deal of blood pigment and innumerable, clear, elliptical slits representing dissolved-out crystals. About these slits is a well-marked foreign-body multinucleated giant cell formation. Incorporated in the denser connective tissue at the periphery are some small fragments of bone. Scattered throughout are small numbers of lymphocytes in the connective tissue. The appearance is that of a chronic granuloma due to crystalline foreign material which, in the presence of the abundance of blood pigment, could be interpreted as organization of an old hæmatoma (see Fig. 10).

Examination of sections of tissue removed at the Montreal Neurological Institute on July 28, 1944, shows tissue similar to that described in the granulomatous areas of the M.G.H. sections above; in addition there is, at its periphery, well-vascularized granulation tissue with fresh hæmorrhage and quite heavy infiltration with lymphocytes and a few polymorphonuclear leucocytes. In certain places in the granulation tissue there are many foam cells. In some fields, this granulation tissue merges with the foreign body type of granuloma, which consists of innumerable, closely-arranged elliptical slits separated by cellular, well-vascularized connective tissue which contains a little collagen, moderate numbers of foregn-body giant cells, and is infiltrated with lymphocytes and a few polymorphonuclear leucocytes. Comparing this M.N.I. section with the M.G.H. biopsy, taken six months previously, there is a more recent inflammatory reaction with active granulation tissue formation, less fibrous tissue, and more recent foreign-body granuloma. In this tissue there is hæmosiderin pigment and a good deal of fresh hæmorrhage; the latter may have been consequent to the operation (see Fig. 11).

Pathological diagnosis: post-traumatic granuloma in bone.

CASE 2

A white, 44-year old chauffeur, was struck over the left eye with a baseball bat without loss of consciousness in 1912. Following some temporary swelling, he had no apparent complaints. In 1934, he was held up by a thug who struck him on the left temporal region near the orbital margin with a "knuckle-duster". He lost consciousness for "a few seconds", and again there were no apparent, permanent sequelæ.

During the summer of 1946, he began to notice swelling and protrusion of the left eye, which would take place after driving or after seeing a movie. He complained of double vision on looking upwards, or upwards and outwards. This condition became progressively worse and during January, 1947, the left eye became permanently and progressively protruded.

On admission to the Montreal General Hospital on February 10, 1947, there was a palpable swelling in the upper outer corner of the left orbit which visibly displaced the eye downward (see Fig. 6); there was marked proptosis (exophthalmometer readings; right eye = 17.0 mm.; left eye = 23½ mm.) with almost absent upward rotation of the left eye. There was venous engorgement in the left fundus, but the fields of vision were essentially normal. No pulsation or bruit was heard over the orbital area; vision right = 6/9, left = 6/12. Apart from this, personal and family history, general physical examination, and laboratory tests including blood and cerebro-spinal fluid serology were essentially negative. Detailed x-rays, including a pneumogram, showed a concentric, expanding lesion with rarefication of the left frontal bone. It extended from the frontal sinus on its medial aspect, along the outer, superior orbital margin to the zygomatico-frontal suture, and backwards in the temporal bone involving the greater wing of the sphenoid (see Figs. 7 and 8). An electroencephalogram showed some slow wave activity in the left antero-lateral frontal region. Several pathological diagnoses were considered, among them cholesteatoma, Schüller-Christian's disease,[4] mucocele, hæmangioma of the left frontal sinus,[5] or some other neoplasm (see above table from Dandy).

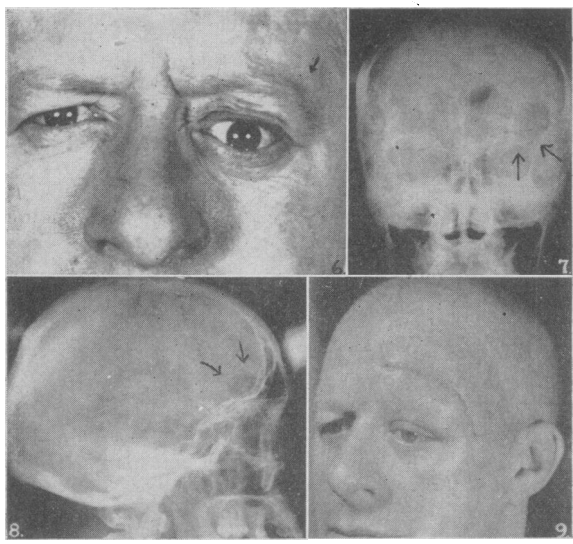

Fig. 6. (Case 2).—Preoperatively. **Figs. 7 and 8.** (Case 2).—X-ray views of lesion. **Fig. 9.** (Case 2).—Postoperatively.

