(*FROM APELVIKEN COAST SANATORIUM, VARBERG, SWEDEN*
CHIEF: ROBERT HANSON, M. D.)

TREATMENT OF TUBERCULOSIS OF THE ELBOW BY RESECTION AND ARTHROPLASTIC OPERATION IN ONE SÉANCE

BY
RAGNAR MAGNUSSON

After the resection of a tuberculous joint, the aim as a rule is to obtain an anchylosis. An anchylosed joint, however, entails an invalidity, the degree of which, to a great extent, depends on the localization of the joint. While, e.g., an anchylosis of the shoulder in a good position on account of the mobility of the scapula seldom forms any impediment in the practice of a trade, an anchylosed elbow is quite another matter. A more or less retained mobility, after a resection in the elbow-joint, plays in many cases a great rôle for the patient as regards his chance of returning to his former trade or learning a new one after his discharge from the hospital. Some surgeons, among others *Sorrel,* seek to obtain a mobile joint after resection. A resected joint, however, in most cases tends to anchylose, and the anchylosis then develops gradually and perhaps a long time after the patient has left the hospital, for which reason there is the risk of the joint's anchylosing in an undesirable position. In order to prevent the occurrence of anchylosis after resection and gain the highest degree of mobility, an arthroplastic operation is the best means.

During the years 1928—1935 altogether 87 cases of tuberculosis of the elbow were treated at Apelviken Coast Sanatorium (constituting 2,5 % of the total number of cases of bone tuberculosis treated during this period of time). In 9 of these cases the operation was limited to resection, arthroplastic operation was performed in 18 case.

The technique employed in the hitherto reported cases of plastic operation for tuberculosis of the elbow is based on the rule, that after the resection a certain interval of time is allowed to pass, after which the plastic operation is performed (2 séances). In the material here presented, on the other hand, the resection and the arthroplastic operation have been performed at the same occasion (1 séance)[1]). One patient has been operated on according to the former method, 17 after the latter. One more patient has now been operated on according to the method stated above. All these operations have been performed by the Chief of the Coast Sanatorium, Robert Hanson, M.D., to whom I here beg to express my gratitude for placing the material at my disposal.

Indications for operation.

The general opinion seems to be that the lower age-limit for the performance of an arthroplastic operation would be at 18 to 19 years, and the upper limit at 45 to 50. In children resection should not be taken into consideration, as the epiphysial line, and thereby the growth of the bones, is impaired by the operation. Nor is the operation be thought of in very young persons, as the musculature is usually not fully developed. Moreover, young persons lack the mental qualifications required for a successful after-treatment.—The tuberculous process should clinically and roentgenologically have come to a standstill and be well walled-off, and the destructions within the joint must not have reached such an extent that it excludes the formation of a functioning joint. On the other hand, the presence of fistulas or tuberculous abscesses is no contra-indication for resection and arthroplastic operation in one séance, as is evident from the experiences gathered with the present material. Abscesses in the soft tissues occur in five cases (Nos. 1, 2, 6, 9,

[1]) Addition to the proof. In Japan reports on two cases of resection and arthroplastic operation in one séance in tuberculosis of the elbow-joint have recently been published. (Masahisa: Über die primäre Mobilisierungsgelenkresektion bei Ellbogengelenktuberkulose. Z. jap. chir. Ges. 36. 1935. Reported in Zentralorg. gesamt. Chir. 79 Band. Heft 5. 1936.

and 15) and fistulas in two cases (Nos. 5 and 11). The atrophy of the muscles, on the other hand, should not have progressed too far. As successful result of the operation is dependent on an energetic after-treatment, and as this treatment is both slow and trying to the patient, and in many cases painful, it is not advisable to perform this operation on patients who are nervous and timid, sensitive and impatient. Furthermore one must consider the patient's physical and psychical possibilities of returning to his former trade or learning a new one after he leaves the hospital.

Surgical technique and after-treatment.

All the operations have been performed under ether narcosis, after the application of an Esmarch's tourniquet. The incision in the skin is made in the shape of a U from the epicondylus lat. humeri, down across the olecranon (about 3 cm. distally of its apex), and up to the epicondylus med. humeri. Then the ulnar nerve is made free and held to one side by a broad loop of gauze. The olecranon is chiselled through about 3 cm. distally to its apex, and the soft tissues on the sides are cut through so far as to allow the flap thus obtained to be turned up. The lateral and medial epicondyles are then chiselled through and turned down together with appendant insertions of ligaments and muscles. Should abscesses be present they are, if possible, extirpated or scraped out and cauterized with phenol and alcohol; fistulas are excised. All the articular surfaces (thus those in the artic. radio-ulnaris also) are resected and tuberculous foci in the bones are removed until healthy bone is reached. Especial stress is laid on the requirement, that the proc. coronoideus is resected and the periosteum excised. Should the proc. coronoideus be left or not be resected to a sufficient extent, there will easily come jagged exostoses which may form a hindrance to flexion. The synovial capsule is removed as a whole. A properly adjusted piece of the fascia lata is then put in, with the outer side towards the cavity of the joint. The transplanted piece of fascia is fastened with sutures of catgut to the edges of the articular surfaces. By a circular suture around the col-

lum radii the transplanted fascia is fixed around the capitulum radii, and by a penetrating suture through the fossa olecrani it is fixed across the articular surface of the humerus. The dislocated epicondyles are then replaced and fixed in an exact position by penetrating bone sutures. The ulnar nerve is replaced and, if necessary, embedded in a thin layer of adipose tissue. The chiselled off apex of the olecranon is fixed by a nail which is inserted percutaneously. In some cases (Nos. 5, 6, 13, 14, 15, and 17) a divergence from the technique here mentioned has been made in such a manner, that the capitulum radii has been covered with a seperate piece of fascia. The skin has in all cases been sutured primarily, after which a circular plaster bandage is applied with the arm in a half-flexed position and about 5°—10° pronation. The plaster bandage is then cut through along the whole of the flexor side of the arm as a safeguard against pressure by possible haematomas. The sutures are taken out after 7—10 days and after three weeks the nail through the olecranon is removed. At this point the patient receives a well modelled plaster splint along the extensor side of the arm, and therapeutic exercises commence, which are always given by the house-surgeon. After 2—3 weeks the patient is allowed to start training his muscles himself by performing active muscular contractions. In addition, treatment with electricity and heat is applied. Massage has not been given in any of the cases. When the active mobility has reached 10°—15° the patient is allowed to start with active exercises under resistance, which is arranged in the simplest manner. With his arm hanging straight down the patient holds a weight in his hand and tries to lift it. Or else the patient is placed with his elbow resting on a table, and with a weight, suspended by a string, in his hand he alternately bends and extends his arm. In some of the latest cases operated on, part of the therapeutic exercises have been done in a Zander apparatus which, for one thing, has the advantage that it enables one to regulate the resistance in the exercises in an adequate manner.—Great stress is laid on the patients' personal activity and on the turning of their energy and interest upon the therapeutic exercises.

In order to obtain a good result after an arthroplastic operation it is highly important that an unstable joint does not ensue, a condition which is not uncommon after arthroplastic operations in the elbow-joint. *Sorrel* in fact considers an unstable joint to be better than an anchylosis, and *Rebaudi* is of the opinion that a slightly unstable joint is not disturbing. But, as the stability of the joint and consequently its serviceableness in practical work is thereby reduced, without there being any corresponding advantages to gain, we have to reject such an opinion. In one of the cases (14) presented here it has been possible to establish an instable joint. One detail in the surgical technique described above was aimed to prevent the occurrence of an unstable joint, namely: the chiselling off of the epicondyles on the humerus together with appendant collateral ligaments. By replacing and fixing the epicondyles after the resection, the collateral ligaments have thus remained intact and the risk of an unstable joint has been reduced to a minimum.

Casuistics.

A personal after-examination of all the cases would have been very desirable, but the fact that the patients are scattered around in the country has made it impossible to carry out such an examination in more than three cases. Instead, the after-examination has now in 10 cases been performed in dispensaries, which have answered a set of questions sent to them. Of the remaining 4 cases it has been impossible to find one of the patients, 2 patients have themselves given an account of their condition, and one has not yet been discharged from the hospital. The disadvantages of such an examination are apparent, but on the whole I think it will be possible on this basis to form an opinion of their present status. The after-examinations performed by the dispensaries have been marked »Disp.« and the accounts given by the patients themselves »Pat.«

CASE 1. 562/30. Male, born 16.9.1909. Admitted 31.1.30. Discharged 20.6.30. *Diagnosis: Tbc. art. cubiti sin. c. abscess.*—In 1918, treated at an hospital for tuberculosis of the left elbow. Since then free of symptoms until 1929, when symptoms from the elbow again appeared.—Physical

exam.: General condition good. Left elbow-joint: Extensive swelling around the joint. The forearm is held in a position of 90° flexion. Pains when trying to move the arm. Considerable muscular atrophy. Roentgenogram: Destructive changes in all the articular surfaces. 21.2.30, Operation (R. Hanson): In the inc. semilunaris a tuberculous focus (size of a brown bean). The cartilage on both condyles of the humerus to a large extent destroyed. The whole cavity of the joint filled with tuberculous pus. An abscess on the volar side, down towards the forearm. The whole articular surface of the radius is destroyed. With the exception of a small fistula, which persisted for 4 months, the post-operative course was uneventful. Final status: Healed. No swelling of the soft tissues. No tenderness to palpation. 30° extension defect. From that point active and passive flexion to 90°. No pains when moving the arm. Active pro- and supination 70°. The musculature of the arm fairly good. No deflective movements in the joint.

After-examination in January, 1936. (Disp.): The patient earns his living as a timber-floater. The elbow healed. In full extension a defect of 25°. From that point 40° active flexion is possible. No symptoms whatever from the elbow, not even after considerable exertion.

CASE 2. 666/31. Male, born 13.6.1886. Adm. 9.5.31. Disch. 11.12.31. *Diagnosis: Tbc. art. cubiti dx. c. abscess.*—In 1924 tuberculosis of the right kidney. Nephrectomy. Since 1928 symptoms of tuberculosis of the left elbow-joint.—Physical exam.: General condition good. Left elbow-joint: Moderate swelling around the elbow. Over the lateral epicondyle an abscess (size of a plum). The elbow is held in a position of 70° flexion. From this point about 20° flexion and extension, although with pain. Intermediate position between pro- and supination. Considerable muscular atrophy of both the forearm and the upper arm. Roentgenogram: Caput radii destroyed and obliterated. Remaining articular surfaces destroyed. The slit of the joint almost extinguished. 4.6.31: Operation (R. Hanson): The abscess on the lateral side contained a watery, sanguineous pus + caseous granulations. Extirpation + scraping out. The cartilage destroyed on all the articular surfaces. The capsule thickened and shrunk. In the cavity of the joint about 1 tablespoonful of yellowish green pus. Capsule and articular cartilage were removed radically. The patient got a slight ulnar paresis, which soon passed. Otherwise the post-operative course was uneventful. Final status: Healed. Active and passive mobility in the elbow 40°—90°. Good pro- and supination. No deflective movements.

After-examination on 15.4.32: Has had no symptoms since his discharge from hospital. Complaint of a reduction in crude strength; has not performed any real work. Status: The musculature of the upper arm now quite good. 15° extension defect. From that point 50° passive flexion.

Active mobility: 20° extension defect. From that point 50° flexion. Normal active and passive pro- and supination. No swelling or tenderness over the elbow-joint. No deflective movements. Roentgenogram: All the surfaces after the resection even and sharp.

After-examination in January, 1936. (Disp.): Is unable to perform regular work. He is nervous and everything seems hopeless to him. The elbow healed. In full extension a defect of 10°—15°. From that point active flexion to 70°, passive to 90°. At times pains in the elbow, especially in connection with changes in the weather. No swelling. Has tried to train his elbow but lacks the strenght to do so. »He is able to carry a pail of water, but has not the strength to lift a water-bottle from the table without standing up.«

CASE 3. 337/32. Male, born 8.1.1910. Adm. 9.10.31. Disch. 3.3.33. *Diagnosis: Tbc. art. cubiti sin.*—Since 1925 symptoms from the left elbow. Has had cervical adenitis and exudative pleurisy. Of late increased swelling of the left elbow. Has had no pains. Physical exam.: General condition relatively good, rather lean and pale. Left elbow: Rather swollen. 55° extension defect. From that point 55° flexion. Normal pro- and supination. Pains in extension of the arm. Roentgenogram: Destructions within the incisura semilunaris. The slit of the joint decreased. 22.10.31: Operation (R. Hanson): The articular capsule distended. The articular cartilages on the olecranon and the trochlea humeri are thinner than usual and have an uneven, nodular surface. Ulcerations of the cartilage on the cap. radii and the inc. semilunaris. On the capitulum humeri also the cartilage is undermined and ulcerated. A granulation-like tissue continues down into the bone to a depth of nearly 1 cm. Pathologic-anatomical diagnosis: Tuberculosis. The post-operative progress was complicated by the occurrence of tuberculous granulation tumours in the operation scar. Free of symptoms after these were excised.—Final status: Healed. Extension defect of 30°. Flexion to 115°. Pronation to a normal extent, supination 5°—10°. Roentgenogram: The marking of the bone and amount of lime without remark. All the surfaces after the resection smooth and even. No deflective movements.