On February 27, a craniotomy was performed, by Dr. Harold Elliott, through a transverse incision along the superior margin of the orbit. The surface of the frontal bone, from the supraorbital notch laterally into the temporal fossa, was bluish in colour and "eggshell" in thickness. The tumour had eroded through the bone into the temporal fossa, and brownish, amorphous-looking material escaped on breaking through the eggshell-like outer plate. The immediate frozen-section report was: "foreign-body reaction to a crystalline substance and blood pigments without evidence of neoplasm". All the affected bone (the floor of the anterior fossa, the superior orbital plate, the orbital margin including the fronto-zygomatic process, and part of the temporal bone) was removed. The upper orbital fascia was also removed leaving the dura mater under the left frontal pole exposed to the orbital fat. The dead space was filled with fibrin foam and the wound closed (see Fig. 9).

The postoperative course was uneventful, and on March 8, he was discharged. At this time he noticed improvement in his diplopia. On April 14, he was readmitted for tantalum cranioplasty of the left fronto-orbital defect. Since then, he has had no subjective symptoms, and the mild ptosis following the first operation has disappeared.

Ophthalmological examination August 5, 1947: No diplopia. Esophoria 8Δ. Right hyperphoria 4Δ. Vision, right = 6/6–; with correction = 6/6; left = 6/6–; with correction = 6/6. No exophthalmos; complete comfort. He has returned to his job and to his usual normal activity.

Pathological report.—Specimens obtained at time of operation February 27. One group of sections consists of irregular masses of disintegrating blood clot, the majority of the red cells of which are laked. Throughout this clot, there are large numbers of elliptical crystal clefts together with numerous yellow-brown crystals, rhombic in shape, and a smaller number of fine, brown, pigment granules. Relatively few leucocytes are entangled in the clot, together with a few larger, rounded cells with small, central, pyknotic nuclei, and eosinophilic, sometimes-vacuolated cytoplasm. These resemble macrophages. Some such cells contain finely-granular, brown pigment within the cytoplasm. Included with the clot is a minute fragment of disintegrating, dead bone and an attached mass of dense fibrous tissue. There are several fragments of dense fibrous connective tissue in which there are elliptical crystal clefts, surrounded by a granulomatous reaction. This consists of fibroblasts, lymphocytes, and eosinophilic macrophages; some of the latter contain fine, granular, greenish-brown pigment. Similar pigment is seen in clusters of macrophages throughout the fibrous tissue, together with a light scattering of lymphocytes and an occasional polymorphonuclear (see Figs. 12 and 13). In unstained frozen sections, bright red crystalline material was seen. This is not evident in the paraffin section. These are probably some form of iron.

A second group of sections consists of a mass of moderately cellular and fibrous connective tissue, throughout which there are innumerable, elliptical clefts with pointed ends. Many of these spaces are lined and surrounded by enormous numbers of foreign-body-multinucleated giant cells. In some areas there are foci of swollen macrophages many of which contain finely granular greenish-brown pigment which is also abundantly scattered throughout the

tissue. In addition there is an abundance of yellowish-brown round and oval pigment granules.