CASE 4. 527/32. Female, born 30.10.1912. Adm. 29.1.32. Disch. 22.6.32. *Diagnosis: Arthrit. tbc. cubiti dx.*—Since 1921 swelling and increased restriction of mobility in the right elbow-joint.—Physical exam.: General condition good. Right elbow-joint: Diffuse swelling. No tenderness to palpation. No increase in the temperature of the skin. Thickening of the capsule. No exudate. In full extension there is a defect of 80°. From that

point 20° flexion possible. Pro- and supination 25° around the median position. Roentgenogram: All the articular surfaces destroyed, the destruction being most pronounced in the inc. semilunaris. 4.3.32, Operation (R. Hanson): In the inc. semilunaris considerable destructions of the bone, filled up with granulations. On the trochlea humeri and the capitulum humeri all the cartilage is destroyed. Large bone foci in the fossa intercondyloidea. In the apex of the olecranon a large, tuberculous focus, which was removed. Post-operation course uneventful.—Final status: Healed. No swelling or tenderness. No increase in the temperature of the skin. 30° extension defect. From that point 60° active flexion. Pro- and supination almost normal. Some atrophy of the musculature. No deflective movements.

After-examination in January, 1936. (Disp.): Manages all her household duties, even heavier work, herself. The elbow healed. »Mobility is good. Is nearly able to extend the arm to its full extent.« At times, after more strenuous exertions, she feels tired in her elbow.

CASE 5. 541/32. Male, born 30.6.1892. Adm. 29.1.32. Disch. 9.9.32. *Diagnosis: Tbc. art. cubiti sin. c. fist* In 1929 operated for epididymit. tbc. Since 1930 a slight feeling of discomfort in the left elbow, but has worked as usual. Since Oct., 1931, pains and stiffness in the elbow-joint. Physical exam.: General condition good. Left elbow: Considerable atrophy of the musculature of the upper arm. Swelling around the elbow-joint. The articular capsule swollen. Slight tenderness to palpation over the joint. The forearm is held in a position of 80° flexion and a few degrees' supination. Pains when trying to move the arm. Over the lateral part of the joint a small abscess and on the posterior side of the joint a somewhat larger one. During the patient's stay in the hospital there appeared a fistula on the lateral side. Roentgenogram: All the articular surfaces destroyed. 28.5.32. Operation (R. Hanson): The fistula over the lateral epicondyle together with the abscess underneath it was excised. The joint is filled with smeary, tuberculous granulations. The articular cartilages everywhere destroyed. In the apex of the olecranon a focus of the size of a brown bean, filled with granulations. On the anterior surface of the capitulum humeri a focus (size of a hazel-nut), filled with caseous and purulent granulations. The radio-ulnar joint is filled up with fibrous tissue.—Post-operative course uneventful. Final status: 10° extension defect. From that point 80° active flexion. Pronation normal, supination reduced to half of the normal. Feeble strength. No deflective movements. Roentgenogram: The surfaces after the resection even and sharply defined.

After-examination on 20.9.33. Since his return home from the hospital

he has taken part in lighter agricultural work. The strenght of the arm has increased. 25° extension defect. From that point 75° active flexion possible. Supination 60°, pronation normal. Considerable atrophy of the musculature of the upper arm. No deflective movements. Was again admitted on 19.3.34 for spond. tbc. lumbal. Discharged on 29.9.35. The crude strenght in the elbow-joint poor. 20° extension defect. From that point 80° active flexion possible. No pains when moving the arm. Pronation normal. Supination slightly reduced. No deflective movements.

After-examination in January, 1936. (Disp.): Is unable to earn his living by his own work. (The patient has also spondylitis.) The elbow healed. Mobility as on 29.9.35. From time to time slight pains in the elbow.

CASE 6. 742/32. Female, born 6.9.1905. Adm. 12.5.32. Disch. 24.10.33. *Diagnosis: Tbc. art. cubiti dx. c. fist.* In June 1931 incipient pains in the right elbow-joint. Gradually increased pains and restricted mobility. Roentgenogram in Oct., 31 showed changes in the olecranon.—Physical exam.: General condition good. Right elbow-joint: Diffuse swelling over the elbow-joint. Over the olecranon a fistula with scanty secretion. No tenderness to palpation. 30° extension defect. From that point 50° passive flexion. No active mobility. Roentgenogram showed destruction of all the articular surfaces. During the stay in the hospital, the fistula healed. 9.3.33. Operation (R. Hanson): The cicatrice after the fistula was excised. On chiselling through the olecranon a cavity (size of a hazel-nut) filled with granulations was revealed. All cartilage on the articular surfaces was absent. On the anterior surface of the humerus, deep destructions filled with granulations. The caput radii was resected almost completely. Laterally of the caput a large abscess, filled with pus and granulations. The abscess was scraped out and extirpated. Pathological anatomic-diagnosis: Tuberculosis. The progress after the operation uneventful. Final status: 20° extension defect. From that point 50° active flexion. Pro- and supination 30° each. No deflective movements. Roentgenogram: The surfaces after the resection even, clear-cut, and well-defined.

After-examination in June, 1936. (The author). General condition good. Moderate atrophy of the musculature of the forearm and upper arm.—Healed.—No subjective discomfort, not even after heavy work.—25° extension defect. From that point 75° active and passive flexion possible. In full supination a defect of 30°. Pronation to a normal extent.—No crepitations

when moving the arm.—No deflective movements.—Has worked for a year as midwife at a nursing-home.

CASE 7. 852/32. Female, born 25.10.1914. Adm. 22.7.32. Disch. 3.3.33. *Diagnosis: Tbc. art. cubiti dx.* Is supposed to have had swelling of the right elbow-joint together with fistulas and reduced mobility in it since three years of age. Physical exam.: General condition relatively good. Lean and pale. Right elbow-joint; No swelling or tenderness to palpation. Around the joint a number of pale, retracted scars. 60° extension defect. From that point 25° flexion possible. Pronation somewhat reduced. Almost no supination at all. No pains when moving the arm. Roentgenogram: Considerable destruction within the incisura semilunaris. 3.11.32, Operation (R. Hanson): In the humerus a focus (size of a brown bean) with fibrous granulations, surrounded by sclerotic bone. The focus communicates with the joint. The cartilage in the incisura semilunaris destroyed. The articular surfaces of the humerus deformed, covered with thin cartilage. From these to the caput radii and ulna there are firm adherences of connective tissue. The caput radii is luxated forward. After the resection of the articular surfaces it was impossible to extend the arm more than to a right angle on account of tightness in the tendon of the biceps, for which reason this was tenotomized. Post-operative course uneventful. Final status: 55° extension defect. Active flexion to 90°. Pronation about half of the normal, supination 30°. No pains when moving the arm. No deflective movements.

After-examination in January, 1936. (Disp.) Earns her own living as a seamstrees. The elbow healed. 35° extension defect. Active flexion to 90°. Pro- and supination as at her discharge from hospital. No symptoms from the elbow, even after greater exertions.

CASE 8. Female, born 22.2.1914. Adm. 30.8.29. Disch. 4.4.30. Again adm. 9.9.32. Disch. 27.1.33. *Diagnosis: Tbc. art. cubiti dx.* Since June, 1928, pains in the right elbow, gradually increased swelling and restriction of mobility. Physical exam.: General condition good. Right elbow: Considerable atrophy of the musculature. Fusiform swelling around the joint. No increase in the temperature of the skin. Passive mobility from 60°—90°. No active mobility. Roentgenogram showed destructions within all the articular surfaces. The patient was discharged with a bandage. Free of symptoms for ½ year after her return home. After that time increasing pain and swelling. Was readmitted. Physical exam.: General condition good. Right elbow-joint: Moderate swelling of the capsule. No tenderness to palpation. The arm is held in a position of 40° flexion. Further flexion 10°. No pro- or supination possible. Considerable pains

when moving the arm. Moderate atrophy of the musculature. Roentgenogram: Improved marking of the bone since the preceding photo. No new destructions. The slit of the joint decrased still further. 7.10.32, Operation (R. Hanson): The cartilage on all the articular surfaces for the most part absent. Only a thin, irregular layer of cartilage remains here and there on the articular surfaces. Small foci in the ulnar part of the inc. semilunaris and in the capitulum humeri. The capsule is shrunk. Nowhere fresh granulations or caseous masses. A small destruction in the articular surface of the caput radii. With the exception of a slight ulnar paresis the post-operative course was free of complications. Final status: 30° extension defect. From that point 70° active flexion possible. Pro- and supination about 20° each. The crude strenght not particularly great. No deflective movements.—About one year after her discharge the patient states that the strenght in her elbow-joint has improved. She is able to lift a pail of water wihtout trouble.

After-examination in March, 1936. (Pat.) Earns her own living as assistant in a shop. She was before employed as maid-servant and at that time performed all housework without trouble.—The elbow healed. At present somewhat more mobile in the elbow than on her discharge from hospital. No symptoms from the elbow, even after heavier work.

CASE 9. 969/32. Female, born 28.11.1901. Adm. 3.10.32. Disch. 16.6.33. *Diagnosis: Tbc. art. cubiti dx. c. abscess.* In 1924 operated for suppuration in the right elbow. After that, free of symptoms until the spring of 1932. At that time incipient restriction of mobility and fatigue in the elbow. Pains when moving the arm. Physical exam.: General condition good. Right elbow-joint: Moderate atrophy of the musculature. Slight swelling around the joint, which is fixed in a position of 95° flexion. Over the medial epicondyle a healed operation cicatrice. Over the base of the olecranon an abscess (size of a walnut). Only a few degrees of passive mobility possible. Pro- and supination only a few degrees Roentgenogram showed destruction of all the articular surfaces. Caput radii for the most part destroyed. The capitulum humeri destroyed in to the epiphyse. 2.12.32, Operation (R. Hanson): Capsule several mm. in thickness, limp and fungous. Large foci in the olecranon close to the inc. semilunaris. The greater part of the epiphysis of the humerus contains a mass of granulations and sequestra. The caput radii practically totally destroyed and obliterated. On the front side of the forearm an abscess, containing caseous masses and pus, which was extirpated and scraped out, and then cauterised with phenol and alcohol. Guinea-pig test on pus from the joint positive for tbc.—Post-operative course uneventful. Final

status: 40° extension defect. From that point 40° active flexion and 45° passive. Pro- and supination restricted only a few degrees each. Moderate atrophy of the musculature. No deflective movements. Roentgenogram showed an irregular contour on the surface after the resection on the radius. No definite caries.

After-examination in February, 1936. (Disp.) Manages all the housework in a family of 6 persons. »The mobility in the elbow-joint is rather good, and she is able, without difficulty, to perform any kind of work.« No symptoms from the elbow-joint, even after greater exertions.

CASE 10. 970/32. Female, born 7.11.1885. Adm. 27.8.30. Disch. 27.10.30. *Diagnosis: Tbc. art. cubiti dx.* Since 1924 restricted mobility in the right elbow-joint. Physical exam.: General condition good. Right elbow-joint: The arm is held in a position of 60° flexion. From that point 25°—30° passive flexion is possible. Slight swelling of the soft tissues around the joint. No tenderness to palpation. On the lateral side a small, fluctuating intumescence. Slight atrophy of the musculature. Roentgenogram showed destruction of all the articular surfaces. 18.9.30. Operation (R. Hanson): The cartilage for the most part destroyed on all the articular surfaces. In the lateral part of epiphysis of the humerus and in the ulnaris metaphysis there are large foci.—Post-operative course uneventful. Final status: 20° extension defect. From that point 80° active flexion is possible. Passive flexion a few degrees more. Pro- and supination very near to normal. No deflective movements. Roentgenogram showed the surfaces after the resection to be well-defined.

After-examination at the hospital on 2.2.31: No swelling or tenderness. 10°—15° defect in full extension. Flexion almost normal. Pronation normal, supination restricted to about 20°. No deflective movements. Since her discharge from hospital the patient has had no pains or discomfort from the elbow-joint. Manages her own housekeeping.