A third group of sections consists of an elongated strip of moderately cellular, and in part hyaline, connective tissue, in which there is a light scattering of lymphocytes, polymorphonuclears, and macrophages, with, at a few points, elliptical clefts bordered by foreign-body giant cells. Pigment, as described above, is also present. Along one margin and enclosed within the fibrous tissue are several narrow strips of bone which are atrophic and disintegrating. Along the surfaces there is blood clot. In frozen sections stained by Scharlach-R, abundant lipoid droplets are present within large numbers of

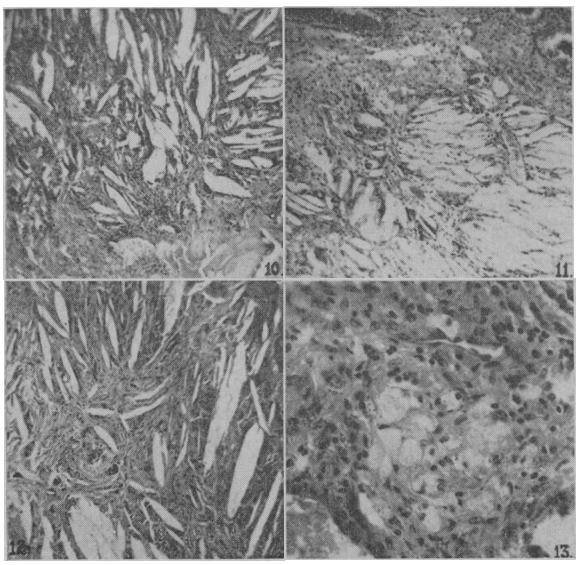

Fig. 10. (Case 1).—Shows the mass of granulation tissue with many clear elliptical slits about which there are foreign body multinucleated giant cells. At the lower margin of the section is a fragment of bone embedded in fibrous tissue. **Fig. 11.** (Case 1).—Shows chronic granulation tissue with innumerable elliptical slits and foreign body giant cells. Along the upper margin of the section is a considerable area of foam cells. **Fig. 12.** (Case 2).—Shows well organized fibrous tissue in which are many elliptical clear slits and a few multinucleated giant cells. **Fig. 13.** (Case 2).—Shows chronic granulomatous tissue with many foam cells.

macrophages. In addition some of the rhombic crystals retain the Scharlach-R.

There is no histological evidence of malignancy in these sections, nor of neoplasia for that matter. The lesion is a granulomatous one, with marked foreign-body giant cell reaction, fibrosis, and minimal inflammatory cellular exudate about lipoid crystals. Pigments of several types are also present; these are probably of hæmoglobin origin. In view of the abundance of hæmatogenous pigment, and the type of reaction, we are inclined to view this as a traumatic lesion, following the formation of a hæmatoma at some remote period.

Pathological diagnosis: post-traumatic chronic granuloma in bone.

CASE 3

This third case is presented because it shows an identical type of lesion in a rib. Although it might appear to spoil the continuity of the presentation, it is included since it adds to the understanding of this type of tissue reaction.

A white 53-year old male suffered multiple injuries in an automobile accident in 1916. He injured the left side of the chest but he was told that "no bones were broken". In 1918 he suffered war wounds involving the head, legs, and left elbow, but does not recall rib injuries at that time. On May 3, 1939, he fell down three flights of stairs and was admitted the same day to the Montreal General Hospital with pain in the left side of the chest suggesting a rib fracture. X-ray films showed a fracture line through an area of "cystic change" in the left tenth rib, and the possibility of a metastatic tumour was suggested. On May 20, an excision of part of the left tenth rib, from the midaxillary line to a point 2" from its neck, was carried out. An expanded portion of rib near its angle was found, and the periosteum was especially adherent in this region. This included the "cyst" as well as the recent fracture.

His personal history, family history, general physical examination, and laboratory tests including the blood Wassermann were non-contributory.

His subsequent clinical course was uneventful.

Pathological report.—A longitudinal section consists of 3½ cm. of rib. At one end, the diameter is that of a normal rib; the cortex on either side is intact and of normal thickness; the whole of the marrow cavity with the exception of a little bit of subcortical, trabeculated bone on one side is replaced by a granulomatous tissue. This consists of cellular fibrous tissue in which are incorporated many fat cells and some small cysts. Throughout, there is considerable lymphocytic infiltration and some minute fragments of preformed bone. Beneath the cortex of one side there is a broad band composed of large foam cells with small nuclei. The whole granulomatous area is permeated with thin-walled blood vessels. About the centre of the marrow space is a small focus of new bone formation (see Figs. 14 to 17).