After-examination in January, 1936. (Disp.): Is able to perform lighter housework but cannot earn her own living. Suffers from organic disease of the heart. The elbow anchylosed.

CASE 11. 1024/32. Female, born 16.4.1895.Adm. 16.11.32. Disch. 7.7.33. *Diagnosis: Tbc. cubiti dx. c. fist.*—During a short period of time in 1925 swelling of the right elbow-joint and pains in same. After a few years increasing flexion contraction. Since 1931 a fistula over the lateral part of the joint. Of late pains in the joint. Physical exam.: General condition good. Right elbow-joint: A considerable tender swelling around the joint.

Over the lateral epicondyle a fistula with scanty secretion. No tenderness to palpation. 60° extension defect. From that point 10° passive flexion is possible. Normal pronation. Supination restricted to about half of the normal. No pains when moving the arm. Roentgenogram showed destruction of all the articular surfaces. 27.2.33. Operation (R. Hanson): The fistula was excised. The articular capsule shrunk, in part rind-like. The cartilage to a very great extent destroyed on all the articular surfaces. Deep ulcers in the caput radii and the trochlea humeri.—Pathological anatomical diagnosis: Tuberculosis. Post-operative course uneventful. Final status: Extension defect of 30° From that point 50° active and 60° passive flexion is possible. Passive pronation 45°, active 0°. Active and passive supination 60°. No deflective movements.

After-examination in February, 1936. (Disp.): Performs all household duties at an inn except the very heaviest work which is too much for her. The elbow healed. Crepitations when performing pro- and supination. 60° extension defect. From that point 35° flexion. Slight pains in the elbow after greater exertions.

CASE 12. Female, born 5.2.1916. Adm. 27.1.33. Disch. 30.9.35. *Diagnosis: Tbc. art. cubiti sin.*—Was admitted to the hospital for multiple tuberculous processes in both hands and both feet. During her stay in the hospital (in Aug. 1933): symptoms from the left elbow in the form of swelling and restricted mobility, which gradually increased. Was immobilized by a circular plaster bandage. Roentgenogram in Dec. 1934 showed destructions within the olecranon. 20° extension defect. From that point 35° flexion possible. Pro- and supination without remark. 18.1.35, Operation (R. Hanson): The capsule limp, several mm. thick, oedematous, and fungous. In the lateral part of the ulna, by the inc. semilunaris, a focus of the size of a shell-almond. In the caput radii a central focus (size of a pea). The cartilage to a large extent destroyed. Pathologic-anatomical diagnosis: Tuberculosis. Post-operative course uneventful.—Final status: Extension defect of 40°. From that point 60° active flexion and 70° passive is possible. In full supination there is a defect of about 45°, and in full pronation about 10°. Slight atrophy of the musculature. No deflective movements.

After-examination in February, 1936. (Disp.): Is able to perform most of the ordinary household duties. The elbow healed. Mobility as at her discharge from the hospital. No discomfort from the elbow.

CASE 13. 280/33. Female, born 27.1.1913. Adm. 14.7.33. Disch. 24.8.34. Again adm. 27.4.35. Disch. 21.4.36. *Diagnosis: Tbc. art. cubiti sin.*—Since the summer of 1932 swelling and pain of the left elbow-joint. Was admitted to a hospital where a bone focus in the olecranon was scraped out. Was immobilized.—Physical exam.: General condition good. Left elbow-joint: Some swelling around the joint. No tenderness to palpation. 65° extension defect. From that point 15° active and passive flexion, and 45° supination and 10° pronation is possible. Roentgenogram showed destructions within the inc. semilunaris and the trochlea humeri.—Discharged free of symptoms and without a bandage.—At first, after her return home, free of symptoms; later, discomfort again. Readmitted on 27.4.35. Physical exam.: No abscesses or fistulas. No swelling or tenderness. The forearm is held in a position of 80° flexion. From that point 15° active and passive flexion. In full pro- and supination a defect of 10° each. Roentgenogram did not show any new destructions. Amount of lime and spongiosa markedly improved.—10.5.35, Operation (R. Hanson): Between the inc. semilunaris and the articular surface of the humerus firm fibrous adherences. The capsule several mm. thick, limp, and oedematous. All cartilage in the inc. semilunaris destroyed. Under this rind-like, fibrous, and in part gelatinous granulations. In the trochlea humeri a small focus, filled up with granulations. Pathologic-anatomical diagnosis: Tuberculosis. A few weeks after the operation there appeared a small fistula in the operation cicatrice, which soon healed, and is still healed. *Status on 10.3.36:* No swelling or redness over the elbow-joint. Healed. No tenderness to palpation. Passive extension and flexion to a normal extent. Active mobility: 25° extension defect. From that point 75° flexion. Active and passive pro- and supination 2/3 of the normal. No deflective movements. Roentgenogram: The surfaces after the resection even and smooth. (Fig. 1).

CASE 14. 432/33. Female, born 25.8.1911. Adm. 10.11.33. Disch. 26.7.35. *Diagnosis: Tbc. cubiti sin.*—Since 1931 swelling and pain of the left elbow. In 1932 there appeared a small fistula. Since about the same time spondylit. tbc. and left-sided gonit. tbc.—Physical exam.: General condition good. Left elbow-joint: On the lateral side of the joint a fistula (healed during her sojourn at the hospital). Moderate swelling around the joint. 45° extension defect. From that point 35° passive flexion possible. Roentgenogram showed destructions within the olecranon and in the distal part of the inc. semilunaris. Otherwise no certain changes. 31.10.34, Operation (R. Hanson): When the joint was opened a large amount of typical tuberculous pus flowed out. The capsule smearily desquamating. The cartilage on all the articular surfaces destroyed. Deep bone destructions underneath the ligamentous insertions on the humerus. Pathologic-anatomical diagnosis: Tuberculosis. Post-operative course un-

eventful.—Final status: 15° extension defect. From that point 90° active flexion. Some 10° pro- and supination each. Passive mobility almost to a normal extent of all the qualities of motion. Moderate atrophy of the musculature of the upper arm. No deflective movements. Roentgenogram: The surfaces after the resection even and sharp.

After-examination in June, 1936 (the author): In the lateral part of the operation scar a small fistula, in the process of healing. The fistula was fixed to the ulna. 50° extension defect. From that point 85° active and passive flexion possible. Pronation almost normal. Supination about 20°. Considerable atrophy of the musculature of the upper arm. 10° deflective movement. —The fistula appeared soon after the patient's return home.— Has worked as a seamstress and very nearly been able to earn her own living in this manner.

CASE 15. 7/34. Male, born 11.9.1900. Adm. 10.1.34. Disch. 30.9.35. *Diagnosis: Tbc. art. cubiti dx. c. abscess* At 5 years of age coxit. tbc. Since Dec. 1932, from time to time pains, stiffness, and swelling in the right elbow. Has been treated with plaster casts.—Physical exam.: General condition good. Right elbow-joint: Some swelling around the joint. No tenderness to palpation. Increased temperature of the skin. The joint practically anchylosed in a position of 90° flexion. No pro- and supination possible. Moderate atrophy of the musculature of the upper arm. Roentgenogram: In the capitulum humeri a sequestrum of the size of a shell-almond. Destruction of the articular surfaces. 20.4.34, Operation (R. Hanson): Nearly the whole of the capitulum humeri was occupied by a sequestral cavity, which had perforated forward and communicated with a large abscess in the soft tissues, containing thick, tuberculous pus. The articular capsule nearly ½ cm. thick, fungous, and limp. Large ulcerations underneath the medial ligament-insertion on the humerus. The cartilage on all the articular surfaces to a large extent destroyed. Laterally in the caput radii a focus (size of a brown bean) filled with limp granulations. Pathologic-anatomical diagnosis: Tuberculosis.—The progress after the operation smooth.—Final status: 30° extension defect. From that point 60° active flexion possible. Pronation to a normal extent. 35° supination defect. No deflective movements. Roentgenogram: The surfaces after the resection even and sharp.

After-examination on 22.5.36 (Disp.): States that he has no pains in the joint either in motion or at rest; on the other hand, a grinding pain after work, which he himself localizes to

the upper part of the flexor musculature of the forearm. Has done »various odd jobs«, but has not succeded in getting employment in his usual field of work (bootmaker). He believes, however, that he would be able to manage such work.—Otherwise he feels in good health. The right upper arm at the thickest point 5 cm, thinner than the left one, the atrophy principally localized to the triceps musculature. The forearm also about 5 cm, thinner than the left one at the thickest point. Elbow-joint: Well healed operation scar without fistulas, signs of abscesses, or tenderness to palpation. Mobility: Extension defect of 40°. From that point 50° flexion possible. Supination only to about the median position, pronation from that point hardly 80°. None of the movements cause any pain.—No deflective movements.

CASE 16. Female, born 1.5.1905. Adm. 11.1.27. Disch. 24.8.28. Again adm. 19.7.29. Disch. 29.1.32. *Diagnosis: Tbc. art. cubiti sin.* Treated at a hospital for the first time for tbc. carpi dx. In Dec. 1928 pains in the left elbow-joint and incipient restriction of mobility.—Physical exam.: General condition good. Left elbow-joint: Moderate swelling of the soft tissues around the joint. 75° active and 90° passive mobility. Pro- and supination without remark. Roentgenogram showed destruction of all the articular surfaces. 24.4.31, Operation (R. Hanson): The articular capsule fungously transformed. The cartilage to a large extent destroyed. Small foci here and there in the articular surfaces. Progress after the operation without remark.—Final status: No swelling or tenderness. 15° extension defect. From that point 110° active flexion possible. Only some few degrees restriction in pro- and supination. No deflective movements. Roentgenogram showed even surfaces after the resection.

After-examination in March, 1936. (Pat.): Is unable to earn her living by her own work on account of chronic polyarthritis. Several times during the last few years she has been treated at a hospital for chronic polyarthritis of both knee-joints and both ankle-joints, the left wrist, and a few joints of the fingers.—The elbow healed. In full extension there is a defect of 30°. Is able to bend the arm to a right angle. No discomfort whatever from the elbow.

CASE 17. 219/35. Male, born 2.3.1916. Adm. 15.6.35. Still at the hospital. *Diagnosis: Tbc. art. cubiti dx.* In 1933 flexor contracture in the

right elbow-joint of unknown cause. No pains, but the patient feels powerless in the arm. The condition on the whole unchanged until April 1935, when a fistula appeared on the medial side of the right elbow-joint. In this connection pains in the joint. Has continued with his work, partly as agricultural labourer, partly as miner, until the fistula appeared. Physical exam.: General condition good. Right elbow-joint: On the medial side of the joint an ulceration about 2 cm. in diameter. Moderate swelling around the elbow-joint. 45° extension defect. From that point 50° flexion possible. Pronation without remark. 10° supination defect. Moderate pains when moving the arm. Slight atrophy of the musculature of the right upper arm. Roentgenogram: Destruction of all the articular surfaces within the right elbow-joint.—The cutaneous ulceration and the fistula on the medial side of the joint healed with conservative treatment. —7.2.36, Operation (R. Hanson): Usual technique. The ulnar nerve surrounded by typical tuberculous granulation tissue, which was removed. The olecranon was chiselled through 2 cm. from its apex. In the medial part of the fragment chiselled off there was a tuberculous focus (size of a pea) filled with limp granulations. The cartilage on all the articular surfaces destroyed. The proc. coronoideus was chiselled off to a depth of ½ cm. and the remaining periosteum was extirpated. The articular surfaces of the humerus, ulna, and capitulum radii were resected. The articular surfaces of the humerus and ulna were covered with a flap of fascia. The capitulum radii was covered with a special flap of fascia. —Pathologic-anatomical diagnosis: Tuberculosis.—Status 2.7.36: General condition good. Has been treated with therapeutic exercises since 27.2.36. Healed. Mobility: 15° extension defect. From that point 70° active and passive flexion possible. About 10° supination. Pronation to a normal extent. No deflective movements. Very slight atrophy of the musculature of the upper arm.

DISCUSSION:

The average age of the male patients, operated in one séance, was 36.5 years (the lowest age 21 and the highest 45 years), and of the females the average age was 26 years (the lowest age 18 and the highest 45 years). In all cases except 3 (cases 1, 3, and 13) the operation wound healed primarily. In case 1 a small fistula appeared in the operation scar, but it healed in 4 months; in case 3 there appeared a number of granulating fistulas, which healed after being scraped out. In case 13 there appeared, a few weeks after the operation, a small fistula in the operation scar; it soon healed spontaneously, and the wound has now been healed for more than ½ year.—In two cases (cases 3

and 9) slight ulnar pareses occurred. They soon disappeared without leaving any trace, for which reason the cause of these pareses is probably to be sought in oedema of the ulnar nerve. In all the remaining cases the post-operative course has been entirely free of complications.