As the section is traced along, the cortex becomes thin and the rib expanded. At one point the cortex is fractured and one fragment is depressed into the underlying granulation tissue. The central part of this area is composed of masses of homogeneous, eosinophilic, coagulum, in which may be seen many poorly-preserved, red blood cells and many elliptical slits repre-

senting dissolved-out crystals. Surrounding these areas there is fibrosing granulation tissue showing variable infiltration by lymphocytes and plasma cells, great numbers of foam cells, and many elliptical crystal slits, about which foreign-body giant cells are numerous. At several points there is new bone formation and some areas of recent hæmorrhage. In places the cortex shows lacunar absorption with widening of the Haversian canals filled with a loose vascular connective tissue. The overlying periosteum, where intact, is thickened and is quite cellular in its deeper part.

Pathological diagnosis: post-traumatic chronic granuloma in rib.

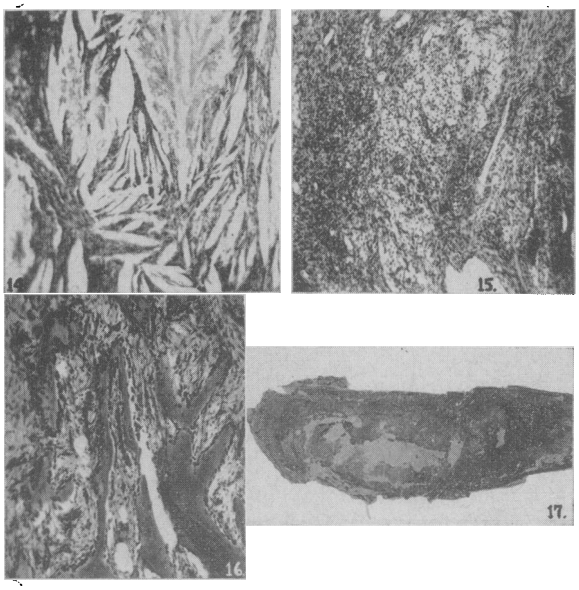

Fig. 14. (Case 3).—Shows chronic granulomatous tissue about elliptical slits, and in which there is fibrous tissue formation. **Fig. 15.** (Case 3).—Chronic (Case 3).—New bone formation at the margin of the granuloma. **Fig. 17.** (Case 3).—Longitudinal section of rib showing the expanding granuloma.

DISCUSSION

Radiologically, this condition can simulate any osteolytic lesion involving the frontal bone adjacent to the frontal sinus. Such possibilities are solitary myeloma, metastatic carcinoma, primary osteogenic tumours, mucocele from the frontal sinus, other chronic granulomas, and traumatic bone rarefactions.[1, 2]

The primary osteogenic tumours are rare in this age period and also infrequent in the skull. If we exclude these and the other above malignant conditions, we must consider the possibility of a mucocele of the frontal sinus. This may be mistaken for a new growth or a chronic granuloma. It may grow and encroach upon the orbit. X-ray films show an area of decreased density surrounded by a zone of reactive bone with a history of slow growth. The sinus may show evidence of thickened mucous membrane. Any such defect in the bone may be due to a monostotic fibrous dysplasia of bone. The granulomas such as lipoid granuloma or eosinophilic granuloma are to be suspected. Syphilis, the great imitator, is always to be considered.

An osteolytic lesion of this type does not present features that permit of an exact etiological diagnosis.

Pathologically, the study of the two cases of tumour of the bony orbit shows identical features. The essential lesion is a chronic granuloma composed of granulation tissue about multiple elliptical crystal clefts and cholesterol crystals. The granulation tissue contains multinucleated giant cells and many fat-laden phagocytes and a variable degree of fibrosis. Different kinds of blood pigment can be identified in both lesions. The third case herein reported represents an identical type of lesion in a rib of a man who gave a history of multiple injuries similar to the two orbital cases. This identical reaction in the three cases is interpreted as a post-traumatic chronic granuloma due to degeneration of blood and fat. Associated bony fracture may be concerned in the mechanism of production. It is characteristic of these granulomas that the process is progressive over a long period of time and causes expansion and absorption of the bone and is sometimes accompanied by bone regeneration at the more organized fibrous periphery.

The type of reaction here reported is one which is familiar to the general pathologist. It is not different from the soft tissue granulomas often encountered following hæmorrhage into the tissues, injury to body fat, injection of hydrolyzable oils into the tissues, and where the cholesterol and fatty acid content of epithelial cysts is extravasated into the surrounding tissues.