Of the 16 cases which now have been after-examined, anchylosis has thus occurred in one (case 10). In a few of the 15 cases with retained mobility the period of observation is, however, too short for an estimation of the prognosis to be made with some degree of certainty. Thus in case 13, which recently was discharged from the hospital but has been kept under observation for 1 year after the operation, and in case 17, which still remains at the hospital. As, however, their mobility is very good, and as they are free of symptoms, there is well-founded reason to assume, that the mobility will persist. If these cases also are included, the result is one anchylosis in 16 after-examined cases, in which resection and arthroplastic operation has been performed in one séance.—Case 14, in which anchylosis has occurred, is that of a woman who was 45 years at the time of the operation, and who from her 39th year had had symptoms of a tuberculous arthritis of the elbow-joint. On after-examination in the hospital ½ year after the operation the mobility was very good, but it would seem as if it later had diminished more and more, and finally the elbow has become anchylosed. The point of time at which this occurred is unknown. A contributory cause of the anchylosis would seem to be an organic disease of the heart, manifested after her stay in the hospital, which has forced her to keep still.—In the 15 after-examined cases with retained mobility the period of observation has been 6 years at the most (case 1) and 6 months at the least (case 17, which still remains at the hospital). The average period of observation is thus more than 3 years. The after-examinations have shown that 3 of these (cases 2, 5, and 16) have not been able to earn their living by work of their own. Case 2 concerns a man of a nervous and hypochondrical disposition. In addition he has undergone nephrectomy for tuberculosis of the right kidney. Although he has an active mobility

of 60° the atrophy of the musculature is too pronounced to allow his performing any real work. Before the operation also the atrophy of the musculature was highly developed on both forearm and upper arm.—In case 5 the patient's lumbar spondylitis is probably the cause of his inability to provide for himself. The elbow seems on the whole to be free of symptoms, and the mobility is good.—In case 16, which concerns a woman at present 31 years of age, the cause of her inability to work is a chronic polyarthritis, which has set in after her discharge from the hospital and which has affected both knee- and both ankle-joints, the left wrist, and a few joints of the fingers.

As women, for the greater part, have been operated on, they have also, for the most part, earned their living by household-work. One of these performs all the work at an inn, and another one alone manages a household of 6 persons. Case 6, a woman now 26 years old, who has been operated on for tuberculosis of the right elbow, has earned her living for more than a year as midwife, and a few others gain their livelihood as seamstresses.—Of the six men operated it has not been possible to find one at the after-examination, and two are incapable of work (see above), while one still stays in the hospital. One of the remaining two earns his living as a timber-floater, an exceedingly hard and tiring form of work; and the sixth, finally, is to all appearances capable of working but has not succeeded in getting employment.

In all the cases the elbow has remained healed after the discharge from hospital with the exception of case 14, where a small fistula has appeared after the patient's return home.—The range of flexion-extension in the different cases varies between 35° and 100°. The fact that so different results have been gained naturally depends on many different factors, but one circumstance above all others seems to be decisive as to the final result, namely the length of time of the illness up to the time of the operation. On examining the cases stated in this thesis one will find, that in those cases where the illness has lasted for 2—3 years the mobility is obviously greater (cases 2, 5, and 6) than in those cases where the illness extends over a

period of 8—10 years (cases 4, 7, and 11). The cause of this fact is to be sought, in the first place, in the shrinking of the soft tissues, especially the fibrous capsule, which is occasioned by a fixation of long duration. Quite naturally age also plays a certain rôle, as older patients throughout have less mobility in the operated joint than younger ones. It has in nearly all cases been possible to maintain the movements of pro- and supination almost to the normal extent.—As the female material is nearly twice as large as the male (11 and 6 cases resp.), a direct comparison of the results gained in both sexes can not be made. It is, however, without further explanations evident, that the results in the female material are at least just as good as in the male. So one has reason to be cautious in subscribing to the view advanced by *Putti,* that women should be less suited to an arthroplastic operation than men.

In nearly all cases the patients have been entirely free of symptoms after their discharge from hospital (12 cases) and have not had any pain or other symptoms from the operated joint, even after greater exertions. In four cases slight pains have been alleged to occur after hard work.

The material presented here thus goes to prove that in tuberculosis of the elbow resection and arthroplastic operation in one séance can be the means of bringing about good mobility in the joint. By this procedure the patient is also spared the inconvenience of more than one operation. As regards the lenght of time of the treatment this is shorter, if an arthroplastic operation is performed, than if the operation is carried out in two séances. As only one patient at Apelviken Coast Sanatorium has been operated on according to the latter method, it is not possible here to make any direct comparison of the results obtained after the two methods and of the length of the treatment. Considering only those cases which have been treated *solely* for tuberculosis of the elbow, the average length of treatment for patients operated in one séance will be somewhat more than 8 months. It can be mentioned for comparison that the average length of the treatment in those cases, where merely resection is performed, is 8 months. A patient who has had

symptoms from the elbow-joint for many years before his admission to the hospital requires as a rule not so long a treatment as does a patient, who has been ill for only a short time. This of course depends on the fact that the tuberculous process in the elbow in the former case has come to a standstill and become walled-off already when the patient enters the hospital, and the operation may thus be performed a short time later, while patients who have been ill for a relatively short time require a period of observation of several months before the operation can be carried out.—However, as patients who have been ill for a long time obtain less mobility after resection and arthroplastic operation than patients who have been ill for a relatively short time (see above), it is still desirable that patients with tuberculosis of the elbow receive treatment early in a special hospital, as it is highly probable that such a measure will also shorten the duration of the illness.

RESUMÉ

Der Verfasser berichtet über 17 Fälle von Ellbogentuberkulose, bei denen Resektion und arthroplastische Operation in *einer* Sitzung ausgeführt wurden. Das Vorhandensein von tuberkulösen Abszessen oder Fisteln bildet keine Kontraindikation für die Operation. — 16 Fälle wurden nachuntersucht. In einem Falle war es zu einer Ankylosis gekommen. Von den überigen Fällen, in denen die Mobilität erhalten war, waren drei arbeitsunfähig, zwei davon infolge anderer Affektionen. — Da es sich gezeigt hat, dass die Resultate der arthroplastischen Operation um so besser sind, je kürzer die Krankheitsdauer ist, ist es dringend geboten, Patienten mit Ellbogentuberkulose bereits in frühem Krankheitsstadium in einem Spezialkrankenhause zu behandeln.

SUMMARY

The author gives an account of 17 cases of tuberculosis of the elbow, in which resection and arthroplastic operation have been performed in one séance. The presence of tuberculous abscesses or fistulas do not constitute a contraindication for the

operation.—16 cases have been after-examined. In one case anchylosis had occurred. Of the remaining cases with retained mobility three were incapable of working, two of these on account of other affections.—As it has become evident that the results of the arthroplastic operation are better the shorter the duration of illness is, it is urgent that patients with tuberculosis of the elbow receive treatment at a special hospital already at an early stage of the illness.

RÉSUMÉ

L'auteur communique 17 cas de tuberculose du coude où l'on a pratiqué, en une seule séance, la résection et l'opération arthroplastique. La présence d'un abcès ou d'une fistule d'origine tuberculeuse n'est pas une contre-indication à l'opération. — 16 cas ont été soumis à un examen ultérieur. Dans l'un d'eux il s'était développé de l'anchylose. Dans les autres cas, où la mobilité avait été gardée, trois malades étaient incapables de travailler, deux de ceux-ci, cependant, par suite d'autres maladies. — Étant donné qu'il est apparu avec beaucoup d'évidence que les résultats de l'opération arthroplastique sont d'autant meilleurs que la maladie a duré moins longtemps, il est absolument nécessaire que les malades atteints de tuberculose au coude soient mis en traitement dans un hôpital spécial, à un stade aussi récent que possible de la maladie.

LITERATURE

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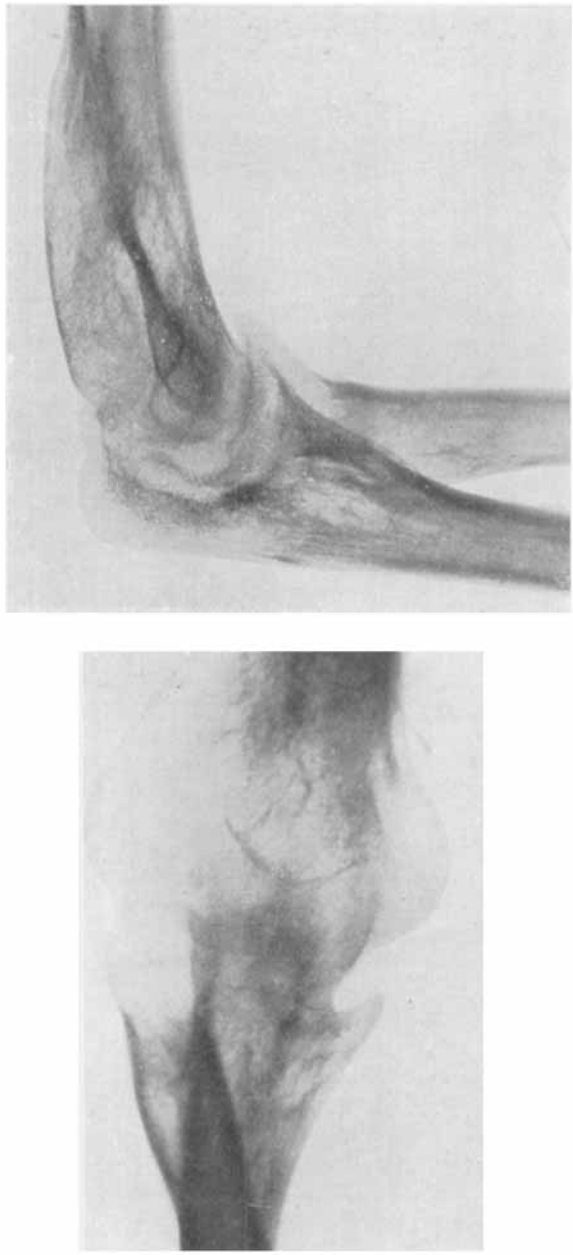

Fig. 1 a. Case 14. Photo taken on 29.10.1934.
(2 days before the operation.)

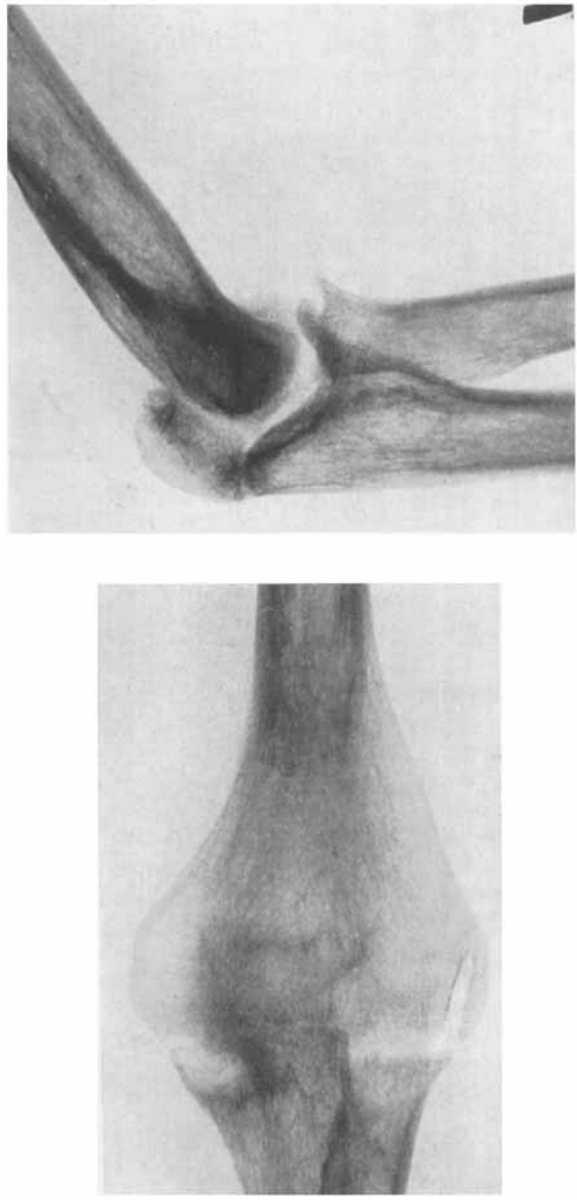

Fig. 1 b. Case 14. Photo taken on 2.4.1935.
(5 months after the operation.)