In the pathological differential diagnosis, giant cell tumour can be ruled out on two main counts: firstly, giant cell tumour does not occur in membranous bones and the frontal bone is developed in membrane; secondly, histologically, there is no reason whatever to consider giant cell tumour. Bone cyst and enchondroma can be ruled out on the same grounds as for the giant

cell tumour. Other possible tumours such as enchondral fibroma, fibro-sarcoma, xanthoma, fibro-xanthoma, myoangioma, perineural fibroma, parasitic cyst, angioma, myeloma, cholesteatoma, mucocele, osteogenic sarcoma, and metastatic tumour can readily be ruled out by the histology of this lesion. It bears no resemblance, histologically, to fibrous dysplasia. Eosinophilic granuloma and Hand-Schüller-Christian's disease cannot be maintained as a diagnosis because there is not the reticulo-endothelial feature nor are there eosinophiles. No specific features of tuberculosis or syphilis can be demonstrated nor are there features of pyogenic granuloma. The one lesion that is most nearly simulated histologically is infarction in bone, but bone infarction, so far as we know, has been described only in the long bones where it never causes expansion.[6] Moreover, infarction tends to calcify and ossify in time, producing a condensation of the bone as seen by the radiograph. The similarity of the histological appearance in post-traumatic granuloma and bone infarction can be accounted for by the antecedent hæmorrhage and interference with the circulation followed by necrosis of the blood and marrow content. Just recently, we observed an identical type of reaction in an eye in which there had been a known hæmorrhagic separation of the retina following an injury.

SUMMARY

Two cases of "post-traumatic granuloma of the bony orbit simulating tumour" are presented. These cases are augmented by a third case showing the identical pathological process in a rib.

From the radiological point of view, they are characterized by an osteolytic lesion. Pathologically, when a hæmatoma takes place in a bone, with or without actual fracture, the sterile elements of broken down blood may act as a foreign body which often lies dormant apparently for many years, and may become "activated" following another injury, or may cause a slow, steady reaction over several years. This "reaction" results in a destructive, expansile, tumour-like lesion in the radiograph which is actually a chronic granuloma with many foam cells and a foreign-body multinucleated giant cell formation around elliptical crystal clefts, cholesterol crystals, hæmosiderin, hæmatoidin, and other hæmoglobin pigments. Surgically, they are very amenable to radical therapy.

We are indebted to: Dr. J. W. McKay, Radiology Department, Montreal General Hospital, for radiological advice. Dr. Wilder Penfield, Director of the Montreal Neurological Institute, for the report with drawings of the first operative case. Dr. D. L. Thomson, Prof. of Biochemistry, and Dean of Graduate Studies, McGill University, for his comments on the difficulty of assessing the morphology of the lipoid crystals which are here called elliptical crystal clefts.

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PROGRESS IN WAR MEDICINE SINCE 1939

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AS an introduction to discussing the various aspects of progress in war medicine since 1939 I should like to quote the two following comments:

"For the first time in the history of warfare there were more surgical than medical casualties. Strange as it may seem, in all past wars, disease has exacted a higher toll of manpower than has the trauma of conflict." (Col. William S. Middleton, M.C., U.S. Army, Chief Consultant in Medicine, E.T.C., U.S. Army.)

"The most important medical lesson learned in the past war, was that executive and combatant officers must be taught that the enforcement of hygienic measures, to preserve the health, morale and fighting efficiency of their troops, is as important as any other military duty." (Surgeon Vice-Admiral Sir Sheldon Dudley, K.C.B., F.R.S., Medical Director-General of the Royal Navy.)

BLOOD TRANSFUSION SERVICE

In view of the excellent work accomplished, I feel that some acknowledgment should be made of the organization planned and originated by Sir Lional Whitby, to keep the British and Canadian Armies supplied with sufficient blood and plasma. Six months before the war, the British policy was established of having a distinct transfusion service which could produce its own equipment, its own blood substitutes, and supplies of stored blood, and which could train and earmark officers and orderlies especially for this work. The object was first to put all the material and equipment needed, into the hands